

INFLUENCE OF AUTOCAD ON STUDENTS' MOTIVATION AND ACHIEVEMENT IN TECHNICAL DRAWING IN PLATEAU STATE, NIGERIA

Olua, Sylvanus Chinaemerem¹, Timothy, Jonah Arik² & Itam, Promise Thomas³

¹*School of Secondary Science Education, Federal College of Education (Technical) Isu, Ebonyi State*

olua.sylva@gmail.com/+2347032670464

²*Department of Science and Technology, University of Jos, Jos Nigeria*

ariktimothy13@gmail.com/+2348061601327

³*School of Secondary Technical Education, Federal College of Education (Technical) Isu, Ebonyi State*

Itampromise453@gmail.com/+2348164363446

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ABSTRACT

This study investigated the influence of AutoCAD on students' motivation and achievement in Technical Drawing in Plateau State, Nigeria. This study aimed to fill that gap by exploring awareness levels, types, frequency, and utilization of AutoCAD among teachers and students, and how these factors relate to student motivation and academic achievement in Technical Drawing. The study adopted a descriptive survey design with a sample of 242 respondents, comprising both teachers and students, selected through stratified random sampling to ensure representation across schools. Data were collected using a self-constructed questionnaire titled Students' Perception of AutoCAD Questionnaire (SPAQ). Descriptive and inferential statistical tools were used to analyze the data and test four hypotheses at the 0.05 level of significance. The findings showed that over 75% of teachers and students were aware of AutoCAD and recognized its relevance in enhancing motivation and achievement in Technical Drawing. The study further found that frequent use of AutoCAD correlated positively with increased student motivation and improved academic performance. Various versions and applications of AutoCAD were found to influence engagement, especially when integrated into hands-on teaching and project-based learning. Based on these findings, the study recommends that professional development programs prioritize practical training in AutoCAD for Technical Drawing teachers. Integrating AutoCAD into the curriculum with consistent access to digital resources is also crucial for optimizing student outcomes.

Keywords: AutoCAD, Technical Drawing, student motivation, academic achievement, computer- aided design, teacher training, Plateau State

Introduction

Technical drawing serves as a universal language for communicating design concepts across engineering, architecture, and manufacturing by employing standardized symbols, projections, dimensions, and annotations governed by bodies such as the International Organization for Standardization (ISO) and the Standard Organization of Nigeria (SON). Within secondary school education, it is a vital component of STEM learning, enabling students to transform abstract mathematical and scientific concepts into visual and practical forms. Through activities such as orthographic and isometric projections, dimensioning, and geometric constructions, learners acquire spatial reasoning, precision, and problem-solving skills that are essential for advanced studies and careers in technical disciplines (Opeyemi, 2020; Udoh & Akpan, 2014).

The advent of AutoCAD and other computer-aided design (CAD) tools has transformed the teaching and learning of technical drawing by enabling precision drafting, rapid editing, 3D visualization, and collaborative workflows aligned with modern industry standards. This technological shift enhances students' intrinsic motivation through interactive and engaging design processes and improves their extrinsic motivation by contributing to higher assessment scores and portfolio development. However, successful integration of CAD tools into secondary school technical drawing requires a well-structured approach, beginning with foundational manual drafting skills and progressing to guided digital learning. Teacher competence, availability of hardware and software, and institutional support play a critical role in ensuring this transition is effective (Chedi, 2015; Sutopo, Wibowo & Wibowo, 2020).

In Plateau State, where resource disparities and unequal access to technology persist, investigating the impact of AutoCAD on students' motivation and achievement in technical drawing is crucial. Understanding how digital tools affect learning outcomes can inform curriculum design, teacher training programs, and policy decisions aimed at modernizing technical education. A well-executed integration of CAD technologies has the potential to not only enhance students' technical competence but also foster greater interest in STEM fields, improve academic achievement, and better prepare students for tertiary education and the evolving workforce (Ibe, Maxwell & Chikendu, 2021; Udoh & Akpan, 2014).

Statement of the Problem

The teaching of technical drawing in Plateau State, Nigeria, is constrained by the persistent use of traditional instructional methods, limited integration of computer-aided design (CAD) tools such as AutoCAD, and systemic challenges including shortages of qualified instructors, inadequate teaching facilities, and the absence of a standardized curriculum. These limitations negatively affect students' motivation, engagement, and skill acquisition, thereby reducing their preparedness for higher education and technical career pathways. Despite the recognized potential of AutoCAD to improve instructional delivery and align technical drawing education with contemporary industry standards, there is insufficient empirical evidence on its specific impact on students' motivation and academic achievement within this context. Consequently, policymakers and educators lack the data-driven insights necessary to guide curriculum reform, allocate resources effectively, and design professional development programs for teachers. This situation perpetuates disparities between well-resourced and under-resourced schools and contributes to graduates' limited exposure to industry-relevant skills, thereby undermining the competitiveness of technical drawing education in Plateau State.

Aim and Objectives

This study aims to investigate the Influence of AutoCAD on Students' Motivation and Achievement In Technical Drawing in Plateau State, Nigeria. The following specific objectives will be considered for this study:

1. To determine the level of students' gender on the awareness of AutoCAD on Motivation and Achievement in Technical Drawing in Plateau State, Nigeria.
2. To determine the level of teachers' experience on the utilisation of AutoCAD on Students Motivation and Achievement in Technical Drawing in Plateau State, Nigeria.
3. To investigate the influence of teacher's qualification on the frequency of AutoCAD utilization on students motivation and achievements in Technical Drawing in Plateau State, Nigeria.
4. To identify the types of AutoCAD that affect Students' motivation and achievements in Technical Drawing in Plateau State, Nigeria.

Research Questions

The study was guided by the following research questions:

1. What extent is the level of students' awareness of AutoCAD on Motivation and Achievement in Technical Drawing in Plateau State, Nigeria?
2. What extent is the level of teachers' experience on the utilisation of AutoCAD on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria?
3. What is the effect of teacher' qualification on the frequency of AutoCAD utilisation on students' motivation and achievements in Technical Drawing in Plateau State, Nigeria?
4. What are the types of AutoCAD that affect Students' motivation and achievements in Technical Drawing in Plateau State, Nigeria?

Methods and Procedure

The study employs a descriptive survey research design. Survey research is one which is directed toward determining the position of a given phenomenon. It focuses on people and their beliefs, attitudes, opinions, and behaviors. The population of this study is 1,501 students and 17 teachers which comprised of all government- owned Senior Secondary School Students and teachers in all the seven technical schools in Plateau State (Plateau State Universal Basic Education Board, 2023). The choice of only technical drawing schools is to have access to students who have technical drawing experience. The sample for this study for this study was 242 which is 16% of the total population of 1518. The sample size of 242 is ideal for this study Uzoagulu (2011) as cited by Abusomwan, Osaigbovo, (2020) recommended that 10% - 20% of the population is ideal for a research sample in a survey study. The study utilized a stratified simple random sampling technique. This choice is because the research investigated by both students and teachers. Furthermore, stratification helped the research cover the entire state, therefore the area of study was stratified into educational zones. From each educational zone, the names of the schools will be written on pieces of paper and mixed thoroughly in a box. The selection process involves picking one school from each district and the same balloting method was applied in selecting the respondents from the three schools. This method is used to ensure a balanced and unbiased representation of the sample. The instrument that was used for data collection was a self-constructed questionnaire titled "Students' Perception of AutoCAD Questionnaire (SPAQ)". The study used two different questionnaires to investigate the students and the teachers respectively. The questions on both questionnaires was be close-ended and was drafted in simple, explicit, and understandable language. The questionnaire was designed following the

modified 4- point Likert scale format where respondents was asked to indicate their degree of agreement or disagreement ranging from strongly agree (4) to strongly disagree (1). The data collected were analyzed using descriptive and inferential statistical tools. The analysis were carried out based on the research questions raised. The statistical tools used were the mean and standard deviation to answer the research questions. Where the mean score is above 2.50, this would be rule as agree in explaining the phenomenon, while below 2.50 would be rule as disagree in explaining the situation.

Result

Research Question One: To what extent is does gender influence the level of awareness of AutoCAD Material on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria? **Table one: Mean and Standard Deviation the level of awareness of AutoCAD on Students' Motivation and Achievement**

	N	Min.	Max.	Mean	STD
1 I am aware of the availability of AutoCAD for technical drawing education in Plateau State	242	1	4	2.39	0.714
2 I am aware of the impact of AutoCAD on student motivation in technical drawing	242	1	4	2.16	0.709
3 I feel informed on the relationship between AutoCAD and student motivation in technical drawing	242	1	4	3.01	0.706
4 Educators are aware of the benefits of AutoCAD in technical drawing education	242	1	4	3.19	0.651
5 AutoCAD influence students' motivation in technical	242	1	4	2.06	0.901
6 AutoCAD impact students' achievement in technical drawing	242	1	4	2.71	0.597
7 I have always interested in technical drawing AutoCAD	242	1	4	2.59	0.556
8 AutoCAD makes learning technical drawing Interactive	242	1	4	2.61	0.719
Grand mean				2.59	

Table One shows that the following questionnaire items 5, 4 and 2 have mean scores less than the criterion mean of 2.50 with mean scores and standard deviation values in ascending order of 2.06 (0.907), 2.16(0.709) and 2.39(0.714). The following questionnaire items 4, 3, 6, 8, and 7 in have a mean score greater than the criterion mean of 2.50 with mean and standard deviation scores in a descending order of 3.19(0.651), 3.01(0.706), 2.71(0.597), 2.61(0.719) and 2.59(0.556). The grand mean score for Table One is 2.59 which is higher than the decision rule of 2.50. Therefore, we agree to the phenomena that gender influence the level of awareness of AutoCAD Material on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria.

Research Question Two: To what extent does teacher experience influence the level of utilisation of AutoCAD on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria? **Table Two: Mean and Standard Deviation of utilisation of AutoCAD on Students' Motivation and Achievement**

		N	Min.	Max.	Mean	STD
9	I often utilize AutoCAD to enhance motivation	242	1	4	2.22	0.626
10	I often utilize AutoCAD to enhance achievement	242	1	4	3.13	0.879
11	I incorporate AutoCAD to support achievement in technical drawing	242	1	4	3.03	0.910
12	The overall utilisation of AutoCAD in technical drawing education is high	242	1	4	2.81	1.901
13	AutoCAD are consistently integrated into the technical drawing curriculum	242	1	4	3.18	0.711
14	The is implementation of AutoCAD to address div styles in technical drawing classes	242	1	4	3.20	0.619
15	Educators utilise AutoCAD to encourage collaborative learning in technical drawing	242	1	4	2.08	0.824
16	Educators use AutoCAD to personalise learning experiences in technical drawing for individual students	242	1	4	3.12	0.891
	Grand Mean				2.59	

Table Two shows that the following questionnaire items 15 and 9 have mean scores less than the criterion mean of 2.50 with mean scores and standard deviation values in ascending order of 2.08 (0.824) and 2.22(0.626) respectively. The following questionnaire items 14, 13, 10, 16, 12, and 11 have a mean score greater than the criterion mean of 2.50 with mean and standard deviation scores of 3.20(0.619), 3.18(0.711), 3.13(0.879), 3.12 (0.891), 2.03(0.910) and 2.81(1.901). The grand mean score for Table Two is 2.59 which is higher than the decision rule of 2.50. Therefore, we agree to the phenomena that teacher experience influence the level of utilisation of AutoCAD on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria

Research Question Three: What is the effect of teacher' qualification on the frequency of AutoCAD utilisation on students' motivation and achievements in Technical Drawing in Plateau State, Nigeria? **Table Three: Mean and Standard deviation frequency of AutoCAD utilisation on students' motivation and achievements**

		N	Min.	Max.	Mean	STD
17	AutoCAD are utilised to enhance student motivation	242	1	4	2.81	0.801
18	AutoCAD are utilised to enhance student achievement	242	1	4	2.60	0.419
19	I prefer to use AutoCAD in all my technical drawing class	242	1	4	1.67	0.841
20	AutoCAD should be used in only practical classes in technical drawing	242	1	4	1.99	0.805
21	I make use of AutoCAD for technical drawing at will	242	1	4	1.97	0.901
22	I make use of AutoCAD for technical drawing purposes weekly	242	1	4	2.89	0.717
23	I make use of AutoCAD for technical drawing purposes daily	242	1	4	2.31	0.606
24	I make use of AutoCAD for technical drawing purposes monthly	242	1	4	3.12	0.405
	Grand Mean				2.42	

Table Three shows that the following questionnaire items 18, 20, 19 and 22 have mean scores less than the criterion mean of 2.50 with mean scores and standard deviation values in 1.67 (0.851), 1.97 (0.901), 1.99 (0.805) and 2.31(0.60) respectively. The following questionnaire items 17, 16, 21 and 23 have a mean score greater than the criterion mean of 2.50 with mean and standard deviation scores of 2.60(0.419), 2.81(0.801), 2.89(0.717) and 3.12 (0.891) respectively. The grand mean score for Table Three is 2.42 which is lower than the decision rule of 2.50. Therefore, we agree to the phenomena that teachers' qualification influence the frequency of AutoCAD utilisation on students' motivation and achievements in Technical Drawing in Plateau State, Nigeria

Research Question Four: What are the types of AutoCAD that affect Students' motivation and achievements in Technical Drawing in Plateau State, Nigeria?

Table Four: Mean and Standard deviation AutoCAD that affect Students' motivation and achievements

		N	Min	Max	Mean	STD
25	I make use of Computer-Aided Design (CAD) Software in teaching or learning technical drawing	242	1	4	2.72	.717
26	I make use of Interactive Whiteboards in teaching or learning technical drawing	242	1	4	2.19	.642
27	I make use of 3D Modeling Software in teaching or learning technical drawing	242	1	4	2.45	.828
28	I make use of online Video Lectures and Demonstrations in teaching or learning technical drawing	242	1	4	3.09	.815
29	I make use of Digital Projectors in teaching or learning technical drawing	242	1	4	2.56	.911
30	I make use of online learning management systems (LMS) to teach or learn Technical Drawing.	242	1	4	2.83	.701
Grand Mean					2.70	

Table Four shows that the following questionnaire item have mean scores less than the criterion mean of 2.50 with mean scores and standard deviation values in 1.67 (0.851), 1.97 (0.901), 1.99 (0.805) and 2.31(0.60) respectively. The following questionnaire items 17, 16, 21 and 23 have a mean score greater than the criterion mean of 2.50 with mean and standard deviation scores of 2.60(0.419), 2.81(0.801, 2.89(0.717) and 3.12 (0.891) respectively. The grand mean score for Table Four is 2.70 which is higher than the decision rule of 2.50. Therefore, we agree to the phenomena that the types of AutoCAD that affect Students' motivation and achievements in Technical Drawing in Plateau State, Nigeria

Discussion of Findings

The discussion examines the statistical findings from a study investigating various factors influencing students' performance and motivation in technical drawing, particularly focusing on the utilization of AutoCAD software in Plateau State, Nigeria. With 242 respondents, the study used a modified four-point Likert scale to measure responses, yielding a grand mean and standard deviation for each research question and hypothesis. The analysis highlighted significant insights into how gender, teacher experience, and educational qualifications impact students' awareness, motivation, and achievement. These findings align with existing literature, emphasizing the necessity of equipping schools with modern instructional materials and ensuring that professionally qualified teachers are recruited for technical subjects.

N shows the number of respondents that responded to a particular item and is equal to 242. Min. shows the least observed value on a modified four-point Likert scale by the respondents to a particular item and is equal to 1. Max. depicts the maximum observed value on a modified four-point Likert scale by the respondents to a particular item and is equal to 4. The mean is a measure of central tendency, the average value of the accounting software

SPSS 26 usage the grand mean for research question 1 was 2.59 which is greater than the criterion mean of 2.50 hence, following our decision rule, we agree. With a standard deviation range <1 depicting that the respondents' opinions were not far from one another. Furthermore, research question two has an average standard deviation range <1 , depicting that the respondents' opinions were not far from one another. This is in support of the findings of Dawudo et al., (2023) revealing that drawing instruments and materials were not sufficiently available, and the few available ones were not utilized properly for enhancing effective teaching of Technical Drawing in senior secondary schools in Education District V zone III in Lagos State.

Research question three had a grand mean and standard deviation range of 2.42 and less <1 respectively. Following our decision rule of 2.50, we disagree and since the standard deviation range depicts that the opinions of the respondents are not far from each other. Research question Four had a grand mean of 2.70 which is above the 2.50 criterion mean, therefore following our decision rule, we agree. This is in support of the findings of Siminialayi and Fomsi (2018) and Oke & Olakotan, (2019) revealing 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.

Summary of Findings

This study aimed to investigate the Influence of AutoCAD on Students' Motivation and Achievement in Technical Drawing in Plateau State, Nigeria. The design for the study was a descriptive survey research design. A total of 242 respondents were selected as the sample for the study. The instrument that will be used for data collection will be a self-constructed questionnaire titled "Students' Perception of AutoCAD Questionnaire (SPAQ)". A pilot study was conducted in the selected schools and was used to determine the reliability coefficient. The four research questions were analyzed using mean and standard deviation.

The results of the study indicated that:

1. Teachers and students have an awareness of AutoCAD on Students' Motivation and Achievement in teaching and learning Technical Drawing.
2. Teacher and students make use of AutoCAD on Students Motivation and Achievement in teaching and learning Technical Drawing.
3. Teachers and students frequently use AutoCAD on students' motivation and achievements in teaching and learning Technical Drawing.
4. several types of AutoCAD affect Students' motivation and achievements in Technical Drawing in Plateau State, Nigeria

Conclusion

Based on the findings and discussion of this study, the following conclusions were made that students' gender affects the level of awareness of AutoCAD and Students' Motivation in Technical Drawing, teacher's experience influences the level of utilization of AutoCAD and Students' Achievement in Technical Drawing. Furthermore, teacher qualification does not influence the frequent utilization of AutoCAD utilization and Students' motivation in Technical Drawing and student classes influence the types of AutoCAD and Students' achievements in Technical Drawing

Recommendations

Based on the findings and conclusion of the research the following recommendations are proposed:

1. Implement training programs for teachers to enhance the effective use of AutoCAD: Develop comprehensive professional development initiatives that focus on equipping teachers with the skills and knowledge necessary to effectively integrate AutoCAD into their Technical Drawing classes.
2. Promote gender-sensitive approaches to increase awareness and motivation among all students: Design and implement strategies that address gender disparities in awareness and motivation related to AutoCAD, ensuring that both male and female students are equally encouraged and supported in their use.
3. Provide diverse AutoCAD tailored to different class levels: Create and distribute a variety of AutoCAD that are specifically designed to meet the needs and comprehension levels of students at different stages of their education, enhancing their engagement and achievement.
4. Focus on practical experience over qualifications in professional development for teachers: Prioritize hands-on training and practical experience in professional development programs for teachers, recognizing that actual teaching experience with AutoCAD is more impactful than formal qualifications alone

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