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Utilization of AutoCAD for Teaching and Learning of Technical Drawing in Oyo and Ogun State Universities of Education

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Abstract
Preliminary observations of Nigerian universities indicate that a substantial proportion of lecturers and students continue to depend on conventional lecture-based approaches, with limited integration of technologies. In response to this situation, this study examined the extent to which AutoCAD is utilized in the teaching and learning of technical drawing in Universities of Education. The investigation was guided by two research questions and two null hypotheses were formulated and tested at the 0.05 level of significance. Survey research design was employed for the study. The population consisted of 28-lecturers and 105-students from the selected Universities of Education in Oyo and Ogun States. Given the manageable size of the population, a total enumeration technique was adopted. Data were collected using a structured questionnaire designed on a four-point modified Likert scale. Content validity of the instrument was established by 3-research experts, while a pilot test was conducted to determine its reliability. Reliability coefficients of 0.93 for lecturers and 0.91 for students were obtained using the Cronbach Alpha method. Descriptive statistics, including percentages, mean and standard deviation, were used to analyze the research questions, moreso t-test was utilized for hypotheses testing at 0.05 significance level. It was revealed that the use of AutoCAD for teaching and learning technical drawing by both lecturers and students was generally low. Furthermore, no statistically significant difference was found between the mean ratings of federal and state lecturers and students regarding their utilization of AutoCAD for instructional purposes. Based on these findings, it was recommended that academic departments should regularly organize workshops and retraining programmes to enhance technology education lecturers' competence in the use of AutoCAD. Additionally, lecturers should intensify efforts to promote active students participation through increased integration of AutoCAD in teaching process.

Keywords: AutoCAD, Teaching and learning, Technical drawing, University of Education, Utilization.

1. Introduction

In the contemporary global landscape, characterized by rapid technological advancement and constantly evolving labour market demands, educational systems are increasingly required to adapt in order to remain relevant. The expectations placed on graduates in terms of employability skills and functional literacy are no longer static; rather, they are continually being redefined by technological progress and societal change. Traditionally, education has served the dual purpose of preserving and transmitting a society's cultural values. In line with these objectives, educational practices must continuously evolve to reflect emerging realities. Within this context, Information and Communication Technology (ICT) has assumed a central role in modern educational curricula. Its integration into teaching and learning processes is aimed at preparing students to effectively navigate and respond to present and future technological challenges. The advent of ICT has fundamentally transformed how information is generated, accessed, processed, stored, retrieved, and shared, both within organizations and across global networks. These transformations cut across multiple formats, including visual, audio, textual, numerical and digitally encoded data, thereby redefining the scope and efficiency of information management in the digital age.

In Nigeria, ICT has emerged as a significant driver of educational reform, fostering a transition from traditional, teacher-centred instructional practices to more innovative, learner-centred, and technology-driven approaches. This shift represents a departure from the conventional model in which teachers dominate classroom activities through one-way information delivery, often with minimal learner engagement. As noted by Ajayi (2018) the integration of ICT into teaching practices enhances instructional effectiveness by promoting active learner participation and expanding instructional possibilities beyond the constraints of the traditional classroom. Through the use of digital tools and resources, teachers are better

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positioned to create interactive learning environments that encourage exploration, experimentation and critical thinking.

The growing prominence of ICT in education underscores a broader transformation in instructional delivery, particularly in skill-oriented disciplines such as technical drawing. The increasing reliance on digital technologies for teaching and learning signals a gradual decline in the relevance of instructional approaches that exclude ICT competencies. Consequently, the era in which lecturers could effectively teach technical drawing without adequate ICT skills is steadily giving way to a new paradigm that emphasizes technological proficiency as an essential component of effective teaching and learning. Technical drawing constitutes a fundamental course of study within technology and engineering-oriented disciplines. It is widely recognized as a specialized form of graphical communication that facilitates the interpretation and representation of industrial, technological and vocational concepts, while simultaneously promoting the development of learners' manipulative abilities and higher-order cognitive skills. In support of this view, Akanwa and Amodu (2020) described technical drawing as an effective medium through which ideas and concepts are accurately and concisely communicated in order to transform abstract thoughts into tangible outcomes. Similarly, Kudu et al. (2024) emphasized that technical drawing becomes indispensable in situations where verbal explanations alone are insufficient to convey the required level of detail. Consequently, when properly understood and applied, technical drawing serves as a versatile communication tool capable of simplifying complex engineering and technological tasks.

The objectives of technical drawing, as articulated by the Nigerian Educational Research and Development Council (NERDC, 2007) highlight its strategic role in technological education. These objectives include: providing learners with a sound understanding of both theoretical and applied principles related to the use of information and communication technology for effective visual communication in construction and production industries; introducing students to contemporary drawing studio practices; establishing a solid foundation for technological advancement and further studies in building and engineering fields; and fostering the stimulation, development and enhancement of entrepreneurial skills across various areas of drawing studio practice. Achieving these objectives necessitates the adoption of effective and efficient instructional strategies and technological tools capable of addressing modern demands such as AutoCAD.

AutoCAD is an Information and Communication Technology (ICT) tool that enhances communication of ideas and technical information through digital drawing. Other alternative ICT digital drawing tools includes, SketchUp, Revit and Fusion 360. However, AutoCAD is more preferable because it is an industry-standard software known for its high precision, versatility, wide compatibility and strong support across many technical disciplines. AutoCAD is a computer-aided design and drafting software developed to enable the creation, modification and visualization of objects on a graphical display interface. Its flexibility and interactive features allow users to produce precise and adaptable drawings with a high level of accuracy. Compared with traditional instructional methods such as manual drawing using pencil and paper, AutoCAD offers significant advantages in terms of speed, clarity, neatness and precision. The software employs basic geometric elements, including lines, polylines, circles, arcs and text, as core components for the efficient development and editing of two-dimensional and three-dimensional digital designs (Asilokun, 2016; Kudu et al., 2024; Oyebode, 2015). In educational contexts, AutoCAD is widely applicable for producing architectural, mechanical and electrical drawings among other.

Utilisation, in this context, refers to the effective and appropriate application of both tangible and intangible resources such as AutoCAD for intended purposes (Okolocha & Nwadiani, 2015). In Nigeria, concerted efforts have been made by government authorities at both federal and state levels, often in collaboration with non-governmental organizations (NGOs), to promote the integration and use of AutoCAD within colleges and universities. Despite substantial financial investments in ICT infrastructure and resources, the rate at which modern facilities required for effective technical drawing instruction are acquired and deployed in universities remains relatively slow. This situation persists even as contemporary educational reforms increasingly demand the integration of digital technologies into instructional delivery processes.

Empirical studies have consistently demonstrated the instructional benefits associated with the use of AutoCAD. Recent findings by Kudu et al. (2024) and Oyebode et al. (2015) indicated that AutoCAD significantly enhances students' learning outcomes, promotes deeper comprehension of technical drawing principles and equips learners with relevant skills for future professional practice. Furthermore, studies conducted by Odo (2019) as well as Aysen and Kemal (2016) identified AutoCAD as an innovative instructional strategy that aligns with the evolving requirements of engineering-related disciplines. Hence, in light of the above scenarios inspired the researchers' curiosity to assess the utilization of AutoCAD for teaching and learning of technical drawing in Oyo and Ogun State Universities.

2. Problem Statement

Technology education lecturers continue to depend predominantly on demonstration-based approaches with limited adoption of ICT tools such as AutoCAD in instructional delivery. It has been observed that AutoCAD software is either insufficiently provided or

where available, grossly underutilized. This situation reflects a growing concern that undergraduates in technology education programmes are not adequately keeping pace with global advancements in ICT integration within education.

Empirical studies have consistently demonstrated that AutoCAD possesses the flexibility and instructional potential required to promote a deeper and more meaningful understanding of technical drawing principles. In view of the disparity between the proven benefits of AutoCAD and its apparent limited classroom application, there exists a clear gap that warrants systematic investigation. Consequently, these circumstances motivated the researchers to examine the extent to which AutoCAD is utilized in the instructional delivery of technical drawing in universities.

3. Purpose of the Study

The primary objective of this study was to investigate the level of utilization of AutoCAD in the teaching and learning of technical drawing in universities in Oyo and Ogun States. Specifically, the study aimed to:

1. Determine the extent to which lecturers employ AutoCAD in the instruction of technical drawing in universities of education in Oyo and Ogun States

2. Evaluate the degree to which students make use of AutoCAD in the learning of technical drawing in universities of education in Oyo and Ogun States.

4. Research Questions

The study was guided by the following research questions:

1. To what extent do lecturers utilize AutoCAD in teaching technical drawing in universities of education in Oyo and Ogun States?

2. To what extent do students utilize AutoCAD in learning technical drawing in universities of education in Oyo and Ogun States?

5. Hypotheses

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

1. There is no statistically significant difference between the mean ratings of lecturers in federal and state universities of education regarding the utilization of AutoCAD for teaching technical drawing.

2. There is no statistically significant difference between the mean ratings of undergraduates in federal and state universities of education concerning the utilization of AutoCAD in learning technical drawing.

6. Methodology

6.1 Design of the Study

This investigation adopted a descriptive survey research design.

6.2 Population of the Study

The population for the study consisted of 28 lecturers and 105 (300 level) undergraduate students enrolled in the Department of Technology Education during the 2024/2025 session in universities within Oyo and Ogun States. Detailed information on the population distribution is presented in Tables 1 and 2.

6.3 Sample and Sampling Technique

The study adopted a total enumeration approach, in which the entire population of interest was included as the study sample. Specifically, the population consisted of 28 lecturers and 105 undergraduate students enrolled in technology education programmes within Universities of Education in Oyo and Ogun States. This sampling strategy was deemed appropriate because the population was relatively small and manageable, allowing the researchers to collect comprehensive data from all members without the need for additional sampling procedures.

6.4 Instrumentation

Data for this study were gathered through a structured questionnaire designed by the researchers, which was titled *Utilization of AutoCAD for Teaching and Learning of Technical Drawing Questionnaire (UATLTDQ)*. The instrument was divided into two main sections to ensure systematic data collection. Section A focused on capturing demographic information about the respondents, including variables such as the type of institution attended (federal or state) and the respondent's status (lecturer or student). Section B contained items directly related to the objectives of the study, aimed at eliciting respondents' perceptions of how AutoCAD is employed in the teaching and learning of technical drawing. These items were presented using a four-point modified Likert scale, with response options ranging from Very High Extent (4), High Extent (3), Low Extent (2), to Very Low Extent (1). This scale allowed for a nuanced measurement of respondents' engagement and familiarity with AutoCAD.

6.5 Validity of the Instrument

To ensure the instrument accurately measured what it was intended to assess, the questionnaire underwent both face and content validation. Three experts from the Department of Vocational and Technical Education, Faculty of Education, University of Benin, Benin City, evaluated the items for clarity, relevance and adequacy in capturing the constructs under investigation. Their professional feedback was carefully reviewed and recommended revisions were incorporated into the final version of the questionnaire. This validation process helped to enhance the credibility and appropriateness of the instrument for the study.

6.6 Reliability of the Instrument

The reliability of the questionnaire was established

Table 1: Distribution of Building Technology Lecturers across Selected Institutions

Name of Institution	Number of Lecturers
Emmanuel Alayande University of Education, Oyo	17
Tai Solarin Federal University of Education, Ijagun	11
Total	46

Source: HOD's offices from the Universities (2025)

Table 2: Distribution of Building Technology Students across Selected Institutions

Name of Institution	Number of Students
Emmanuel Alayande University of Education, Oyo	55
Tai Solarin Federal University of Education, Ijagun	50
Total	105

Source: HOD's offices from the Universities (2025)

Table 3: School Type distribution of respondents (Lecturers) in percentage

School Type	Frequency	Percentage
Federal	11	39.3
State	17	60.7
Total	28	100.0

Source: Field Work (2025)

Table 4: School Type distribution of respondents (Students) in percentage

School Type	Frequency	Percentage
Federal	50	47.6
State	55	52.4
Total	105	100.0

Source: Field Work (2025)

through a pilot study conducted among ten lecturers and ten students from the Department of Technical Education, University of Lagos, who were not part of the main study. Responses collected during the pilot test were analyzed using the Cronbach Alpha reliability method to determine the internal consistency of the instrument. The results indicated a reliability coefficient of 0.93 for the lecturers' questionnaire and 0.91 for the students' questionnaire. These high reliability values confirmed that the instrument was consistently measuring the intended variables and was suitable for use in the main study.

6.7 Method of Data Collection

The administration of the questionnaire was carried out by the researchers with the assistance of two research assistants. Prior to data collection, the assistants were adequately briefed on the purpose, objectives and administration procedures of the research instrument. The questionnaires were distributed and retrieved on the same day, resulting in a complete retrieval rate of 100 percent.

6.8 Method of Data Analysis

The data obtained from the study participants were systematically analyzed using a combination of descriptive and inferential statistical methods to ensure comprehensive interpretation. Descriptive statistics, specifically the mean ($\bar{X}$) and standard deviation, were applied to summarize and interpret the responses to the research questions, providing insights into the central tendencies and variability of lecturers' and students' utilization of AutoCAD for teaching and learning technical drawing.

For the purpose of hypothesis testing, inferential statistics were employed, with the independent-samples t-test used to determine whether there were significant differences between federal and state university respondents regarding their engagement with AutoCAD. The level of significance was set at 0.05, which served as the criterion for evaluating the statistical reliability of the observed differences. Decisions regarding the null hypotheses were based on comparing the calculated t-values against the critical t-values at the specified degree of freedom, ensuring that conclusions drawn reflected both the magnitude and consistency of the data. This combined analytical approach allowed for both a descriptive understanding of usage patterns and a rigorous inferential assessment of potential differences between respondent groups.

7. Results and Data Presentation

7.1 Respondents Profile

The demographic attributes of the respondents were

Table 5: Lecturers' level of autocad application in teaching technical drawing

S/N	AutoCAD Utilization Indicators	Mean ($\bar{X}$)	SD	Interpretation
1	Ability to launch and operate the AutoCAD software	2.96	0.87	High Extent
2	Application of the line command for creating linear drawings	2.58	0.89	High Extent
3	Use of modification tools for editing existing drawings	1.51	0.84	Low Extent
4	Application of chamfer and fillet commands to refine edges of geometric forms	1.80	0.85	Low Extent
5	Creation of basic geometric shapes and objects using AutoCAD	2.00	0.86	Low Extent
6	Use of AutoCAD in producing plumbing detail drawings	1.74	0.87	Low Extent
7	Application of AutoCAD for architectural or building drawing construction	1.61	0.89	Low Extent
8	Utilization of AutoCAD for electrical installation drawings	1.23	0.85	Low Extent
	Overall Mean	**1.92**	**0.86**	**Low Extent**

Source: Field Survey (2025)

Table 6: Mean scores and standard deviations of students' application of autocad in learning technical drawing

S/N	Indicators of AutoCAD Use by Students	Mean ($\bar{X}$)	SD	Interpretation
1	Ability to open and run the AutoCAD software	3.60	0.73	High Extent
2	Use of the line command for creating straight-line drawings	3.53	0.75	High Extent
3	Application of modification tools for editing drawings	2.44	0.76	High Extent
4	Use of chamfer and fillet commands to smooth edges of geometric figures	1.78	0.73	Low Extent
5	Creation of basic geometric forms and objects using AutoCAD	1.24	0.73	Low Extent
6	Utilization of AutoCAD for plumbing detail drawings	1.08	0.75	Low Extent
7	Application of AutoCAD in architectural or building drawing construction	1.87	0.78	Low Extent
8	Use of AutoCAD for electrical installation drawings	1.11	0.75	Low Extent
	Overall Mean	**2.08**	**0.74**	**Low Extent**

Source: Field Survey (2025)

examined using frequency distribution and simple percentage analysis, as presented in the Table 3.

Findings presented in Table 3 show the percentage distribution of lecturer respondents based on institutional ownership. The results indicate that 11 respondents, representing 39.3 percent, were drawn from federal universities, while 17 respondents, accounting for 60.7 percent, were from state universities. This distribution demonstrates that lecturers from state universities constituted a higher proportion of the respondents compared to those from federal universities.

Similarly, the data in Table 4 present the percentage distribution of student respondents by institution type. The results reveal that 50 students, corresponding to 47.6 percent, were from federal universities, whereas 55 students, representing 52.4 percent, were from state universities. This outcome indicates that student respondents from state universities slightly outnumbered their counterparts from federal universities.

7.2 Research Questions

7.2.1 Research Question One

To what extent do lecturers utilize AutoCAD for teaching technical drawing in Oyo and Ogun State Universities of Education?

The results presented in Table 5 illustrate lecturers' responses across eight indicators measuring the level of AutoCAD utilization in the teaching of technical drawing. The mean scores ranged between 1.23 and 2.96. Among the items, the highest mean score of 2.96 was recorded for the ability to launch and operate the AutoCAD application, suggesting a relatively high level of basic software familiarity among lecturers. Similarly, the use of the line command for drawing construction also recorded a high extent of utilization with a mean score of 2.58. Conversely, more advanced applications of AutoCAD recorded notably lower mean scores. In particular, the use of AutoCAD for electrical drawing tasks yielded the lowest mean value of 1.23, indicating minimal application in this area. Other aspects such as drawing modification, edge smoothing using chamfer and fillet tools, construction of basic objects, and the production of plumbing and building drawings were also rated at a low extent. The overall mean score of 1.92 reveals that, on the aggregate, lecturers' utilization of AutoCAD for teaching technical drawing was generally low.

7.2.2 Research Question Two

To what extent do students utilize AutoCAD for learning technical drawing in Oyo and Ogun State Universities of Education?

The data presented in Table 6 summarize students' responses across eight indicators measuring the extent of AutoCAD utilization in learning technical drawing.

Table 7: t-test comparison of federal and state university lecturers' utilization of AutoCAD

Variables	N	Mean ($\bar{X}$)	SD	Df	t-cal	t-critical	p-value	Interpretation
Federal University Lecturers	11	2.33	0.60	4	1.07	1.96	0.28	Not Significant
State University Lecturers	17	1.94	0.70					

Source: Field Survey (2025)

Table 8: t-test comparison of federal and state university students' utilization of AutoCAD

Variables	N	Mean ($\bar{X}$)	SD	Df	t-cal	t-critical	p-value	Interpretation
Federal University Students	50	1.91	0.71	205	1.68	1.96	0.09	Not Significant
State University Students	55	2.15	0.61					

Source: Field Survey (2025)

The mean scores recorded for the items ranged from 1.08 to 3.60. The highest mean score of 3.60 was observed for students' ability to launch and operate the AutoCAD application, indicating a high level of familiarity with basic software operation. Similarly, the use of the line command and drawing modification tools recorded relatively high mean values, reflecting moderate engagement with fundamental AutoCAD functions. In contrast, the application of more advanced AutoCAD features such as edge refinement using chamfer and fillet tools, construction of basic shapes and the development of plumbing, building, and electrical drawings was rated at a low extent. The overall mean score of 2.08 suggests that, on the whole, undergraduate students' utilization of AutoCAD for learning technical drawing in Universities of Education in Oyo and Ogun States was generally low. The standard deviation values, which ranged from 0.73 to 0.78, indicate a high level of consistency in respondents' perceptions, as there was minimal variation in their responses across the measured items.

7.3 Hypotheses Testing

7.3.1 Hypotheses 1

There is no statistically significant difference between the mean ratings of lecturers in federal and state universities of education regarding the utilization of AutoCAD for teaching technical drawing.

The results presented in Table 7 indicate a comparison between federal and state university lecturers regarding their use of AutoCAD and other ICT tools in teaching technical drawing within Universities in Oyo and Ogun States. The analysis revealed that federal university lecturers had a mean score of 2.33, while their state university counterparts recorded a mean score of 1.94. The computed t-value of 1.07 with df=44 and p(0.28)> 0.05, thus hypothesis accepted.

7.3.2 Hypotheses 2

There is no statistically significant difference between the mean ratings of undergraduates in federal and state universities of education concerning the utilization of AutoCAD in learning technical drawing.

Table 8 presents a comparison of federal and state university students in terms of their engagement with AutoCAD for learning technical drawing in universities of education in Oyo and Ogun States. The analysis indicates that federal university students had a mean score of 1.91, whereas state university students recorded a slightly higher mean of 2.15. The calculated t-value of 1.68 with 205 degrees of freedom corresponds to a p-value of 0.09, which exceeds the conventional significance level of 0.05. These results suggest that there is no statistically significant difference between federal and state university students regarding their utilization of AutoCAD for learning technical drawing. Consequently, the second null hypothesis, which posited no significant difference in AutoCAD usage between federal and state university students, is accepted. This outcome implies that students' engagement with AutoCAD in technical drawing courses is largely comparable across federal and state universities in the studied region.

8. Discussion of Findings

Findings revealed that lecturers utilize AutoCAD only to a limited degree. This outcome contrasts with previous studies by Akanwa and Amodu (2020), Asilokun (2016), Kudu et al. (2024) and Oyebode et al. (2015) who reported that AutoCAD has been widely adopted worldwide to replace traditional methods of technical drawing and graphic design in educational institutions and industrial settings. These earlier studies highlighted the software's functionality and flexibility in enhancing students' comprehension of technical drawing principles and equipping them with skills relevant for future careers.

Similarly, findings indicated that students' use of AutoCAD remains limited. This result differs from Kudu et al. (2024) who observed that AutoCAD is generally embraced by university students enrolled in technical education programmes. Nevertheless, the finding aligns with observations by Odo (2019), who emphasized that AutoCAD provides students with the flexibility to create and interpret complex drawings effectively. Furthermore, Aysen and Kemal (2016) noted that AutoCAD represents an innovative instructional strategy that aligns with the evolving demands of engineering-related disciplines.

The study also found no statistically significant differences between federal and state university lecturers and students in terms of AutoCAD utilization for instructional delivery of technical drawing in Oyo and Ogun State universities. This uniformity may be

linked to the inadequate provision of resources for technology education programmes, as highlighted by Akinlabi and Adeagbo (2018) which affects both federal and state institutions similarly.

9. Conclusion

It can be affirmed that both lecturers and students in technology education programmes underutilize AutoCAD for instructional delivery in technical drawing. Despite this low utilization, AutoCAD offers substantial benefits for both instructors and learners, making its adoption a critical step toward modernizing technology education and integrating technology effectively into instructional practices.

10. Recommendations

1. Departments should organize regular seminars, workshops and retraining programmes to enhance technology education lecturers' competence in utilizing AutoCAD for teaching technical drawing.
2. Lecturers should implement strategies that actively engage students in the use of AutoCAD, thereby increasing practical exposure and improving learning outcomes in technical drawing courses within universities in Oyo and Ogun States.

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