



# Computer-Aided Design (CAD) and Its Impact on Students' Creativity in Textile Design: A Case Study of Ahmadu Bello University, Zaria

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Abstract		Case Studies
<p>Computer-Aided Design (CAD) has become an integral tool in contemporary textile design education, transforming traditional design processes through enhanced speed, precision, and flexibility. Despite its widespread adoption, scholarly debate continues regarding the extent to which CAD influences students' creative development in textile design. This study examines the impact of CAD on the creativity of textile design students, using Ahmadu Bello University, Zaria, as a case study. A quantitative research approach was employed, with the study population stratified into undergraduate and postgraduate students. Data were collected through structured questionnaires administered to a sample of sixty respondents and analyzed using descriptive statistics the Statistical Package for the Social Sciences (SPSS). The findings reveal that CAD significantly supports students' creative processes by improving design efficiency, visual presentation, and experimentation with patterns, colours, and textures. While some concerns were expressed regarding reduced engagement with manual techniques, the results indicate that CAD does not prevent creativity but rather complements traditional design methods when appropriately integrated. The study concludes that a balanced pedagogical approach combining both digital and manual techniques is essential for fostering creativity in textile design education. The findings provide useful insights for educators, curriculum developers, and professionals seeking to optimize the integration of CAD in textile design programmes.</p> <p><b>Keywords:</b> Computer-Aided Design (CAD), Textile Design, Creativity, Education, Digital Tools.</p>		

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## INTRODUCTION

In today's digital era, computer-aided textile design has become an essential tool in the design and weaving industries. Most fashion and textile illustration processes in developed countries are now computerized, speeding up the work, simplifying it, reducing costs and increasing productivity. (Guder,

Isik & Anagun, 2024). Textile designers have access to a wide range of software for a variety of tasks including textile design, fashion research, fashion design and illustration, pattern design, pattern making, garment construction and production management, marketing and sales. Textile, clothing and their manufacturing processes have been around



since early human civilization. However, in recent years the textile industry has undergone a significant transformation due to the mechanization and computerization of various stages. CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) are technologies that are used in digital computers to carry out specific functions in design and manufacturing with increased efficiency, effectiveness, and accuracy (Dzikite, 2015). Computer Aided Design has become an integral part of the revolution in textile design. Computerization is one of the main trends in the apparel / textile industry today. The use of computers by designers around the world is revolutionizing the way they work.

The application of Computer-Aided Design (CAD) has become increasingly indispensable in contemporary textile design practice. Advancements in Information and Communication Technology (ICT) have significantly influenced various sectors, including the textile industry. Williams and Agbo (2013) observe that technological innovations in ICT have transformed design processes and expanded creative possibilities across disciplines. The textile industry has historically contributed to the economic growth of developed nations such as China, France, and the United States (Biney-Aidoo & Antiaye, 2013). Consequently, the integration of CAD into textile education is essential for equipping students with relevant digital competencies required for modern industry practice and for supporting broader economic development.

Cynthia (2000), also recorded that “CAD is used to design, develop and optimize products, which can be goods used by end consumers or intermediate goods used in other products. Walther, Robertson and Radcliffe (2007) looked at the educational context on the use of CAD noticed the student’s inability to use suitable forms of communication such as sketches or verbal explanations to convey his design ideas. This was as a result of a combination of the enhanced visualization capabilities of CAD and the significance that design education puts on the value of CAD models. The assessment of student work showed this. They recommended that educators should avoid confined thinking and promote good design in their students by making sure the students

become aware of the realities of continual and repetitive design.

## LITERATURE REVIEW

### Theoretical Framework

Computer-Aided Design (CAD) is fundamentally rooted in the advancement of computer technology, which serves as the enabling infrastructure for its application across various design disciplines. Naing, Chua, Leong, and Wang (2005) assert that the effectiveness of CAD systems is directly dependent on the availability and development of computer technologies. As computational capabilities have evolved, CAD systems have become more sophisticated, offering enhanced tools for visualization, simulation, and design manipulation.

From a theoretical perspective, the adoption of CAD in textile design education can be explained through the lens of technological determinism and constructivist learning theories. Technological determinism suggests that technological innovations significantly shape human activities and practices, including the design process. In this context, CAD influences how students conceptualize, develop, and present their design ideas. (Hallström, 2020) In contrast, constructivist learning theory emphasizes that learners actively construct knowledge through interaction with tools and experiences.

### The Concept of Student Creativity

In simple terms, creativity is the process of coming up with new ideas or creating work that is typically useful and original. Since education is becoming more and more globalized, creativity is a valuable addition. Aqda, Hamidi, and Ghorbandordinejad (2011) asserted that creativity is not a trait that is inherent to certain individuals. Each and every one of us possesses the capacity for creativity, which can be enhanced and stimulated through the application of knowledge and skills from professionals. Creativity, which is defined as the capacity to innovate, create new possibilities, and produce new ideas or knowledge, has emerged as a crucial

component of producing creative and innovative thinking, according to Kementarian (2013). It is possible to view creativity as a crucial component of design, which is crucial for innovation and change (Chen & Hwang, 2017).

In contrast to other sciences, which concentrate on the analysis and description of existing realities, design involves the imagination and development of new realities, so a key component of a designer's work is the search for novel and cutting edge solutions to issues. Similar to how the arts are directed by human purposes towards the actualization of intended functions, design emphasizes the need of meeting requirements and producing appropriate solutions (Chen & Hwang, 2017).

### Impact on Students' Creativity:

The influence of CAD on students' creativity in textile design is complex. CAD empowers students to transcend traditional design boundaries and explore innovative design solutions that may not be feasible with conventional methods. The ability to manipulate shapes, textures, and colours digitally opens up new avenues for creative expression, inspiring students to push the limits of their imagination. Furthermore, CAD facilitates the rapid iteration of designs, allowing students to experiment with different variations and refine their ideas iteratively. However, some scholars argue that excessive reliance on CAD may stifle students' creativity by limiting tactile engagement and intuitive expression. Thus, striking a balance between digital and analogue approaches is crucial to nurturing students' creativity effectively.

### The Concept of CAD in Textiles

In today's world, the work of textile students has become a lot easier when compared to decades ago as a result of development of personal computers and software. Creativity and innovation are key factors that shape the textile design industry in its fast-paced environment. The field of textile design has experienced a significant shift due to technological

advancements, specifically the introduction of Computer-Aided Design (CAD). The idea of computer-aided design (CAD) in textiles is examined in this essay, along with its development, uses, and significant influence on the industry. Several CAD software options are available for textile design, each offering unique features and capabilities tailored to the needs of textile designers. Some of the major CAD software used in textile design include:

- i. **Adobe Photoshop and Adobe Illustrator:** Adobe Photoshop is one of the most popular graphic design programs in the textile industry. Photoshop is used by designers to edit images, create digital works of art, and add texture and pattern to fabrics. Illustrator is used to create designers, logos, and intricate patterns that can be expanded on without compromising on quality.
- ii. **EFI Optitex:** EFI Optitex is a leading CAD software solution for textile and apparel design, pattern making, and 3D virtual prototyping. It offers a range of tools for pattern development, grading, and marker making, as well as advanced features for fabric simulation and garment visualization.
- iii. **CorelDRAW:** CorelDRAW is a versatile graphic design software used for creating illustrations, layouts, and vector-based designs. Textile designers use CorelDRAW for pattern creation, colour manipulation, and textile printing. It offers intuitive tools for drawing, editing, and manipulating design elements, making it suitable for various textile design applications.
- iv. **Textronics Design System:** The Textronics Design System is a graphical CAD software solution specially designed for the design of textiles and surfaces. It provides modules for pattern generation, colour control and textile simulation as well as high-end features for Jacquard Design and Electronic Dobby Weaving.

## Applications of CAD in Textile Design

- i. Pattern Creation:** CAD enables textile designers to create intricate patterns and motifs digitally. Designers can experiment with different shapes, sizes, and arrangements to develop unique and innovative designs.
- ii. Colour Exploration:** CAD allows designers to explore an extensive range of colours and colour combinations. Designers can visualize how different colours will appear on textiles and experiment with various palettes to achieve desired effects.
- iii. Texture Simulation:** CAD includes tools for simulating textures and surface effects on textiles. Designers can replicate the look and feel of different fabrics, such as silk, denim, or lace, to accurately represent their designs.
- iv. Repeat Design:** CAD automates the process of creating repeat patterns, eliminating the need for manual repetition. Designers can easily generate seamless repeats and adjust pattern elements to achieve optimal visual balance.
- v. Digital Printing:** CAD facilitates digital printing processes by providing files that can be directly transferred to digital printers. This streamlines the production process and allows for greater flexibility in printing complex designs.

## Impact of CAD on Textile Design:

The integration of CAD into textile design has had a profound impact on the industry, influencing various aspects of the design process and the final products:

- i. Enhanced Creativity:** CAD empowers textile designers to explore new ideas and push the boundaries of creativity. The digital platform allows for greater experimentation and iteration, leading to more innovative and avant-garde designs.
- ii. Improved Efficiency:** CAD streamlines the design process, reducing the time and

resources required to develop textile designs. Designers can work more efficiently, iterate quickly, and respond to market demands with greater agility.

- iii. Precision and Accuracy:** CAD ensures precision and accuracy in textile design, minimizing errors and inconsistencies. Designers can manipulate design elements with exactitude, ensuring that the final products meet quality standards and specifications (Gwari, 2008).
- iv. Cost-Effectiveness:** While initial investment in CAD software and training may be required, the long-term benefits of CAD outweigh the costs. CAD reduces material wastage, production errors, and labor costs, resulting in overall cost savings for textile manufacturers.
- v. Sustainability:** CAD promotes sustainable design practices by facilitating digital prototyping and minimizing material waste. Designers can optimize designs for efficiency and sustainability, contributing to a more environmentally friendly textile industry (Gwari, 2008).

## State of CAD in Textile Design

In the Department of Industrial Design at Ahmadu Bello University, Computer-Aided Design (CAD) has been incorporated into the teaching of textile design to support creative development and digital innovation. However, its level of integration within the textile design curriculum remains relatively limited. Among first- and second-year students, the use of CAD tools is minimal, as greater emphasis is placed on the acquisition of foundational skills such as freehand sketching, motif development, pattern drafting, and colour application. At this stage, students primarily rely on manual techniques, and most textile design outputs such as surface patterns and fabric concepts are produced using traditional hand methods.

However students in the third to final years are introduced to CAD applications that are more relevant to textile design, although freehand

sketching remains essential at the conceptual stage. At this level, CAD is used to refine and digitize manually developed ideas, allowing students to explore pattern repeats, colour variations, and layout compositions more efficiently. By the fourth year, students are encouraged to integrate CAD into their workflow, particularly in the development of final textile designs, surface pattern arrangements, and presentation boards.

## METHODOLOGY

Data for this study were collected using a quantitative research approach. The study population was categorized into undergraduate and postgraduate students. Surveys were also employed to collect information from the various groups.

### Research Design

This study adopted a descriptive survey research design to investigate the impact of Computer-Aided Design (CAD) on students' creativity in textile design. The design was considered appropriate because it allows for the systematic collection of quantitative data from a defined population and facilitates the analysis of students' perceptions, experiences, and usage patterns of CAD within an educational context.

### Population and Sample

The population of the study comprised all undergraduate and postgraduate students offering Textile Design in the Department of Industrial Design, Ahmadu Bello University, Zaria. These students were considered appropriate for the study due to their exposure to both manual and computer-aided textile design practices.

A sample size of sixty (60) students was selected for the study using a purposive sampling technique. This technique was adopted to ensure that only students with prior experience in the use of Computer-Aided Design (CAD) tools in textile design were included. The sample consisted of fifty (50) undergraduate students and ten (10) postgraduate students. This distribution allowed for representation across

different academic levels and provided diverse perspectives on the use of CAD in textile design education.

### Instruments for Data Collection

Data for the study were collected using a structured questionnaire designed by the researcher. The instrument was divided into sections to capture relevant information on respondents' demographic characteristics, level of exposure to CAD, frequency of usage, and perceptions of its influence on creativity.

The questionnaire consisted of close-ended items measured on a Likert-type scale, ranging from Strongly Agree to Strongly Disagree, as well as frequency based response options. This structure ensured uniformity in responses and facilitated quantitative analysis.

### Method of Data Analysis

Data collected from the questionnaires were coded and analyzed using descriptive statistical techniques, including frequencies and percentages. The analysis was carried out using the Statistical Package for the Social Sciences (SPSS). The results were presented using tables to facilitate interpretation.

## PRESENTATION AND DISCUSSION OF RESULTS

The data collected from respondents are analyzed in this section using descriptive statistical tools, including frequencies and percentages. The results were interpreted to examine the impact of Computer-Aided Design (CAD) on students' creativity in textile design.

### Academic Level of Respondents

The distribution of the respondents according to academic levels is shown in Fig. 1 below. The details of the distribution show that 5.0% of the total respondents were 100 level students. Furthermore, 15.0% of the respondents were 200 level students, 28.33% of the total respondents were 300 level and

35.0% of the total respondents were 400 level students. At the postgraduate level, 13.33% were

M.A. students and 3.33% of the respondents were PhD. Students.

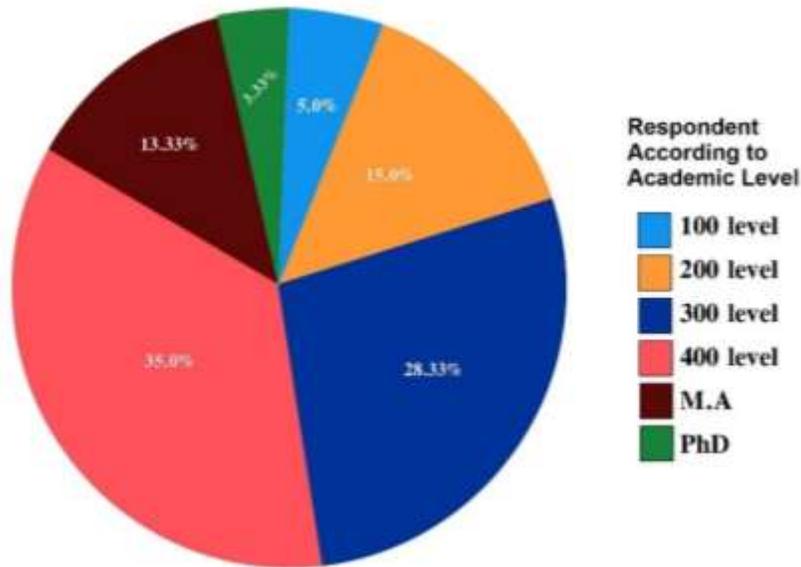


Figure 1: Current Academic Level of Respondents

Table 1. Showing duration of students using CAD.

	Period of usage (yrs.)	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 6 months	8	13.3	13.3	13.3
	1 to 2 years	19	31.7	31.7	45.0
	2 to 3 years	10	16.7	16.7	61.7
	3 to 4 years	16	26.7	26.7	88.3
	More than 4 years	7	11.7	11.7	100.0
	Total	60	100.0	100.0	

Source: Researcher's Survey 2025

Table 1, shows a diverse range of experience levels among students using CAD, with 88.3% having used it for one year or longer. Only 13.3% are in early

stages, indicating continuous adoption. The results indicate that CAD usage increases progressively with students' academic progression, with a slight

decline among respondents who have completed their programmes.

**Table 2.** Showing Students' opinions in regards to how CAD promote creativity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	21	35.0	35.0	35.0
	Agree	32	53.3	53.3	88.3
	Undecided	4	6.7	6.7	95.0
	Disagree	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

*Source: Researcher's Survey 2025*

According to table 2, the majority of students who expressed their opinions about using CAD said that it encourages creativity in them. Although Some

respondents expressed concerns that excessive reliance on CAD may reduce engagement with manual design techniques.

**Table 3.** Showing Students' opinions as to why hand drawing is a better option to using CAD.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	2	3.3	3.3	3.3
	Undecided	9	15.0	15.0	18.3
	Disagree	24	40.0	40.0	58.3
	Strongly Disagree	25	41.7	41.7	100.0
	Total	60	100.0	100.0	

*Source: Researcher's Survey 2025*

Table 3, shows that when students were asked to compare manual drafting and the use of CAD for

designs, the majority of them said that CAD was superior to manual drafting. Contrary to popular belief, CAD does not slow down students' ability to



think. While some students disagreed, many would prefer that CAD be taught at all university levels,

with lectures on the subject starting at the 300 level for undergraduates.

**Table 4.** Showing frequency at which students utilize CAD to exhibit their designs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	11	18.3	18.3	18.3
	Occasionally	13	21.7	21.7	40.0
	Frequently	22	36.7	36.7	76.7
	Always	14	23.3	23.3	100.0
	Total	60	100.0	100.0	

Source: Researcher's Survey 2025

The data presented in Table 4 indicate that a majority of respondents (60.0%) frequently or consistently use CAD for design presentation, highlighting its central role in contemporary student practice. A significant portion of respondents (21.7%) use CAD occasionally, indicating that while not their primary

tool, CAD still plays a role in their design presentations. A smaller proportion of respondents (18.3%) rarely use CAD for design presentations, suggesting that CAD may not be widely adopted or preferred by this subset of students.

**Table 5.** Highlighting students' perceptions of the visual appeal of CAD design in textiles

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somehow visually appealing	3	5.0	5.0	5.0
	Neutral	7	11.7	11.7	16.7
	Visually appealing	13	21.7	21.7	38.3
	Very visually appealing	37	61.7	61.7	100.0
	Total	60	100.0	100.0	

Source: Researcher's Survey 2025

The survey results indicate that CAD designs are generally perceived as visually appealing by the majority of students, with a significant portion finding them very visually appealing. This positive perception of CAD designs' visual appeal suggests that CAD is effective at producing aesthetically

pleasing designs that align with the preferences of the surveyed students. Educators and institutions may consider leveraging the visual appeal of CAD designs to enhance textile design and promote its adoption among students.

**Table 6.** Showing students' output satisfaction with CAD-based concept design layout

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dissatisfied	10	16.7	16.7	16.7
	Neutral	4	6.7	6.7	23.3
	Satisfied	22	36.7	36.7	60.0
	Very satisfied	24	40.0	40.0	100.0
	Total	60	100.0	100.0	

*Source: Researcher's Survey 2025*

According to the surveys in Table 6. most students are happy with the outcomes they get while utilizing CAD to create design concepts. This shows that CAD is a useful tool for generating concept layout, as indicated by the survey's high degree of student satisfaction. When encouraging the use of CAD for

developing designs idea and making sure that students have the necessary materials and training to optimize the success of CAD, lecturers and textile students may take this high satisfaction rate into account.

**Table 7.** Showing students' employing manual techniques while developing design ideas.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	14	23.3	23.3	23.3

Occasionally	22	36.7	36.7	60.0
Frequently	8	13.3	13.3	73.3
Always	16	26.7	26.7	100.0
Total	60	100.0	100.0	

*Source: Researcher’s Survey 2025*

The majority of respondents (60.0%) use manual techniques occasionally, frequently, or always to present their ideas, indicating that manual techniques is a commonly used method among the surveyed students. A significant portion of respondents (26.7%) always use manual techniques to present

their ideas, suggesting that manual techniques is a preferred method for a notable group of students. A smaller percentage of respondents either use manual techniques frequently (13.3%) or occasionally (36.7%). However, these groups still represent a significant percentage of the sample.

**Table 8.** Showing number of students’ manual designs presented in a semester to lecturers.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2 ideas	15	25.0	25.0	25.0
	3-5 ideas	28	46.7	46.7	71.7
	6-10 ideas	15	25.0	25.0	96.7
	More than 10 ideas	2	3.3	3.3	100.0
	Total	60	100.0	100.0	

*Source: Researcher’s Survey 2025*

The results in Table 8 indicate that the majority of students (46.7%) present between 3–5 manual design ideas to lecturers in a semester. This is followed by 25.0% of students who present 1–2 ideas and another 25.0% who present between 6–10 ideas. Only a small percentage of respondents (3.3%) present more than 10 manual design ideas in a semester. This

distribution suggests that while manual design practices remain relevant, most students engage in a moderate level of manual design production, possibly alongside the use of CAD tools. This distribution indicates a moderate level of engagement with manual design practices by the students. This indicates that although computer-

aided design (CAD) improves efficiency, manual design practices remain prevalent, particularly for conceptual exploration.

## Discussion

The findings of this study demonstrate that Computer-Aided Design (CAD) plays a significant role in enhancing creativity among textile design students. The high proportion of respondents who acknowledged that CAD promotes creativity indicates that digital tools serve as effective platforms for expanding students' design capabilities. This supports the view of Chen and Hwang (2017), who argue that technology-enhanced learning environments foster innovation by enabling learners to experiment with diverse design possibilities.

The results further reveal that students frequently utilize CAD in presenting their design work, with a majority indicating regular or consistent usage. This suggests that CAD has become an integral component of contemporary textile design practice among students. The increased reliance on CAD can be attributed to its ability to facilitate precision, flexibility, and rapid iteration of design ideas. As noted by Dzikite et al. (2016), the integration of Information and Communication Technology (ICT) tools in design education enhances both efficiency and the quality of creative outputs.

In addition, the strong positive perception of the visual appeal of CAD-generated designs highlights the importance of digital tools in improving aesthetic presentation. A significant percentage of respondents rated CAD designs as visually appealing or very visually appealing, indicating that CAD contributes not only to creativity but also to the refinement and professional presentation of design outcomes. This aligns with Gwari (2008), who emphasized that CAD improves accuracy and visual quality in textile production processes.

Despite the advantages of CAD, the findings also reveal that students continue to engage with manual techniques, particularly during the conceptualization phase of design. The use of manual methods alongside CAD suggests that students recognize the

importance of tactile engagement and traditional skills in the creative process. This supports the constructivist perspective, which emphasizes that learning occurs through interaction with both tools and experiences (Hallström, 2020). The coexistence of digital and manual practices indicates that creativity in textile design is best supported through a blended approach.

## Recommendations

Students studying textiles should be encouraged to use CAD as much as possible because of its efficiency in design and the fact that time and presentation are important factors in today's world. Students should be encouraged to develop proficiency in CAD applications to enhance their efficiency and professional competence in textile design. They should also study how to use these tools by reading books and watching tutorials. Additionally, because some CAD tools have features that others do not have, students should experiment with a variety of these tools. Because there are alternative design methods, such as manual drafting, and because the final product of a design is more important than the process of creating it, students shouldn't be restricted to using CAD alone. Since most students become disinterested in repetition, they ought to be assigned a variety of design projects, such as those for furnishing and dress fabric, etc. Lawson pointed out that when a computer uses an incorrect illustration to describe a design feature, it can have a negative impact on the creative integration that design requires. To encourage the use of CAD tools, CAD tool manufacturers should try to make their products as user-friendly as possible.

## Conclusion

The use of CAD often enhances a student's creativity without increasing or weakening it, as in many cases CAD did not influence the results of the designs. The findings suggest that CAD does not hinder students' cognitive or creative processes when integrated effectively into textile design education. If a student is lazy or studious, it will be reflected in their use of CAD to complete their designs. Students can use

different approaches to show their textile creations, whether they are fully finished or not. These approaches may be manual or involve the use of CAD.

To sum up, computer-aided design, or CAD, has a great deal of potential to improve students' creativity in textile design classes. Through the facilitation of experimentation, iteration, and collaboration, computer-aided design (CAD) enables students to discover novel avenues of exploration and carry out their design concepts. However, careful consideration of pedagogical approaches, technical infrastructure, and the preservation of traditional craftsmanship are necessary for effective integration of CAD. Teachers and practitioners will need to keep coming up with new ideas and adjusting to new situations in order to fully utilize CAD's transformative potential in the future of textile design education.

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