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The Use of Computer-Aided Design (CAD) Software for Drafting Patterns for Training Students of Home and Rural Economics College of Agriculture, Science and Technology, Lafia

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Abstract

This study explored the use of Computer-Aided Design (CAD) software for drafting patterns for training students of Home and Rural Economics in Nasarawa State. Four research questions guided the study which include; what type of CAD software suitable for pattern drafting? How can CAD instructional materials be developed effectively for students training? What is the importance of integrating CAD into pattern drafting education? What are the challenges of using CAD software in teaching pattern drafting? Research and Development (R&D) design was adopted. Fifty respondents, comprising staff and students of the Department of Home and Rural Economics, College of Agriculture, Science, and Technology Lafia, participated. Structured questionnaire titled "Questionnaire on the Use of CAD for Drafting Patterns as Instructional Material Questionnaire (CADPATTIQ). A Four point rating scale of Strongly Agreed (SA)4, Agreed (A)3, Disagreed (DA)2, and Strongly Disagreed (SD)1. CAD software such as CorelDraw and Auto CAD were used to develop basic garment patterns including; bodice, skirts, trousers, and sleeves. Data were collected through structured questionnaires and evaluated using mean and Standard Deviation analysis. The results indicated that the use of CAD enhanced precision, creativity, speed, and technological literacy among students. The CAD materials were highly accepted, and respondents agreed that CAD offers significant economic and educational advantages. It is recommended that CAD be integrated into tertiary clothing and textile curricula to better align students with modern industry demands.

Keywords: Computer-aided design, software, pattern drafting, instructional materials, training

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Introduction

The advent of Computer-Aided Design (CAD) technology has revolutionized several sectors, including engineering, architecture, and more recently, the fashion industry. Computer-aided Design systems enable professionals to create, modify, analyze, and optimize designs digitally, offering greater precision and efficiency compared to traditional manual methods [1]. In clothing and textile education, particularly for pattern drafting, Computer-aided Design has emerged as a powerful instructional tool, bridging the gap between theoretical knowledge and industry demands Afolayan and Adisa [2]. Despite the evident global trend, in developing regions such as Nasarawa State, Nigeria, the integration of Computer-aided Design in tertiary institutions' curriculum remains minimal, necessitating a shift toward modern instructional methodologies [3].

The primary objective of this study is to identify the different types of CAD systems that can be used for teaching and learning pattern drafting. Several CAD software options are available, ranging from specialized fashion software like Gerber AccuMark, Optitex, and LectraModaris to multipurpose design tools such as CorelDraw and AutoCAD [4]. Each software offers unique features for pattern making, including 2D drafting, 3D garment simulation, grading, and marker making [5]. Studies by Adewumi and Olurunfemi [6] emphasize that the availability of various CAD tools enhances learning flexibility, allowing institutions to select software based on their specific needs, budget, and training goals

Another core objective is to develop instructional materials using Computer-aided Design software specifically for training students in pattern drafting. Instructional materials play a critical role in teaching complex technical skills such as pattern making [7]. A study by Mbakwe and Obidile [8] demonstrated that students exposed to Computer-aided Design-based instructional materials in garment construction courses showed significant improvements in accuracy and creativity compared to those trained using traditional methods. Similarly, Eze and Nwakwo [9] noted that instructional materials designed around Computer-aided Design increase learners' motivation, promote independent learning, and reduce training time, making them highly effective for technical education settings.

Furthermore, this study aims to determine the importance of software tools used for pattern drafting. Computer-aided Design software enhances pattern drafting through precision, speed, easy editing, digital storage, and seamless scaling of patterns into multiple sizes [10]. Beyond these technical benefits, Computer-aided Design systems facilitate collaboration and remote learning, which have become crucial in most educational environment. Research by Johnson and Lee [11] in the Journal of Fashion Technology indicates that students trained with Computer-aided Design software exhibit higher employability rates, as digital literacy is increasingly demanded in the global fashion and apparel industries.

Additionally, it is necessary to identify the challenges associated with using CAD software for pattern drafting. While CAD offers many benefits, its integration into teaching and learning environments is not without challenges. Issues such as the high cost of software licenses, inadequate access to computers, lack of technical know-how among instructors, and resistance to change are major obstacles [12]. Findings by Uche and Arinze [13] corroborate that without proper training and institutional support, even the most advanced CAD software can fail to deliver its full potential in improving educational outcomes. Similarly, Okorie and Onuh [14] reported that network limitations and poor electricity supply in some Nigerian tertiary institutions hamper the effectiveness of technology-based instructional methods.

Oguche [15] explain that, despite these challenges, studies from diverse contexts show a growing consensus that integrating Computer-aided Design into pattern drafting education is essential. For instance, Okorie and Onuh [14] found that students in institutions equipped with CAD facilities were better prepared for industrial attachment and employment, and they displayed superior creativity and adaptability. Also, the works of Allen and Brown [16] reveal that Computer-aided pattern Drafting significantly reduces material wastage, promotes sustainable practices, and opens new avenues for entrepreneurial ventures among fashion design graduates. Globally, universities and polytechnics are investing heavily in the use of Computer-aided Design technology to aid in keeping up to the current trends in the department of fashion and textiles.

Research by Liu and Chen [17] shows that Asian institutions that integrated CAD experienced up to a 45% improvement in student project quality compared to those using traditional teaching methods. Similarly, Umar and Adegoke [18] observed that Computer-aided Design training encourages innovation, as students can experiment with complex designs that would otherwise be difficult or impossible to execute manually.

The growing body of evidence suggests that tertiary institutions adopt a proactive approach toward the integration of CAD into their curriculum. Given the rapid evolution of the global fashion industry toward digitalization, it is critical that students are equipped with skills that match current industrial standards. This aligns with the findings of Oyelola and Adebayo [19], who argued that exposure to CAD not only improves technical competency but also fosters a mindset of continuous learning and adaptability.

In view of these points, this study seeks to answer the following critical research questions:

1. What are the different types of CAD software suitable for pattern drafting instruction?
2. How can CAD instructional materials be developed effectively for students training?
3. What is the importance of integrating CAD into pattern drafting education?
4. What are the challenges of using CAD software in teaching pattern drafting?

In addressing these questions, the study aims to bridge the existing gap between traditional pattern drafting methods and modern technological innovations. It will also provide recommendations on how tertiary institutions can effectively implement CAD-based instruction to improve educational outcomes, professional readiness, and global competitiveness of graduates. Ultimately, the integration of CAD into clothing education in Nasarawa State is expected to redefine pattern drafting instruction, promote innovation, and contribute significantly to sustainable educational development.

Materials and Methods

The study adopted Research and Development (R & D) design. R & D method of research design follows specific methods in the development of instructional material using Computer-aided Design for drafting patterns in clothing use for instructing students. Steps were outline on the process of how CAD is used as instructional material for teaching clothing student in Home Science and Management students.

Area of study

The research was carried out at the Department of Home and Rural Economics, College of Agriculture, Science, and Technology, Lafia, located in Nasarawa State. This institution offers programs related to clothing and textile technology but has limited exposure to digital technologies such as CAD. The department was chosen for its focus on producing graduates skilled in clothing and textiles, making it an ideal ground for testing new instructional methodologies. Nasarawa State itself, situated in North Central Nigeria, is gradually developing its educational and technological sectors but still lags behind in integrating ICT into vocational education. The area represents a typical case of a developing region where technological intervention in education could yield transformative impacts. The study location provided access to both students and staff who needed to upgrade their skills to innovative teaching and learning methods.

Population and sampling

The population for the study consisted of all students and staff of the Department of Home and Rural Economics as well as staff and students of Home Science and management. Out of this population, a

purposive sampling of 100 respondents were selected which comprised staff and students of both institutions. A sample size from both schools was 20 staff and 10 students. This sampling method ensured that only those with direct engagement in clothing and textile education were included. The selected students had prior experience in manual pattern drafting, allowing for comparative assessment after CAD training. The staff members had varying degrees of familiarity with the use of CAD, providing a broad perspective on the acceptability. The relatively small sample size allowed for intensive hands-on training, individual attention during demonstrations, and thorough evaluation of responses.

Instrument for data collection

The main instrument for data collection was a structured questionnaire titled "Questionnaire on the Use of CAD for Drafting Patterns as Instructional Material Questionnaire (CADPATTIQ)." The questionnaire contained closed-ended items based on the objectives of the study. It consisted of four sections: demographic information, types of patterns drafting software, how it can be used for drafting patterns, the importance and challenges on the use of CAD as instructional materials for teaching pattern drafting in Tertiary institutions in Nasarawa State.

Responses were measured on a 4-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). Additionally, evaluation forms were used by judges to rate the quality and usability of CAD-drafted patterns. The instrument was validated by experts in clothing and textile education as well as ICT specialists. A pilot test was conducted to ensure reliability, and necessary adjustments were made based on feedback.

Materials and tools

The materials used for developing the instructional materials included laptops, desktop computers, and high-resolution printers. Software tools comprised CorelDraw, AutoCAD, and Adobe Illustrator, selected for their versatility in fashion design applications. Measuring tools such as digital rulers were utilized for calibration to ensure pattern accuracy. Graphic tablets were used for freehand sketching and annotation when needed. The patterns drafted included basic bodice blocks, skirts, trousers, sleeves, and children's wear. Printed versions of drafted patterns were distributed to students for hands-on exercises and assessments. A multimedia projector was used for classroom demonstrations.

Production/development process (flowchart) (see Fig. 1)

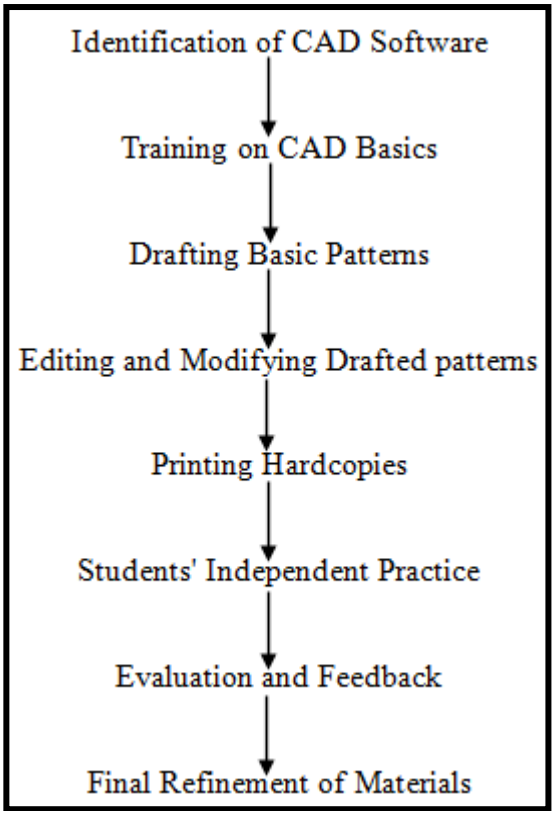

Figure 1: Production/development process Computer-Aided Design (CAD) software for drafting patterns

Method of data collection

The data were collected in two phases: instructional delivery and questionnaire administration. During instructional delivery, CAD basics were taught using projectors, live demonstrations, and supervised practical sessions. Participants practiced drafting assigned garment patterns using CAD. Following practice sessions, questionnaires were distributed, and respondents were given time to provide thoughtful answers. Evaluation forms were also filled out independently by judges assessing the clarity, accuracy, and aesthetic appeal of the drafted patterns. All questionnaires and evaluation forms were retrieved immediately to ensure a high response rate and minimize data loss.

Method of data analysis

The responses from the questionnaire and evaluation forms were analyzed using descriptive statistics.

Mean scores were calculated for each item to determine the overall CAD instructional materials. Items with mean scores of 2.50 and above were considered positive responses. SPSS software was used for data entry and analysis to ensure accuracy. Tables were used to present findings for easy interpretation. Comparative analysis was done between staff and student responses to identify any significant differences.

Results and Discussion

The presentation and interpretation of the analyzed data are based on the four objectives of the study. Several

Tables (1–4) have been generated under each objective to capture details comprehensively.

The results in Table 1 shows a strong agreement among respondents regarding the types of CAD software suitable for drafting patterns for instructional materials for teaching students of Tertiary institutions. CorelDraw stood out with a Mean ± SD of 4.00 ± 0.00, indicating unanimous strong agreement among respondents without any variation. AutoCAD and Adobe Illustrator also recorded high agreement levels, although slight variability (SD = 0.31 and 0.41) suggests minor differences in respondent experiences.

Table 1: Responses on types CAD Software use in drafting patterns for instructional materials for teaching students of Tertiary institutions

S/N	CAD Software	Mean	Remark
1	CorelDraw	4.00 ± 0.00	Strongly Agreed
2	AutoCAD	3.90 ± 0.31	Agreed
3	Adobe Illustrator	3.80 ± 0.41	Agreed
4	Photoshop	3.90 ± 0.31	Agreed
5	Optitex	3.80 ± 0.41	Agreed
6	LectraModaris	3.70 ± 0.46	Agreed

Specialized fashion CAD software like Gerber AccuMark, Optitex, and LectraModaris were also well-rated, with mean scores between 3.70 and 3.90. Although there was a slightly wider spread (up to SD = 0.46 for LectraModaris), the general consensus remains positive. This implies that both general-purpose and fashion-specific CAD applications are recognized as highly effective for teaching and learning pattern drafting. These results agree with previous studies such as Liu and others [17, 8], who emphasized the growing reliance on CAD in educational training and the versatility of different software across institutions globally.

Overall, the consistency of high mean scores and relatively low standard deviations reflects a shared understanding among staff and students that CAD software is critical for modernizing pattern drafting education.

The Tables above show a clear and consistent pattern: instructional materials created with CAD tools were highly accepted by both staff and students. In Table 2 the development of basic bodice patterns had a mean score of 4.00 ± 0.00, demonstrating absolute consensus. Other pattern types like skirts, trousers, and sleeves also recorded very positive responses (means ranging from 3.80 to 3.90) with minimal variability.

In Table 2 activities such as drafting 2D layouts and editing or scaling patterns also attracted high scores. Especially notable is the agreement on the activity of creating layouts (4.00 ± 0.00), indicating that CAD allows users to structure complex garment patterns with great ease and accuracy.

The low standard deviations across activities (mostly with in 0.31 to 0.41) imply that the respondents had similar positive experiences with the CAD-developed instructional materials. These findings reinforce studies like that of [10], who observed that CAD makes instruction more interactive, understandable, and professionally aligned for students learning garment construction.

Table 2: Responses on the use of CAD software in drafting patterns for instructional materials for teaching students of Tertiary institutions

S/N	Pattern Drafted	Mean	Remark
1	Basic Bodice	4.00 ± 0.00	Strongly Agreed
2	Skirt	3.90 ± 0.31	Agreed
3	Trouser	3.80 ± 0.41	Agreed
4	Sleeve	3.80 ± 0.41	Agreed
5	Drafting 2D Layouts	4.00 ± 0.00	Strongly Agreed
6	Editing and Modifying Patterns	3.90 ± 0.31	Agreed
7	Scaling patterns into different sizes	3.80 ± 0.41	Agreed
8	Printing Final Patterns	3.90 ± 0.31	Agreed

Table 3: Responses on the importance of using CAD software in drafting patterns for instructional materials for teaching students of Tertiary institutions

S/N	Importance	Mean ± SD	Remark
1	Improves Precision	4.00 ± 0.00	Strongly Agreed
2	Reduces Errors	3.90 ± 0.31	Agreed
3	Speeds Up Drafting Process	4.00 ± 0.00	Strongly Agreed
4	Aligns Training with Industry Standards	4.00 ± 0.00	Strongly Agreed
5	Enhances students' employment opportunities	3.90 ± 0.31	Agreed
6	Develops Digital Literacy Skills	4.00 ± 0.00	Strongly Agreed

The Tables show unanimous agreement on the technical and educational importance of CAD in pattern drafting. In Table 3, CAD was rated as significantly improving precision (4.00 ± 0.00) and speeding up drafting processes (4.00 ± 0.00) with no variation in opinion, indicating that every respondent saw these as key benefits.

Similarly, CAD's alignment with global industry standards (4.00 ± 0.00) and its contribution to digital literacy (4.00 ± 0.00) were strongly agreed upon. Even enhancing employment opportunities scored a high mean (3.90 ± 0.31), showing that most respondents see CAD skills as vital for employability.

The extremely low or zero standard deviations show not only consensus but strong conviction among respondents that CAD is not just a technical tool, but a necessary professional skill set.

These results support the assertions by some researchers [18, 1] about the central role of CAD in modern vocational education.

Tables 4 Reveals that respondents strongly agreed that the cost of CAD software licenses is a major barrier (4.00 ± 0.00). This indicates perfect agreement that financial limitations are the biggest hurdle to CAD adoption.

Technical challenges such as frequent software crashes (3.70 ± 0.46) and hardware expenses (3.80 ± 0.41) were

also agreed upon, although with slightly more spread in responses (higher SDs).

For human and infrastructure challenges, a lack of skilled instructors (3.90 ± 0.31) was seen as critical. Poor internet access (3.70 ± 0.46) and resistance to change (3.60 ± 0.50) also featured prominently, with slightly higher variability indicating mixed experiences across institutions.

These challenges align with the studies of [18, 2], who reported similar barriers to technology integration in education. Thus, the data suggest that while the benefits of CAD are clear, successful adoption will require serious institutional investments in training, infrastructure, and culture change.

Table 4: Responses of challenges of using CAD software in drafting patterns for instructional materials for teaching students of Tertiary institutions

S/N	Challenge	Mean	Remark
1	High Cost of Software Licenses	4.00 ± 0.00	Strongly Agreed
2	Frequent Software Crashes	3.70 ± 0.46	Agreed
3	Expensive Hardware Requirements	3.80 ± 0.41	Agreed
4	Lack of Skilled Instructors	3.90 ± 0.31	Agreed
5	Poor Internet Access	3.70 ± 0.46	Agreed
6	Resistance to Change among Staff	3.60 ± 0.50	Agreed

The findings of this study provide a comprehensive understanding of the potentials and challenges of integrating Computer-Aided Design (CAD) into pattern drafting instruction in tertiary institutions in Nasarawa State. The results were carefully analyzed with Mean and Standard Deviation (SD) measures to reflect not only the average views but also the consistency of respondent opinions.

Starting with the first objective, the study identified a range of CAD software considered suitable for teaching and learning pattern drafting. Both general-purpose CAD tools such as CorelDraw (4.00 ± 0.00), AutoCAD (3.90 ± 0.31), and Adobe Illustrator (3.80 ± 0.41) and specialized fashion CAD programs like Gerber AccuMark (3.90 ± 0.31) and Optitex (3.80 ± 0.41) were highly rated. The low standard deviations indicate strong agreement among respondents, particularly for CorelDraw, where all respondents rated it uniformly. This reflects findings by [10], who emphasized the versatility of combining general design CAD tools and fashion-specific software in curriculum delivery.

The second objective sought to examine the development of instructional materials through CAD. The findings clearly show that CAD is highly effective in drafting different garment patterns — basic bodices (4.00 ± 0.00), skirts (3.90 ± 0.31), trousers (3.80 ± 0.41), and sleeves (3.80 ± 0.41). Activities like 2D drafting (4.00 ± 0.00) and pattern editing (3.90 ± 0.31) were equally positively rated. The consistently low SD values suggest that participants found CAD-based instructional materials uniformly clear, efficient, and easy to use. These results align with the work of [14], who demonstrated that CAD-enhanced learning materials foster deeper understanding and faster mastery among students.

On the third objective, regarding the importance of CAD software in pattern drafting, the study findings are very telling. CAD was shown to improve precision (4.00 ± 0.00), reduce drafting errors (3.90 ± 0.31), and speed up the production process (4.00 ± 0.00). Moreover, the use of CAD in educational contexts was seen to align training with industry standards (4.00 ± 0.00), enhance employment opportunities (3.90 ± 0.31), and develop students' digital literacy skills (4.00 ± 0.00). The unanimity of responses (as indicated by low SDs) suggests a widespread recognition of the centrality of CAD in modern technical education. Similarly, Johnson and Lee [11] noted that digital competence is now a non-negotiable requirement for employability across technical industries.

Despite these promising benefits, the fourth objective highlighted some significant challenges associated with CAD adoption. The high cost of software licenses (4.00 ± 0.00) was identified as the most pressing challenge, showing complete agreement among respondents. Other challenges like frequent software crashes (3.70 ± 0.46), expensive hardware requirements (3.80 ± 0.41), lack of skilled instructors (3.90 ± 0.31), poor internet access (3.70 ± 0.46), and staff resistance to change (3.60 ± 0.50) were also acknowledged.

It is important to note that while the SDs for challenges like frequent crashes and resistance to change was slightly higher, the overall consensus remained strong. These findings reflect those reported by [17], where financial constraints, technical skill gaps, and infrastructural deficiencies were found to be major barriers to the adoption of digital technologies in Nigerian tertiary institutions.

Interestingly, despite these challenges, the attitudes of both students and staff were largely positive towards adopting CAD technologies, indicating readiness for innovation if institutional support structures are strengthened. This observation supports [14] who stressed that a positive mindset among faculty and students is critical for successful ICT integration in education.

Overall, the study confirms that integrating CAD into pattern drafting instruction offers transformative potentials for technical education. With strong agreement (Mean values close to 4.00) and low variability (small SDs), the evidence points towards CAD as a critical tool for modernizing clothing and textile education.

The adoption of CAD is not only a technological upgrade but also an educational necessity in a world increasingly driven by digital innovation.

Conclusion

This study investigated the use of Computer-Aided Design (CAD) for drafting patterns as instructional materials in tertiary institutions in Nasarawa State. Using a robust methodological framework and statistical analysis that incorporated both Mean and Standard Deviation, the findings have shown

substantial agreement on the potentials and challenges associated with CAD adoption. CAD software such as CorelDraw, AutoCAD, Adobe Illustrator, Gerber AccuMark, Optitex, and LectraModaris were identified as highly suitable for teaching and learning pattern drafting, with Mean ratings ranging from 3.70 to 4.00 and minimal variability (SD ranging from 0.00 to 0.46). Instructional materials developed using CAD tools were consistently rated highly, with the Mean scores for major pattern drafting tasks standing at 3.80 and above. This indicates that CAD technologies enhance clarity, speed, precision, and creativity in drafting, compared to traditional manual methods. Moreover, the importance of CAD in improving educational outcomes, aligning training with industry demands, and preparing students for employment was overwhelmingly supported. The consistently low standard deviations across responses suggest a unified recognition of CAD's role as an essential component of 21st-century technical education.

However, the study also revealed significant challenges including the high cost of software licensing, lack of technical manpower, and infrastructural limitations. These challenges, although serious, are surmountable through strategic investments, capacity building, and institutional reforms.

In conclusion, integrating CAD into pattern drafting education is crucial for bridging the gap between traditional teaching methods and contemporary industry standards. It offers significant advantages not only in improving the quality of education but also in ensuring that graduates are globally competitive, digitally literate, and innovation-driven.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Tertiary institutions should update clothing and textile curricula to make CAD skills mandatory for all students.
2. Intensive and continuous professional development programs should be organized to train lecturers in the effective use of CAD software.
3. Institutions should invest in high-quality computers, licensed CAD software, stable internet access, and backup power supply to support seamless digital learning.
4. Government, NGOs, and industry stakeholders should provide grants or academic licensing deals to subsidize the cost of CAD software acquisition.
5. Institutions should establish CAD laboratories accessible to students for practice, research, and innovation outside lecture hours.
6. Collaboration between institutions and industry players should be fostered to provide real-world exposure and internship opportunities for students.
7. Change management programs should be developed to reduce resistance among staff and encourage the acceptance of digital innovations.
8. Educational policymakers should develop specific policies encouraging the adoption of ICT and CAD tools in technical and vocational education nationwide.

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