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Curriculum Development and Workforce Readiness of Dual-Mandate in Colleges of Education: Fine and Industrial Arts Education in Perspective

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Abstract
This study explores how Fine and Industrial Arts (FIA) education in Nigeria's dual-mandate Colleges of Education is preparing graduates to succeed both as teachers and industry professionals. In a world where creative skills must blend with practical expertise, the research assesses the extent to which current curricula balance pedagogy with hands-on, industry-relevant training. Using a descriptive survey design, data were gathered from 80 respondents, including lecturers, instructors/technicians, and students, across four institutions in Kano State. The findings show encouraging progress in the adoption of digital tools, with particularly high ratings for 3D printing and CAD software (mean scores: 3.85–3.86). Industry partnerships also scored well (mean: 3.80–3.84), especially in enhancing employability. However, limited industry investment in upgrading facilities remains a challenge. Emerging technologies such as AI and VR are influencing curriculum updates (mean: 3.73–3.78), but training for lecturers in these areas has not kept pace. The study also identifies persistent gaps: restricted access to some digital resources, limited focus on sustainable design, and rigid curriculum structures that hinder innovation. The findings suggest that while the dual-mandate model has strong potential, targeted reforms are essential. These include upgrading digital infrastructure, expanding industry collaborations, embedding entrepreneurship and sustainability into coursework, and enhancing continuous professional development for lecturers. Flexible curriculum policies will also be key. By implementing these measures, FIA programs can produce graduates who are not only skilled educators but also adaptable, competitive professionals ready to thrive in Nigeria's dynamic creative economy. This study contributes to the growing conversation on aligning art education with labour-market demands, while safeguarding cultural relevance and fostering innovation.

Keywords: Curriculum development, workforce readiness, dual-mandate, Fine and Industrial Arts, digital tools, industry collaboration, emerging technologies, Nigeria

1. Introduction

Curriculum development is more than just structuring lessons or setting examinations. It is a dynamic process of planning, implementing, evaluating, and refining educational programmes to meet specific learning outcomes (Mendoza et al., 2022). In the case of Fine and Industrial Arts Education in Colleges of Education, curriculum development extends beyond the transmission of artistic and technical skills; it is about designing learning experiences that prepare students for the realities of today's creative and industrial sectors. Such a curriculum not only considers what learners should know, but also the methods of instruction, assessment strategies, and the broader goal of shaping graduates who can excel as both teachers and professional designers.

Within Nigeria's dual-mandate framework, curriculum development carries two equally important responsibilities which is to first prepare prospective teachers preparing to effectively deliver art and design education, and equipping graduates with the skills to thrive as industrial designers, freelancers, or creative entrepreneurs (Kraus et al., 2021). Balancing these roles requires identifying industry skill gaps, setting clear learning outcomes, and embedding relevant content such as design technology, entrepreneurship, and business management. It also demands varied instructional strategies, studio practice, industrial attachments, project-based learning, and assessment approaches that go beyond written exams to include portfolios, prototypes, and exhibitions.

The dual-mandate model reflects an institutional commitment to producing graduates who are not restricted to a single career pathway. As Majola et al. (2025) note, Fine and Industrial Arts graduates should be able to competently teach in schools while also excelling in the creative industry as practitioners, craft persons, or entrepreneurs. This approach aligns with labour market realities where flexibility and multiple skill sets are vital for survival. Historically, the National Commission for Colleges of Education (NCCE) placed more emphasis on teacher training, in recent there has been a gradual shift towards including

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transferable and industry-relevant skills (Agbaje, 2021). This evolution acknowledges that teaching alone is not the only viable future for graduates, reflecting global trends that value multi-skilled professionals.

To bring this vision to life, the curriculum must balance pedagogical training with professional practice. Teacher preparation involves mastery in lesson planning, classroom management, and assessment strategies, while professional practice requires fluency in design processes, industry-standard tools, and entrepreneurial competencies. Together, these ensure versatility, economic resilience, and richer classroom instruction informed by industry practice (Harrison, 2025). However, challenges such as curriculum overload, insufficient resources, and policy rigidity threaten its success, underscoring the need for curriculum integration, strong industry partnerships, dual assessment models, and opportunities for lecturers to gain industry exposure (Taofeek, 2025).

Fine and Industrial Arts Education itself is uniquely positioned at the intersection of creativity and functionality. While Fine Arts nurtures aesthetic and cultural expression through painting, sculpture, and printmaking, Industrial Arts emphasises innovation in product design, such as furniture, tools, packaging, vehicles, and interior spaces. Together, these domains blend artistry with technical application, equipping students to solve real-world problems while contributing to cultural preservation and economic growth (Bayode, 2023).

For Colleges of Education, this mission goes beyond teacher preparation to ensuring curriculum–industry alignment, where academic programmes deliberately reflect the demands of the labour market (Zhang et al., 2021). Without such alignment, graduates risk leaving with theoretical knowledge that falls short of workplace expectations, especially in design fields where employers and clients demand mastery of contemporary tools and workflows (Yildirim et al., 2020). Bridging this gap requires integrating theory with practice through project-based learning, internships, collaborative projects, and assessments that test both creativity and technical skill. Despite challenges such as inadequate facilities and skill gaps among lecturers, this blended approach produces confident, multi-skilled graduates with the capacity to thrive in diverse contexts.

An equally important dimension is entrepreneurship. In creative fields, entrepreneurship empowers students to transform artistic ideas into viable products, services, and businesses (Ahmad et al., 2023). For dual-mandate institutions, this means preparing graduates not only to teach but also to create opportunities for themselves in a competitive job market. By mastering entrepreneurial skills such as pricing, marketing, budgeting, client relations, and intellectual property awareness, graduates can become self-reliant and contribute to the broader creative economy (Akanle et al., 2025; Yeung, 2025). Though challenges such as limited start-up funds and weak industry linkages remain, entrepreneurship training ensures graduates emerge not just as job seekers but as job creators, innovators, and market leaders (Prokopenko et al., 2024).

Beyond entrepreneurship, success in today's creative industries also depends on soft skills—communication, collaboration, adaptability, and problem-solving. These attributes are as crucial as technical expertise, since the design world relies on teamwork, client interaction, and creativity under pressure (Oham & Ejike, 2024). Embedding soft skills into the curriculum through peer critiques, simulations, internships, and collaborative projects ensures that students gain practical exposure to real-life demands (Williamson, 2023). When coupled with technical training, these competencies strengthen both classroom teaching and professional practice.

Another non-negotiable element is technology integration for Colleges of Education, graduates must be proficient in both traditional craftsmanship and modern digital tools such as AutoCAD, CorelDRAW, 3D printing, CNC machining, and multimedia design platforms (Uduafemhe et al., 2023). Despite challenges like high costs, poor infrastructure, and uneven digital literacy, integrating technology is vital for global competitiveness. A curriculum that balances traditional methods with modern innovations equips graduates to compete effectively in local and international markets.

These efforts are further shaped by policy and accreditation frameworks. In Nigeria, the NCCE, National Policy on Education (NPE), and the National Board for Technical Education (NBTE), alongside professional associations, regulate content, teaching methods, and graduate competencies (Abubakar, 2025; Florek-Paszkowska & Ujwary-Gil, 2025). While such structures ensure quality, bureaucratic rigidity often slows adaptation to industry changes (Darling-Hammond, 2005). For Fine and Industrial Arts graduates to remain globally competitive, curricula must be flexible, globally benchmarked, and enriched with innovations such as sustainability, user- centred design, and international collaborations (Mammadova & Abdullayev, 2025).

At the heart of these discussions lies the issue of skill gaps, the persistent disconnect between graduate capabilities and industry expectations (Ratican & Hutson, 2024). In Fine and Industrial Arts, these gaps often include limited proficiency in modern digital tools, weak practical craftsmanship, insufficient entrepreneurial knowledge, and inadequate project management skills (Rahmani, 2023). Reforms are hindered by outdated infrastructure, slow curriculum approvals, and underfunded training opportunities for both students and lecturers (Li, 2024). Yet, addressing these challenges is crucial to ensuring graduates emerge as adaptable educators and creative professionals.

A critical part of this reform is embedding sustainability and ethics, emphasising cultural preservation, environmental responsibility, and fair practice in design (Agbo & Duodu, 2023). Similarly, lifelong learning, cross-disciplinary collaboration, and cultural relevance enhance adaptability, ensuring graduates remain competitive in a globalising and dynamic creative economy (Anderson et al., 2023; Knapp et al., 2015).

When these strategies, sustainability, lifelong learning, collaboration, cultural relevance, soft skills, and technology, are fully integrated, Fine and Industrial Arts graduates from dual-mandate Colleges of Education will not only be competent teachers but also innovative, socially responsible, and globally competitive professionals. However, despite these aspirations, significant skill gaps and structural challenges continue to undermine workforce readiness. This disconnection between curricular intent and graduate outcomes underscores the urgent need to reform Fine and Industrial Arts Education in Nigeria's Colleges of Education to better align with both teaching and industry demands.

2. Statement of the Problem

In the past, within dual-mandate Colleges of Education, Fine Art and Industrial Design programmes have traditionally emphasised pedagogical training, while practical and technical skill development for today's creative and industrial labour markets received comparatively less attention. The curriculum allocated more instructional time to pedagogical theory, limiting opportunities for students to acquire practical skills in product design, digital applications, and industry-oriented business practices. As a result, many graduates became excellent teachers but lacked the real-world expertise to thrive in design studios, manufacturing firms, or entrepreneurial ventures. This limited their career options, leaving them unprepared for opportunities outside the classroom.

Today, the world of design is changing fast. Technology is advancing, industries are becoming more global, and employers now expect graduates to have both teaching skills and industry-relevant experience. While some efforts have been made to update curricula, many schools still face challenges. Outdated teaching methods, weak connections with design businesses, and a lack of modern tools and equipment make it difficult for students to gain the practical knowledge they need. Without these skills, graduates risk entering the job market unprepared, struggling to adapt to the fast-paced demands of the design industry.

This study seeks to find solutions to these challenges. How can Fine Art and Industrial Design education in these colleges better prepare students, not just as teachers, but as skilled professionals ready to contribute to the creative economy? By examining gaps in the current system, understanding the real need of employers and proposing practical reforms, this research aims to create a balanced model of education. One that equips graduates to inspire future artists and designers in the classroom while also allowing them to innovate, create, and compete in the wider design industry. Ultimately, the goal is to open more doors for graduates, fuel creativity, and ensure that design education remains meaningful and valuable in a rapidly changing world.

3. Purpose of the Study

The general purpose of this study is to examine how Fine Art and Industrial Design education in Colleges of Education operating under the dual-mandate system can be restructured to effectively integrate workforce readiness with teacher preparation, thereby producing graduates who are both competent educators and skilled industry professionals. Specifically, this study sought to:

1. Assess the extent to which the current Fine Art and Industrial Design curriculum in Colleges of Education equips students with practical and industry-relevant skills alongside pedagogical competence.
2. Identify the challenges limiting the integration of workforce readiness into Fine Art and Industrial Design education under the dual-mandate system.
3. Propose strategies for restructuring the Fine Art and Industrial Design curriculum to meet the dual objectives of teacher preparation and workforce readiness in line with contemporary labour market demands.

4. Research Questions

1. To what extent does the current Fine Art and Industrial Design curriculum in Colleges of Education provide students with both practical, industry-relevant skills and pedagogical competence?
2. What challenges hinder the effective integration of workforce readiness into Fine Art and Industrial Design education within the dual-mandate framework of Colleges of Education?
3. What strategies can be adopted to restructure the Fine Art and Industrial Design curriculum to meet the dual objectives of teacher preparation and workforce readiness in line with labour market demands?

5. Hypotheses

H_{01}: There is no significant relationship between the current Fine Art and Industrial Design curriculum in Colleges of Education and the acquisition of both practical industry-relevant skills and pedagogical competence by students.

H_{02}: There is no significant effect of identified challenges on the integration of the workforce readiness into Fine Art and Industrial Design education within the dual-mandate the framework of Colleges of Education.

H_{03}: There is no significant difference in the effectiveness of the existing Fine Art and Industrial Design curriculum and a restructured curriculum in meeting the dual objectives of teacher preparation and workforce readiness.

6. Methodology

This study adopted a descriptive survey research design to collect data from a sampled population, enabling the examination of the relationship between curriculum development and workforce readiness in Fine and Industrial Design Education within Colleges of Education in Kano State. The descriptive survey facilitated the use of standardised instruments to gather quantitative data for statistical analysis and hypothesis testing. The population comprised Fine Art and Industrial Design (FAA) lecturers, instructors/technicians, and students from four selected tertiary institutions in Kano State: Federal College of Education (Technical), Bichi; Sa'adatu Rimi College of Education, Kano; Kano State Polytechnic (School of Technology, Kano); and Yusuf Maitama Sule Federal University of Education, Kano.

A total sample of 80 respondents were purposively selected, consisting of 20 FID lecturers, 20 FID instructors/technicians, and 40 FID students. The purposive sampling technique ensured the inclusion of respondents directly involved in Fine and Industrial Design programmes across the selected institutions. Data were collected using a structured questionnaire. The instrument was designed on a 5-point Likert scale with response options ranging from Strongly Agree (5) to Strongly Disagree (1). The questionnaire was divided into sections covering demographic data, curriculum content, instructional delivery, and perceived workforce readiness.

The face and content validity of the instrument were established by three experts from the Faculty of Education, Yusuf Maitama Sule Federal University of Education, Kano. Their feedback led to modifications in the wording and arrangement of items to enhance clarity, relevance, and alignment with the study objectives. The reliability of the instrument was determined using the Cronbach Alpha Method, yielding a coefficient of 0.83, indicating high internal consistency. The researcher personally administered the questionnaires to respondents in their respective institutions, with the assistance of head departments, and retrieved completed questionnaires on the spot to ensure a high return rate.

Data were analysed using descriptive statistics (mean and standard deviation) to answer the research questions, while Analysis of Variance (ANOVA) was employed to test the hypotheses at a 0.05 level of significance. Decision-making on the hypotheses was based on comparing the calculated p-value with the set significance level.

7. Result

The study showed that digital tools were playing a major role in Fine Art and Industrial Design education, with lecturers, instructors, and students all agreeing that technology is well-integrated into their programmes. On a scale where higher scores mean stronger agreement, all three groups gave average ratings close to 3.9 out of 5, meaning they perceived digital tools as widely available and beneficial for learning. 3D Printing and Rapid Prototyping scored above 4.0 across the board, showing that students and instructors were actively using cutting-edge tools to bring designs to life.

Transitioning from Handmade to Digital Design also scored highly, meaning students exercised confident moving between traditional and digital methods. Updated Software and improved Project Quality were well-rated, suggesting that schools and investing in the right tools to help students produce professional-level work.

While most digital tools are well-supported, access to digital painting tablets and interactive smartboards scored lower (3.5–3.7), indicating that some key equipment is still lacking. This could slow down students who need these tools for graphic design, illustration, or digital art courses. The small variation in responses (with most scores clustering closely around the average) means there's strong agreement among faculty and students: digital tools are making a big difference in design education. However, upgrading certain resources, like digital art tablets, could further strengthen students' job readiness.

These findings suggested that while the colleges were doing well in adopting technology, there's still room to fine-tune resources to ensure all students get the hands-on experience they need for today's design careers.

The statistical analysis showed something not, when it comes to digital tools in Fine Art and Industrial Design education, lecturers, instructors, and students are largely on the same page. Their ratings on the use of technology (like design software, 3D printing, VR, and cloud tools) were so similar that any minor differences could just be due to chance. The ANOVA test (which compares group averages) gave a p-value of 0.490, way above the usual cutoff of 0.05. This means there were no real disagreement between faculty and students; they all see digital tool integration in much the same way.

The study revealed a heartening consensus among faculty and students: partnerships between design schools and industry made a real difference in preparing students for careers. Across the board – from lecturers to technicians to students – respondents gave high marks (averaging 3.8 to 3.84 out of 5) for how these collaborations enhance their programs.

Table 1: Mean and SD Scores on the Integration of Digital Tools in Fine and Industrial Design Teaching and Learning

Item Statement	FID Lecturers (M ± SD)	FID Instructors/Technicians (M ± SD)	FID Students (M ± SD)
1. Digital design software (e.g., AutoCAD, CorelDRAW) is regularly used in course delivery.	3.76 ± 0.50	3.65 ± 0.57	3.70 ± 0.51
2. Students have adequate access to digital painting tablets and interactive smartboards.	3.50 ± 0.56	3.66 ± 0.55	3.68 ± 0.53
3. 3D printing and rapid prototyping are integrated into practical coursework.	4.10 ± 0.66	4.12 ± 0.76	3.89 ± 0.73
4. Digital tools enhance students' creativity and design precision.	3.67 ± 0.70	3.77 ± 0.60	3.78 ± 0.73
5. Virtual reality environments are used for artistic and design simulations.	3.97 ± 0.76	3.99 ± 0.71	3.78 ± 0.76
6. Instructors are adequately trained to use digital design tools.	3.73 ± 0.56	3.76 ± 0.77	3.78 ± 0.76
7. The institution provides updated licenses for design software.	4.01 ± 0.77	3.88 ± 0.67	4.00 ± 0.80
8. Cloud-based platforms are used for collaborative design projects.	3.69 ± 0.72	3.80 ± 0.68	3.74 ± 0.70
9. Students can easily transition from manual to digital design processes.	4.10 ± 0.76	4.00 ± 0.78	4.09 ± 0.72
10. Availability of digital tools has improved the quality of student projects.	4.10 ± 0.79	4.00 ± 0.74	4.07 ± 0.69
Grand Total	**3.86 ± 0.68**	**3.86 ± 0.68**	**3.85 ± 0.69**

Table 2: Summary of the Integration of Digital Tools in Fine and Industrial Design Teaching and Learning

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F	p-value
Between Groups	0.690	2	0.345	0.719	0.490
Within Groups	36.933	77	0.480		
Total	**37.623**	79			

Level of Significance: $\alpha = 0.05$

Table 3: Mean and SD Scores on Collaboration between Colleges of Education and Industry in Fine and Industrial Arts

S/N	Item Statement	FID Lecturers (Mean ± SD)	FID Instructors/Technicians (Mean ± SD)	FID Students (Mean ± SD)
11	The department maintains strong partnerships with relevant industries.	3.88 ± 0.71	3.87 ± 0.77	3.89 ± 0.78
12	Students participate in industrial training and internships.	3.88 ± 0.76	3.77 ± 0.71	3.72 ± 0.76
13	Industry experts are regularly invited for guest lectures.	3.69 ± 0.70	3.77 ± 0.76	3.67 ± 0.79
14	Collaborative projects with industry partners are part of the curriculum.	3.78 ± 0.67	3.96 ± 0.75	3.84 ± 0.71
15	Industry collaboration helps align curriculum with market demands.	3.88 ± 0.66	3.76 ± 0.67	3.87 ± 0.67
16	Students receive mentorship from practicing professionals.	3.85 ± 0.70	3.88 ± 0.72	3.84 ± 0.78
17	Industry partners assist in upgrading studio/lab facilities.	3.65 ± 0.55	3.60 ± 0.67	3.77 ± 0.70
18	There are opportunities for joint research with industry players.	3.72 ± 0.77	3.93 ± 0.76	3.86 ± 0.78
19	Industry collaboration has improved student employability.	3.90 ± 0.76	3.86 ± 0.78	3.98 ± 0.67
20	Students are exposed to sustainable and innovative design practices through industry links.	3.80 ± 0.69	3.79 ± 0.68	3.99 ± 0.67
	Grand Total	**3.80 ± 0.70**	**3.82 ± 0.73**	**3.84 ± 0.73**

Table 4: Summary of Collaboration between Colleges of Education and Industry in Fine and Industrial Design

Source of Variation	SS	df	MS	F	p-value
Between Groups	0.0220	2	0.0110	0.0211	0.9792
Within Groups	40.2182	77	0.5223	—	—
Total	40.2402	79	—	—	—

Level of Significance: $\alpha = 0.05$

Table 5: Mean and Standard Deviation Scores on the Influence of Emerging Technologies on the Fine and Industrial Design Curriculum

Item Statement	FID Lecturers (M ± SD)	FID Instructors/Technicians (M ± SD)	FID Students (M ± SD)
21. Artificial intelligence tools are incorporated into design coursework.	3.86 ± 0.75	3.98 ± 0.75	3.89 ± 0.79
22. Augmented reality is used for immersive product and art visualization.	3.65 ± 0.67	3.57 ± 0.59	3.59 ± 0.64
23. Virtual reality enhances the understanding of 3D spatial design concepts.	3.78 ± 0.75	3.81 ± 0.67	3.78 ± 0.78
24. Internet of Things (IoT) concepts are integrated into product design education.	3.84 ± 0.74	3.80 ± 0.78	3.88 ± 0.71
25. Emerging technologies have influenced the creation of new elective courses.	3.87 ± 0.77	3.89 ± 0.77	3.82 ± 0.72
26. The institution regularly updates design studio equipment.	3.89 ± 0.77	3.85 ± 0.76	3.75 ± 0.71
27. Lecturers receive training on modern design technologies.	3.70 ± 0.55	3.67 ± 0.67	3.59 ± 0.65
28. Emerging technologies improve the accuracy and quality of student projects.	3.70 ± 0.67	3.79 ± 0.54	3.70 ± 0.67
29. Students are trained to use generative design tools.	3.65 ± 0.75	3.68 ± 0.54	3.65 ± 0.70
30. Curriculum review processes consider technological advancements.	3.67 ± 0.56	3.74 ± 0.59	3.66 ± 0.67
Grand Total	**3.76 ± 0.70**	**3.78 ± 0.67**	**3.73 ± 0.70**

Table 6: Summary of the Influence of Emerging Technologies on the Fine and Industrial Arts Curriculum

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F	p-value	Decision ($\alpha = 0.05$)
Between Groups	0.19	2	0.095	0.193	0.825	Not Significant
Within Groups	28.73	77	0.373			
Total	28.92	79				

All groups strongly agreed that industry ties improve student employability (scoring 3.86-3.98), showing these connections, help graduates land jobs. Exposure to sustainable and innovative design practices through industry links scored nearly 4.0 among students, proving they value learning real-world, contemporary approaches. While the benefits are clear, one area lags slightly: direct support for facilities. Ratings were lower (3.60-3.77) when it came to industry partners helping upgrade studios and labs – suggesting classrooms could benefit from more hands-on investment from companies. The remarkably similar responses across groups (with little variation in opinions) informed something important: everyone perceived the value of these partnerships. From teachers to students, there's shared enthusiasm for how industry connections bridge the gap between school and professional practice. These collaborations were working well to make education more relevant and career-focused. But with stronger investment in facilities and resources, schools and companies could take this partnership – and student success – to the next level.

The numbers gave a clear narrative, whether a professor, technician, or student in Fine Art and Industrial Design, you likely share the same positive view of your program's industry collaborations. The statistical analysis (ANOVA) revealed near-identical ratings across all three groups ($p = 0.9792$). This remarkable consistency means: Lecturers perceived the same benefits in these partnerships as students did. Technicians/instructors observed the same practical advantages. Everyone agrees these collaborations are working

This rare alignment suggested that the value of

industry is not just theoretical; it's something everyone experiences firsthand. The curriculum's industry connections are being implemented consistently across different roles. From faculty to students, there was collective belief in how these partnerships prepare graduates. While all agreed collaborations were strong, this unity also presents an opportunity. With such consensus, programmes could:

Leverage this alignment to deepen industry engagement. Address any remaining gaps (like facility upgrades) with collective input. Use this shared perspective to strengthen curriculum further. In essence, this statistical harmony reflected a healthy ecosystem where industry partnerships are not just happening, they're being felt and valued equally by all stakeholders in design education.

The results in Table 3 indicated a generally high level of agreement among all three respondent categories, Fine and Applied Arts (FID) Lecturers, FID Instructors/Technicians, and FID Students, on the significant influence of emerging technologies in the Fine Art and Industrial Design curriculum. Across all items, mean scores ranged between 3.57 and 3.98, suggesting that respondents agreed (≥ 3.50 on a 4-point scale) that modern technological tools are well-integrated into teaching, learning, and curriculum review processes.

FID Lecturers reported the highest mean score (3.98) for the incorporation of artificial intelligence (AI) tools, indicating strong adoption and perceived importance of AI in the curriculum. Similarly, Instructors/Technicians rated AI integration and the influence of new technologies on elective course creation highly (3.98 and 3.89, respectively). Students' responses mirrored these trends, with high ratings for IoT integration (3.88) and AI incorporation (3.89).

The relatively low standard deviation values (ranging between 0.54 and 0.79) across all items implied a high level of consensus among respondents. The overall grand means were 3.76 (Lecturers), 3.78 (Instructors/Technicians), and 3.73 (Students), confirming a uniformly positive perception of the role of emerging technologies in shaping Fine Art and Industrial Design education in Colleges of Education.

These findings reinforced the necessity for sustained investment in technological infrastructure, continuous curriculum updates, and regular professional development to maintain relevance and ensure graduates' workforce readiness in an increasingly digital and innovation-driven global design industry.

The one-way ANOVA revealed no statistically significant difference in mean ratings among Fine Art and Industrial Design lecturers, instructors/technicians, and students regarding the influence of emerging technologies on the curriculum, $F(2, 77) = 0.193$, $p = 0.825$. This suggests that all three respondent groups have a similar perception of the integration and impact of emerging technologies in Fine and Industrial Design education. The minimal variance between groups compared to within groups indicates a high level of consensus across the categories.

8. Discussion of Findings

This study offered an important window into how Fine and Industrial Arts (FID) education in Nigeria's dual-mandate Colleges of Education is evolving to meet both teaching and industry demands. The results echoed what researchers have been saying globally (Kraus et al., 2021; Majola et al., 2025) and locally (Agbaje, 2021): that a strong curriculum should strike a balance between solid pedagogical training and industry-ready skills.

One of the clearest takeaways is the strong agreement among lecturers, instructors, and students (mean scores: 3.85–3.86) on the value of integrating cutting-edge tools, like 3D printers, CAD software, and virtual reality, into teaching and learning (Table 1). This reflects the growing recognition, globally and locally, that digital literacy is now a non-negotiable skill for design graduates (Uduafemhe et al., 2023; Zhang et al., 2021). Yet, the comparatively lower ratings for tools such as digital painting tablets (means: 3.50–3.68) expose a familiar challenge, limited access to modern resources, something Yildirim et al. (2020) has already identified as a common barrier in developing contexts.

Interestingly, the non-significant ANOVA result ($p = 0.490$, Table 2) showed that stakeholders see things in a similar light. This kind of consensus is encouraging—it suggests that the curriculum was being implemented in a way that is coherent across the board (Darling-Hammond, 2005). Still, there was no denying that certain investments, such as smartboards and other interactive tools, would further close the gap between what is taught and what industry requires.

Industry partnerships scored well (means: 3.80–3.84, Table 3), especially when it came to boosting employability (means: 3.86–3.98) and exposing students to sustainable design practices (means: 3.79–3.99). These results reinforced the point made by Prokopenko et al. (2024) and Ahmad et al. (2023) that collaboration between academia and industry often leads to entrepreneurial success. But not all areas performed as well, industry assistance in upgrading facilities (means: 3.60–3.77) remained weak point, echoing Abubakar's (2025) concerns about systemic underinvestment in vocational education.

Again, the ANOVA ($p = 0.9792$, Table X) showed stakeholder agreement, proof that the dual-mandate approach can unify teaching and industry needs (Harrison, 2025). That said, deeper forms of collaboration, like joint research and development

(Florek-Paszkowska & Ujwary-Gil, 2025), could further bridge the gap between the classroom and the workplace.

Concerning emerging technologies, the findings were clear: AI, IoT, and VR were influencing curriculum updates (means: 3.73–3.78, Table 4). AI, in particular, received high ratings (means: 3.86–3.98), aligning with global education trends (Li, 2024). But lecturer training (mean: 3.59–3.70) did not score as high, signaling the urgent need for continuous professional development (Rahmani, 2023).

The non-significant ANOVA here ($p = 0.825$, Table 6) once again showed consensus, but it also points to the need for flexible policy frameworks that can keep up with rapid technological change (NCCE, in Agbaje, 2021). The study also found that while students valued learning about sustainability (mean: 3.99), they still lacked access to eco-friendly materials and robust entrepreneurship training, an ongoing disconnect from the realities of today's job market (Ratican & Hutson, 2024; Agbo & Duodu, 2023; Yeung, 2025).

9. Conclusion

This study underscored that curriculum development is not just an academic exercise after, it's the backbone of workforce readiness for Fine and Industrial Arts graduates in Nigeria's dual-mandate Colleges of Education. The findings painted a hopeful picture: digital tools were being embraced, industry collaborations are growing, and new technologies are making their way into the classroom. Yet, there are still bottlenecks, outdated infrastructure, gaps in lecturer training, limited access to sustainable materials, and underinvestment from industry.

The dual-mandate model clearly has the potential to produce graduates who can thrive in both classrooms and creative industries. But for it to succeed, the curriculum must stay nimble, balancing theory with practice, innovation with tradition, and local needs with global standards.

10. Recommendations

1. Invest in modern tools like digital tablets, 3D printers, and VR headsets, ensuring software stays up-to-date so students train on what's actually used in industry.
2. Expand internships, guest lectures, and collaborative projects. Actively involve the industry in facility upgrades and curriculum reviews to keep training relevant.
3. Incorporate business management, marketing, and intellectual property rights into the curriculum. Emphasize sustainable design, eco-materials, and waste reduction for graduates can compete globally.
4. Provide regular CPD opportunities for lecturers on emerging technologies and industry trends. Encourage participation in industry events and certifications.
5. Allow institutions to adapt courses to local industry needs. Streamline accreditation so curricula can evolve in step with technology.
6. Partner with engineering, business, and ICT departments to bring real-world problem-solving into design projects.
7. Seek both government and private sector backing to improve studios, workshops, and digital labs. Support student-led design ventures through grants.

By following these steps, dual-mandate Colleges of Education can turn out graduates who are not just qualified teachers, but confident, adaptable professionals ready to shape Nigeria's place in the global creative economy. A forward-thinking curriculum that embraces technology, sustainability, and industry collaboration will ensure FID education remains relevant, dynamic, and impactful for years to come.

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