

Effect of Computer Aided Instruction on Students' Academic Achievement in Technical Drawing in Secondary Schools in Edo State

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Abstract. This study was aimed at investigating the Effect of Computer Aided Instruction on Students' Academic Achievement in Technical Drawing in Secondary Schools in Edo State. A quasi-experimental design was adopted for the study. The population of the study consisted of one hundred and thirty-five (135) SS, 2 Technical Drawing Students in Four Selected Secondary Schools in Oredo metropolis. The sample comprised one hundred and five (105) students of two intact classes purposively sampled from two (2) of the four schools. Technical Drawing Achievement Test (TDAT) was used for data collection. A reliability coefficient of 0.77 was obtained using test-retest reliability technique. Three research questions guided the study and two hypotheses were tested; Data collected was analyzed using mean and standard deviation for the research questions and Analysis of Variance (ANOVA) was used for the hypotheses at .05 level of significance. Findings revealed that students taught with CAI method have higher mean scores in TDAT than those taught with traditional teaching method. It was also revealed that there was a significant difference in the post-test mean scores between male and female students taught with the traditional method. However, there was no significant difference between male and female taught with CAI method. It was recommended, that technical drawing teachers should be encouraged to adopt the use of computer aided instruction and more female students should be encouraged to offer Technical Drawing at Secondary School level.

Keywords: Computer Aided Instruction, Academic Achievement, Technical Drawing, Traditional Method, Edo State of Nigeria.

1. Introduction

Education is a major tool used to develop the society through various training offered at different levels of institutions. Such training is expected to equip recipients to become better citizens who are able to contribute meaningfully to the society. According to Federal Republic of Nigeria, (FRN) (2013), the goals of education are the development of appropriate skills, mental, physical, and social abilities and competencies to empower the individual to live in and contribute positively to the society. The extent to which these goals are achieved is determined by students' achievement in examinations conducted by various examination bodies. In recent years, reports of secondary schools and technical colleges students' performances in external examinations conducted by these bodies have not been encouraging. According to Aworanti (2013) the goals of technical education might not be achieved with the rate of decline of secondary school students' achievement 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 practiced as a subject/module at various levels of the Nigerian educational system such as post-primary schools and tertiary institutions. Technical drawing stands as a subject from the senior secondary school (SSS1-SSS3) and it is a subject designed with curriculum objectives for senior secondary school students which foster pre-vocational orientation in technology, medium of communication among technologists, engineers, architects among others and is widely used in many fields and professions. The subject teaches how human beings can be useful in planning and development of our society's infrastructure. However, within the context of technical education Technical drawing has been

identified as a very important science subject and its importance in science and technological development of any nation has been widely reported.

Okorie (2010) asserted that technical drawing is essentially the universal language which technicians, engineers, craftsmen and industrialist used to communicate. The author further stated that technical drawing can be understood correctly by technicians, engineers, designers, craftsmen, manufacturers and those who have interest in making and reading it. The usability of technical drawing transcends cultures and languages and for any country to progress technologically, therefore, it is essential that a country develops the training of its citizen in the language of the technology which is technical drawing.

Technical drawing is a subject that is being offered in most science and technical oriented courses in the senior secondary schools and this calls for the need in teaching technical drawing effectively in our schools. A systematic integration of variety of instructional methods have been used in teaching and learning of technical drawing and various methods are adopted so as to improve the learning and to increase the level of high performance of the students' academic achievement and productivity as well as the methodology employed in teaching technical drawing in schools.

In teaching students, various methods are used, some of which are, lecture method, questioning method, discussion, play-way method, problem posing method, demonstration method, field trip/excursion method, dramatization method among others. Ezeji (2008) posited, that effective teaching may include high level of creativity in analyzing, synthesizing and presenting knowledge in new and effective ways. Various subjects have methods of imparting to the learners and these are the criteria to be considered in teaching and learning process.

Technical Drawing is a subject that students find difficult to pass because it requires psychomotor skills (FRN, 2009). Psychomotor skills in technical drawing involve activities that need coordination of finger and hand movement as a result of cognitive planning. The activities might include several tasks such as handling the pencils, manipulation of drawing instruments; sliding the T-square, set-squares, ruler, and proper use of eraser. The issue of poor academic achievement of students in technical drawing has been blamed on teachers' method adopted in teaching the subject.

According to Osinen and Nwoji (2016) 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, Igbo, Nwanchukwu, Onyenachi and Ekong 1999). Consequently, to eradicate the challenges of traditional teaching method that have not been able to improve students' achievement in technical drawing, Ahmet (2008) suggested bringing in new technologies which play an important role in the development of the education process to safeguard students against the negative effect of rote memory based learning. Example of such new technology is Computer Aided Instruction (CAI). The use of computer is now the order of the day. Adedokun (2004) posited that, it is so firmly established throughout all sectors of education and training that it can be claimed they constitute not only technology education but technology of education and training. Computer Aided Instruction (CAI) referred to as a self-learning technique usually offline/online, which involves the interaction of students with programmed instructional materials. (CAI) is an interactive instructional technique whereby a computer is used to present the instructional materials and monitor the learning that takes place.

According to Traylor (2013), computers are used in preparing "electronic" presentations using computer presentation programmes and LCD projectors. He further stressed that many schools have incorporated interactive computer-aided instruction into teaching and learning programmes to provide students opportunities to master specific educational objectives or standards. The potential benefits of Computer Aided Instruction (CAI) cannot be underestimated in the contemporary world. There are abundance of established findings on the instructional value of computer. According to Orisebiyi (2007) CAI is an effective instructional strategy in science and related subjects. Also, Yusuf and Afolabi (2010) asserted that the use of computer assisted instruction CAI as a supplement to discussion method, produced higher achievements by the learners than using discussion method only.

There are now several CAI packages available for graphics design and learning which include CorelDraw, Auto TED, Archi CAD, Auto CAD among others. The most suitable software for a drawing and construction in technical drawing is

Auto CAD. Auto CAD is an interactive drafting software package developed for construction of objects on a graphics display screen. The use of this software for construction is important in terms of neatness, fastness and accuracy unlike the traditional teaching method. (Pencil and paper work) It uses primitive entities such as lines, polylines, circles, arcs and text as the foundation for more complex object. Auto CAD is one of the most powerful computer aided design CAD software which can perform nearly any graphics task. However, Heidi (2016) noted that graphics display screen leads to improvement in cognitive, perceptual and motor skills, which will assist in anchoring the students into the reality for the use of visual construction in which students ability can be improved. Software packages can be used to encourage discovery and experimentation in classroom and their visualization feature can be effectively employed in teaching to generate conjectures (Lavicza, 2006). Most technical drawing concepts are difficult to impart to the student in traditional teaching method but only need certain feature of teaching of technology to bring the lesson closely to the learners; the features to propel these are present in Auto CAD packages.

1.1 Statement of the Problem

Advancement in technology has influenced all sphere of human lives and all sectors of the economy positively. Technology has made work easier and faster. In the educational sector for example, technology are employed in the areas of teaching and learning, for generating, keeping and retrieving of information. However many workers including teachers seems not to have the knowledge and skills for using the new technology and method for their daily work routine. It was observed that Technical Drawing teachers are still using one or a combination of two or more conventional teaching methods to deliver their lessons. This teaching method seems not to encourage students participation in the teaching-learning process. Consequently, students are not likely to have mastery of the subject matter. This could have resulted to poor academic achievement in technical drawing over the years. However, one of the objectives of educational programme is to enhance students' academic excellent. A number of studies been conducted, it was discovered that students find it difficult to understand technical drawing due to factors among which teaching method is a major concern. Drawing isometric from orthographic and converting orthographic to isometric components is one of the areas students find difficult to understand (National Examination Council 2010, 2012). Technical Drawing is a subject

that students find difficult to pass because it requires psychomotor skills (FRN, 2009). Psychomotor skills in technical drawing involve activities that need coordination of finger and hand movement as a result of cognitive planning. The issue of poor academic achievement of students in technical drawing has been blamed on teachers' method adopted in teaching-learning process.

Computer Aided Instruction CAI are relevant in teaching and learning process of technical drawing because students can gain knowledge and skills by watching procedures and demonstration on the screen of the computer. A lots of computer software have been developed and incorporated with some drawing instruments in such a way that each tool can be picked where there is need for it by experts to teach technical drawing. In spite of all the advantages of using CAI, most teachers of Technical Drawing use discussion methods to teach the subject. It is therefore, imperative to determine the effects of Computer Aided Instruction (CAI) on students' academic achievement in technical drawing in secondary schools in Edo State.

1.2 Purpose of the Study

The main purpose of this study was to determine the effect of Computer Aided Instruction (CAI) on students' academic achievement in technical drawing in Edo State. Specifically, the study is to determine the following:

- The difference between the pre-test and post-test mean scores of students taught technical drawing with Computer Aided Instruction and those taught with the traditional method.
- The difference between the post-test mean scores of male and female students taught technical drawing with traditional method.
- The difference between the post-test mean scores of male and female students taught technical drawing using Computer Aided Instruction method.

1.3 Research Questions

The following research questions guided the study:

- What is the difference between the pre-test and post-test mean scores of students taught Technical Drawing using computer aided instruction and those taught using the traditional method?
- What is the difference between the post-test mean scores of male and female students

taught Technical Drawing using traditional method?

- What is the difference between the post-test mean scores of male and female students taught technical drawing using Computer Aided Instruction method?

1.4 Hypotheses

The following null hypotheses were tested at .05 level of significance.

- There is no significant difference between the post-test mean scores of students taught technical drawing using Computer Aided Instruction and those taught using traditional method.
- There is no significant difference between the mean scores of male and female students taught technical drawing with CAI and those taught with traditional method.

1.5 Significance of the Study

The findings of this study are of immense benefits to all students, technical drawing teachers, government, curriculum planners, parents and the general public.

It enable students acquire technical graphic skills in interpreting and drawing of building plans. The acquisition of these skills enhances students' achievement and thus reduces persistent failure in public examination and teacher made test.

Students' improvement in academic achievement in technical drawing as a result of the use of computer aided instruction which helps the teacher to improve on their instructional delivery system in the teaching-learning process.

It is obvious that students' academic improvement in technical drawing is an evidence that the resources committed to teaching technology education by government were judiciously utilized this will encourage the government to be more committed in funding education.

Male and female students' academic achievement in technical drawing is as a result of the use of CAI in helping the curriculum planers to incorporate computer aided instruction teaching strategy into teachers programme for effective delivery of instruction in the classroom.

Finally, continuous students' academic improvement could bring about improved national economy in the

sense that, such improvement will produce graduates who are knowledgeable, skilled and committed to their jobs. Curriculum planners would therefore include CAI so that there would be improved delivery of instruction.

1.6 Scope of the Study

This study focused on the effect to Computer Aided Instruction on students' academic achievement in Technical Drawing in Secondary Schools in Edo State, specifically Senior Secondary in Benin metropolis. The study was delimited to all (SS2) students offering technical drawing in the selected schools. The study focuses on traditional teaching method, computer aided instruction, students' academic achievement, students gender and problem associated with the use of CAI in Technical Drawing.

2. Methodology

The research was carried out using quasi-experimental design. It involved two intact groups: Computer aided instruction and traditional teaching method with pre-test and post-test for both groups, According to Nworgu (2015), Quasi-experimental study does not allow for randomization of subjects to experimental and control groups. This design was considered suitable for the study because there was no room for randomization, intact classes were used to avoid disruption of normal classes lessons.

The population of the study was 135 students currently in (SS2) in Edo State. However, the sample size for the study was 105 (SS2) technical drawing student for 2018/2019 academic session. Edo College Model Secondary School and Uniben Demonstration School were purposively selected out of the schools offering technical drawing in Benin metropolis. Edo College Model Secondary has a total 77 SS2 technical drawing students while Uniben Demonstration has a total 28 SS2 technical students which consist of Nineteen (19) males and Nine (9) females.

The instrument used for data collection was Technical Drawing Achievement Test (TDAT). The test is a multiple test items with options A-D. A pilot test was conducted in neighbouring Ondo State, using Adeyemi College of Education Demonstration Secondary School Akure. The score obtained from the first and second administration were correlated using pearson product moment correlation coefficient formular. A correlation coefficient of 0.77 was obtained.

3. Method of Data Analysis

Research Question 1: What is the difference between the mean scores of students taught Technical Drawing using Computer Aided Instruction and those taught using traditional method?

Summary of mean achievement of Experimental group and control group

Table 1: Table of pre-test and post-test mean scores of experimental and control group.

N	Pre-test	Pro-test	Mean	Mean	Mean	SD	Gain	difference
Group		Mean	SD					
Experimental	77	50.82	4.58	68.73		5.06	17.91	
Control	28	50.82	4.60	53.39	4.58	4.57		13.34

Source: Field study, 2019.

Table 1 shows that the pre-test and post-test mean scores of the experimental group are 50.82 and 68.73 respectively, while those of control group are 50.82 and 53.39 respectively. The table shows that the mean gain for experimental and control group are 17.91 and 4.57 respectively. The post-test mean difference of 13.34 shows that those taught technical drawing using CAI method performed better than those taught with traditional method.

Research Question 2: What is the difference between the post-test mean achievement scores of male and female students taught Technical Drawing using traditional method?

Table 2: Table of post-test mean score of male and female student.

Gender	N	Mean	SD	Mean	Difference
Male	19	57.84	2.65		
Female	9	50.22	3.27	7.62	

Source: Field study, 2019.

Table 2 shows that post-test mean score of male and female students in the control group are 57.84 and 50.22 respectively. The result show that the post-test mean difference between male and female students taught Technical Drawing using traditional teaching method is 7.62 and the male students performed better than the female students.

Research Question 3: What is the difference between the post-test mean achievement of male and female students taught Technical Drawing using Computer Aided Instruction?

Summary of mean achievement of post-test between male and female in the Experimental group.

Table 3: Table of mean difference between the post-test score of male and female students

Gender	N	Mean	SD	Mean	Difference
Male	62	68.77	5.11		
Female	15	68.53	5.00	0.24	

Source: Field study, 2019.

Table 3 shows that the post-test scores of male and female students in the experimental group are 68.77 and 68.53 respectively. The result shows that the post-test mean difference between male and female students taught technical drawing using CAI technique is 0.24 and their achievement were relatively the same.

Testing of Hypotheses

Hypotheses 1: There is no significant difference between the post-test mean score of students taught Technical Drawing using Computer Aided instruction and those taught using traditional method.

Table 4: Analysis of covariance (ANCOVA) achievement between the Experimental and control group.

Type III Sum		Mean					
Source	of Square	Df	Square	F	Sig.	Remark	
Corrected model	6030.8469	2	3015.423	2294.156	.000		
Intercept	63.639	1	63.639	48.417	.000		
Pretest	2379.883	1	2379.883	1810.632	.000		
Group	3652.828	1	3652.828	2779.097	.000	Rejected	
Error	134.068	102	1.314				
Total	452133.000	105					
Corrected Total	6164.914	105				Rejected	

Significant at $F < .05$

Source: Field study 2019.

Table 4 show that the F-value of the group is 2770.097, while the P-value is .000. Testing at alpha value of .05, the null hypothesis is rejected since the P-value is less than the alpha value. Thus, there is significant difference between the mean achievement of students taught Technical Drawing using Computer Aided Instruction method and those taught with traditional method.

Hypothesis 2: There is no significant difference between the post-test mean achievement of male and female students taught Technical Drawing using Computer Aided Instruction method.

Table 5: Table of ANCOVA of male and female students with CAI and those taught with traditional method

Gender	N	Mean	SD	Df	T-value	P-value	Decision
Male	62	68.77		5.11	75	.164	.87
Female	15	68.53		5.00			Retained

Table 5 shows that the mean score of male and female students are 68.77 and 68.53 respectively. The table reveals that the t-value is .164 while the P-value is .870. Since, the P-value is greater than the alpha value of .05, the null hypothesis is therefore retained. Thus, there is no significant difference between the post-test mean achievement of male and female students taught technical drawing using Computer Aided Instruction method.

4. Discussion of Results

The analysis of the result of the achievement test shown on table 1 indicates that experimental group performed better than the control group in post-test. Also, the analysis of covariance of the post-test mean performance presented on table 4 confirmed, that the difference between the mean performance of students in both group in the post-test is significant. This significant difference is attributed to the treatment. These findings showed that CAI method has proved to be more effective in enhancing student academic achievement in technical drawing than traditional teaching method. This findings is in line with the work of Lemut, Pedemonte & Robboti (2010) and Asiloku (2016) who in their separate studies found that constructing object with CAI provides students with deeper understanding of geometric construction than the traditional teaching method. Furthermore,

UNESCO (2012) in ascertaining the effectiveness of requisite facilities especially ICT-based packages explained that computer technology provide power tools to support the shift to student-centered learning, and is capable of creating more interactive and engaging learning environment for teachers and learners, and as well improves students' performance.

Secondly, the analysis of the result of the achievement test of students in control group on table 2 indicated that male students perform better than the female students in post-test. This findings is in consonance with the findings of Hayrie (2003) that gender Schema tends to relate most of the technology trades or subjects to masculine gender and there is a differential performance of sexes in technology education.

Finally, the analysis of the result of the achievement test of students in experimental group shown on table 3 indicated that performance of both sexes were relatively the same due to the effect of CAI. Also the t-test analysis of the post-test mean performance presented on table 5 confirmed that there is no significant difference between the mean performance of male and female students taught Technical drawing using CAI method. This implies that CAI approach is not gender bias. The finding agree with the work of Ogbuanya and Usoro (2013) whose

research indicated that there is no significant difference between boys and girls who learnt technical drawing with Auto CAD.

5. Conclusion

Based on the findings of the study, it was concluded that Computer Aided Instruction CAI method is a better and more viable teaching method compared to the traditional teaching method and irrespective of the gender, it can be concluded that, Computer Aid Instruction would be highly effective if employed by technical drawing teachers in enhancing teaching activities, students' performance, mastery of basic knowledge and skills.

6. Recommendations

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

- The use of CAI for instructional facilitation should be employed by teachers and administrators to enhance meaningful learning in technical drawing.
- Computer assisted materials should be developed on topics that may need some extra support to teach.
- Technical drawing teachers should be trained in instructional development and implementation with use of CAI and related technologies for effective teaching.
- Incorporation of technology based teaching techniques should be made compulsory most especially in science and technology based subjects.

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