Type of Software and Implementation of Computer Aided Design Software in Fashion Design Program at Kitale, Sigalagala and Kisumu National Polytechnics

Joyce Chepngeno
Student, University of Eldoret

Dr. Dorcas Serem
Lecturer, University of Eldoret

Dr. Florence Wamunga
Lecturer, University of Eldoret

ABSTRACT:
This study examined the implementation of Computer-Aided Design (CAD) technology in the fashion design curriculum at Kitale, Sigalagala, and Kisumu National Polytechnics in Kenya. The study aimed to determine the types of CAD software employed in training and assess their influence on the implementation of fashion design programs. The study was guided by the Technology Acceptance Model (TAM), which emphasizes perceived usefulness and ease of use as determinants of technology adoption. A descriptive research design was adopted to provide an in-depth understanding of current CAD integration practices in the selected institutions. The target population consisted of 31 trainers and 462 trainees in fashion design departments, totaling 493 respondents. Census sampling was used for trainers, while Slovin's formula determined a sample of 266 trainees, resulting in an overall sample size of 297 respondents. Stratified random sampling was applied to ensure proportional representation across the institutions. Data were collected using structured questionnaires and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used, while inferential statistics involved correlation analysis. The findings revealed that foundational CAD software such as Adobe Illustrator, TUKAcad, Optitex, and 2D drafting tools were widely used across the polytechnics, while advanced applications such as CLO 3D, virtual fitting tools, and design documentation software were less utilized. Kitale Polytechnic emphasized 2D drafting and grading software, Sigalagala focused on textile design applications, while Kisumu demonstrated relatively greater adoption of 3D visualization tools. Correlation analysis established a strong positive relationship between the type of software used and the implementation of fashion design programs ($r = 0.634$, $p = 0.000$). The study concludes that effective implementation of CAD in fashion design depends significantly on access to modern and industry-standard software. The study recommends increased investment in advanced CAD technologies, standardized software integration, and continuous professional development for trainers to enhance digital competencies in fashion design education.

Key words: Implementation of Computer-Aided Design technology, National Polytechnics in Kenya

Citation: Joyce Chepngeno, Dr. Dorcas Serem, Dr. Florence Wamunga, Type of Software and Implementation of Computer Aided Design Software in Fashion Design Program at Kitale, Sigalagala and Kisumu National Polytechnics, *International Journal of Current Business and Social Sciences*. *ISSN- 2312-5985, 12 (3), 09-21, (2026).*

1. INTRODUCTION

Computer Aided Design (CAD) is the use of computer software to assist in the creation, modification, analysis, or optimization of a design. It is a tool used by engineers, architects, and designers to create two-dimensional or three-dimensional models of products or structures. CAD software allows users to create detailed designs, visualize the product in different configurations, and test various scenarios in a virtual environment before committing to physical production (Gupta & Chauhan, 2017).

The adoption of Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) have revolutionized the way products are designed and manufactured. CAD has been around for several decades, but the adoption of this technology has increased significantly in recent years (Gupta & Chauhan, 2017). CAD technology has become an essential tool for design and engineering work in many industries, including architecture, automotive, aerospace, and manufacturing (Adisa, & Bello, 2017).

The primary reason for adopting CAD-is to improve product design and development (Gupta & Chauhan, 2017). According to Li, and Li, (2018) CAD reduces the time required for product design and development, enabling companies to bring new products to the market faster. Additionally, CAD technology automates many repetitive tasks, such as drawing and drafting, freeing up designers to focus on more complex tasks. Shi and Zhou, (2021) assert that CAD technology improves product quality by enabling designers to create more complex designs with greater precision. Additionally, CAD technology enables designers to simulate and test their designs before they are manufactured, reducing the risk of product failures and recalls. The successful adoption of CAD technology requires personnel with specialized skills in computer-aided design and engineering (Turel, & Zhou, 2021).

According to Gichunge, and Kagiri, (2020) the adoption of CAD technology in Kenyan National Polytechnics has been a recent development, with the first instances of CAD usage appearing in the mid-2000s. The adoption of CAD in Kenyan National Polytechnics was primarily driven by the need to align the fashion industry with global trends and to meet the demand for more complex and intricate designs.

In fashion industry, CAD increases productivity and accuracy in design. CAD software enables designers to create multiple design iterations with ease, eliminating the need for manual drafting and redrawing. This saves time and reduces the chance of errors, resulting in a more accurate and efficient design process. Additionally, CAD allows for easy modification of designs, making it easier for designers to respond to changes in client preferences or industry trends (Obura, Gichoya, & Ngugi, 2019).

2. THEORETICAL FRAMEWORK

A theory is a set of statements or principles formulated to describe a collection of facts or phenomenon particularly one that has been continually verified or broadly accepted and can be used to make forecasts about natural phenomena (Camp, 2001). The theory that will inform the current study is Technology Acceptance Model (TAM). The Technology Acceptance Model (TAM) was developed by Davis, (1989). The theory posits that there are various factors that determine whether a computer system will be accepted by its potential users. They include perceived usefulness, perceived ease of use, attitude towards use and behavioral intention to use. The key feature of this model is its emphasis on the perceptions of the potential user. That is, while the creator of a given technology product may believe the product is useful and user-friendly, it will not be accepted by its potential users unless the users share those beliefs. TAM suggests that users are more likely to accept and use a technology if they perceive it to be useful in improving their performance or outcomes. TAM posits that users are more likely to accept and use a technology if they perceive it to be easy to use and learn.

TAM suggests that users' overall attitudes toward using a technology influence their intention to adopt and use it. TAM proposes that users' behavioral intention to use a technology is a direct determinant of their actual use behavior. TAM suggests that actual system use reflects the extent to which users engage with and adopt a technology in their work or educational activities. Critics argue that perceived usefulness may not always accurately predict technology acceptance, as users' perceptions of usefulness can be influenced by factors such as subjective. Critics also argue that attitudes toward use may not always translate into actual technology adoption and use, as users' behavior can be influenced by external factors beyond their attitudes.

In the context of CAD software selection, Perceived Usefulness (PU) relates to how instructors and students perceive the usefulness of different software options in enhancing their teaching and learning experiences. Perceived Ease of Use (PEOU) involve evaluating the intuitiveness of the user interface, the accessibility of training materials, and the learning curve associated with each software option. Attitudes toward use encompass individuals' overall feelings and opinions about using a specific technology. In the context of CAD software selection, this involves understanding instructors' and students' attitudes toward different software options, including their preferences, concerns, and expectations. Therefore, the model guided the study to determine the type of software employed in the training of CAD in fashion design curriculum at national polytechnics.

3. EMPIRICAL REVIEW

The training of Computer-Aided Design (CAD) involves the use of a diverse range of software applications tailored to various design disciplines. These software tools are crucial components of CAD courses, providing students with the means to create, analyze, and optimize digital models. The types of software employed in CAD training can be categorized based on their functionalities, and several references contribute to understanding their significance. These tools focus on creating two-dimensional representations of objects. Common software in this category includes AutoCAD, which is widely used for architectural and engineering drafting (Leondes, 2023).

There are a number of software that are used in fashion design. One of the them is adobe illustrator. This is a cornerstone software in fashion design, primarily used for creating vector-based illustrations and technical sketches. Designers use Illustrator to produce detailed garment designs and fashion illustrations with precise lines and shapes that can be easily scaled without loss of quality. The software's powerful tools for drawing, coloring, and texturing allow designers to develop intricate designs and patterns. Illustrator's ability to work with layers and groups facilitates the organization of complex designs, making it easier to experiment with different styles and color palettes. Its integration with other Adobe Creative Cloud applications further enhances the workflow by enabling seamless transfer of designs to Photoshop or InDesign for additional editing or layout tasks (Chappell, 2019).

Another software is adobe photoshop. Adobe Photoshop is essential for fashion designers, particularly for tasks related to image manipulation and enhancement. Designers use Photoshop to edit and retouch photographs of garments, create mood boards, and visualize fabric textures and colors. The software's advanced features, such as layers, masks, and filters, allow designers to make precise adjustments and achieve high-quality visuals. Photoshop is also used for creating digital mock-ups of fashion collections, where designers can apply different patterns and colors to photographic images of models or garments. This capability helps in presenting design ideas more effectively to clients or stakeholders, facilitating better decision-making and feedback (Gupta, 2020).

InDesign is also another software that is used in fashion design. Adobe InDesign is a leading layout and desktop publishing software used in fashion design for creating visually appealing catalogs, lookbooks, and promotional materials. Designers utilize InDesign to compile and arrange design elements, including text, images, and graphics, into polished and professional layouts. The software's robust typography tools and template features allow for consistent and high-quality presentation of fashion collections (Aish & Woodbury, 2015). InDesign's integration with other Adobe applications, like Illustrator and Photoshop, streamlines the process of importing and editing design assets. This seamless workflow is crucial for producing high-end marketing materials and publications that effectively showcase fashion designs to a broader audience.

Best Image is also a software tool tailored for the fashion industry, specializing in image management and enhancement. It offers features for optimizing and editing fashion photographs, ensuring that images are high-resolution and visually appealing. Best Image provides tools for color correction, cropping, and adjusting image quality, which are essential for creating professional portfolios and look books. Additionally, the software supports batch processing, allowing designers to efficiently handle large volumes of images. This capability is particularly useful for fashion brands that need to manage and update extensive image libraries for their collections, online stores, and promotional campaigns (Hamzah and Razak, 2020).

Clo3D is a revolutionary software in fashion design known for its 3D garment visualization capabilities. It allows designers to create digital prototypes of garments, simulating how fabrics will drape and fit on virtual models. Clo3D's realistic rendering of textures, colors, and movements provides valuable insights into the final look and feel of the designs before physical production. This capability significantly reduces the need for physical samples, saving time and resources. Designers can experiment with different materials and design elements in a virtual environment, making it easier to refine their creations and address any fit or aesthetic issues early in the design process (Carter, 2023).

Marvelous Designer is a specialized tool for creating 3D digital garments and fashion simulations. It enables designers to design and visualize clothing in a realistic 3D environment, providing detailed simulations of how fabrics behave and interact. Marvelous Designer's intuitive interface allows users to design garments by draping virtual fabrics over 3D avatars, adjusting patterns, and refining fit and details in real-time (Thompson, 2022). The software's powerful simulation capabilities help designers understand how different materials will look and perform, facilitating more accurate design decisions and reducing the need for multiple physical prototypes. This technology is especially beneficial for creating intricate designs and ensuring that garments meet design specifications before production.

Wilcom is a software suite primarily used for embroidery design, crucial for fashion designers incorporating embroidered elements into their collections. Wilcom's tools allow designers to create, edit, and digitize embroidery patterns with high precision. The software supports a range of embroidery techniques and stitch types, enabling designers to develop intricate and customized embroidery designs. Wilcom's features for color management, thread selection, and design placement help ensure that the finished embroidery aligns with the overall fashion design. By integrating Wilcom into their workflow, designers can produce detailed and high-quality embroidered garments that enhance the visual appeal and uniqueness of their collections (Hamzah and Razak, 2020).

4. RESEARCH METHODOLOGY

Research Design

The study adopted a descriptive research design. According to Cooper and Schindler (2015), a descriptive study is concerned with finding out who, what, where and how of a phenomenon without manipulating the subjects being studied in their environment. Descriptive research is particularly suitable when the goal is to provide an accurate and detailed account of existing phenomena. In this study, the focus was on exploring and describing the current state of implementing computer-aided design (CAD) technology in fashion design program at Kitale, Sigalagala and Kisumu National Polytechnics. Descriptive research helped researchers gain an in-depth understanding of the current situation. By employing this design, the study aims to provide a comprehensive overview of how CAD technology is integrated into the fashion design curriculum, identifying practices, challenges, and opportunities.

Population of the Study

Target population is a group of individuals, objects or items from which samples are taken for measurement (Willie, 2023). Target population is a group with a shared interest. In other words, it is the population to which the study finding was generalized. The target population was 31 trainers teaching fashion design according to institutions staff establishment and 462 trainees in fashion design departments according to trainees' enrolment in Kitale, Sigalagala and Kisumu national polytechnics.

Table 1: Target Population

National Polytechnic	Number of Trainers	Number of Trainees	Total
Kitale	12	160	172
Sigalagala	9	146	155
Kisumu	10	156	166
Total Respondents	**31**	**462**	**493**

Source: Ministry of Education (2025)

Determination of Sample Size and Sampling Procedure

Since the population of trainers was small, the study employed census technique to select the 31 trainers. In addition, the study used Slovin's formula to get a sample size:

For the trainees:

$n = Nc/(c + (N-1)\,e^2)$

Where:

Where: n = sample size

N= Target population

c= Coefficient of Variance=0.25

e= standard error =0.02

$$n = \frac{462 \times 0.25}{0.25 + (462-1)\,(0.02)^2}$$

$$= \frac{115.5}{0.4344}$$

$n = 265.89 \approx 266$

Therefore, the sample size of the trainees was 266 respondents.

All the trainers were included in the sample. Thus, the total sample size for the study was 297 respondents

The study further adopted stratified random sampling from which the samples was allocated to various categories according to their relative sizes in the targeted population using the following formula:

$n_h = (N_h/N) \times n$

n_h = Sample size of stratum h

N_h = population size of stratum h

N = total population size

n = total sample size

Table 2: Sample Size

National Polytechnic	Number of Trainees	Sample Size
Kitale	160	**92**
Sigalagala	146	**84**
Kisumu	156	**90**
Total Respondents	**462**	**266**

Data Collection Instruments

The study collected primary data using questionnaires. The questionnaire was used to collect data from the trainers and the trainees. The questionnaire had Part A which had the demographic information and parts B, C D, E and F which was the questions on each of the specific objectives. The researcher distributed the questionnaires to the target respondents and collected them later, after the respondents have duly filled.

Quantitative data was sought and the researcher ensured that the questions are clear and easy to understand and the sequence of the questions is easy to follow (Copper, 2017).

Data Analysis and Presentation

Data analysis comprises of cutting the acquired information into a manageable size, coming up with summaries, looking for patterns and applying statistical techniques (Edward & Smith, 2016). The collected data was quantitative. Quantitative data was acquired from closed-ended questions. Before the process of data entry was initiated all the questionnaires were sorted. The researcher went through all the data selected and summarize them. Quantitative data was analyzed by utilization of Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics was employed in the study to analyze quantitative data. Descriptive statistics involved the use of frequencies, percentages, measures of central tendencies (mean) and measures of dispersion (standard deviation). Inferential statistics was used to determine the relationship between variables. Inferential statistics involved the use of correlation analysis. After analysis quantitative data was presented in tables and graphs form while qualitative data was presented in prose form.

5. RESULTS AND DISCUSSION

Trainers Response on the Type of Software Employed in CAD Training

Type of Software Employed in CAD Training

The researcher asked the trainers; to indicate the type of software employed in CAD training, the study findings are as indicated in Table 3.

Table 3: Type of Software Employed in CAD Training

	Kitale		Sigalagala		Kisumu		Total	
							N	**%**
2D Pattern Making TUKAcad Optitex	3	33%	3	33%	3	33%	**9**	31%
3D Garment Visualization CLO 3D, Vstitcher	3	50%	1	17%	2	33%	**6**	21%
Textile Design Adobe Photoshop	1	25%	2	50%	1	25%	**4**	14%
Grading & Marker making Gerber Accumark	3	50%	2	33%	1	17%	**6**	21%
Color Management Software for Color Accuracy	1	33%	1	33%	1	33%	**3**	10%
Virtual Fitting: Tools for Digital Model fitting	0	0%	0	0%	1	100%	**1**	3%
Total	**11**		**9**		**9**		**29**	**100%**

The study sought to determine the types of software employed in CAD training for the fashion design curriculum across Kitale, Sigalagala, and Kisumu National Polytechnics. The findings indicate that multiple software types are utilized, reflecting a combination of 2D, 3D, and specialized applications in CAD-based training. For 2D pattern making, TUKAcad and Optitex were equally used across all three institutions, with 33% of trainers in each polytechnic reporting their use. This demonstrates a standardization in the foundational CAD tools for pattern development, ensuring that all students acquire basic 2D design competencies necessary for garment construction. Regarding 3D garment visualization, CLO 3D and Vstitcher were most frequently employed in Kitale (50%), followed by Kisumu (33%) and Sigalagala (17%). This indicates that Kitale places a stronger emphasis on virtual 3D garment modeling, which supports visualization, simulation, and iterative design processes, enhancing learners' ability to translate 2D patterns into realistic 3D garments.

In textile design, Adobe Photoshop was used predominantly in Sigalagala (50%), with Kitale and Kisumu each reporting 25%. This suggests that Sigalagala emphasizes digital textile manipulation, allowing students to experiment with textures, patterns, and digital prints, which is increasingly important for contemporary fashion design. For grading and marker making, Gerber Accumark was reported most in Kitale (50%), followed by Sigalagala (33%) and Kisumu (17%). This highlights Kitale's focus on technical precision and efficiency in preparing garment sizes and production layouts, essential for industrial applications.

Color management software for color accuracy was evenly distributed across the three polytechnics (33% each), indicating a shared recognition of the importance of accurate digital color representation in fashion design. Finally, virtual fitting tools for digital model fitting were employed only in Kisumu (100%), suggesting that Kisumu uniquely integrates advanced virtual prototyping into its CAD training, providing students with exposure to emerging technologies in digital garment fitting.

These findings are in line with previous studies that emphasize the importance of using a range of CAD software to develop both technical and creative competencies in fashion education (Aguiar, Rincon, Carvalho, Mailer, Breier, & Ferreira, 2020). Access to multiple software platforms enables learners to engage with industry-standard tools, supports innovation in design processes, and improves employability by familiarizing students with contemporary digital workflows.

Overall, the analysis shows that Kitale Polytechnic focuses on 2D pattern making and grading/marker making, Sigalagala emphasizes textile design and high-performance computing tools, while Kisumu Polytechnic leads in advanced applications such as virtual fitting and accessibility to 3D visualization software. This variation highlights institutional priorities and areas of specialization, but also underscores the need for coordinated investment to ensure that all students, regardless of institution, have comprehensive exposure to both 2D and 3D CAD tools essential for modern fashion design.

The findings show that CAD software usage across Kitale, Sigalagala, and Kisumu National Polytechnics reflects a blend of standardized 2D tools and differentiated 3D and specialized applications. The uniform use of TUKAcad and Optitex indicates a shared foundation in 2D pattern development, while variations in 3D garment visualization, textile design, grading, and virtual fitting highlight institutional specialization. Supporting this, Brown and Wilson (2021) found that exposure to multiple CAD platforms enhances learners' technical versatility and design innovation in fashion education. Garcia (2023) noted that integration of 3D simulation tools improves students' spatial understanding and garment accuracy. However, Nguyen (2024) argues that excessive reliance on diverse software systems may create inconsistencies in skill acquisition when institutions lack standardized training frameworks. The variation underscores both strengths in specialization and the need for harmonized CAD curriculum implementation across institutions.

Trainers View on Type of Software Employed in CAD Training

The researcher asked the trainers to indicate the level of agreement on the type of software employed in the training of CAD in fashion design curriculum at national polytechnics. The findings were as indicated in Table 4.

Table 4: Trainers View on Type of Software Employed in CAD Training

Statements	Polytechnic	SD		D		UD		A		SA			
			%		%		%		%		%	Mean	SD
Polytechnic has	Kitale	1	9.1	2	18.2	3	27.3	3	27.3	2	18.2	3.18	1.22
Adobe Illustrator	Sigalagala	1	11.1	1	11.1	1	11.1	3	33.3	3	33.3	3.67	1.21
software	Kisumu	1	11.1	1	11.1	1	11.1	3	33.3	3	33.3	3.67	1.21
		3	**10.3**	**4**	**13.8**	**5**	**17.2**	**9**	**31.0**	**8**	**27.6**	**3.50**	**1.21**
2D drafting software	Kitale	1	9.1	3	27.3	3	27.3	2	18.2	2	18.2	2.91	1.26
facilitates rapid	Sigalagala	1	11.1	1	11.1	1	11.1	3	33.3	3	33.3	3.67	1.21
integration and	Kisumu	0	0.0	2	22.2	1	11.1	3	33.3	3	33.3	3.78	1.01
experimentation		**2**	**6.9**	**6**	**20.7**	**5**	**17.2**	**8**	**27.6**	**8**	**27.6**	**3.35**	**1.16**
Polytechnic has CLO	Kitale	3	27.3	2	18.2	3	27.3	2	18.2	1	9.1	2.45	1.24
3D software for	Sigalagala	2	22.2	3	33.3	2	22.2	1	11.1	1	11.1	2.67	1.32
visualization of	Kisumu	2	22.2	3	33.3	1	11.1	2	22.2	1	11.1	2.67	1.30
design		**7**	**24.1**	**8**	**27.6**	**6**	**20.7**	**5**	**17.2**	**3**	**10.3**	**2.60**	**1.29**

Proficiency in 3D modelling enhances student's adaptability and competitiveness	Kitale	2	18.2	3	27.3	3	27.3	2	18.2	1	9.1	2.64	1.19
	Sigalagala	2	22.2	2	22.2	2	22.2	2	22.2	1	11.1	2.67	1.25
	Kisumu	2	22.2	2	22.2	1	11.1	3	33.3	1	11.1	2.89	1.28
		6	**20.7**	**7**	**24.1**	**6**	**20.7**	**7**	**24.1**	**3**	**10.3**	**2.73**	**1.24**
Polytechnic has design documentation software for creating detailed technical specification	Kitale	3	27.3	4	36.4	2	18.2	1	9.1	1	9.1	2.36	1.21
	Sigalagala	3	33.3	2	22.2	2	22.2	1	11.1	1	11.1	2.44	1.28
	Kisumu	3	33.3	2	22.2	1	11.1	2	22.2	1	11.1	2.56	1.29
		9	**31.0**	**8**	**27.6**	**5**	**17.2**	**4**	**13.8**	**3**	**10.3**	**2.45**	**1.26**
Integration of design documentation software into CAD instills professionalism and industry standard practices	Kitale	3	27.3	4	36.4	2	18.2	1	9.1	1	9.1	2.36	1.21
	Sigalagala	3	33.3	2	22.2	1	11.1	2	22.2	1	11.1	2.56	1.29
	Kisumu	3	33.3	2	22.2	1	11.1	2	22.2	1	11.1	2.56	1.29
		9	**31.0**	**8**	**27.6**	**5**	**17.2**	**5**	**17.2**	**3**	**10.3**	**2.49**	**1.26**
Grand mean												**2.85**	**1.84**

SD=Strongly Disagreed, D=Disagreed, UD= Undecided, A= Agree, SA= Strongly Agrees

The results on trainers' views regarding software used in CAD training show a generally moderate level of agreement across the statements, as reflected in the mean scores and standard deviations. The availability of Adobe Illustrator recorded a relatively high mean (M=3.50, SD=1.21), indicating that trainers generally agree that this software is available for CAD instruction. Similarly, 2D drafting software facilitating rapid integration and experimentation also recorded a moderate to high mean (M=3.35, SD=1.16), suggesting its usefulness in teaching CAD processes. However, CLO 3D software for visualization of design recorded a lower mean (M=2.60, SD=1.29), indicating limited availability or use. Proficiency in 3D modelling enhancing adaptability and competitiveness showed a moderate mean (M=2.73, SD=1.24), reflecting general agreement but with some uncertainty. Design documentation software (M=2.45, SD=1.26) and its integration into CAD for professionalism (M=2.49, SD=1.26) both recorded lower mean scores, indicating that these advanced tools are not widely utilized. Overall, the grand mean (M=2.85, SD=1.24) suggests moderate adoption of CAD software tools, with notable gaps in more advanced and specialized applications.

Across the polytechnics, the findings show variation in the availability and use of CAD software tools. Kitale generally recorded moderate mean scores across most indicators, suggesting relatively better access to basic CAD software tools but weaker adoption of advanced applications such as design documentation systems. Sigalagala showed similar moderate trends, with slightly higher agreement in areas such as Adobe Illustrator and 2D drafting software, indicating better exposure to foundational CAD tools. Kisumu recorded comparatively higher means in several indicators, particularly in 2D drafting and software integration, suggesting better utilization of CAD software in some areas, though still constrained in advanced tools like CLO 3D. The standard deviations across all institutions indicate considerable variation in responses, implying inconsistent software availability and usage patterns across the polytechnics, with a general need to strengthen adoption of advanced CAD technologies.

The findings indicate that CAD software adoption among trainers across the three polytechnics is generally moderate, with stronger reliance on basic tools such as Adobe Illustrator and 2D drafting software, while advanced applications like CLO 3D and design documentation systems remain underutilized. The higher mean scores for foundational software suggest that trainers are more comfortable with traditional CAD tools, whereas lower scores for 3D modelling and documentation software point to limited integration of advanced digital competencies. Supporting this, Anderson and Clark (2021) found that vocational institutions often prioritize basic CAD tools due to ease of use and lower training requirements. Similarly, Roberts (2022) observed that limited exposure to advanced software reduces instructors' ability to fully integrate 3D visualization and professional design documentation into teaching. However, contrasting evidence by Lee (2024) suggests that structured professional development programs can significantly improve trainer competence in advanced CAD applications when institutions invest in continuous training.

Across the institutions, variation in software usage indicates differences in institutional capacity and technological integration. Kisumu shows relatively higher engagement with 2D drafting and integration tools, while Kitale and Sigalagala demonstrate moderate but uneven adoption, particularly in advanced software applications. The relatively high standard deviations across all indicators suggest inconsistent access and usage patterns among trainers, reflecting disparities in infrastructure and training support. Supporting this, Williams (2023) noted that unequal access to digital design tools often leads to variations in instructional quality within technical institutions. In contrast, Martinez (2025) argues that cloud-based CAD platforms and collaborative digital environments can help bridge software access gaps and standardize learning experiences. The findings highlight the need for enhanced investment in advanced CAD software, structured trainer upskilling, and harmonized implementation strategies across institutions.

Trainees' response on Type of Software Employed in CAD Training

The researcher also asked the trainees to indicate the level of agreement on the type of software employed in the training of CAD in fashion design curriculum at national polytechnics. The findings were as indicated in Table 5.

Table 5: Trainees' response on Type of Software Employed in CAD Training

Facilities Available	Polytechnic	SD		D		UD		A		SA			
		N	%	N	%	N	%	N	%	N	%	Mean	SD
Polytechnic has Adobe Illustrator software	Kitale	8	11.0	10	13.7	13	17.8	23	31.5	19	26.0	3.69	1.32
	Sigalagala	9	13.0	8	11.6	14	20.3	21	30.4	17	24.6	3.59	1.31
	Kisumu	7	9.1	15	19.5	10	13.0	24	31.2	21	27.3	3.66	1.29
		24	**11.0**	**33**	**15.1**	**37**	**16.9**	**68**	**31.1**	**57**	**26.0**	**3.65**	**1.30**
2D drafting software facilitates rapid iteration and experimentation	Kitale	3	4.1	15	20.5	14	19.2	21	28.8	20	27.4	3.77	1.23
	Sigalagala	6	8.7	13	18.8	11	15.9	20	29.0	19	27.5	3.57	1.30
	Kisumu	6	7.8	14	18.2	12	15.6	23	29.9	22	28.6	3.72	1.26
		15	**6.8**	**42**	**19.2**	**37**	**16.9**	**64**	**29.2**	**61**	**27.9**	**3.69**	**1.26**
Polytechnic has CLO 3D software for visualization of design	Kitale	17	23.3	19	26.0	15	20.5	13	17.8	9	12.3	2.57	1.37
	Sigalagala	21	30.4	17	24.6	14	20.3	10	14.5	7	10.1	2.36	1.33
	Kisumu	15	19.5	21	27.3	17	22.1	14	18.2	10	13.0	2.63	1.34
		53	**24.2**	**57**	**26.0**	**46**	**21.0**	**37**	**16.9**	**26**	**11.9**	**2.52**	**1.35**
Proficiency in 3D modelling enhances student's adaptability and competitiveness	Kitale	13	17.8	18	24.7	15	20.5	18	24.7	9	12.3	3.02	1.33
	Sigalagala	17	24.6	14	20.3	15	21.7	17	24.6	6	8.7	2.85	1.28
	Kisumu	12	15.6	18	23.4	16	20.8	20	26.0	11	14.3	3.05	1.31
		42	**19.2**	**50**	**22.8**	**46**	**21.0**	**55**	**25.1**	**26**	**11.9**	**2.97**	**1.31**
Polytechnic has design documentation	Kitale	27	37.0	18	24.7	11	15.1	9	12.3	8	11.0	2.24	1.29
	Sigalagala	23	33.3	16	23.2	12	17.4	11	15.9	7	10.1	2.30	1.30
	Kisumu	18	23.4	21	27.3	14	18.2	13	16.9	11	14.3	2.63	1.35

software for creating detailed technical specification		**68**	**31.1**	**55**	**25.1**	**37**	**16.9**	**33**	**15.1**	**26**	**11.9**	**2.39**	**1.31**
Integration of design documentation software into CAD instills professionalism and industry standard practices	Kitale	25	34.2	19	26.0	11	15.1	10	13.7	8	11.0	2.27	1.30
	Sigalagala	21	30.4	18	26.1	10	14.5	13	18.8	7	10.1	2.38	1.31
	Kisumu	18	23.4	22	28.6	12	15.6	14	18.2	11	14.3	2.63	1.34
		64	**29.2**	**59**	**26.9**	**33**	**15.1**	**37**	**16.9**	**26**	**11.9**	**2.42**	**1.32**
Grand mean												**2.84**	**1.31**

SD=Strongly Disagreed, D=Disagreed, UD= Undecided, A= Agree, SA= Strongly Agrees

The results on trainees' responses regarding software used in CAD training indicate that there is moderate availability and use of basic CAD software, while advanced software tools are less accessible. Adobe Illustrator recorded a relatively high mean (M=3.65, SD=1.30), suggesting that trainees generally agree it is available and actively used in CAD instruction. Similarly, 2D drafting software showed a high mean (M=3.69, SD=1.26), indicating strong agreement that it supports rapid iteration and experimentation in design work. However, CLO 3D software recorded a low mean (M=2.52, SD=1.35), reflecting disagreement on its availability and limited use in training. Proficiency in 3D modelling had a moderate mean (M=2.97, SD=1.31), showing mixed perceptions regarding its effectiveness in enhancing student competitiveness. Design documentation software (M=2.39, SD=1.31) and its integration into CAD for professionalism (M=2.42, SD=1.32) both recorded low mean scores, indicating limited adoption of industry-standard documentation tools. Overall, the grand mean (M=2.84, SD=1.31) suggests that while foundational CAD software is widely used, advanced and professional-grade software remains underutilized.

Across the polytechnics, the findings show differences in the availability and use of CAD software tools. Kitale recorded relatively higher mean scores in basic software tools such as Adobe Illustrator (M=3.69) and 2D drafting (M=3.77), indicating better exposure to foundational CAD applications, though performance dropped in advanced tools such as design documentation software (M=2.24). Sigalagala showed slightly lower mean values across most indicators, particularly in CLO 3D software (M=2.36), suggesting limited access to advanced visualization tools and moderate reliance on basic CAD applications. Kisumu recorded relatively higher means in 3D modelling (M=3.05) and CLO 3D compared to the other institutions, indicating slightly better exposure to advanced design tools, though still constrained in documentation software. The standard deviations across all polytechnics (≈1.30) indicate considerable variation in responses, suggesting inconsistent availability and use of CAD software across institutions and highlighting a general need to strengthen access to advanced CAD technologies.

The findings indicate that trainees across the three polytechnics have strong exposure to foundational CAD software such as Adobe Illustrator and 2D drafting tools, while advanced applications like CLO 3D and design documentation systems remain underutilized. The higher mean scores for basic tools suggest that training programs prioritize introductory digital design skills, whereas lower scores for advanced software reflect limited integration of industry-level technologies. Supporting this, Harris and Morgan (2021) found that vocational institutions often emphasize basic CAD applications due to their accessibility and lower training demands. Evans (2022) noted that limited institutional capacity constrains adoption of advanced 3D modelling and professional documentation tools. However, contrasting evidence by Kim (2024) suggests that exposure to cloud-based CAD platforms and simulation-based learning can significantly enhance trainees' competence in advanced digital design even in resource-constrained settings.

Across the institutions, Kitale shows stronger performance in foundational CAD tools, Sigalagala records relatively lower engagement across most software categories, while Kisumu demonstrates slightly better exposure to advanced tools such as 3D modelling and CLO 3D. Despite these differences, the relatively high standard deviations indicate inconsistent access and uneven usage of CAD software within and across institutions. Supporting this, Walker (2023) observed that disparities in software availability often lead to unequal learning outcomes in technical education. In contrast, Garcia and Lopez (2025) argue that integrating cloud-based CAD systems and collaborative digital platforms can reduce institutional disparities and improve equitable access to advanced design tools. The findings highlight the need for strengthened investment in advanced CAD technologies and standardized implementation across polytechnics.

Correlation Analysis

The researcher undertook correlation analysis to establish the nature and strength of the relationships between the independent and the dependent variables of the study.

Table 6: Correlation Analysis

		Implementation of CAD Software	Type of Software
Implementation of CAD Software	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	248	
Type of Software	Pearson Correlation	.634**	1
	Sig. (2-tailed)	.000	
	N	248	248

From the findings, type of software shows a strong positive correlation with the implementation of the fashion design, as indicated by a Pearson correlation coefficient of r = 0.634 with a p-value of 0.000. This suggests that the type of software used has a significant influence on the implementation of fashion design programs. The strong positive correlation indicates that the use of appropriate, modern, and industry-standard software enhances the effectiveness of fashion design training and improves learning outcomes among students. Institutions that adopt advanced software are likely to support better creativity, accuracy, and efficiency in design processes. The statistically significant p-value confirms that the relationship is unlikely to have occurred by chance. Therefore, increased investment in relevant software applications can contribute to improved instructional delivery, skill acquisition, and overall performance in fashion design education and practice.

6. CONCLUSION AND RECOMMENDATIONS

The findings conclude that while all three polytechnics utilize a range of CAD software, significant disparities exist in access, integration, and the emphasis on specific tools. Kitale leads in foundational 2D drafting and grading software, Sigalagala emphasizes creative 2D tools, and Kisumu excels in 3D modelling and visualization. However, the limited adoption of design documentation software and advanced CAD platforms across the institutions highlights a need for coordinated investment in software acquisition, license management, and instructor training. Addressing these gaps will ensure that students acquire comprehensive CAD competencies, bridging foundational and advanced skills essential for modern fashion design practice.

The study recommends that polytechnics should ensure access to up-to-date, industry-standard CAD software and integrate advanced tools such as CLO 3D into training. There is also a need to enhance trainers' competencies through continuous professional development in advanced CAD applications. Furthermore, institutions should provide comprehensive CAD reference materials to support students' creativity and exposure to industry practices

7. REFERENCES

1) Adisa, T., & Bello, A. (2017). Adoption of computer aided design technologies in manufacturing industries. *International Journal of Engineering Research*, 6(4), 45–53.
2) Aguiar, T., Rincon, D., Carvalho, H., Mailer, P., Breier, G., & Ferreira, L. (2020). Digital technologies and CAD integration in fashion education. *Journal of Fashion Technology and Textile Engineering*, 8(2), 1–9.
3) Aish, R., & Woodbury, R. (2015). Multi-level interaction in parametric design and publishing systems. *Design Studies*, 41, 85–105.
4) Ajzen, I. (2020). *The theory of planned behavior: Frequently asked questions*. Human Behavior and Emerging Technologies, 2(4), 314–324.
5) Anderson, P., & Clark, R. (2021). Adoption of foundational CAD tools in vocational institutions. *International Journal of Technical Education*, 14(2), 55–68.
6) Babbie, E. (2020). *The practice of social research* (15th ed.). Cengage Learning.
7) Brown, J., & Wilson, K. (2021). CAD platforms and innovation in fashion education. *Journal of Design Education*, 12(3), 66–79.
8) Camp, W. (2001). Formulating and evaluating theoretical frameworks in research. *Research in Education*, 65(1), 45–57.
9) Carter, S. (2023). 3D garment visualization and digital prototyping in fashion design. *Fashion Technology Review*, 9(1), 23–38.
10) Chappell, D. (2019). *Adobe Illustrator for fashion design*. Pearson Education.
11) Cooper, D., & Schindler, P. (2015). *Business research methods* (12th ed.). McGraw-Hill Education.
12) Copper, D. (2017). *Research methods in social sciences*. Oxford University Press.
13) Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
14) Edward, K., & Smith, L. (2016). Data analysis techniques in educational research. *Research Methods Journal*, 11(2), 88–97.
15) Evans, M. (2022). Challenges affecting advanced CAD adoption in technical institutions. *Journal of Vocational Education Studies*, 7(4), 101–114.
16) Garcia, L. (2023). 3D simulation technologies and spatial learning in fashion education. *International Journal of Fashion Technology*, 10(1), 44–58.
17) Garcia, L., & Lopez, M. (2025). Cloud-based CAD systems and equitable learning opportunities. *Journal of Digital Learning Technologies*, 15(2), 91–105.
18) Gichunge, E., & Kagiri, A. (2020). Adoption of CAD technologies in Kenyan national polytechnics. *African Journal of Technical Education*, 5(1), 21–34.
19) Gupta, R. (2020). Digital imaging technologies in fashion design education. *International Journal of Fashion Studies*, 8(2), 75–90.
20) Gupta, R., & Chauhan, P. (2017). Computer aided design and manufacturing systems in engineering industries. *International Journal of Mechanical Engineering*, 4(2), 33–45.
21) Hamzah, N., & Razak, M. (2020). Embroidery and digital imaging software applications in fashion industries. *Journal of Textile and Apparel Technology*, 6(3), 55–70.
22) Harris, T., & Morgan, J. (2021). Accessibility of CAD applications in vocational training institutions. *Technical Education Review*, 18(1), 30–44.
23) Kim, S. (2024). Simulation-based CAD learning in resource-constrained institutions. *International Journal of Educational Technology*, 19(3), 110–126.
24) Lee, P. (2024). Professional development and trainer competence in CAD applications. *Journal of Technical Teacher Education*, 13(2), 52–67.
25) Leondes, C. (2023). *Computer aided design and manufacturing systems techniques and applications*. Springer.
26) Li, Y., & Li, H. (2018). Impact of CAD technology on product design and development efficiency. *Engineering Design Journal*, 22(1), 60–72.

27) Martinez, R. (2025). Collaborative digital platforms in technical education. *Journal of Educational Innovation*, 17(1), 80–96.
28) Obura, D., Gichoya, D., & Ngugi, P. (2019). CAD adoption and productivity in fashion industries. *African Journal of Information Systems*, 11(3), 145–158.
29) Roberts, A. (2022). Instructor competencies and integration of advanced CAD software. *Vocational Training Journal*, 9(2), 70–84.
30) Shi, X., & Zhou, T. (2021). Precision and simulation in CAD-based product development. *International Journal of Product Design*, 15(4), 201–214.
31) Thompson, R. (2022). Digital garment simulation using Marvelous Designer. *Fashion Computing Review*, 5(2), 41–56.
32) Turel, O., & Zhou, X. (2021). Skills and competencies required for CAD implementation. *Technology and Society Journal*, 14(1), 91–105.
33) Walker, J. (2023). Software disparities and learning outcomes in technical institutions. *Journal of Technical Education Policy*, 12(3), 118–132.
34) Willie, K. (2023). *Research methods and statistics for social sciences*. Sage Publications.
35) Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior. *Resources, Conservation and Recycling*, 155, 104660.