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Technical Drawing With AutoCAD – Impact On Students' Interest And Engagement In Unity Schools In Rivers State, Nigeria.

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Abstract

The study investigated the effect of AutoCAD on students' interest and level of engagement in Technical Drawing in Unity Schools in Rivers State. The study adopted the 2-group post-test only quasi-experimental design. Ninety-two (92) Technical Drawing students from two Unity Schools drawn from a population of 1071 were purposively sampled. Two research questions were answered while two hypotheses were tested at 0.05 level of significance. The instrument used for data collection was Technical Drawing Structured Questionnaire (TDSQ). The TDSQ was made up of two sections, A and B, which measured students' interest and engagement towards AutoCAD usage in Technical Drawing. A reliability co-efficient of 0.72 was obtained using Cronbach Alpha. Mean and standard deviation were used to answer the research questions, while Independent t-test was used to test the hypotheses. The findings revealed among others that AutoCAD had a significant effect on students' interest and level of engagement in Technical Drawing. Based on the findings, it was recommended that Technical Drawing teachers, and school Administrators should employ necessary measures to sustain the positive attitude of students towards the use of AutoCAD in Technical Drawing.
Keywords: AutoCAD; Technical Drawing; Interest; Engagement.

1. Introduction

The 21st century student uses different digital tools, such as; laptops, computers, tablets and smart phones to communicate and access information. Since students always carry these devices on them, incorporating these devices into the teaching-learning process would likely arouse students' interest in subjects taught such as Technical Drawing (TD). For the teacher, this is a call for quick adaptation to technological trends in other to meet the learning needs of the digital learners. Technical Drawing has existed for many centuries dating back to 4000 B.C (Kamrani & Nasr 2010). TD then was mostly the pictorial illustrations of parts which did not necessarily include details like dimensions and features, as most manufacturing then was done manually by skilled workers (Kamrani & Nasr 2010). TD before now simply meant drawings created by draftsmen (when people participated directly in parts production and the assembly of products).

But over the years, with the use of Personal Computers (PC) in design processing and manufacturing, the word 'Technical Drawing' has broadened to include communication graphics. Technical Drawing is taught in Universities, Polytechnics, and some other tertiary institutions in Nigeria. It is also taught in Colleges of Education, Unity Colleges, and Technical Colleges. It is a core subject offered by technology students in senior classes in secondary schools in Nigeria, with the primary objective of equipping students with basic technical and technological skills required in pursuit of engineering courses in higher institutions. It is also a pre-requisite subject for engineering and related courses in higher institutions in Nigeria. The importance of engineering technology in any nation cannot be overemphasized, as technology is the bed rock of any nation (Ighodalo 2011). So if in a country, such as Nigeria, there are few students who graduate from higher institutions as engineering students every year, it will eventually affect national development considering the roles Engineers play in national development of any country.

2. Technical Drawing

The concept of technical drawing as posited by (Goetsch et al. 2000):

Technical Drawing is a graphic illustration of a concept, or an entity that exists in real life. It is a method used to convey information; example an idea or concept and a graphic illustration of parts of machines, house, or tool. Drawing is one of the oldest ways of communication, dating back much more than verbal message. The familiar proverb 'A picture is worth a thousand words' is still a basis for Technical drawing.

2.1 Application of Technical Drawing

Technical Drawing (TD) has wide application in manufacturing, engineering, architecture and construction. Architects document their designs of residential, commercial as well as industrial buildings using Technical Drawing. TD serves as records or plan for the manufacture of products; erection of building; construction of roads; and maps for navigation or geological survey. TD serves as blueprints in transforming the architectural and engineering designs into reality.

2.2 Technical Drawing Curriculum

The general objectives of Technical Drawing curriculum as highlighted by the Nigerian Educational Research and Development Council (NERDC 2013)) are to:

i). Provide accepted theoretical and applied concepts relating to utilization of ICT to facilitate communication of ideas in construction and production industries;

ii). Provide introduction to modern drawing studio practice;

iii).Lay foundation for technological development; and (iv) stimulate, develop and enhance entrepreneurial skills.

NERDC (2013) Technical Drawing curriculum content was basically enriched with hands-on practical activities such as computer applications which provide platforms for competency, active teaching, learning and work experiences. Among the demands required for successful implementation of the curriculum are: the provision of drawing studios, computers equipped with Computer Aided Design (CAD) application software such as AutoCAD, Corel draw, Harvard graphic and well trained and motivated teachers who are computer literate.

3. AutoCAD

The term "AutoCAD" stands for 'Automatic Computer Aided Design' (tutorial 45.com, 2017).

It is a computer-aided drafting software program used to create blueprints, buildings, bridges, and computer chips among others things (study.com, 2017). It is an interactive drafting software package for construction of object on a graphic display. AutoCAD is a standout amongst the most capable Computer Aided Design (CAD) programming which can perform nearly any graphic task, (Jimoh 2010). It is a commercial software application used to draft 2-dimensional and 3-dimensional models. The software is utilized over variety of industries by draftsmen, engineers, graphics designers and other professionals.

3.1. Advantages of AutoCAD

The following are some advantages of using AutoCAD as highlighted by (Grabowski 2002):

Accuracy: computer-generated drawings are drawn and plotted to an accuracy of up to 14 decimal places of the units used. The numerical entry of critical dimensions and tolerance is more reliable than the traditional methods of manual scaling.

This means the use of the software in the teaching and learning of Technical Drawing can make drawing to accuracy which always pose problem to learners, very easy and so motivating their interest and hence increasing their performance and level of engagement.

Speed: the ability of CAD operator to copy, offset, trim, array items and edits the work on the screen speeds up the drawing process. When the operator customizes the system for specific tasks, speed of work greatly increases. Another factor that poses a problem with the manual drawing techniques is speed, as drawing using the manual drawing instruments is time consuming, so the application of the AutoCAD software package can enhance speed in the drawing process.

Neatness and Legibility: the capability of the plotter to produce exact and legible drawings is an obvious advantage of the software package over conventional methods of hand-drawn work. CAD drawing is uniform; contains lines of constant thickness, evenly- spaced hatch patterns, and print quality lettering. CAD drawings are neat; free of smudges and other editing marks. AutoCAD application can enable the students not only to draw legibly, but it also makes room for neat and clear drawing, as legibility of letters is of utmost importance in technical drawing (Parker & Pickup, 2009).

Consistency: the application of AutoCAD techniques in drawing eliminates the problem of individual styles as the software is constant in its approach. For example, an industry may have various draftsmen carrying out same projects and still create constant set of graphics. This therefore suggests that application of the software packages in drawing can make students consistent and thereby promote uniformity in drawing.

4. Students' Interest

Since there are lots of advantages in the use of AutoCAD, it is likely that using it to teach TD will enhance students' interest and engagement in learning. Students' interest holds much power in a subject. According to (Schiefele 2011), interest is a content-specific-motivational characteristic made out of inherent feeling- related and esteem- related values. This means that when a teaching relates to what students are keen on doing; the intensity of interest of the students deepens as they keenly invest time considering, dialoguing and creating ideas in useful ways which imply that students' interest works well with instructional planning based on readiness and learning profiles. In agreement to this, (McCarthy 2014) posited that matching learning profiles with students' interest such as watching videos, and the use of computer aided instructions, allow learners to process understanding of concepts through different modalities.

Udoekoriko (cited in Oyenuga 2010) posited that a very close relationship exists between a student's interest and academic performance. This means student's academic performance is tied to interest in the subject. Students' interest in a subject such as TD can go a long way in motivating them to learn. This motivation on the other hand, enables students to get fully engaged in the lesson being taught.

5. Students' Engagement

Students' engagement refers to the level of attention, interest, optimism and zeal that students show when they are learning or being taught, which extends to the level of motivation they have to learn and improve in education (glossary 2017). The concept of student engagement is based on the belief that learning is enhanced when learners are inquisitive, interested, and inspired. This means students' engagement can be measured by the level of commitments the students exhibit in learning processes. Fletcher (2015) defined students' engagement as constant relationship a learner has towards any part of learning, schools or education. Fletcher's position implies that students' engagement depends to a large extent on the students' mind-set towards the learning method. For students to be engaged, it is expected that the teacher should create a condition that can encourage the students to learn. So it is the duty of the teacher to create enabling condition or environment to encourage students' engagement. The different types of students' engagement as stated by (Taylor & Parsons (2011) include: intellectual, institutional, emotional, behavioral, social, and psychological.

This research is anchored on the theory of engagement. Engagement theory according to (Daway 2014) is a model for learning in technology-based environment. The engagement theory is based on motivation –the idea that when students find lessons meaningful and have a high level of interest in the tasks, they study more, likely to keep the information, as well as transfer it to new contexts. This suggests that when a teaching approach used by the teacher motivates the students, they get more committed and involved in the learning procedure. Daway (2014) views engagement theory as framework designed for technology-based instructions. The fundamental thought underlying engagement theory is that learners must be genuinely occupied with learning exercises through connection with others and meaningful tasks. The theory can be associated with situated learning theory because it stresses collaboration between peers and group of learners. The present study is therefore relevant to the principle of engagement theory because the utilization of the software in Technical Drawing can create room for collaboration among the students and thereby increase their motivation to learn. Also the use of AutoCAD in teaching-learning of Technical Drawing can make the drawing more creative and purposeful and so help students develop problems solving abilities and thereby engaging the learners.

On empirical studies, (Jimoh 2010) investigated the effect of AutoCAD on National Diploma students' interest in Engineering Graphics in a Nigerian Polytechnic. He used a sample of 227 students and Engineering Graphic Interest Inventory as instrument for collecting data.

The reliability coefficient computed for the Inventory was 0.91. Findings showed AutoCAD was effective in stimulating learners' interest in Engineering Graphics. Jimoh (2010) noted that students' interest and achievement in any learning activity is sustained by active participation of the learner. Similarly, (Ogwo & Oranu 2006), in a study titled "innovative method on teaching informal and formal Technical and Vocational

Education in University of Nsukka", employed quasi-experimental design, and multi-phase sampling techniques to select 80 students. Their findings revealed that unless the teachers stimulate students' interest in learning, learners' success can be minimal. They added that to facilitate learning, teachers must secure and sustain attention and interest of the learners, they also emphasized that unless attention is maintained and interest sustained, learning can hardly take place.

Akpan and Umobong (2013) studied impact of achievement and motivation on students' engagement in senior secondary schools. They used 540 students as sample size, and Academic Engagement Questionnaire (AEQ) as instrument for data collection. Their findings revealed that achievement and motivation have significant impact on the level of student's engagement with the highly motivated students being more engaged. In the same vein, (Gunuc 2014) studied the relationship between engagement and students' Academic Achievement in higher education in Turkey. He collected data using students Engagement Scale and Demographic Variables Form (SESVF) from 304 students which were drawn through random sampling. To analyze the data collected, he used descriptive statistics and two-step cluster analysis. Result revealed that there were significant relationships between the students' performance and students' engagement.

Statement of the Problem

The paucity of students offering TD in secondary schools in Nigeria is a cause of concern. This is so because TD is a pre-requisite subject for studying engineering in Tertiary Institutions in Nigeria. Therefore, if fewer students offer TD, then the numbers that eventually enrol for engineering courses at the tertiary institutions is likely to decrease. Engineers are known as the 'backbone of nation building' (Mr. Teacher 2016). The Technical Drawing and engineering students today are the engineers tomorrow. This means, if the learners at this level are not motivated by way of teaching approach to show interest in technology subjects such as Technical Drawing, it could continue to have adverse effect on the number of students who enrol for engineering courses in tertiary institutions. This could in turn give rise to inadequate engineering graduates in the country, leading to insufficient manpower in the industries and construction companies, and thus affecting national development. The authors wonder whether incorporating Computer Aided Design (CAD) software in teaching and learning of Technical Drawing can arouse students' interest and keep them engaged.

Aim and Objectives of the Study

The aim of this study is to find out the impact of AutoCAD on students' Interest and Engagement in Technical Drawing in Unity Schools in Rivers State.

In specific terms, the study intend to:

1. Ascertain the effect of AutoCAD on students' interest in Technical Drawing.
2. Determine students' level of engagement in TD when using AutoCAD.

Research Questions.

i. How does the use of AutoCAD affect students' interest in Technical Drawing?
ii. What is students' level of engagement in TD when AutoCAD is used?

Hypotheses

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

1: There is no significant difference in the interest of those taught with AutoCAD and those taught without AutoCAD towards Technical Drawing.

2: The level of engagement of students taught with AutoCAD and those taught without AutoCAD towards Technical Drawing do not differ significantly.

Methods

The design of this study is the 2-group post-test only quasi-experimental design. The population of the study consisted of 1071 Technical Drawing students in three (3) Unity Schools in Rivers State, Nigeria. Rivers State is one of the 36 states in Nigeria. Its capital, Port Harcourt is the biggest city in the state and is financially buoyant as the focal point of Nigeria's oil industry. The 2006 census conducted by the (Nigeria Bureau Statistic 2018), revealed that Rivers State has an estimated population of 5,185,400, and is the most prominent oil producing State. It has two major refineries, two major Seaports and various industries, (Encyclopedia 2013). So the authors are certain that when students show interest in engineering courses, there can be adequate opportunity for them in the various industries available in the State.

The sample of the study was made of 92 SS2 Technical Drawing students from two intact classes in two selected Unity Colleges (see table 1).Instrument for data collection was Technical Drawing Structured Questionnaire (TDSQ). The questionnaire consisted of two sections A and B. Section A was designed to determined if the use of computer Aided Design can improve students' Interest in TD and section B consisted of item designed to test students' level of engagement in TD. The questionnaire was designed based on the authors' wide knowledge and exposure to literature on the variables in question. The face and content validity of the instrument were done by three experts in the field of Educational Technology, Technical Drawing Department and, Measurement and Evaluation. They assessed the suitability of the items in the instrument in line with what the study was aimed to measure. Cronbach Alpha was used to ascertain the reliability of the instrument, and a reliability coefficient of 0.72 was obtained. The students' interest subscale had 0.683, and students' engagement subscale had reliability coefficient of 0.675.

With respect to the procedures, prior to the teaching, two lesson plans were prepared; a conventional lesson plan used in teaching the control group and an integrated technology lesson plan for the experimental group. The lessons lasted for three (3) weeks, the control group was taught by the subject teacher using the lesson plan, while the experimental group was taught by both the subject teacher and a CISCO (Computer Information System Company) staff. At the end of the three weeks, the questionnaires were administered to the two groups for data collection. The 92 copies of the questionnaires were administered and retrieved by the authors.

The research questions were answered using mean, and standard deviation, while Independent t-test was used to test the hypotheses at 0.05 significant level.

Table1: Sample Distribution

Groups	School	female	Male	Total
EXP.	A	40	12	**52**
CONTROL	B	33	7	**40**
Total		**73**	**19**	**92**

Results and Discussion

Research Question 1: How does the use of AutoCAD affect students' interest in Technical Drawing?

Table 2: Mean and standard deviation analysis showing the interest of TD students taught with AutoCAD and those taught without AutoCAD.

Interest	N	Mean Interest	S/D
AutoCAD Group	52	55.9423	5.073
Non-AutoCAD Group	40	46.2000	8.305

AutoCAD group mean score of 55.94 is higher than Non-AutoCAD group mean of 46.20.

Research Question 2: What is the level of students' engagement in the use of AutoCAD in Technical Drawing?

Table 3: Mean and standard deviation analysis showing the engagement of students taught with AutoCAD and those taught without AutoCAD towards Technical Drawing.

Student Engagement	N	Mean engagement	S/D
AutoCAD Group	52	58.5962	5.0846
Non-AutoCAD Group	40	46.2750	8.7987

The result shows that engagement of students towards Technical Drawing in the AutoCAD group (58.60) is higher than Non-AutoCAD group (46.28).

Hypothesis 1: There is no significant difference in the interest of TD students taught with AutoCAD and those taught without AutoCAD.

Table 4: Independent samples t-test analysis showing difference in the interest of those taught TD with

AutoCAD and those taught without AutoCAD.

t-test for equality of means				
t	Df	P	Sig (2-tailed)	Decision
6.539	90	0.05	.000	Rejected Ho_1

t (90) = 6.54p < 0.05, i.e. p = 0.000 is less than 0.05.

Hypothesis 2: The engagement of students taught with AutoCAD and those taught without AutoCAD towards Technical Drawing do not differ significantly.

Table 5: Independent samples t-test analysis showing difference in the engagement of students taught with AutoCAD and those taught without AutoCAD towards Technical Drawing.

t-test for equality of means				
t	Df	P	Sig (2-tailed)	Decision
8.674	90	0.05	.000	Rejected Ho_1

t (90) = 8.674p < 0.05, i.e. p = 0.000 is less than 0.05.

The findings reveal that the mean interest score of students taught with AutoCAD is 55.94 while the mean interest score of students taught without AutoCAD is 46.20. This shows that students taught with AutoCAD software indicated more interest in Technical Drawing than those taught without the AutoCAD software. Again, statistical analysis as shown in Table 4 indicates computed t value at 90 df is 6.54 and p=0.000 is less than the significant level of 0.05, thus, the null hypothesis of no significant difference in the interest of those taught with AutoCAD and those taught without AutoCAD towards Technical Drawing is rejected. This indicates that the interest of those taught with AutoCAD and those taught without AutoCAD is significantly different. This finding means that those taught with the software indicated more interest than those taught without the software, implying that the students would want the incorporation of the AutoCAD software in the teaching and learning of Technical Drawing. However, this result was not surprising, because 21st century learners often regarded as 'digital natives' will always show more concern and interest when these technological tools are employed into teaching. This finding is in agreement with (Ogwo & Orano 2006) who posit that except the teachers stimulate students' interest in learning; learners' success can be minimal.

In terms of students' engagement, the study revealed that students taught with AutoCAD showed high level of engagement than those taught with the conventional method. This is evident in their mean score of 58.60 as against 46.28 of the control group. The statistical analysis from Table 5, shows that the t value at 90 df is 8.674, p < 0.05 i.e. p = 0.000 is less than 0.05, and therefore the null hypothesis of no significant difference in the engagement of students taught with AutoCAD and those taught without the AutoCAD is rejected. Indicating that engagement of students towards Technical Drawing of those taught with the software differs significantly with those taught without the software. The finding implies that those taught with AutoCAD with higher level of engagement are likely to perform significantly well than those taught without the software, as students' performance in a subject area can be tied to their level of engagement in that particular subject. This agrees with (Gunuc 2014), who posits that significant relationship exist between student's performance and level of engagement.

Conclusion

From the findings, it can be concluded that the use of AutoCAD software in the teaching and learning of Technical Drawing had a positive impact on students' interest in Technical Drawing. More so, the students' interest in AutoCAD usage created a passion for learning Technical Drawing and this was reflected in the high level of engagement shown by those taught with AutoCAD. The significant difference between the students taught with AutoCAD and those taught without the software was attributed to the enabling environment created by the AutoCAD environment. This proves that the 21st century learners will always indicate keen interest when a technology tool such as AutoCAD is being used as an instructional tool in teaching and learning. The study also takes into cognizance the role engineering technology plays in National Development of any country. This is in agreement with (Ighodalo 2011) that technology is the bed rock of any nation. Creating an enabling

environment in the teaching and learning of Technical Drawing will not only arouse students' interest and level of engagement, it will also improve their creative ability in the subject which is very paramount in Technical Drawing. Furthermore, with the numerous advantages of AutoCAD software usage, more students will be interested in offering engineering courses in tertiary institutions leading to more manpower in the industries and thereby promoting National Development. So it is pertinent that the TD teachers make use of the AutoCAD software as instructional tool in teaching, in order to sustain the students' interest and engagement in Technical Drawing.

Recommendations

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

i) AutoCAD should be incorporated by teachers into the teaching of Technical Drawing to motivate students' interest and increase their engagement in Technical Drawing.

ii) Technical Drawing teachers should embrace the innovative approach offered by Computer Aided Design software package by embarking on self-updating, so as to make them relevant in the technology era.

iii) The Ministry of Education should make provisions to train and re-train Technical Drawing teachers/instructors on ICT training programs on regular basis, so as to equip them in latest technology software in the teaching of Technical Drawing. When the teachers are motivated by way of training to meet the latest trend in the graphic technology they will be able to impact same to the learners.

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