

Utilization of Autocad as Innovative Teaching Strategy for Technical Drawing Students in Colleges of Education in North Central Nigeria

¹Dr. Umar B. Kudu., ² Dr. Engr Abdullahi M. Tyabo., ³Dr. Danjuma B. Beji & ⁴Dr. Chado M. I. Doko.

¹Department of Technical Drawing
^{2 & 3} Department Building Technology
⁴Department of Metalwork
School of Technical Education
Niger State College of Education, Minna

Abstract

The study was designed to determine the utilization of AutoCAD as innovative teaching strategy for technical drawing students in colleges of education in North Central Nigeria. Three research questions guided the study. A descriptive survey research design was adopted for the study. The population for the study was 476 comprising 22 technical drawing lecturers and 454 technical drawing final year students in all colleges of education in North Central Nigeria. There was no sampling for the study because the population was manageable. The instrument for data collection was titled: Utilization of AutoCAD as Innovative Teaching Strategy for Technical Drawing Students Questionnaire (UAITSTDSQ). The UAITSTDSQ was subjected to face validation by three experts. One from the Department of Architecture, Federal University of Technology Minna, one expert from the Department of Architecture, Federal Polytechnic, Bida and one registered member in Nigerian Institute of Building (NIOB) from Ministry of Works and Infrastructure Niger State, Minna. The instrument was developed by the researchers using 4 points Likert Scale of Strongly Agreed (4), Agreed (3), Disagreed (2) and Strongly Disagreed (1). Cronbach Alpha method was used to determine the reliability coefficient of the instrument which was 0.82. The findings of the study revealed among others that utilization of AutoCAD for teaching technical drawing students in colleges of education in North Central Nigeria are very effective. Based on the findings it was recommended among others that: Government at all level should provide adequate facilities such as regular supply of electricity, functional drawing studio, textbook and other learning materials to training institutions and ensure that students have access to AutoCAD software, either through institutional licenses or by providing affordable options for individual purchase. This will enable students to practice outside class and develop proficiency with the software.

Key words: AutoCAD, Teaching strategy and Technical Drawing

Date of Submission: 03-10-2024

Date of Acceptance: 16-10-2024

I. Introduction

Technical Education is the acquisition of knowledge and application of skill and attitude. As stipulated in the National Policy on Education (FGN, 2014), the goal of technical education is to provide trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technical levels. This can be achieved through understanding of technical drawing.

Technical drawing is defined as a means of language for communicating shape, size, position and proportion of ideas. Akanwa et al. (2020) defined technical drawing as a means of clearly and concisely communication of all the information necessary to transform an idea or a concept into reality which also contains dimensions, notes, and specifications. Technical drawing is a vital skill for engineers; architectures designers, and other professional who need to communicate their ideas and designs clearly and accurately. The purpose of technical drawing is to convey all the information that will allow manufacturers to produce a component. However, technical drawing, often considered the language of engineers and designers, demands a blend of artistic creativity and precise technical skills. As such, it requires an ideal context for exploring innovative teaching methods that leverage modern technology, or integration of digital technologies, pedagogical best practices, such as the use of computer. The age of computers brought about a significant change in the fields of technical drawing and also to all other field related to drawings. According to Oyeyinka

et al. (2021) what makes computer invaluable tools is the ability to store data, perform logic functions and make mathematical computation such as AutoCAD.

AutoCAD is computer aided design software that allows a designer to draw and edit digital 2D and 3D designs more quickly and easily than traditional pencil and paper drawings. The files can also be easily saved and stored in storage media tools such as flash CD plates and the cloud among others, so that they can be accessed anywhere at any time. AutoCAD is primarily used to create details of 2D and 3D drawings, plans, and models in a variety of industries such as architecture, engineering, manufacturing and construction. However, technical drawing is one of the compulsory subjects offered by some colleges of education students in tertiary institution in Nigeria.

Tertiary education is the education given after senior secondary education in institutions such as universities, colleges of education, polytechnics, monotronics and enterprise schools. As mention in the National Policy on Education (FGN, 2009), the goals of tertiary education shall be to: contribute to national development through high level manpower training; develop the intellectual capability of individuals to understand and appreciate their local and external environments. Hence, in line with the TETFund's objectives of supporting and promoting problem solving through research and development, the study intends to determine the innovative teaching skills for technical drawing students in colleges of education in North Central Nigeria.

Statement of the Problem

Colleges of education in North Central Nigeria face several significant challenges in effective teaching of technical drawing to the NCE Technical Education programme. These issues hinder the quality of education provided to technical education students and, consequently, impact on the broader educational system. Technical drawing skills are fundamental component of technical education, serving as a bridge between conceptualization and real-world application in fields such as engineering, architecture, and design. The goals of technical drawing according to Akanwa et al. (2020) are to contribute to infrastructural development projects, Innovate and design solutions to local challenges and Pursue higher education in technical fields. Unfortunately, these goals are not achieved due to traditional or poor teaching methods and outdated teaching facilities, which led to poor performance of students in technical drawing. These challenges and other necessitate the study: utilization of AutoCAD as innovative teaching strategy for technical drawing students in colleges of education in North Central Nigeria

Purpose of the Study

The major purpose of this study is to determine the utilization of AutoCAD as innovative teaching strategy for technical drawing students in colleges of education in North Central Nigeria. Specifically, the study sought to determine

1. The effects of utilization of AutoCAD for teaching technical drawing students in colleges of education in North Central Nigeria
2. The challenges of using AutoCAD as teaching strategy for technical drawing students in colleges of education in North Central Nigeria.
3. The strategies to improve effective use of AutoCAD for technical drawing students in colleges of education in North Central Nigeria

1.5 Research Questions

The following research questions were posed to guide the study.

1. What are the effects of utilization of AutoCAD for teaching technical drawing students in colleges of education in North Central Nigeria?
2. What are the challenges of using AutoCAD as teaching strategy for technical drawing students in colleges of education in North Central Nigeria?
3. What are the strategies to improve effective use of AutoCAD for technical drawing students in colleges of education in North Central Nigeria?

II. Methodology

A survey design was adopted for the study. The study was conducted in North Central Nigeria. The population for the study was 476 comprising 22 technical drawing lecturers and 454 technical drawing final year students in all colleges of education in North Central Nigeria. There was no sampling for the study because the population was manageable. The instrument for data collection was titled: Utilization of AutoCAD as Innovative Teaching Strategy for Technical Drawing Students Questionnaire (UAITSTDSQ). The UAITSTDSQ was subjected to face validation by three experts. One from the Department of Architecture, Federal University of Technology Minna, one expert from the Department of Architecture, Federal Polytechnic, Bida and one registered member in Nigerian Institute of Building (NIOB) from Ministry of Works and Infrastructure Niger

State, Minna. The instrument was developed by the researchers using 4 points Likert Scale of Strongly Agreed (4), Agreed (3), Disagreed (2) and Strongly Disagreed (1). Cronbach Alpha method was used to determine the reliability coefficient of the instrument which was 0.82. The questionnaire was administered directly to the respondents by the research assistants and all the four hundred and seventy six (476) copies of questionnaire administered to the respondents were retrieved given return rate of 100%. Data collected were analyzed using mean and standard deviation to answer the research questions. Any items with a mean value of 2.50 or above was regarded as agree, but disagree, if less than the cutoff point of 2.50.

III. RESULTS

Research Question 1: What are the effects of utilization of AutoCAD for teaching technical drawing students in colleges of education in North Central Nigeria?

Table 1: Mean and Standard Deviation of the Respondents on the effects of Utilization of AutoCAD for Teaching Technical Drawing Students in Colleges of Education in North Central Nigeria
N=476

S/N	Items	Mean	SD	Decision
1	Drawing are precise and accurate	3.70	0.63	Agreed
2	Users are familiar with software used in construction industry	3.80	0.52	Agreed
3	Provide users with 2D and 3D drafting	3.30	0.63	Agreed
4	Foster collaboration amongst the students by exchanging ideas	2.70	0.84	Agreed
5	Drawings are enhanced and visualized	3.83	0.61	Agreed
6	Drawings are efficient and faster	3.71	0.64	Agreed
7	Many online material and other resources of information	3.61	0.80	Agreed
8	Improve student's technical and digital skill	3.41	0.71	Agreed
9	AutoCAD enhances critical thinking	3.71	0.63	Agreed
10	Motivate teaching and learning of technical drawing	3.82	0.52	Agreed
11	Improve student's performance and achievement in technical drawing	3.72	3.72	Agreed
12	Curriculum is arranged and taught logically from basic to advanced concepts	3.41	0.72	Agreed
13	Practical exercises are available for users to apply AutoCAD tools to solve drawing problems	3.00	0.81	Agreed
14	Curriculum is aligned with industry standards and practices	3.03	0.74	Agreed
15	AutoCAD can be integrated into various related disciplines or fields such as architecture, engineering, and interior design	3.40	0.44	Agreed

The result presented in Table 1 showed that respondents agreed that utilization of AutoCAD have great effects for teaching technical drawing students in colleges of education in North Central Nigeria. The mean values of the items ranged from 3.00 to 3.85, while standard deviation (SD) ranged from 0.44 – 0.81 indicating that the respondents were closed in their rating.

Research Question 2: What are the challenges of using AutoCAD as teaching strategy for technical drawing students in colleges of education in North Central Nigeria?

Table 2: Mean and Standard Deviation of the Respondents on the Challenges of Using AutoCAD as Teaching Strategy for Technical Drawing Students in Colleges of Education in North Central Nigeria.
N=476

S/N	Items	Mean	SD	Decision
1	Irregular supply of electricity	3.50	0.82	Agreed
2	Inadequacy of AutoCAD facilities for technical drawing	3.07	0.71	Agreed
3	Availability of drawing studio	3.34	0.77	Agreed
4	Functional drawing studio	2.34	0.86	Disagreed
5	Time allotted for technical drawing lecture is not adequate	3.56	0.49	Agreed
6	Inadequate AutoCAD textbooks and other material	3.76	0.48	Agreed
7	Inadequate and experience professional technical drawing	3.31	0.78	Agreed
8	Available technical drawing lecturers are not re-trained to be acquainted with modern AutoCAD facilities	3.87	0.43	Agreed
9	Inadequate fund to maintain the available computer system in drawing studio for practical	3.78	0.65	Agreed
10	High cost of acquisition of AutoCAD facilities	3.02	0.78	Agreed
11	Incompatibility of some software to the hardware	3.67	0.56	Agreed
12	Limited access of license of AutoCAD by students	3.30	0.80	Agreed
13	Resistance to change	3.56	0.74	Agreed

The result presented in Table 2 showed that respondents agreed with the challenges of using AutoCAD as teaching strategy for technical drawing students in colleges of education in North Central Nigeria while only item 4 disagreed. The mean values of the items ranged from 3.02 to 3.87, while standard deviation (SD) ranged from 0.43 – 0.86 indicating that the respondents were closed in their rating.

Research Question 3: What are the strategies to improve effective use of AutoCAD for technical drawing students in colleges of education in North Central Nigeria?

Table 3: Mean and Standard Deviation of the Respondents on the Strategies to Improve Effective Use of AutoCAD for Technical Drawing Students in Colleges of Education in North Central Nigeria.
N=476

S/N	Items	Mean	SD	Decision
1	Provision of AutoCAD facilities	3.80	0.56	Agreed
2	Regular supply of electricity/stand by generator or solar	3.82	0.51	Agreed
3	Provision of functional technical drawing studio	3.70	0.56	Agreed
4	Allocation of extra time for technical drawing lecture	3.91	0.49	Agreed
5	Provision of AutoCAD textbooks and other materials	3.01	0.75	Agreed
6	Provision of adequate and experience technical drawing lecturers with knowledge and skills on AutoCAD	3.76	0.60	Agreed
7	Retraining of technical drawing lecturers on AutoCAD	3.64	0.58	Agreed
8	Provision of adequate fund for maintenance of computers system	3.91	0.61	Agreed
9	Provision of adequate software and hardware	3.70	0.76	Agreed
10	Provision of AutoCAD license to the students and instructors	3.62	0.54	Agreed

The result presented in Table 3 showed that respondents agreed on the strategies to improve effective use of AutoCAD for technical drawing students in colleges of education in North Central Nigeria.. The mean values of the items ranged from 3.01 to 3.91, while standard deviation (SD) ranged from 0.54 – 0.76 indicating that the respondents were closed in their rating.

IV. Discussion of Findings

Data presented in Table 1 provided answers to research question one. The findings revealed that all the 15 items on the effects of utilization of AutoCAD for teaching technical drawing were agreed by respondents. Thus drawing are precise and accurate; users are familiar with software used in construction industry; provide users with 2D and 3D drafting; foster collaboration amongst the students by exchanging ideas; drawings are enhanced and visualized; drawings are efficient and faster; many online material and other resources of information; improve student’s technical and digital skill; AutoCAD enhances critical thinking; motivate teaching and learning of technical drawing; improve student’s performance and achievement in technical drawing; curriculum is arranged and taught logically from basic to advanced concepts; practical exercises are available for users to apply AutoCAD tools to solve drawing problems; curriculum is aligned with industry standards and practices; AutoCAD can be integrated into various related disciplines or fields such as architecture, engineering, and interior design were in line with the findings of Tang et al (2019) on the need for technical drawing students to use AutoCAD in drawing because studies worldwide emphasize the importance of technical drawing skills in various fields, including engineering, architecture and product design. These skills are considered fundamental for innovation and problem-solving. The finding is in consonance with the study of Akanwa et al (2020) which explained that a common theme in the literature is the call for the integration of technology into technical drawing education. This includes the use of Computer-Aided Design (CAD) software, 3D modeling tools, and digital projectors. Research suggests that technology-enhanced instruction which can improve students understanding and enthusiasm for the subject

Data presented in Table 2 provided answers to research question two. The findings revealed that 12 out of 13 items were identified as the strategies for improving effective use of AutoCAD for technical drawing students which includes: irregular supply of electricity; inadequacy of AutoCAD facilities for technical drawing; availability of drawing studio; time allotted for technical drawing lecture is not adequate; Inadequate AutoCAD textbooks and other material; inadequate and experience professional technical drawing; available technical drawing lecturers are not re-trained to be acquainted with modern AutoCAD facilities; inadequate fund to maintain the available computer system in drawing studio for practical; high cost of acquisition of AutoCAD facilities; incompatibility of some software to the hardware; limited access of license of AutoCAD by students; resistance to change. The findings are in agreement with the study of Bamidele (2016) who stated that the challenges in technical drawing education are access to quality resources and instructional materials, is a recurring in many regions, hindering students’ ability to learn effectively. The findings of this study were in conformity with the findings of Olowo et al (2019) who found out that teachers training program play a crucial role improving instructional quality and also continuous professional development ensures that educators are equipped with latest teaching techniques and technology

Data presented in Table 3 provided answers to research question three. The findings revealed that all the 10 items on the strategies to improve effective use of AutoCAD for technical drawing students were agreed by respondents. In line with the findings of this study Atsumbe. (2013) observed that the integration of digital tool and computer-aided design (CAD) software in to technical drawing curricula has become increasingly. The work highlights the benefits of incorporating technology to enhance learning outcomes and prepare students for modern workplace after graduation. The findings are in agreement with the study Oyeyinka et al (2021) who explained on the strategies for improving effective use of AutoCAD for technical drawing

students to enhance the curriculum through the inclusion of digital tool and software is a way forward strategy to engage students and improve technical drawing skills.

V. Conclusion

The integration of AutoCAD into technical drawing instruction in North Central Nigeria offers a compelling approach to enhance student learning outcomes. This innovative strategy aligns with the contemporary demands of the engineering and architectural fields, where proficiency in AutoCAD is a prerequisite for professional success. By providing students with hands-on experience and exposure to industry-standard software, AutoCAD can foster a deeper understanding of technical drawing principles, improve problem-solving skills, and prepare students for future career opportunities.

VI. Recommendation

1. Government at all level should provide adequate facilities such as regular supply of electricity, functional drawing studio, textbook and other learning materials to training institutions
2. Provide comprehensive training programs for technical drawing instructors to equip them with the necessary knowledge and skills to effectively teach AutoCAD. This includes hands-on experience with the software, pedagogical techniques for integrating AutoCAD into the classroom, and strategies for assessing student learning.
3. Ensure that students have access to AutoCAD software, either through institutional licenses or by providing affordable options for individual purchase. This will enable students to practice outside of class and develop proficiency with the software.
4. Implement project-based learning activities that utilize AutoCAD to simulate real-world engineering and architectural design challenges. This will allow students to apply their AutoCAD skills in a meaningful context and develop critical thinking and problem-solving abilities.
5. Foster partnerships with local engineering and architectural firms to provide students with opportunities for internships, guest lectures, and industry-sponsored projects. This will expose students to real-world applications of AutoCAD and help them develop professional networks.

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