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Optimizing Architectural Technology Education with Computer-Aided Architectural Design (CAAD) Integration in Polytechnics

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Abstract

This research explores the integration of Computer-Aided Architectural Design (CAAD) into architectural technology education, aiming to enhance pedagogical outcomes and professional preparedness among students. As the architectural landscape increasingly relies on digital tools, traditional educational frameworks must adapt to include advanced technological competencies. The study aimed to identify barriers to the effective use of Computer-Aided Architectural Design (CAAD) tools in Nigerian architecture schools and propose solutions based on student perspectives. Through a mixed methodology involving 120 questionnaires administered from various graduate levels at Kaduna Polytechnic's Department of Architecture and Nuhu Bamalli Polytechnic Zaria, (NDII, HNDI, HNDII, and HND graduates) the study analyzed data using SPSS v. 21. While architectural education in Nigeria combines manual and digital approaches, the disconnect between these methods hampers students' ability to transfer skills. This highlights the need for a training approach embracing advancements in technology, particularly in CAAD. The paper advocates for the integration of CAAD tools into the curriculum to bridge the gap between theoretical knowledge and practical skills, enhancing the overall educational experience. The findings suggest that CAAD tools are primarily used for visualization, potentially leading to a decline in design quality, prompting a reconsideration of the architectural educational model.

Keywords: Computer-Aided Architectural Design (CADD), Architectural education, Digital design tools, Curriculum development.

Introduction

Computer-aided Architectural Design (CAAD) simply refers to the process whereby computers and specialist software are used to produce virtual three-dimensional models and two-dimensional drawings of products. according to (Olukoya & and Kuti, 2015) Several types of CAAD software have been developed for use in a range of applications and industries. Architectural Education has evolved to integrate innovative technological tools in alignment with rapidly shifting global market behaviours. The use of innovative technological tools in studio environments must encourage students to work more collaboratively yet foster autonomy. Computer-aided Architectural Design (CAAD) simply refers to the process whereby computers and specialist software are used to produce virtual three-dimensional models and two-dimensional drawings of products.(Olukoya & Kuti, 2015). Several types of CAAD software have been developed for use in a range of applications and industries. (Sireesha, 2018).

The mission of the Polytechnic Education in Nigeria is teaching, technical and vocational training to produce quality graduates, innovative information, and improvement in technology, and the educational objectives are conceived in the effort by individual institutions to produce proficient higher and lower technicians that will occupy the middle-level manpower cadre.

Architectural Technology Programs offered in Nigerian Polytechnics are accredited by the National Board for Technical Education (NBTE), leading to the award of National Diploma (ND) and Higher National Diploma (HND) certificates in Architectural technology. The mission of the program is the provision of functional, technical, vocational, and entrepreneurial education and training that targets individual and national development.(Olukoya & Kuti, 2015) The main objective of the program is to provide contemporary and sustainable manpower nurtured by ICT-driven human resources development which will remain responsive to the dynamism of the practice environment in Nigeria. Since the effects of technology on Architectural Education remain profound, students and instructors must work stridently toward closing theoretical and practical knowledge gaps to produce more sustainable outcomes.

By drawing from critical theory, instructors in Architectural Education Programs focus seminar discussions on how various dimensions of society drive

major shifts in design principles (Salman et al., 2011). However, researchers have identified a significant divide between Architectural Theory and practice. (Salman et al., 2011)When instructors of Architectural Programs draw primarily from critical theory to critique the role of Technology and deliver seminar materials covering design principles, discussions may turn into political debates about which cultural variables will influence practice. (Sireesha, 2018).

Researchers inspired by educational theory have discussed the impacts of technology on academic program outcomes suggesting that an emphasis on visual training produces sound aesthetic judgments. Specifically, (Kocaturk & Kiviniemi, 2013) noted how the 80-year tradition of education theory needs instructors capable of challenging dominant theoretical paradigms. Technological innovation allows instructors and lecturers to challenge assumptions about what types of coursework will produce students who achieve success after completing a graduate-level program. (Jones, 2016).

STATEMENT OF RESEARCH PROBLEM

Architectural technology education is evolving rapidly, driven by advancements in digital tools and methodologies. However, many architectural technology programs struggle to keep pace with these developments, leading to a gap between industry expectations and the skills of graduates. The traditional approaches to teaching architectural technology often lack integration with cutting-edge tools like Computer-Aided Architectural Design (CADD), which are essential for modern architectural practice. This disconnect can result in graduates who are underprepared for the demands of the profession, potentially hindering their career development and limiting their ability to contribute effectively to the industry.

The problem is further compounded by the challenges of effectively incorporating CADD into existing curricula. There is a need to optimize the way CADD is integrated into architectural technology education to ensure that students not only acquire technical proficiency but also develop a deep understanding of how these tools can enhance design processes and outcomes. This research seeks to address this gap by exploring methods to optimize architectural technology education through the strategic integration of CADD, thereby aligning educational practices with the needs of the contemporary architectural profession.

AIM OF THE STUDY

This study aims to enhance how architectural technology education can be enhanced through the integration of Computer-Aided Architectural Design (CAAD), focusing on bridging the gap between theory and practice to create a cohesive and immersive learning experience for students. It will examine the current state, trends, and best

practices of CAAD education across various contexts and educational levels. Additionally, the study will assess the benefits and challenges of CAAD integration in architectural technology education, including its impact on learning outcomes, student engagement, teacher development, and alignment with industry needs.

OBJECTIVES

The aim of the research shall be achieved through the following objectives.
The objectives of the study are:

i. To evaluate the importance of incorporating Computer-Aided Architectural Design (CAAD) into architectural curricula and its role in enhancing educational outcomes.
ii. To assess the impact of CAAD tools on the quality of architectural design across all stages, including conceptualization, design development, and presentation.
iii. To investigate the current practices and perceptions of CAAD education among architectural technology students, lecturers, and professionals.

The objectives are guided by the research questions

RESEARCH QUESTIONS

i. What is the importance of the role of CAAD in an architectural curriculum?
ii. What impacts do CAAD tools have on the overall quality of architectural design in all of its stages (conceptual, design development, presentation)?
iii. What are the current practices and perceptions of CAAD education among students, lecturers, and practitioners of architectural technology?

JUSTIFICATION FOR THE STUDY

The architectural profession is undergoing rapid technological advancements, with CAAD becoming a fundamental component of design practices. Employers increasingly expect graduates to possess not only theoretical knowledge but also practical skills in utilizing CAAD tools. This study seeks to ensure that architectural education aligns with industry demands, equipping students with the necessary skills to thrive in a technology-driven profession. Also, integrating CAAD into architectural education enhances graduates' employability by providing them with hands-on experience and proficiency in contemporary design technologies. As the job market becomes more competitive, graduates with practical CAAD skills are better positioned to secure employment and contribute effectively to architectural firms.

SCOPE OF THE STUDY

The scope of this study investigates the perspectives of twenty students and lecturers within the Department of Architecture Kaduna Polytechnic, Nuhu Bamali Polytechnic, who use Computer-Aided Design (CAD) for their day-to-day architectural drafting, teaching, and presentations. The accounts of the interview of twenty (20) Computer-Aided Design (CAD) users in the Department are being used as the yardstick for the progressive summation. This was achieved by evaluation of respondents' CAD works as well as intensive interviews with individuals in context.

REVIEW OF RELATED LITERATURE

Introduction:

The integration of Computer-Aided Architectural Design (CAAD) in architectural technology education is a critical endeavour aimed at optimizing the learning experience by bridging theory and practice. CAAD plays a pivotal role in transforming architectural education, offering students practical exposure to design processes and technological applications. Researchers such as Smith and Johnson (2018) underscore the need for a comprehensive understanding of how CAAD can be seamlessly integrated into existing curricula, ensuring alignment with theoretical concepts and practical skill development.

Pedagogical Strategies and Student Outcomes:

Efforts to integrate CAAD into architectural education involve careful consideration of pedagogical strategies. Wang and Li's study (2020) emphasizes the effectiveness of project-based learning and collaborative problem-solving in optimizing the pedagogical aspects of CAAD integration. Additionally, research by (Botchway et al., 2015) highlights the positive impact of CAAD integration on student learning outcomes, including improved problem-solving skills, critical thinking abilities, and a deeper understanding of theoretical architectural concepts.

Technological Infrastructure and Institutional Support:

A robust technological infrastructure is fundamental to the successful integration of CAAD in architectural education. Gao et al. (2017) stress the importance of investing in up-to-date hardware and software to support seamless interactions between students and CAAD tools. Furthermore, institutional policies play a crucial role in sustaining CAAD integration efforts. Jones and Brown (2019) explore the role of institutional policy in promoting digital literacy in architectural education, emphasizing the need for clear policies to facilitate sustained commitment and investment in technological infrastructure for CAAD applications.(Botchway et al., 2015)

Curriculum

The curriculum of architectural technology programs like other academic curricula of professions is the body of knowledge that houses all the experiences, skills, creativity, and activities going on in the school environment to achieve educational goals. (Obiamaka & -Okafor, 2017)The current curriculum content in the Nigerian schools of architecture is structured to have tutorial courses revolve around studio design which is the core course that carries both the highest contact hours and credit loads (Agbo, Ogbonna, & Okwoli, 2017)

This is also the scenario in the architectural technology departments in polytechnics, where the design studio is both the teaching and learning environment as well as the core course of study of architecture students. (Obiamaka & -Okafor, 2017) emphasize that this implies that it is germane to the study of architectural technology and as such dependent on the pedagogy and curriculum of the school.(Obiamaka & -Okafor, 2017) asserts that since the central issue in architecture is the quality of the human habitat, the goal of architectural education is generally directed toward the attainment of a humane and responsive environment. The extent to which this goal is successfully attained depends on the curriculum content as approved by the regulatory body and various polytechnics, and methods of teaching the courses adopted by the lecturers and technologists. succinctly posits that the structure of the architectural curriculum should aim at giving expressions to and utilizing the factors of socioeconomic and technological transformations in Nigeria.

The curriculum of the ND and HND Architectural Technology programmes consists of four components.

1. General Studies: These include courses in art and humanities, mathematics and sciences, and social and entrepreneurship studies. This component accounts for a maximum of 10% of the total contact hours for the programme.
2. Foundation Courses: These include courses in pure sciences, economics, and statistics and account for 10- 15% of the total contact hours for the programme.
3. Professional Courses: These include theoretical and practical courses in the field of study and provide the student with cognitive and practical skills needed to practice. Consequently, they account for 70-80% of the contact hours for the programme.
4. SIWES for ND programme: the following criteria are used for assessment of this component; i) punctuality ii) attendance iii) general attitude to work iv) technical competence v) respect for authority vi) interest in the field. (Olukoya & Kuti, 2015).

The professional courses which make up the core courses are grouped into six main areas of study or instruction modules as follows.

1. Architectural design courses
2. Architectural graphics courses
3. Architectural professional administration courses

4. Building construction courses
5. Computer courses
6. Entrepreneurial/ Environmental Courses

Teaching methods

Good teaching is tuition that results in useful acquisition of knowledge. Good quality teaching requires a good combination of subject knowledge, teaching methodology, psychology of learning and learners as well as astute resourceful attitudinal orientation characteristic of the teacher. The current teaching method in architectural technology programmes in Nigeria was believed to have developed in Europe and was rooted in two schools: the Ecole des Beaux-Arts and the Bauhaus (Gudey, 2015).

The former was based on studio-oriented design education while the latter ushered in the lecture format to studios and played a complementary role as the information acquired from the lecture series was intended to intellectually equip the trainees in their studio exercises.(Soliman et al., 2019) Pedagogy-based training enables teachers to appreciate the role of learning theory in the plan and purpose of class activities and the selection and use of instructional technologies (Agbo, Ogbonna, & Okwoli, 2017).(Marcel-Okafor & Okafor, 2018) The learning theories that represent hypothetical structures necessary for the assimilation and effective utilization of acquired knowledge are crucial to both the application of the teaching methods and the implementation of the curriculum in architectural technology.

This implies that the strategies used to impart knowledge, and the curriculum must reflect in the output or practice performance of the architectural technologist. The polytechnics have also adopted the lecturing style of teaching which involves passing information orally and remains exclusive of those in the lecturing cadre while the practical aspects of illustrations and student physical participation are handled by the technologists.

The methods of teaching commonly used are lecture methods, discussion methods, and demonstration methods. The lecture formats commonly used are.

1. The participatory/inquiry method
2. The problem-solving method
3. The creative/construction method
4. The case study method

Effects of Computer-Aided Designs (CAD) on Architecture

"The machine is the architect's tool -whether he likes it or not. Unless he masters it, the machine has mastered him" Arc. Frank Lloyd Wright. No matter how much CAD has helped in producing designs, the designer will encounter limitations in the use of CAD. As he or she tackles these limitations, more knowledge of computer

programming is required. Computer-Aided Architectural Design (CAAD) has had a radical impact on the teaching, learning, and practice of design.(Marcel-Okafor & Okafor, 2018)

One can create conceptual detailed designs of 2-D and 3-D drawings, and environmental impact reports, manipulate the shape of images, and tackle more complex design problems in a faster time with the aid of CAAD. CAAD technology's existence in architecture has two primary objectives which are to be applied in the human cognitive design process through computing smart technology and to become an idea-representative media in the architectural design process (Olukoya & Kuti, 2015). Therefore, the effects of the use of Computer-Aided Architectural Design (CAAD) will be discussed under the following aegis.

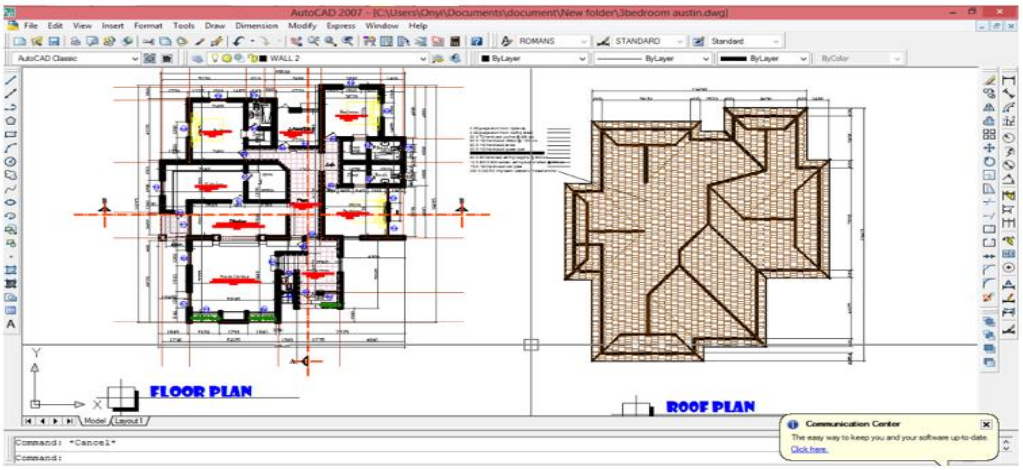


Figure 1: 2D-floor plan using CAAD using Revit software version 2016
Source authors fieldwork,2024



Figure 2: 3D CAAD using Revit software version 2016.
Source authors fieldwork,2024

The State of CAAD Education in Architecture Schools in Nigeria

CAAD has been used in Nigeria since the mid-1990s. Several Architectural firms and contracting companies were interested in the potential of digital technologies as drafting and modelling tools. As an educational tool, CAAD software was installed as an introductory course for undergraduate architectural programs in 1994, but there were only a few faculty members who could teach it then. Several years later, CAAD courses became obligatory (i.e., CAAD I, CAAD II) over two semesters, typically for second-year students, (Marcel-Okafor & Okafor, 2018; Olukoya & Kuti, 2015). (Soliman et al., 2019)Moreover, most schools of architecture in Nigeria attempted to update their curricula through software and digital technologies to bridge the gaps between design theory and practice. Since 2014, however, some schools have begun to re-think the use of digital software as an analytical, generative, and constructive tool. Consequently, software such as "Revit" and "Introduction to BIM" were installed in their curricula.(Obiamaka & -Okafor, 2017)

Generally, schools of architecture in Nigeria combine the physical and digital methods to ensure that students enjoy the benefits of both methods. Thus, most, if not all, schools of architecture prohibit the use of CAAD tools in design for students in their first two years. Design teaching for first- and second-year studios emphasizes the importance of developing manual graphic communication skills, sketching, and the experience of making physical models. However, the current curriculum of architectural design education in most schools suffers from a lack of synchronization and integration between computer courses and design projects. The prevalent tendency at present is to treat each course as a separate entity with its distinct particularity, which prevents the necessary coordination between theoretical and design courses and applied computer courses. Moreover, although the structure of the curricula remains relatively flexible to manage new digital technologies, integrating these technologies with design courses is highly advisable and will ensure a more holistic and creative environment and not use this software only as a drafting tool.

RESEARCH METHODOLOGY

Methods

A purposive sampling technique was used. Samples were drawn from selected polytechnics that offer Architectural Technology programmes in Nigeria. Table 1 shows the distribution of samples by target group. The polytechnics are Kaduna Polytechnic, Nuhu Bamalli Polytechnic Zaria, Kaduna State. Primary data were obtained using structured interviews administered to the staff of the selected polytechnics, and students. Sample surveys were obtained from the polytechnic to ascertain the use of CAAD as one of the methods of teaching in the schools. The interviews focused on teaching methods used and the assessment of the performance

of the graduates in practice on a five-point scale as well as challenges encountered. Secondary data used were obtained from academic curricula for architectural technology programmes of the selected polytechnics, referred journals, some reports available from reliable internet sources and books

Table 1 shows the distribution of sampled respondents by the two (2) polytechnics

S/N	TYPE OF INSTITUTION	INSTITUTION NAME	ACADEMIC STAFF	STUDENTS	TOTAL
1	FEDERAL	KADUNA POLYTECHNIC, KADUNA	45	60	105
2	STATE	NUHU BAMBALLI POLYTECHNIC, ZARIA	25	30	55

Source: Researchers field survey,2024

The data collected were analysed using frequencies, percentages and Chi-square to test the significance of CAAD as a tool in teaching methods and courses taught and the effective Use of CAAD. This study intends to analyse courses presented in the curricula that utilise CAAD potentials in the requirements and expectations of the students to ascertain their relevance to present-day architectural practice. To effectively measure the practice performance of the students. This study examined the benchmark for ascertaining work expectations as stipulated in the NBTE-regulated curriculum for architectural technology programme and the actual work requirements and achievements in the professional practice.

The researcher used a questionnaire as an instrument for collecting data considering the nature and predisposition of the respondents. The instrument used was designed to ensure that relevant data were collected. A questionnaire consists of a set of questions presented to a respondent for answers. The respondents read the questions, interpret what is expected, and then write down the answers themselves. Because there are many ways of asking questions, the questionnaire is very flexible. A questionnaire should be developed and tested carefully before being used on a large scale.

The population for this study is Kaduna Polytechnic, and Nuhu Bamalli Polytechnic, Zaria. The choice of this institution was made because both federal and state institutions have common characteristics of managing the system. The target group for the study will be made up of the Academic Staff and Students of the Polytechnics. With regards to the category of the entire population of the study, this is made of the two (2) Polytechnic. The academic staff and students at the School of Architecture form the sample of the study. This study intends to analyse courses presented in the curricula that utilize CAAD potentials in the requirements and expectations of the

students to ascertain their relevance to present-day architectural practice. To effectively measure the practice performance of the students.

Table 2. Showing the effectiveness of courses learnt and perceived impact on CAAD in places of work

courses		**Do you agree that the CAAD knowledge acquired in school will assist you in future?**	
		Agree	Strongly agree
The final year courses learnt in school will help you in professional practice	Architectural delineation	95 (97.72)	56 (52.28)
	Construction drawing	94 (97.72)	56 (52.28)
	Application of Computer in Architecture	94 (97.72)	56 (52.28)
	Measurement of building works	5 (6.51)	5 (3.49)
	Environmental science	25 (16.29)	0 (0.00)
	Interior design	5 (9.12)	9 (4.88)
	Introduction to Modern Architecture	40 (31.92)	9 (4.88)

Researchers field survey,2024

The table shows the effectiveness of courses learnt and the perceived impact on CAAD in places of work. The p-value (0.00) which is less than the alpha (0.05) or 95% in the table above shows that there is a significant association between the final year courses taught and the impact of CAAD on the student's performance in the future. This implies that the teaching methods were effective.

The study revealed that 94 (62.7%) respondents agreed that the CAAD knowledge acquired in school will assist them in future, while 56 (37.3%) strongly agreed. There were no responses for 'disagree', 'strongly disagree', and 'No Idea'. Lecturing is the predominant teaching method, the lecturers are freely disposed to any of the lecture formats; creative/constructive method, problem-solving method. The results showed that 18 (43.9%) of the staff respondents from the schools think that course content and class size determine their choice of teaching method adopted, while 15 (36.6%) believed that course content only determines the choice and 8 (19.5%) are influenced by class size alone. See Table 3.

Table 3. Showing factors that influence the choice of teaching methods

	Frequency	Percent	Valid Percent	Cumulative %
Course Content	15	36.6	36.6	36.6
Class size	8	19.5	19.5	56.1
Course content and class size	18	43.9	43.9	100.0
Total	41	100.0	100.0	

Researchers field survey,2024

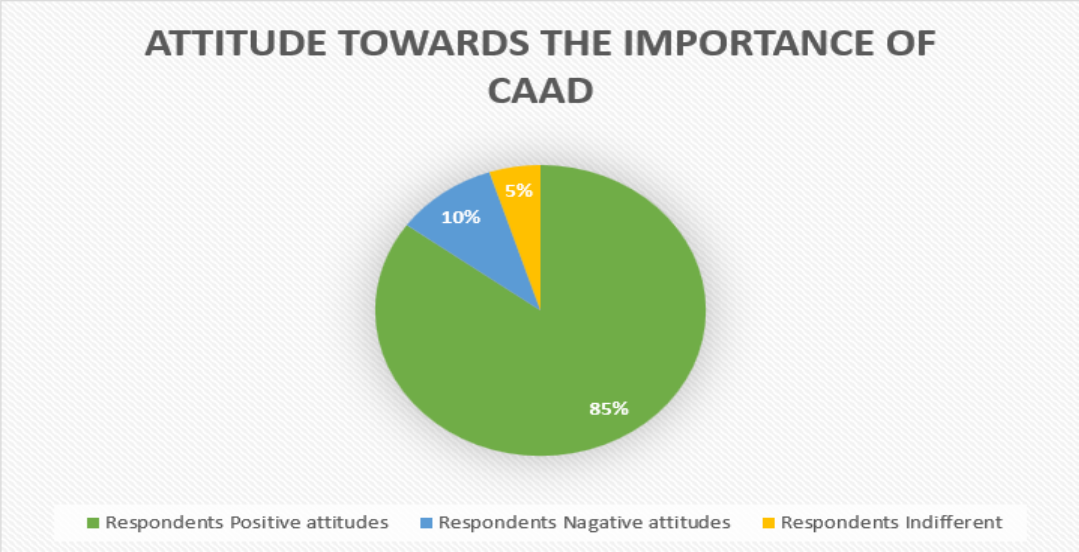
Table 4. Showing the responses on the performance of the students

	Frequency	Percent	Valid percent	Cumulative percent
Above average	15	36.6	36.6	36.6
Average	26	63.4	63.4	100.0
Total	41	100.0	100.0	

Researchers field survey,2024

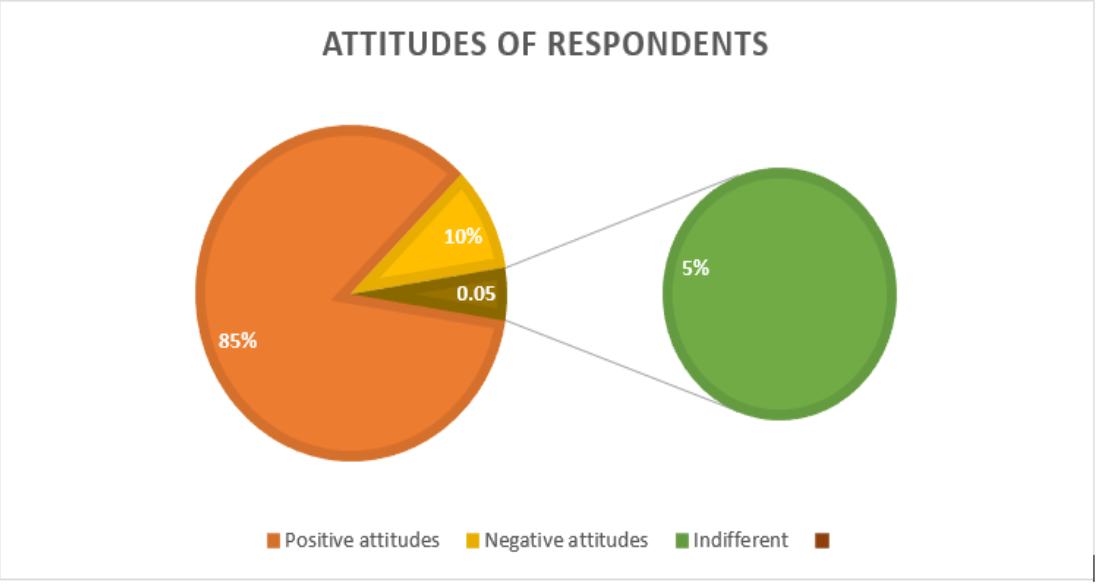
The study revealed that 26 (63%) of the respondents ranked the performance of their students as average, while 15 (36.6%) said their students performed above average. There were no responses for below-average and poor performance in using CAAD. Shown in Table 4 Above.

Table 5 shows the attitudes toward the importance of CAAD compared with traditional methods



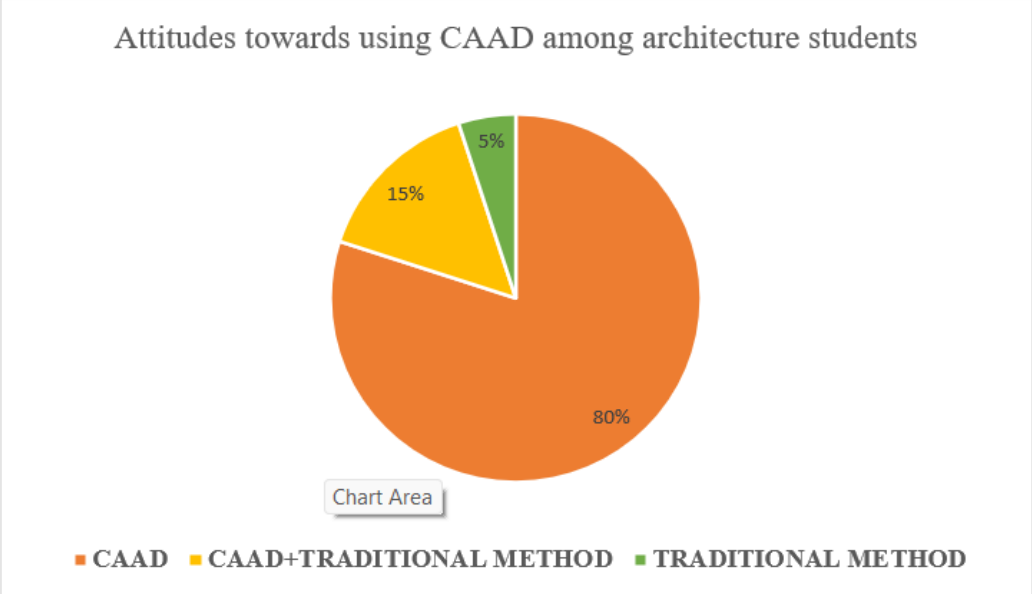
Researchers field survey,2024

Figure 5 shows that the majority of respondents (85%) described their attitudes positively toward the importance of CAAD compared with traditional methods. However, 5% of the respondents were indifferent, they were not sure while 10% of the respondents had negative attitudes regarding the use of CAAD they preferred the use of traditional methods.



Researchers field survey,2024

Table 6 shows the attitudes toward Using CAAD among architecture students.



Researchers field survey,2024

Table 6: showing the superiority of using CAAD over the traditional method of sketching, 80% of the students preferred to use CAAD media over traditional methods, whereas traditional-method users accounted for only 5% of the total respondents above. A great interest in CAAD was noted among all respondents. There seems to be a strong trend for architectural students to convert from traditional methods to CAAD. The dramatic increase in CAAD users suggests that there should be a serious reconsideration of the current curriculum to adapt to the new CAAD trends.

Finally, this paper assessed the impact of CAAD tools on the design process and the quality of the architectural product at two schools of Architecture Kaduna Polytechnic and Nuhu Bamalli Polytechnic Zaria. The findings revealed that all two schools have almost the same architectural design educational approach that mixes traditional design methods with digital methods. Analyses revealed that although majority of students were found to have a strong tendency to use CAAD software programmes for their various advantages, such as accuracy, neatness, speed lower cost, etc. Presently, the mode of teaching CAAD in most, if not all, of the architectural departments in the polytechnic does not encourage the use of CAAD in the early phase of the design, just like in the conceptual stage. The study shows that CAAD tools have not been integrated into the creation processes of the conceptual architectural design and the influence of the CAAD tools in the conceptual design phase is still very minor. Moreover, all interviewees agreed that the creation procedure has not been influenced by the adoption of digital tools. At the same time, findings from the analysed design projects showed that the presented projects are seductive graphics more than realistic architecture. CAAD is still being considered, perceived and utilized as a drafting, modelling, and rendering tool rather than as a problem-solving strategy. Simultaneously, this restricts the potential use of CAAD to develop already created designs, but not to use it as a tool to generate new designs. Very few analysed projects showed the use of CAAD as a medium to create an innovative form in the geometrical formation and conceptual phase. This assures (Botchway, Amos-Abanyie, & Afram, 2015) findings, when they assessed the impact of CAAD Design Tools on Architectural Design Education, as they found out that CAAD is taught in isolation from other design courses in the department. The transformation of students' design trends from traditional methods to CAAD is still not clearly defined. This affects students' ability to transfer the skills that are learned through traditional methods to the more complicated CAAD method. All three departments of architectural technology are in government-owned polytechnics and have been fully accredited at both the National Diploma (ND) and Higher National Diploma (HND) levels by the National Board for Technical Education (NBTE) (see Table 7).

Table 7: Showing background information of selected institutions Programme

Name of Institution	kaduna Polytechnic Kaduna State	Nuhu Bamalli State Polytechnic Zaria
Year of establishment	1956	1989
Ownership Status	Federal government	State government
Programmes offered	ND/HND	ND/HND
Accreditation Status	Fully accredited	Fully accredited

Source: NBTE,2017

Table 8: Showing list of courses offered at the HND1

Kaduna Polytechnic Kaduna State	Nuhu Bamalli Polytechnic, Zaria
1989 reviewed version of NBTE accredited curriculum and course specification	1989 version of NBTE accredited curriculum and course specification
ARC311 Architectural Design and Report	ARC311 Architectural Design and Report
ARC312 Architectural Delineation	ARC312 Architectural Delineation
ARC313 Construction Methods	ARC313 Construction Methods
ARC314 Architectural Detailing	ARC314 Architectural Detailing
ARC 315 Technical Report Writing	ARC 315 Technical Report Writing
ARC316 Building Climatology	ARC316 Building Climatology
ARC 317 Site Planning and Landscape Design	ARC 317 Site Planning and Landscape Design
ARC 318 Estimating and Tendering	ARC 318 Estimating and Tendering
Advanced Mathematics for Architecture	Advanced Mathematics for Architecture
Outline History of Africa	Outline History of Africa
Architectural	N/A

Source: NBTE,2017

Kaduna Polytechnic,kaduna state	Nuhu Bamalli Polytechnic Zaria
ARC411 Architectural Design and Report III	ARC411 Architectural Design and Report
ARC412 Architectural Delineation III	ARC412 Architectural Delineation III
ARC413 Construction Drawings I	ARC413 Construction Drawings I
ARC414 Electrical	ARC414 Electrical

Source: NBTE,2017

Building Services	Building Services	Building Services
ARC415 Specification Writing	ARC415 Specification Writing	ARC415 Specification Writing
ARC416 Principles and Practice of Building Maintenance	ARC416 Principles and Practice of Building Maintenance	ARC416 Principles and Practice of Building Maintenance
ARC 417 Application of Computer in Architecture II	ARC 417 Application of Computer in Architecture II	ARC 417 Application of Computer in Architecture II
ARC 418 Environmental Science	N/A	N/A
Measurement of Building Works II	Measurement of Building Works II	Measurement of Building Works II
Introduction Psychology	Introduction Psychology	Introduction Psychology
Entrepreneurship Development	Entrepreneurship Development	Entrepreneurship Development

Source: NBTE,2017

Table 9: Showing courses offered and objectives from the NBTE curriculum

Objectives from the NBTE curriculum	Courses that target the criterion	Software Recommendation		Remarks
Ability to make sketches based on the brief.	Architectural Delineation	Sketchup version, Archicad,2015	2016	very good
Ability to incorporate superior comments	Architectural Design	AutoCAD version,Revit	2016	excellent

Ability to produce drawings using software.	Construction Drawings Architectural Delineation and Application of Computer in Architecture II	AutoCAD 2016 version	excellent
Ability to produce designs that satisfy brief	Architectural Design	AutoCad 2016 version,Revit	good
Ability to produce standard designs.	Architectural Design and Professional Administration	AutoCAD 2016 version	good
Ability to produce cost-effective designs	Architectural Design and Estimating and Tendering	AutoCAD 2016 version	good
Complete designs within the target time frame.	Architectural Design and Professional Admin.	AutoCAD 2016 version	very good
Ability to assist in the supervision of construction works.	Construction Methods, Principles and Practice of Building Maintenance	AutoCAD 2016 version	Fairly good
Ability to make progress reports.	Technical Report Writing	AutoCAD 2016 version	poor

Researchers field survey,2024

FINDINGS

The study revealed that integrating Computer-Aided Architectural Design (CAAD) into architectural technology education significantly enhances students' technical skills and creativity. However, a noticeable gap persists between theoretical knowledge and practical application. Despite the availability of CAAD tools, many students struggled to apply theoretical concepts in real-world scenarios, suggesting a need for more hands-on learning experiences. Graduates reported challenges in fully utilizing CAAD tools in practice, often relying on them primarily for visualization rather than more advanced design and construction tasks. This indicates that while CAAD improves certain aspects of learning, the current educational approach lacks the depth necessary to prepare students for the evolving demands of the architecture industry.

Interviews with educators and analysis of curricula highlighted key barriers to effective CAAD integration, including insufficient faculty training, outdated technological infrastructure, and limited access to up-to-date software. While some institutions have made significant strides in incorporating CAAD into their programs, in many cases, CAAD was treated as a standalone subject rather than integrated into the broader learning process. This led to a misalignment between academic training and industry expectations. Despite these challenges, the study found that CAAD-equipped students demonstrated better problem-solving abilities, more detailed designs, and higher engagement when the tools were properly integrated into the

coursework. However, addressing infrastructure and curriculum issues is crucial for maximizing the benefits of CAAD and ensuring students are fully prepared for professional practice.

RECOMMENDATIONS

The following recommendations are proposed:

1. Adequate provisions of infrastructural facilities to effectively implement the use of CADD design as a teaching and learning tool which will encourage assimilation of design and technological advances of the 21st century.
2. Collaboration of polytechnics to review and implementation of the curriculum to have a common curriculum, especially for core courses by utilizing CADD design as a modern tool in teaching and learning.
3. The need for a paradigm shift in the value system for polytechnic education in the country, which encourages staff to utilise the use of CADD by staff development training as a tool of teaching and to place technical education in its right place this will encourage more individuals to opt for polytechnic education and receive job satisfaction through enhanced productivity.

CONCLUSION

This paper has documented the current curriculum contents of some polytechnics in Nigeria as well as the job expectations of the architectural technologists. Based on the literature it is critical that the utilization of Computer-Aided Architectural Design (CAAD) training to both staff and students as a modern way of teaching and learning in the polytechnics with modern advances in design and technology to attain far-reaching results. The study has shown that improving the quality and methods of teaching as well as periodic review of the curriculum content are geared towards the quality of graduates and their professional performance. The results will include effective amelioration of the computer-aided Architectural Design (CAAD) as a tool that assists the drafting procedure. It has no place in the thinking process and has very little influence on the initial design stages. It is only a physical tangible tool which transforms the abstraction of the user into reality on the paperless board just like the old traditional method design. Furthermore, the architectural school's instructors should encourage the students to imbibe the practices of Computer-Aided Architectural Design CADD as the basics of the design process. This study posits that the successful fusion of traditional design construction and technological use of Computer-Aided Architectural Design (CAAD) will produce excellent products as finished designs. Thus, in Architectural training as well as practices, there should be a balance in the use of traditional methods as well as Computer-Aided Architectural

Design (CAAD) as a complete architect that has mastered various techniques to proffer design solutions.

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