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Interaction Effect of Pattern Drafting Methods on Achievement, Interest and Knowledge Retention of Home Economics Students of Federal Universities in South East, Nigeria

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Abstract

The study investigated interaction effect of two pattern drafting methods {(Flat and Computer-aided design (CAD)} on achievement, interest and knowledge retention of Home Economics students in two Federal Universities in South East, Nigeria. Specifically, the study determined: achievement scores of Home Economics Education (HomeEc Ed) students taught by two methods; interest of HomeEc Ed students taught by two methods and knowledge retention of HomeEc Ed students taught by two methods. Three null hypotheses (HOs) were tested at 0.05 level of significance. A quasi-experimental design was used. Population was made up of Home Economics undergraduates from two Federal Universities in Southeast Nigeria. Instruments used were the Pattern Drafting Achievement Test (PADAT), Interest Scale (PADIS), and Retention Test (PADRET). Data were analyzed using mean, standard deviation, and ANCOVA at a 0.05 significance level. Findings show CAD improved students' achievement (p=0.52), interest (p=0.64), and retention (p=0.16) more than Flat method. There was no significant interaction between age and instructional methods. The CAD significantly enhanced learning outcomes across age groups CAD consistently enhanced outcomes across groups. It was concluded that CAD is broadly effective in pattern drafting instruction. Five recommendations were made.

Keywords: Pattern, Drafting, Methods, Achievement, Interest, Knowledge, Retention, Flat, CAD.

Introduction

Pattern drafting is the foundational process in garment construction, serving as a blueprint for cutting fabric before sewing. It determines the final fit, structure, and silhouette of a garment (Tate & Edwards, 2021). It involves drawing outlines of garment parts such as bodices, sleeves, collars, and skirts onto paper or software with accuracy and proportion (Adebayo & Musa, 2020). Beyond its use in individual garment creation, pattern drafting also plays a critical role in mass production, ensuring consistency and efficiency in design replication (Kaur & Sharma, 2021). In the

global fashion industry, pattern drafting is increasingly digital. Brands now use Computer-Aided Design (CAD) to optimize layouts and reduce textile waste, aligning with sustainability goals (Choi & Powell, 2020). Ferraro et al. (2022) observed that CAD facilitates faster prototyping, improved precision, and easier customization. While traditional hand-drafting remains relevant, the digital shift is redefining efficiency in the ready-to-wear fashion sector.

Two major approaches to pattern drafting are commonly used in fashion education: The Flat Pattern Method, a manual approach, and Computer-Aided Design (CAD), a digital technique. The flat method involves taking body measurements and translating them onto paper using basic drafting tools (Gavor, 2023). This process, although low-cost and widely used in Nigerian universities, can be time-consuming and rigid. In contrast, CAD uses specialized software to generate patterns with speed and flexibility. However, its adoption in Nigerian tertiary institutions has been limited due to factors such as lack of software, insufficient digital infrastructure, and inadequate training of lecturers (Taylor, 2021; Kamau, 2012). Although CAD is increasingly used in the industry, many Home Economics lecturers in Nigeria still rely heavily on manual techniques like the flat method. This is partly due to their own training backgrounds and the novelty of CAD in the curriculum (Onyeazor, 2019). Many instructors face difficulties in updating their skills and acquiring the necessary resources to integrate digital methods into instruction (Imayanti & Yahya, 2018). The lack of exposure to CAD may negatively affect students' learning experiences and outcomes.

The reluctance to adopt CAD also hinders technological advancement in instructional delivery. Isukpa (2014) noted that when teachers fail to integrate newer technologies, students become disengaged, resulting in poor academic performance and reduced interest in the subject. This issue is especially relevant in today's digital era where most undergraduate students, being digital natives, are more comfortable with and motivated by technology-enhanced learning tools (Tabraz, 2017). In the South East region of Nigeria, the flat pattern method remains the dominant instructional approach in Home Economics departments. Despite its cost-effectiveness and accessibility, it has limitations, including time constraints and lack of adaptability. With students engaged in multiple courses, the tediousness of the manual method may impact their interest and achievement levels. Conversely, the use of CAD in teaching pattern drafting may offer more engaging, efficient, and scalable learning experiences.

Achievement in education refers to measurable academic outcomes, often evaluated through tests, assignments, and practical assessments (Obiweluozo, 2019). Interest, on the other hand, is the motivational factor that drives engagement and active learning (Obiweluozo, 2014). Onah (2015) emphasizes that increased student interest often correlates with higher achievement. Retention is the ability to recall and apply learned knowledge over time is another crucial indicator of effective teaching. According to Uba

(2018), retention reflects the learner's ability to reproduce previously acquired behavior after a period of time, indicating lasting understanding. With the global shift toward digital technologies in education, CAD offers a compelling case for integration into pattern drafting instruction. It enables students to participate in flipped or blended learning models, enhancing flexibility and accessibility. In pandemic or post-pandemic contexts, CAD supports remote learning and reduces dependency on physical classroom interactions.

Moreover, digital literacy in pattern drafting opens up career pathways in the fashion industry, where software-based design is the norm. The integration of CAD in university curricula would not only enhance students' academic performance but also increase their employability. It is observed that most federal universities teaching pattern drafting in Home Economics programmes in the southeast focused more on flat pattern drafting technique and it is the most common method taught with limited adoption of computer-aided design (CAD) methods. However, there's a growing push to integrate Computer-Aided Design (CAD) into the curriculum to modernize the teaching of pattern drafting. Ugwu, Ezeaku, & Attah, (2023), indicates that using CAD software can significantly improve student academic achievement, interest, and knowledge retention. CAD is seen as a more efficient, precise, and industry-relevant method, as it's the standard for mass garment production. As the fashion industry in Nigeria continues to grow, proficiency in digital pattern-making will be an asset for graduates seeking positions in garment production firms. Given these trends, there is a clear need to investigate how different pattern drafting methods Flat Method and CAD affect student achievement, interest, and retention in Home Economics. It is equally important to explore whether age plays a role in how students respond to these instructional methods, as younger learners are often more receptive to digital tools.

Purpose of the study

The general purpose of the study was to investigate interaction effect of two pattern drafting methods {(Flat and Computer-aided design (CAD)} on achievement, interest and knowledge retention of Home Economics students in two Federal Universities in South East, Nigeria. Specifically, the study determined:

1. achievement scores of Home Economics Education students taught by two methods
2. interest of Home Economics Education students taught by two methods
3. knowledge retention of Home Economics Education students taught by two methods

Hypotheses

The following null hypotheses were formulated for the study and were tested at 0.05 level of significance. There are no

significant interaction effects of two pattern drafting methods and age on:

Ho_1: achievement scores of Home Economics Education students taught by two methods.

Ho_2: interest of Home Economics Education students taught by two methods.

Ho_3: knowledge retention of Home Economics students taught by two methods.

Methodology

***Design of the Study*:** The study adopted a quasi-experimental research design which involved the use of two comparable groups of Home Economics students from University of Nigeria, Nsukka (UNN) and Michael Okpara University of Agriculture, Umudike (MOUAU). The experimental design used involved pre-test, post-test design and retention test. The experimental procedures adopted in the administration of the instruments were: Pre-Test session was conducted before the treatment, a pre-PADAT & PADIS were administered on the students by the researchers. Post-Test session was conducted after the treatment, the post-PADAT & PADIS were administered on the students. Lastly, the retention test was done two weeks after the post- PADAT & PADIS, the retention test (PADRET) was administered on the students. Noting that PADAT means pattern drafting achievement test; PADIS means pattern drafting interest scale; and PADRET means pattern drafting retention test

***Area of the Study*:** This study was carried out in two Federal Universities in the South East, Nigeria that offer Home Economics Education with Clothing and Textile as one of the courses offered. The experiment took place in University of Nigeria, Nsukka (UNN) and Michael Okpara University of Agriculture, Umudike. (MOUAU).

***Population of the Study*:** The population for the study comprised 54 second- and third-year undergraduate students enrolled in Home Economics Education programs in UNN (26 students) and MOUAU (28 students). These two universities represent the only federal institutions in the region currently offering Home Economics Education where Clothing and Textile, programme, with pattern drafting, as course. The existing class groups were used intact, as randomizing students into treatment and control groups could disrupt the normal class schedule and introduce the Hawthorne effect. Second- and third-year students were selected because the curriculum in both institutions places pattern drafting in those academic levels within their degree programmes.

***Sample of the Study*:** Purposive sampling technique was used to select two federal universities University of Nigeria, UNN and MOUAU for the study. These universities were specifically chosen because they are the only federal universities in the South East, Nigeria, that offer Home Economics Education with a focus on Clothing and Textiles, including instruction in pattern drafting. Their inclusion was therefore essential to ensure the relevance and applicability of the study. Additionally, both institutions have structured academic programs in Home Economics and possess qualified lecturers and functional teaching facilities for Clothing and Textile courses.

***Instrument for Data Collection*:** Three instruments were utilized for data

collection, they were pattern drafting achievement test (PADAT), pattern drafting interest scale (PADIS), pattern drafting retention test (PADRET). The PADAT, PADIS and PADRET were designed based on the curricular content of the Clothing and Textiles area of Home Economics Education for second and third year undergraduate students as stated in National University Commission (NUC) Benchmark Minimum Academic Standards (BMAS) (Okiki, 2023). The PADAT was a teacher made achievement test developed from the pattern drafting curriculum for second and third year undergraduate university programme. The PADAT consists of forty (40) multiple choice questions with well-structured response options which was utilised in answering specific purpose one. The unit objectives of pattern drafting topics in the curriculum served as a guide in developing the questions. The PADAT was developed from the content areas of pattern drafting by first constructing a table of specification from the main contents of pattern drafting. The Pattern Drafting Interest Scale (PADIS) was the second instrument for data collection, which was also developed by the researcher. The instrument was used to determine the students' interest level in pattern drafting prior to treatment and after the treatment to answer specific purpose two. The third instrument – Pattern Drafting Retention Test (PADRET) was used to test the knowledge retention ability of the students. The instrument was administered to students after two weeks the initial test (PADAT) had been concluded and it was also used to answer specific purpose three. PADRET was the same as PADAT in content and form, but were administered for different purposes. PADAT was administered to determine the academic achievement of students while PADRET was administered to determine the knowledge retention of students. Furthermore, the pre-test post-test effects were removed by modifying the instructions, reshuffling the items, and the sequence of their presentations, to make them look different. All the instruments were validated by five experts. Also, the content validity of PADAT was established through the use of table of specification. Ten lesson plans were developed for both the two groups; flat and CAD methods and were validated. The ages involved were 18 – 20, 21 – 23, and 24 – 26.

***Data Collection Techniques*:** The data were collected with the help of four trained research assistant. The assistants were trained on how to use each of the instructional strategies, each lesson presentation, and how to administer the research instruments that were involved in the experiment. The experiment lasted for six weeks. Six-week lesson plans were developed both groups it students following the selected contents in pattern drafting course. The lesson plans were the same to both groups, containing the level of the students, age, time, objectives, activities in steps and evaluation. The two groups were taught the selected pattern drafting contents allotted their normal class setting. The researcher provided the computers and projector for the one group while the second group used normal white board. An intact class was used in both groups to avoid Hawthorne effect. Before exposing the

students to treatment, there was administration of pre – test of both PADAT and PADIS to all the students in the both groups with the help of their regular lecturers. The test administration was carried out in an informal way for students to assume it is one of their normal class assessments. After the treatment, a post-test on both the PADAT and PADIS were administered to the two groups by the same lecturers. The same instruments used for pre-test was used for the post-test. However, changes were made such as; modifying the instructions, reshuffling the items, and the sequence of their presentations, all in a bid to make them look different. After two weeks, Pattern Drafting Retention Test (PADRET) was issued to students to test their knowledge retention ability.

***Data Analysis Methods*:** Data was analysed using mean, standard deviation and null hypotheses. The formulated null hypotheses were tested using the Analyses of covariance (ANCOVA) at 0.05 level of significance. A null hypothesis was accepted when the P - value is equal or greater than 0.05 and was rejected when it is less than 0.05. Differences between mean was separated using Scheff test.

Findings of the study

Table 1: Mean Scores and Standard Deviation on Students Achievements based on Two Instructional Methods of Pattern Drafting by Age

Instructional Methods	Age of Students	Pre-test		Post-test		**Gain**
		$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_3$
CAD	18-20 years	20.25	5.70	34.88	2.80	14.63
	21-23 years	21.00	5.35	34.80	2.53	13.80
	24-26 years	20.43	7.16	35.43	4.31	15.00
		20.56	6.07	35.04	3.21	14.48
FLAT	18-20 years	18.22	4.41	30.89	2.47	12.67
	21-23 years	18.75	4.33	29.50	3.32	10.75
	24-26 years	16.71	5.91	32.29	1.38	15.58
		17.89	4.88	30.89	2.39	13.00
$\overline{X}_4$ Difference		2.67	1.19	4.15	0.82	

$\overline{X}_1$ = mean for pre-test; $\overline{X}_2$= mean for post-test; $\overline{X}_3$ = mean for gain; $\overline{X}_4$ = mean for differences; $\overline{X}$ = mean;SD= standard deviation, CAD= computer aided design,

Table 1 indicates that students of Home Economics Education at 24-26 years old taught pattern drafting through Flat method performed better than the others (15.58), and this was followed closely by students of 24-26 years old taught pattern drafting through CAD method (15.00). The result further revealed that students at age 21-23 years old taught pattern drafting through Flat method performed poorer than the other age groups. Students of all ages received pattern drafting instruction through CAD method performed better (14.48) than those that received the same instruction through Flat method (13.00).

Table 2: ANCOVA Analysis of the Interaction Between Two Instructional Methods of Pattern Drafting and Age on the Academic Achievement Score of Home Economics Education Students Taught by Two Methods

Source	Type III (SoS)	Df	M.S	F	Sig.	PES
Corrected Model	295.938[a]	6	49.323	5.712	.000	.427
Intercept	3407.778	1	3407.778	394.625	.000	.896
Pre-test	8.275	1	8.275	.958	.333	.020
Instructional Methods	185.373	1	185.373	21.466	.000	.318
Age	27.665	2	13.832	1.602	.213	.065
Instructional Methods * Age	11.450	2	5.725	.663	.520	.028
Error	397.232	46	8.635			
Total	57359.000	53				
Corrected Total	693.170	52				

a. R Squared = .427 (Adjusted R Squared = .352)

Key: Df= Differences, F = Frequency, Sig = significance, SoS = Sum of Square, MS = Mean Square, PES = Partial Eta Squared

Table 2 reveals that there is no statistically significant interaction effect (p=0.52>0.05, F=0.66) of instructional methods and age on the achievement of Home Economics Education students in pattern drafting. The hypothesis which stated that there is no significant interaction effect between the instructional methods of pattern drafting and age on Home Economics Education students is therefore, not rejected. The partial eta squared of 0.028 signifies that only 2.8% of the observed variance in the achievement of students in pattern drafting can the attributed to the instruction methods and age.

Table 3: Mean Scores and Standard Deviation in Students' Interest Based Two Instructional Methods of Pattern Drafting in Age

Instructional Methods	Age ofStudents	Pre-test		Post-test		Gain
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$
CAD	18-20 years	52.00	8.55	48.25	8.70	-3.75
	21-23 years	42.10	10.09	54.30	14.10	12.20
	24-26 years	46.97	7.71	54.29	15.57	7.43
		46.60	8.78	52.28	12.79	5.68
FLAT	18-20 years	51.33	11.54	47.33	8.17	-4.00
	21-23 years	46.83	8.63	52.67	9.66	5.74
	24-26 years	51.71	9.11	46.00	5.10	-5.71
		49.96	9.32	48.67	7.64	-1.29
$\bar{X}_4$ Difference		-3.36	-0.54	3.61	5.15	

$\bar{X}_1$ = mean for pre-test; $\bar{X}_2$= mean for post-test; $\bar{X}_3$ = mean for gain; $\bar{X}_4$ = mean for differences; $\bar{X}$ = mean;SD= standard deviation, CAD= computer aided design,

Table 3 shows that the pre-test interest score of students taught pattern drafting through CAD method was 46.60±8.78 and the post-test interest score was 52.28±12.79 with the mean gain of 5.68 while the counterparts that received the same instruction through Flat method has the pre-test interest score of 49.96±9.32 and a post-test interest score of 48.67±7.64 with the mean gain of -1.29. Furthermore, Home Economics Education students of ages 21-23 years old that received instruction through CAD method had more interest (12.20) in pattern drafting than the other age groups. The interest of students in ages 18-20 and 24-26 years declined by -4.00 and -5.71 respectively after receiving instruction through Flat method while the interest of students in ages 18-20 years declined by -3.75 after receiving pattern drafting instruction through CAD method.

Table 4: ANCOVA Analysis of the Interaction Between Two Instructional Methods of Pattern Drafting and Age on the Interest of Home Economics Education Students taught by two methods

Source	Type III (SoS)	Df	M.S	F	Sig.	PES
Corrected Model	815.781[a]	6	135.964	1.192	.327	.135
Intercept	6403.515	1	6403.515	56.144	.000	.550
Pre-test Interest	245.175	1	245.175	2.150	.149	.045
Instructional Methods	102.477	1	102.477	.898	.348	.019
Age	130.473	2	65.237	.572	.568	.024
Instructional Methods * Age	104.314	2	52.157	.457	.636	.019
Error	5246.521	46	114.055			
Total	142491.000	53				
Corrected Total	6062.302	52				

a. R Squared = .135 (Adjusted R Squared = .022)

Key: Df= Differences, F = Frequency, Sig = significance, SoS = Sum of Square, MS = Mean Square, PES = Partial Eta Squared

Table 4 reveals that there is no statistically significant interaction effect (p=0.64>0.05, F=0.46) of instructional methods and age on the interest of Home Economics Education students in pattern drafting. This implies that the hypothesis which stated that there is no significant interaction effect between instructional methods and age on the interest of Home Economics Education students is not rejected (p>0.05). Moreover, the partial eta squared of 0.019 indicates that only 1.9% of the observed variance in the interest of students of Home Economics Education can the accounted by the instructional methods and age.

Table 5: Mean Score and Standard Deviation on Knowledge Retention Level based on Two Instructional Methods of Pattern Drafting in Age

Instructional Methods	Age of Students	Post-test		Post-Post-test		Gain
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$
CAD	18-20 years	34.88	2.80	37.38	1.69	2.50
	21-23 years	34.80	2.53	36.30	1.64	1.50
	24-26 years	35.43	4.31	36.43	1.51	1.00
		35.04	3.21	36.70	1.61	1.66
FLAT	18-20 years	30.89	2.47	30.89	1.62	0.00
	21-23 years	29.50	3.32	32.25	3.62	2.75
	24-26 years	32.29	1.38	30.43	1.27	-1.86
		30.89	2.39	31.19	2.17	0.30
$\bar{X}_4$ Difference		4.15	0.82	5.51	-0.56	

$\bar{X}_1$ = mean for pre-test; $\bar{X}_2$= mean for post-test; $\bar{X}_3$ = mean for gain; $\bar{X}_4$ = mean for differences; $\bar{X}$ = mean;SD= standard deviation, CAD= computer aided design,

Table 5 shows that Home Economics Education students taught pattern drafting using CAD instructional method had the post-test score of 35.04±3.21 and a post-post-test score of 36.70±1.61 with the knowledge retention of 1.66 while the counterparts taught pattern drafting using Flat method had the post-test score of 30.89±2.39 and a post-post-test score of 31.19±2.17 with the knowledge retention of 0.30. Home Economics Education students at the age of 21-23 years old that received instruction in pattern drafting through Flat method had more knowledge retention (2.75) than other age range which was slightly followed by those at the age of 18-20 years old received instruction in pattern drafting through CAD instructional method (2.50).

Table 6: ANCOVA Analysis of the Interaction Between Two Instructional Methods of Pattern Drafting and Age on the Knowledge Retention of Home Economics Education Students taught by two methods

Source	Type III (SoS)	Df	M.S	F	Sig.	PES
Corrected Model	404.783[a]	6	67.464	13.775	.000	.642
Intercept	323.245	1	323.245	66.000	.000	.589
Post-test	7.250	1	7.250	1.480	.230	.031
Instructional Methods	203.701	1	203.701	41.591	.000	.475
Age	9.659	2	4.830	.986	.381	.041
Instructional Methods * Age	18.972	2	9.486	1.937	.156	.078
Error	225.292	46	4.898			
Total	61423.000	53				
Corrected Total	630.075	52				

a. R Squared = .642 (Adjusted R Squared = .596)

Key: Df= Differences, F = Frequency, Sig = significance, SoS = Sum of Square, MS = Mean Square, PES = Partial Eta Squared

Table 6 shows that there is no significant interaction effect ($p=0.16>0.05$, $F=1.94$) of the instructional methods and age on the knowledge retention of Home Economics Education students in pattern drafting. This implies that the hypothesis which stated that there is no significant interaction between the instructional methods of pattern drafting and age on the knowledge retention of Home Economics Education students is not rejected ($p>0.05$). Furthermore, the partial eta squared of 0.078 signifies that only 7.8% of the observed variance in the knowledge retention of Home Economics Education students in pattern drafting can be attributed to the combined effect of instructional methods and age.

Discussion

The study revealed that Home Economics Education students taught pattern drafting through Computer-Aided Design (CAD) consistently achieved higher scores across all age categories compared to those taught with the Flat Pattern method. Specifically, students aged 24–26 years taught using CAD performed exceptionally well. Despite these differences, the ANCOVA results indicated no significant interaction effect between instructional method and age on academic achievement. This suggests that while CAD enhances achievement overall, age does not significantly moderate this relationship. This finding aligns with Yusuf et al. (2020), who emphasized that technology-enhanced instructional strategies improve academic performance due to their visual and interactive features. Mishra and Koehler (2020) further support this view through their TPACK framework, highlighting how technological integration fosters deeper content understanding. The non-significant age interaction also echoes findings by Adebayo and Bello (2019), who concluded that learners across age groups benefit similarly from CAD tools in vocational subjects. Akkus, Gunel, and Hand (2021) similarly observed no age-based variation in student gains from visual and interactive methods in design education.

With regard to interest, CAD instruction resulted in higher interest levels across most age groups, especially among students aged 21–23 years. Conversely, interest declined among students taught with the Flat method, particularly in the youngest and oldest cohorts. However, statistical analysis revealed no significant interaction effect between instructional method and age. This aligns with Cheng and Yeh (2019), who reported that digital learning tools increase learners' intrinsic motivation regardless of age. Likewise, Lim and Wang (2020) found that technological engagement fosters situational interest among university students irrespective of demographic differences. Njoku (2022) also noted that ICT tools heighten engagement in higher education across age brackets, suggesting that interest is more responsive to instructional innovation than to age differences. Lee and Reeves (2020) support this view in their study on fashion design education, showing that digital tools like CAD improve engagement across diverse learner demographics.

Regarding knowledge retention, students taught with CAD retained

information more effectively over a two-week period than those taught with the Flat method. Some age groups under the Flat method even showed a decline in retention. Although ANCOVA results revealed a non-significant interaction effect between age and instructional method, the observed effect size (partial eta squared = 0.078) was relatively larger than for achievement and interest. This pattern aligns with Mayer's (2021) cognitive theory of multimedia learning, which posits that learning is enhanced when verbal information is paired with relevant visuals precisely what CAD offers. Okoye and Obasi (2020) and Hassan and Babiker (2019) similarly reported improved long-term knowledge retention when visual and interactive methods were employed. The modest but non-significant effect of age might suggest a nuanced relationship, potentially mediated by familiarity with digital platforms or prior exposure. This corresponds with Opara and Akinola (2020), who found small age-related retention differences in technology-supported vocational learning but emphasized that instructional method remained the dominant factor.

Conclusion

The study concludes that CAD as an instructional method significantly improves students' academic achievement, interest, and knowledge retention in pattern drafting among Home Economics undergraduates. However, the interaction between instructional method and age was not statistically significant for any of these outcomes. This suggests that CAD is broadly effective across age groups and that method of instruction, rather than age, plays the most critical role in determining student success in Clothing and Textile education. These findings reinforce the importance of transitioning to technology-integrated pedagogies in vocational education to meet the learning styles of digitally-oriented students.

Recommendations

Based on the findings and supported by empirical literature, the following recommendations are made:

1. Departments of Home Economics in Nigerian universities should formally integrate Computer-Aided Design (CAD) into their pattern drafting curricula to leverage its demonstrated benefits on student achievement, interest, and retention.
2. Universities should organize continuous professional development programs to train lecturers in the use of CAD tools.
3. Universities should allocate resources toward procurement of necessary CAD software, computer labs, and digital support systems.
4. Appropriate Universitycurriculum developers should prioritize technology-enhanced instructional strategies over age-differentiated approaches.
5. Learning environments should be redesigned to embrace self-paced and visually enriched learning.

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