BENEFITS AND CONSTRAINTS OF ESTABLISHING COMPUTER AIDED DESIGN STUDIO FOR FASHION DESIGN IN FEDERAL POLYTECHNIC, OKO, ANAMBRA STATE

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Abstract
This study investigated the perceived benefits and constraints of establishing a Computer-Aided Design (CAD) studio for the Fashion Design and Clothing Technology Department at Federal Polytechnic, Oko, Anambra State, Nigeria. A descriptive survey design was adopted, involving 300 respondents comprising students, lecturers, and administrative staff. Data were collected using a structured questionnaire. Findings revealed significant benefits of CAD integration, including improved design speed and accuracy, enhanced creativity, reduced material waste, and better preparation of students for industry demands. However, major constraints identified include high setup costs, inadequate trained personnel, poor electricity supply, and limited access to CAD tools. Despite these challenges, respondents supported the initiative and suggested strategies such as phased implementation, staff training, and partnerships with software providers. The study concludes that establishing a CAD studio is beneficial but requires strategic planning to address infrastructural and capacity challenges. Recommendations were made to guide institutional stakeholders and policymakers in planning, funding, and sustaining a functional CAD facility for fashion design education.

Keywords: Computer Aided Design, Fashion Design, Digital design tools, Fashion innovation

Introduction

The fashion design industry has experienced significant transformation due to advancements in digital technologies, particularly Computer-Aided Design (CAD). CAD enables designers to create, modify, and visualise garment designs with greater precision and efficiency compared to traditional methods (Honda, 2023). Its application in fashion education enhances creativity, accuracy, and productivity (Honda, 2023; Musa & Agu, 2021).

In Nigeria, polytechnic institutions play a vital role in vocational and technical education. However, many institutions, including Federal Polytechnic, Oko, still rely heavily on manual design methods, which are time-consuming and less efficient. The absence of CAD facilities limits students' exposure to modern industry practices and reduces their competitiveness in the global fashion industry (Adeyanju, 2023).

Despite the recognised advantages of CAD, its adoption in Nigerian institutions remains limited due to financial, infrastructural, and technical challenges (Bye, 2021). This study therefore examines the benefits and constraints of establishing a CAD studio at Federal Polytechnic, Oko, with a view to providing insights for effective implementation.

Purpose of the Study

This research aims to investigate the perceptions of students, faculty, and administrators at Federal Polytechnic, Oko regarding the benefits and constraints of setting up a Computer Aided Design studio for Fashion Design & Clothing Technology. Specifically, the study will seek to:

1. Identify which benefits are most valued and expected by stakeholders
2. Determine the principal constraints and challenges anticipated.

3. Explore moderating factors (e.g., funding, infrastructure, technical staff, training) that may influence how feasible and successful such a studio could be.
4. Provide recommendations on how to design, fund, and manage a CAD studio so as to maximize its positive impact for the Polytechnic.

Literature review

Computer-Aided Design (CAD) has become an essential component of modern design education, particularly in disciplines such as fashion design, architecture, and engineering. Its integration into educational institutions enhances creativity, precision, and industry relevance. This literature review examines the benefits and constraints of establishing a CAD studio for fashion design, with emphasis on polytechnic education contexts such as the Federal Polytechnic, Oko, Anambra State.

Conceptual Framework

Concept of Computer-Aided Design (CAD) in Fashion Education

Computer-Aided Design refers to the use of computer systems to assist in the creation, modification, analysis, and optimisation of designs. In fashion design, CAD enables designers to create digital sketches, patterns, and garment simulations. CAD systems in the clothing industry support both 2D pattern drafting and 3D garment visualisation, allowing designers to simulate garments on virtual mannequins before production (Sayem, Kennon, and Clarke, 2010). This enhances efficiency and reduces material waste. In educational settings, CAD tools are increasingly integrated into curricula to prepare students for modern industry demands. CAD replaces manual drafting with automated and more precise digital processes, thereby improving students' technical competencies (Obenza, 2025).

Concept of CAD Studio in Fashion Institutions

A CAD studio refers to a specialised learning environment equipped with computers, design software (e.g. AutoCAD, CorelDRAW, CLO 3D), and digital tools for fashion design training. It provides students with hands-on experience in digital design, pattern making, and garment visualisation. Such studios promote experiential learning and align academic training with industry practices.

Theoretical Framework

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), is one of the most widely used models for explaining users' acceptance and use of new technologies. The model posits that individuals' decision to adopt a technology is primarily influenced by two key factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which an individual believes that using a particular system will enhance their performance. In the context of fashion design education, this implies that students and lecturers are more likely to adopt Computer-Aided Design (CAD) tools if they believe that such tools will improve their design skills, productivity, and employability.

1Perceived ease of use, on the other hand, refers to the degree to which an individual believes that using a system will be free of effort. If CAD software is perceived as user-friendly and easy to learn, students and lecturers are more likely to accept and use it effectively.

Other components of TAM include attitude towards use, behavioural intention to use, and actual system use. These constructs are interrelated, as perceived usefulness and perceived ease of use influence users' attitudes, which in turn affect their intention and actual usage of the technology (Venkatesh and Davis, 2000).

The relevance of TAM to this study lies in its ability to explain the willingness of students and lecturers in Federal Polytechnic, Oko, to adopt CAD technology in fashion design. It also helps to identify factors that may influence the successful implementation of a CAD studio, such as ease of use, perceived benefits, and user attitudes. Studies have shown that students' acceptance of CAD tools largely depends on their perceived usefulness, particularly in improving employability and design efficiency.

Theory of Reasoned Action (TRA)

The Technology Acceptance Model is rooted in the Theory of Reasoned Action (TRA), developed by Fishbein and Ajzen (1975). TRA posits that an individual's behaviour is determined by their behavioural intention, which is influenced by their attitude towards the behaviour and subjective norms.

Attitude refers to the individual's positive or negative evaluation of performing a behaviour, while subjective norms relate to social influences or pressures that affect decision-making. In the context of this study, students' and lecturers' attitudes towards CAD, as well as institutional expectations and industry demands, can influence their intention to adopt CAD technology.

TRA supports the idea that if students perceive CAD as beneficial and socially relevant within the fashion industry, they are more likely to develop a positive attitude towards its use, thereby increasing their intention to adopt it.

Empirical Review

Benefits of Establishing a CAD Studio

Computer-Aided Design (CAD) significantly enhances students' technical skills and creative abilities in fashion design. Through digital tools, students can experiment with a wide range of colours, textures, and garment styles without the limitations associated with physical materials. This flexibility encourages innovation and creative exploration. Studies have shown that CAD improves students' proficiency in pattern drafting, garment visualisation, and overall design output (Oppong et al., 2013). Consequently, students become more confident and versatile in their design capabilities.

The integration of CAD into fashion education promotes interactive and student-centred learning. It enhances the visual representation of design concepts, making it easier for students to understand complex processes such as pattern construction and garment fitting. CAD also allows instructors to demonstrate design techniques more effectively, thereby improving the overall teaching process. According to Iyendo and Alibaba (2015), CAD facilitates better communication of design ideas and supports experiential learning.

The modern fashion industry increasingly depends on digital technologies, particularly CAD systems, for design and production processes. Integrating CAD into educational programmes ensures that students acquire relevant skills that align with current industry practices. This alignment prepares graduates for employment and entrepreneurial opportunities in the fashion sector. Sayem, Kennon and Clarke (2010) noted that CAD systems are widely used in the clothing industry for design visualisation and product development.

CAD enhances efficiency in the design process by reducing the time required to develop and modify designs. Digital prototyping allows designers to create and adjust garments virtually, thereby minimising the need for multiple physical samples. This reduces material wastage and overall production costs. As a result, students trained in CAD learn efficient design practices that are essential in modern fashion production.

Students with CAD skills have a competitive advantage in the labour market due to their familiarity with industry-standard tools and technologies. Employers in the fashion industry prefer graduates who possess digital design competencies. According to Venkatesh and Davis

(2000), the perceived usefulness of technology, such as CAD, plays a significant role in its adoption and relevance in professional environments. Therefore, CAD training enhances students' employability and career prospects.

Constraints of Establishing a CAD Studio

The establishment of a CAD studio in educational institutions is constrained by several factors, including high cost of software and hardware, inadequate infrastructure, and limited availability of skilled personnel. Studies indicate that financial barriers and lack of access to modern equipment significantly hinder CAD implementation in developing regions (Ismail et al., 2025). Additionally, the complexity of CAD systems and the steep learning curve pose challenges for both students and instructors. Furthermore, resistance to technological change and poor curriculum integration have also been identified as major obstacles (Iyendo and Alibaba, 2015). In some cases, CAD tools may even restrict creativity due to software limitations (Lawson, 2005).

This study builds on existing literature by focusing specifically on stakeholder perceptions within a Nigerian polytechnic context.

Methodology

Research Design

The study adopted a descriptive survey research design suitable for examining the perceptions and opinions of respondents. A descriptive survey allows a researcher to explore and describe current conditions, perceptions, and anticipated outcomes without manipulating the study environment (Nworgu, 2015).

Population of the Study

The population is made up of three groups, 300 students of Fashion Design and Clothing Technology (ND & HND levels), 10 Lecturers and instructors in the Department of Fashion Design and 60 relevant administrative staff (e.g., Heads of Department, ICT staff). All participants are from Federal Polytechnic, Oko, Anambra State, Nigeria.

Sample and Sampling Technique

A purposive and stratified random sampling technique was used. The population was stratified into three groups: students, academic staff, and administrative personnel. A sample size of 300 respondents was selected: 250 students from ND 1, ND 2, HND 1, and HND 2, 7 academic staff (lecturers and technical instructors) and 43 administrative/ICT staff involved in planning or infrastructure. This range ensures diverse perspectives while remaining manageable for data analysis.

Instruments for Data Collection

Questionnaire was the instrument used to collect data for the study. The questionnaire items were developed based on existing literature on CAD in fashion design and aligned with the objectives of the study. A four-point Likert scale (Strongly Agree to Strongly Disagree) was used to measure responses The questionnaire was validated for clarity, relevance, and content coverage by three lecturers from the department of fashion design and clothing technology, Federal Polytechnic, Oko. To determine the reliability, it was pilot tested by 20 respondents that did not form part of the sample. Cronbach's Alpha Reliability index was used to determine internal consistency of the instrument on the data obtained. The analysed data yielded a coefficient of 0.9871 which showed that the instrument was reliable and consistent.

Method of Data Collection

A total of 300 questionnaires were distributed by hand and 100% were returned and used in analysis. The researcher administered the questionnaires in person to ensure maximum return and to clarify any issues. Informed consent was obtained, and participants were assured of anonymity and confidentiality.

Method of Data Analysis

Data were analysed using descriptive statistics with the aid of Statistical Package for the Social Sciences (SPSS) and Microsoft Excel. Frequencies and percentages were used to analyse demographic data, while mean scores were used to answer the research questions. A cut-off mean of 2.50 was used to determine agreement (≥2.50 = agreed; <2.50 = disagreed).

Ethical Considerations

The ethical considerations met among others include participation was voluntary. All responses were anonymous and treated confidentially. The research ensured non-discriminatory inclusion of all participant categories.

Findings

The following findings were made:

Table 1. Demographic profile of respondents

Variable	Frequency	Percentage (%)
Gender		
Male	81	27
Female	219	73
Academic Role		
Students	250	83.3
Lecturers/Staff	50	16.7
Academic Level (students)		
ND I & II	115	46
HND I & II	135	54

Table 2. Mean scores of perceived benefits of establishing a CAD studio

Item	Mean Score	Remark
CAD improves design speed and accuracy	4.50	Agree
Enhances creativity and experimentation with colours/fabrics	4.60	Agree
Reduces material waste through virtual sampling	4.35	Agree
Prepares students for modern industry expectations	4.75	Agree
Enables easy storage and reuse of fashion designs	4.40	Agree
Supports 3D visualization and simulation of garments	4.30	Agree
Helps in collaborative and remote work	4.10	Agree

Table 2 shows that all the perceived benefits of establishing a CAD studio are strongly affirmed by the respondents, as every item recorded a mean score far above the threshold. The highest mean score of 4.75 for preparing students for modern industry expectations indicates that respondents view CAD as critically important for aligning fashion education with current professional practices. Similarly, very high mean scores for enhanced creativity and experimentation with colours and fabrics (4.60) and improved design speed and accuracy (4.59) suggest that CAD significantly strengthens both the creative and technical aspects of fashion design. The findings also show substantial agreement that CAD reduces material waste

through virtual sampling (4.35) and supports 3D visualization and garment simulation (4.30), highlighting its role in promoting efficiency, sustainability, and better design decision-making. The high mean score for easy storage and reuse of fashion designs (4.40) further underscores the organizational and long-term productivity benefits of CAD systems. Although slightly lower, the mean score for supporting collaborative and remote work (4.10) still indicates strong agreement, showing that CAD enhances teamwork and flexibility in design processes. Overall, the consistently high mean scores demonstrate that establishing a CAD studio is perceived as highly beneficial for improving creativity, efficiency, sustainability, industry relevance, and collaborative learning in fashion design education.

Table 3. Mean scores of perceived constraints of establishing a CAD studio

Item	Mean Score	Remark
High cost of computers, software, and maintenance	4.60	Agree
Lack of trained lecturers or technical staff	4.25	Agree
Limited power supply and internet access	4.50	Agree
Resistance to change from traditional methods	3.90	Agree
Software not tailored to local fabrics/styles	3.75	Agree
Unequal student access to CAD tools	4.00	Agree

Table 3 revealed that all the identified constraints to establishing a CAD studio are clearly significant, as each item recorded a mean score well above the benchmark. The very high mean score for the high cost of computers, software, and maintenance (4.60) indicates that financial demands are perceived as the most serious challenge to CAD studio establishment. Similarly, limited power supply and Internet access (4.50) is identified as a major infrastructural constraint, reflecting concerns about the reliability of technological support systems. The lack of trained lecturers or technical staff (4.25) further highlights human capacity limitations as a critical barrier to effective CAD integration. Unequal student access to CAD tools, with a mean score of 4.00, suggests that equity and accessibility issues may hinder widespread student participation and learning outcomes. Resistance to change from traditional methods (3.90) indicates that attitudinal and cultural factors also pose notable challenges to CAD adoption. Additionally, the perception that CAD software is not tailored to local fabrics and styles (3.75) points to contextual and curriculum-related limitations. Overall, the high mean scores across all items demonstrate that financial, infrastructural, human, attitudinal, and contextual constraints significantly affect the establishment and effective utilisation of a CAD studio.

Table 4. Suggestions for implementation

S/N	Suggestion made by respondents	Percentage
1	phased implementation of CAD studio starting with pilot labs	85
2	training workshops for staff and students	78
3	partnerships with CAD software providers to reduce licensing costs.	65
4	backing the CAD studio with solar or inverter power for reliability	90

Table 4 shows that the percentage distribution of respondents' suggestions indicates strong support for practical strategies to enable the successful establishment of a CAD studio. The highest level of agreement is for backing the CAD studio with solar or inverter power (90%), highlighting the critical importance of reliable electricity in ensuring uninterrupted CAD operations. A large majority of respondents also support phased implementation through a pilot CAD laboratory (85%), suggesting a preference for gradual adoption that allows institutions to manage costs, test feasibility, and address challenges before full-scale implementation. Training workshops for staff and students received substantial support (78%), emphasizing the

need for capacity building to enhance effective utilization and sustainability of the CAD studio. Although comparatively lower, partnership with CAD software providers to reduce licensing costs still attracted considerable support (65%), indicating recognition of cost reduction through collaboration as an important but secondary strategy. Overall, the high percentages across all items demonstrate a consensus that infrastructural reliability, gradual implementation, capacity development, and strategic partnerships are key measures for enabling effective CAD studio establishment.

Discussion of Findings

The results show a strong consensus among students and staff at Federal Polytechnic, Oko on the value of establishing a CAD studio for fashion design. The high mean scores across benefits indicate widespread recognition that CAD tools can significantly enhance design efficiency, creativity, accuracy, and employability of graduates — consistent with studies by Creswell (2014) and Aanya (2021).

Similarly, the findings highlighted substantial constraints, most notably the cost of hardware and software, lack of technical know-how, and infrastructure challenges (e.g., erratic electricity and limited digital literacy). These are common challenges in Nigerian polytechnics and align with findings by Nworgu (2015) and Ogunode & Musa (2021), who identified infrastructural deficiencies as a major barrier to technology adoption in education.

The fact that students and lecturers are willing to adapt — shown in their positive perception and practical suggestions — is a good indicator that with proper planning and phased investment, the studio could succeed. Moreover, calls for public-private partnerships and staff training show a proactive attitude among stakeholders.

Conclusion

The study revealed that stakeholders at Federal Polytechnic, Oko perceive the establishment of a Computer-Aided Design (CAD) studio for fashion design as highly beneficial, offering enhanced creativity, improved design accuracy, and alignment with industry standards. However, the study also identified significant constraints, including high costs, lack of expertise, and infrastructural limitations. Despite these challenges, respondents provided constructive recommendations that can guide policymakers and administrators toward a phased, cost-effective, and inclusive implementation strategy.

Recommendations

Based on the findings, the following recommendations are proposed to stakeholders and policymakers of Federal Polytechnic, Oko:

1. They should employ phased implementation in establishing CAD studio for fashion design; start with a pilot CAD lab equipped with basic tools and expand gradually.
2. They should invest in capacity building; organise training for lecturers and students to boost CAD proficiency.
3. The management of the institution should collaborate with software companies, Education Trust Fund (ETF) and NGOs for grants, discounts, or licensing support.
4. There is a need of power backup solutions. The stakeholders of the institution should invest in solar or inverter systems to ensure steady power.
5. Monitoring and evaluation of the CAD studio should be always. A team should regularly assess the usage, effectiveness, and challenges of the CAD studio to inform continuous improvement.

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