



INTEGRATING AI-DRIVEN TOOLS INTO FASHION DESIGN EDUCATION: PEDAGOGICAL CHALLENGES AND OPPORTUNITIES

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Abstrak

Meskipun integrasi platform berbasis kecerdasan buatan terus berkembang di berbagai disiplin pendidikan, penelitian yang secara khusus mengkaji tantangan dan peluang pedagogis teknologi ini dalam pendidikan desain mode kreatif masih sangat terbatas. Mengkaji hal ini sangat penting seiring meningkatnya tuntutan industri fashion terhadap pendidik yang handal teknologi dan mampu menavigasi lingkungan pembelajaran berbasis AI. Penelitian ini bertujuan untuk menginvestigasi tantangan dan peluang pedagogis dalam mengintegrasikan alat berbasis AI di kalangan mahasiswa calon guru desain mode di perguruan tinggi. Menggunakan desain mixed-methods sekuensial, data dikumpulkan melalui kuesioner skala Likert yang telah divalidasi dan diberikan kepada 30 mahasiswa calon guru, dilengkapi dengan wawancara mendalam terhadap 15 peserta yang dianalisis menggunakan kerangka tematik (Braun & Clarke, 2021). Hasil penelitian menunjukkan rata-rata keseluruhan sebesar 4,20 (Tinggi), dengan dimensi tantangan menghasilkan rata-rata kolektif sebesar 4,15 (Tinggi), yang didominasi oleh kesulitan menguasai alat dalam batas waktu perkuliahan (M=4,65), biaya platform (M=4,47), dan kekhawatiran integritas akademik (M=4,29). Dimensi peluang sedikit melampaui dimensi tantangan dengan rata-rata kolektif sebesar 4,26 (Sangat Tinggi), peluang didasarkan pada AI sebagai dukungan kreatif (M=4,47) dan peningkatan kesiapan industri (M=4,29). Temuan ini mengindikasikan bahwa meskipun terdapat sejumlah hambatan yang secara signifikan menghambat integrasi AI di dalam kelas, mahasiswa calon guru tetap memiliki orientasi yang sangat positif terhadap potensi transformatif AI dalam pedagogik desain fashion.

Kata kunci : Kecerdasan Buatan, Pendidikan Fashion Desain, Tantangan & Peluang

Abstract

Despite the growing integration of AI-driven platforms across educational disciplines, limited present studies specifically examines the pedagogical challenges and opportunities these technologies present within creative fashion design education. Understanding this intersection is critically important as fashion institutions increasingly demand technologically proficient educators capable of navigating AI-driven learning environments. This study aimed to investigate the pedagogical challenges and opportunities of integrating AI-driven tools among pre-service fashion design teachers in university. Employing a sequential mixed-

Submitted: 06-03-2026 Approved: 07-15-2026. Published: 07-28-2026



Citation: Maisalinia, R., Rahmawanti, M. R., Saragih, E. E., & Ridwan, A. F. (2026). Integrating Ai-Driven Tools Into Fashion Design Education: Pedagogical Challenges And Opportunities. Educate: Jurnal Teknologi Pendidikan, 171-189.

methods design, data were collected through a validated Likert-scale questionnaire administered to 30 pre-service teachers, supplemented by in-depth interviews with 15 participants, analyzed through Braun and Clarke's (2021) thematic framework. Results revealed an overall mean of 4.20 (High), with challenges yielding a collective mean of 4.15 (High), dominated by difficulty mastering tools within course timeframes (M=4.65), platform costs (M=4.47), and academic integrity concerns (M=4.29). Opportunity dimensions marginally surpassed challenges with a collective mean of 4.26 (Very High), led by AI as creative support (M=4.47) and enhanced industry readiness (M=4.29). These findings indicate that while there are some barriers significantly impede AI integration in the classroom. However, pre-service teachers maintain strongly positive orientations toward AI transformative pedagogical potential in fashion design pedagogy.

Keywords: *AI tools, Design Fashion Pedagogy, Challenges and Opportunities*

I. Introduction

The rapid advancement of artificial intelligence technology has significantly transformed educational practices across various disciplines in education, including fashion design education. Nowadays, industries increasingly adopt AI-driven tools and technologies so that educational institutions are required to prepare students with the competencies necessary to integrate artificial intelligence into their expertise as fashion design future teachers (J. Kim, 2024; Luo et al., 2025; Malik & Shah, 2025). In fashion design, AI-driven platforms such as machine learning-assisted design (CAD) software, AI-powered 3D garment visualization tools, intelligent virtual prototyping applications, and AI-enhanced illustration platforms have become essential components of infusing technology into fashion design education (Guo et al., 2023). Consequently, integrating these AI-driven platforms into fashion design education has emerged as both a necessity and a challenge for educators to support advanced learning especially in field of fashion design education.

The integration of artificial intelligence into education is supported by the broader framework of digital transformation in higher education, particularly in fashion design environment. According to Li et al. (2025), AI technologies have the potential to enhance learning experiences, improve accessibility, and foster innovation when effectively integrated into pedagogical practices. Similarly, Mishra and Koehler (2006) argued that effective AI integration requires the intersection of technological knowledge, pedagogical knowledge, and content knowledge, conceptualized through the Technological Pedagogical Content Knowledge (TPACK) framework in education. This perspective highlights that AI adoption in education is not merely a matter of introducing intelligent tools but also involves redesigning instructional strategies to support meaningful learning in the classroom.

Within fashion education environment, AI-driven platforms offer numerous opportunities to enrich students' learning experiences during the courses, especially when it comes to designing products (Han & Xu, 2026; Jung & Suh, 2024; X. Wu & Li, 2024). These AI design technologies enable students to develop industry-relevant skills, experiment with design concepts efficiently, and engage in collaborative and creative processes that mirror professional practices as future fashion design

teachers. Some prior researches suggest that AI fashion technologies facilitate innovation, sustainability, and design visualization while reducing material waste associated with traditional prototyping methods (Cui, 2026). In conclusion, AI-powered design environments provide learners with opportunities to explore complex design ideas and receive immediate feedback, supporting experiential and constructivist learning approaches during their learning.

Despite these benefits of integrating AI platform into fashion education, the integration of AI-driven platforms presents significant pedagogical challenges while implemented. Teachers often encounter difficulties related to technological proficiency, curriculum redesign, resource availability, and balancing manual design making with AI generated works while integrating technology into classroom (Ayanwale et al., 2024; Ding et al., 2024; Zhang et al., 2025). According to Kim et al. (2025), the adoption of innovations within educational settings is influenced by factors such as perceived usefulness, ease of use, institutional support, and users' readiness to embrace change. In fashion design education, resistance to technological change may arise from concerns that AI tools could diminish the importance of traditional design techniques, original creativity and artistic expression.

Previous studies establish crucial foundations for AI integration in fashion education. Mishra and Koehler (2006) stated that TPACK framework remains foundational, asserting that effective technology integration requires the intersection of technological knowledge, pedagogical knowledge, and content knowledge. Cui (2026) demonstrated that AI fashion technologies facilitate innovation, sustainability, and design visualization while reducing material waste. Kim et al. (2025) mentioned that there are perceived usefulness, ease of use, institutional support, and users' readiness to embrace change influence educational innovation adoption. These interconnected studies collectively support investigating pedagogical challenges and opportunities of AI-driven tools in fashion design education, bridging theoretical frameworks with contemporary educational practice and industry demands.

While previous studies establish theoretical foundations through TPACK adoption framework (Mishra & Koehler, 2006), a critical gap persists: existing research insufficiently examines AI-specific pedagogical challenges within creative disciplines. Cui (2026) addressed sustainability benefits, yet neglected AI's transformative impact on traditional craftsmanship dynamics. Li et al. (2025) emphasized technology's potential broadly, but lacked discipline-specific analysis. This study fills this gap by simultaneously investigating pedagogical challenges and opportunities within AI-driven fashion education. The novelty lies in examining how AI platforms specifically reshape teaching practices, student engagement, and curriculum design while balancing computational efficiency with artistic expression and creativity. This integrated analytical framework advances understanding of AI-Driven creative arts education, addressing the contemporary demand for advanced teachers.

While fashion education seeks to balance creative, technical, and professional competencies, understanding both the opportunities and challenges associated with

AI platform integration becomes increasingly important. Examining these issues can provide valuable insights for educators, curriculum developers, and policymakers seeking to modernize fashion design program to suit with today's demands while maintaining educational quality and creativity. This study aims to explore the pedagogical challenges and opportunities associated with integrating AI-driven platforms into fashion design education and by investigating how AI technologies influence teaching practices, student learning experiences, and material development, the study contributes to the growing discourse on digital transformation in creative arts education and offers recommendations for effective AI-enhanced fashion pedagogy to support effective and modern learning.

II. Research Methodology

This study utilized an explanatory sequential mixed-methods design, combining numerical analysis with contextual inquiry (Creswell & Clark, 2018). Initial quantitative measurement sought to uncover trends and views regarding pedagogical challenges and opportunities within AI-driven fashion design education. Furthermore, qualitative investigation captured pre-service teachers' perceptions and viewpoints about the use of AI-Driven tools into their fashion designing learning as a follow up to, the numerical findings regarding technology integration in fashion pedagogy.

This study involved 30 pre-service teachers enrolled in a vocational fashion design study program. Participants were purposefully selected based on their regular engagement with AI-driven design tools in their coursework and project development. All participants actively utilized AI-powered platforms for garment visualization, pattern generation, design conceptualization, and digital illustration throughout their learning. Their consistent exposure to AI-driven tools provided rich experiential data regarding technology integration effectiveness, learning experiences, and perceived barriers to AI adoption in fashion design education, making them ideal participants to investigate the challenges and opportunities they faced during the implementation. The complete sample of 30 completed the questionnaires, whereas 15 individuals consented to participate in open-ended interview session to measure their perception about pedagogical challenges and opportunities of the integration, to ensure their anonymity participant coded with participant 1-30.

9 items of the questionnaire construct appeared on a graduated Five-point scale (ranging from lowest to highest agreement). Two subject matter experts from education and fashion disciplines reviewed and validated the instruments for relevance and comprehensibility. Quantitative data were analyzed by calculating the mean score for each item for challenges and opportunities of Using Digital Platform into fashion design education purposes, by using the following formula (Creswell & Clark, 2018):

$$\text{Mean} = \Sigma fx / N$$

Where Σfx represents the total weighted score and N represents the total number of respondents. The resulting mean scores were interpreted using predetermined categories as proposed by Wheeldon (2010) as presented in below:

Table 1. Interpretation of Mean Scores

Mean Range	Interpretation
4.21-5.00	Very High
3.41-4.20	High
2.61-3.40	Moderate
1.00–2.60	Low

In-depth interviews with 15 respondents examined their direct experiences with AI technologies, instructional ramifications, and perceived obstacles and benefits. Interview transcripts underwent systematic theme identification employing Braun and Clarke (2021) analytical process. Dual-coder verification utilized Cohen's Kappa coefficient (0.81) confirmed inter-rater consistency and strengthened validity of emergent patterns (Vieira et al., 2010).

III. Findings and Discussion

A. Research Findings

The research findings are presented across three thematic sections that include: the overall results of AI integration in fashion design pedagogy, the second examines the specific challenges pre-service teachers encountered when integrating AI-driven tools into fashion education, and the third explores the perceived opportunities that AI integration offers, highlighting its potential to enhance teaching practices and creative development in contemporary fashion pedagogy.

1. Overall Results of the Challenges and Opportunities of integrating AI-Driven tools into fashion design pedagogy

Table 2. Questionnaires results

No.	Item	category	Σfx	N	Mean	interpretation
1	I face difficulties with internet/hardware access when using digital tools	Challenge	65	30	3.82	High
2	Platform/software costs are a	Challenge	76	30	4.47	Very high

No.	Item	category	Σfx	N	Mean	interpretation
	significant barrier for students					
3	I find it difficult to master digital tools within course timeframe	Challenge	79	30	4.65	Very high
4	Lecturers lack sufficient knowledge to guide AI/digital tool use	Challenge	60	30	3.53	High
5	AI tools cause concerns about originality and plagiarism	Challenge	73	30	4.29	Very high
6	Digital tools help me explore wider design concept possibilities	Opportunity	70	30	4.12	High
7	AI supports my creative process with visual references and inspiration	Opportunity	76	30	4.47	Very high
8	Digital platforms improve my readiness for the fashion industry	Opportunity	73	30	4.29	Very high
9	Digital platforms improve collaboration with classmates on group projects	Opportunity	71	30	4.18	High
Overall Result			643	30	4.2	High

The overall mean score of 4.20 (High) indicates that participants strongly acknowledge both the challenges and opportunities of integrating AI-driven tools into fashion design education. Regarding challenges, results were hierarchically ordered as follows: difficulty mastering tools within course timeframes ranked highest (M=4.65, Very High), followed by platform and software costs (M=4.47, Very High), originality and plagiarism concerns (M=4.29, Very High), internet and hardware access difficulties (M=3.82, High), and lecturer guidance gaps (M=3.53, High). These challenges likely originated from underprepared institutional infrastructure, limited financial provisions for students, and the absence of clear AI-use academic policies in learning. Concerning opportunities, AI as creative support ranked first (M=4.47, Very High), followed by industry readiness (M=4.29, Very High), collaboration support (M=4.18, High), and design concept exploration (M=4.12, High). These findings suggest that students perceive AI tools as meaningful facilitators of creative development and professional preparation, positioning digital integration as a transformative, though structurally demanding, and pedagogical endeavor.

2. Results of the Challenges in integrating AI-Driven tools into fashion design pedagogy

- Difficulty mastering tools within course timeframe

Table 3. Difficulty mastering tools within course timeframe results

No.	Item	category	Σfx	N	Mean	interpretation
3	I find it difficult to master digital tools within course timeframe	Challenge	79	30	4.65	Very high

Pre-service teachers perceive significant difficulty mastering AI design tools within their course duration (M=4.65, Very High). This finding indicates that learning timeframes are insufficient for developing proficiency with complex AI platforms while designing products. The high score suggests time constraints represent the most acute challenge among all dimensions measured of challenges faced by the pre service teachers. This result reveals a critical pedagogical gap: current fashion education programs do not allocate adequate hours for students to achieve competency with AI-driven design tools to fully utilize it. Institutions must extend course durations or reduce non-essential content to provide sufficient practice time, enabling pre-service teachers to develop confident, practical expertise in the field of fashion pedagogy.

This quantitative data supported by participants comment on interview as follow:

"The time is too tight. Learning fashion design principles and AI tools at the same time is overwhelming. I need either more hours in the course or fewer topics to cover properly." (Participant 4)

"We learn the basics, but mastering the software feels impossible with the current schedule. By the time I'm getting comfortable with one tool, we're already moving to the next topic" (Participant 6)

Pre-service teachers reported significant difficulty mastering AI design tools within the allocated course timeframe. Pre-service teachers reported significant difficulty mastering AI design tools within the allocated course timeframe (M=4.65, Very High), ranking this as the most acute challenge across all measured dimensions of challenges in integrating AI-Driven tools into learning. The high mean score indicates that current course durations are insufficient for developing proficiency with complex AI platforms alongside fashion design principles. Participants echoed this quantitatively, describing the schedule as overwhelming and noting they barely grasp one tool before advancing to the next topic, revealing a main obstacle in integrating AI tools into their learning.

- Platform and software cost as a financial barrier

Table 4. Platform and software cost as a financial barrier results

No.	Item	category	Σfx	N	Mean	interpretation
2	Platform/software costs are a significant barrier for students	Challenge	76	30	4.47	Very high

Platform and software costs constitute a very high financial barrier for pre-service teachers integrating AI-driven tools into fashion education (M=4.47, Very High). This finding reveals that premium AI design tools impose substantial economic burdens on students, potentially restricting full access to essential learning resources. Such

financial constraints hinder consistent practice and skill development, widening opportunity gaps among learners.

This quantitative data supported by participants comment on interview as follow:

"The subscription fees for some AI design platforms are really expensive. As a student, I can't afford to pay monthly just to complete the task given" (Participant 3)

"I had to skip some features because I don't have the budget to purchase the premium version of the software. The free version has too many limitations." (Participant 5)

Pre-service teachers identified platform and software costs as a very high financial barrier to AI integration in fashion education (M=4.47, Very High). This quantitative result is further supported by qualitative accounts, where participants described struggling with unaffordable subscription fees and being forced to use limited free versions that restricted their learning experience. Together, both data sources confirm that financial constraints significantly affects full access to AI-driven tools, ultimately hindering skill development and full participation in technology-integrated fashion pedagogy.

- Academic integrity and originality concerns

Table 5. Academic integrity and originality concerns results

No.	Item	category	Σfx	N	Mean	interpretation
5	AI tools cause concerns about originality and plagiarism	Challenge	73	30	4.29	Very high

Pre-service teachers identified academic integrity and originality concerns as a very high challenge in integrating AI-driven tools into fashion education (M=4.29, Very High). This finding indicates that the use of AI design platforms raises substantial concerns regarding plagiarism and authentic creative ownership among students. The high mean score suggests that originality concerns represent a significant dimension of challenges measured, revealing that current fashion education programs inadequately address ethical guidelines surrounding AI-generated outputs, potentially compromising the development of genuine creative competencies among pre-service teachers in doing their design.

This quantitative data supported by participants comment on interview as follow:

"There are no clear rules about how much AI assistance is acceptable. Sometimes I am unsure if using it too much already counts as cheating or plagiarism."(Participant 2)

"I always question whether the design I produced using AI is truly mine. It feels like the tool is doing the creative work for me, and I worry my teacher might think I did not put in genuine effort." (Participant 3)

Pre-service teachers identified academic integrity and originality concerns as a very high challenge in AI integration within fashion education (M=4.29, Very High). This quantitative result is further supported by qualitative results, where participants expressed uncertainty over acceptable AI usage boundaries and questioned the authentic ownership of AI-generated designs. Together, both data sources confirm that the absence of clear institutional ethical guidelines surrounding AI-assisted outputs creates significant ambiguity, undermining students' confidence and potentially compromising the development of genuine creative competencies among pre-service fashion education teachers.

- Internet and hardware access difficulties

Table 6. Internet and hardware access results

No.	Item	category	Σfx	N	Mean	interpretation
1	I face difficulties with internet/hardware access when using digital tools	Challenge	65	30	3.82	High

Pre-service teachers identified internet and hardware access difficulties as a high challenge in integrating AI-driven tools into fashion education (M=3.82, High). This finding indicates that inadequate technological infrastructure imposes considerable constraints on students, limiting consistent engagement with AI design tools. The high mean score reveals that connectivity and hardware limitations significantly disrupt learning continuity, suggesting that current institutional resources inadequately support the technological demands of AI-integrated fashion education.

This quantitative data supported by participants comment on interview as follow:

"My laptop is not powerful enough to handle some of the AI tools we are required to use. It constantly lags or crashes, which wastes a lot of my time " (Participant 5)

"Not everyone has access to high-speed internet at home. When we are given AI design tasks to complete outside school, I struggle because my connection cannot support the software requirements." (Participant 4)

Pre-service teachers reported internet and hardware access difficulties as a high challenge in AI integration within fashion education (M=3.82, High). This quantitative result is further supported by qualitative results, where participants described experiencing slow connectivity, device limitations, and outdated institutional hardware that consistently disrupted their engagement with AI design platforms. Together, both data sources confirm that inadequate technological infrastructure significantly constrains learning continuity.

- Lecturer guidance and pedagogical readiness gap

Table 7. Lecturer guidance and pedagogical readiness gap results

No.	Item	category	Σfx	N	Mean	interpretation
4	Lecturers lack sufficient knowledge to guide AI/digital tool use	Challenge	60	30	3.53	High

Pre-service teachers identified lecturer guidance and pedagogical readiness as a high challenge in integrating AI-driven tools into fashion education (M=3.53, High). This finding indicates that insufficient instructor knowledge in AI design platforms considerably limits effective student guidance and support. The high mean score reveals a significant pedagogical gap, suggesting that fashion education lecturers inadequately possess the necessary competencies to facilitate AI-integrated learning.

This quantitative data supported by participants comment on interview as follow:

"Sometimes I have questions about the AI tool but my lecturer cannot answer them properly. It feels like we are both learning at the same time, which makes it difficult to progress confidently." (Participant 5)

Pre-service teachers identified lecturer guidance and pedagogical readiness as a high challenge in AI integration within fashion education (M=3.53, High). This quantitative result is further supported by qualitative results, where participants described feeling inadequately supported; highlighting that lecturers struggled to address technical questions and demonstrated limited familiarity with AI design platforms. Together, both data sources confirm a critical pedagogical readiness gap, and insufficient background knowledge to integrate AI into Fashion pedagogy.

The five challenge items collectively yielded a dimension mean of 4.15, interpreted as Very High on the 5-point Likert scale (Creswell & Clark, 2018). This finding establishes that pedagogical challenges are not peripheral concerns but deeply felt, near-universally shared experiences but the participants. The hierarchical ordering: Difficulty mastering tools within course timeframe (M=4.65), Platform and software cost as a financial barrier (M=4.47), Academic integrity and originality concerns (M=4.29), Internet and hardware access difficulties (M=3.82), Lecturer guidance and pedagogical readiness gap (M=3.53), reveals that the most acute challenges are structural and systemic (time, cost, integrity) rather than primarily human-resource based (lecturer guidance). The quantitative findings reveal that pedagogical challenges in AI-driven fashion education operate at critically elevated levels (M=4.15, Very High). This differentiation and hierarchal obstacles suggests that resolving AI integration challenges requires systemic institutional intervention addressing temporal, economic, and ethical dimensions rather than exclusively targeting instructor professional development. The findings indicate that technological adoption in fashion pedagogy faces formidable infrastructure and temporal constraints that demand comprehensive organizational restructuring and resource allocation before pedagogical readiness becomes the limiting factor.

3. Results of the Opportunities in integrating AI-Driven tools into fashion design pedagogy

- AI as a creative support and visual reference tool

Table 8. AI as a creative support and visual reference tool results

No.	Item	category	Σfx	N	Mean	interpretation
7	AI supports my creative process with visual references and inspiration	Opportunity	76	30	4.47	Very high

Pre-service teachers identified AI as a creative support and visual reference tool as a high opportunity in integrating AI-driven tools into fashion education (M=4.47, Very High). This finding indicates that digital tools significantly expand students' capacity to explore broader design concept possibilities beyond traditional methods. The high mean score reveals that AI platforms considerably enhance creative exploration, suggesting that fashion education programs incorporating AI-driven tools effectively broaden pre-service teachers' design thinking and conceptual development, fostering innovative approaches essential in contemporary fashion pedagogy.

This quantitative data supported by participants comment on interview as follow:

"Whenever I feel stuck creatively, I use AI to generate visual inspiration that inspire my design direction. It broadens my perspective and pushes me to explore styles beyond my comfort zone." (Participant 5)

"Before AI, my design concepts were limited to what I could sketch by hand. Now I can explore multiple design directions simultaneously." (Participant 10)

Pre-service teachers identified AI as a creative support and visual reference tool as a high opportunity in fashion education (M=4.47, Very High). This quantitative result is further supported by qualitative result, where participants described how AI-driven tools expanded their creative boundaries, providing visual inspiration and enabling simultaneous exploration of multiple design directions beyond traditional hand-sketching limitations. Both data sources confirm that AI platforms significantly enhance design thinking and conceptual development, positioning AI integration as a valuable creative resource that enriches pre-service teachers' fashion design practice in their learning.

- Enhanced industry readiness and professional preparation

Table 9. Enhanced industry readiness and professional preparation results

No.	Item	category	Σfx	N	Mean	interpretation
8	Digital platforms improve my readiness for the fashion industry	Opportunity	73	30	4.29	Very high

Pre-service teachers identified digital platforms as significantly improving their readiness for the fashion industry, recording a very high opportunity rating (M=4.29, Very High). This finding indicates that AI-driven tools substantially enhance students' professional preparedness by familiarizing them with industry-relevant technologies and workflows. The very high mean score suggests that digital platform integration effectively bridges the gap between academic learning and professional practice, equipping pre-service fashion education teachers with advanced technological competencies essential to survive in today's increasingly digitalized global fashion industry.

This quantitative data supported by participants comment on interview as follow:

"Using AI design platforms during my class made me feel more confident about entering the fashion industry. I know that these are the same tools professionals use, so practicing them now gives me a real advantage." (Participant 2)

"AI platforms exposed me to professional design references that I would not have experienced through traditional methods alone." (Participant 4)

Pre-service teachers identified digital platforms as a very high opportunity for enhancing industry readiness and professional preparation in fashion education (M=4.29, Very High). This quantitative result is further support by qualitative results, where participants expressed increased professional confidence through effective AI platform experience, highlights on exposure to industry-standard tools and design references unavailable through traditional methods. Both data sources confirm that AI-driven digital platforms effectively bridge academic training and professional practice, equipping pre-service fashion education teachers with competitive technological competencies demanded by today's digitalized fashion industry.

- Improved collaboration in group design projects

Table 10. Improved collaboration in group design projects results

No.	Item	category	Σfx	N	Mean	interpretation
9	Digital platforms improve collaboration with classmates on group projects	Opportunity	71	30	4.18	High

Pre-service teachers identified digital platforms as significantly improving collaboration in group design projects, recording a high opportunity rating (M=4.18, High). This finding indicates that AI-driven tools considerably enhance cooperative learning by facilitating conducive communication and shared design results among students. The high mean score reveals that digital platform integration effectively strengthens collaborative competencies, suggesting that fashion education programs incorporating AI-driven tools successfully foster teamwork and collective creativity, equipping pre-service teachers with essential collaborative skills reflective of professional fashion industry group design practices.

This quantitative data supported by participants comment on interview as follow:

"Digital platforms made our group projects much easier to manage. We could share design files instantly and give each other feedback in real time."
(Participant 2)

"Working with AI design tools as a team exposed us to each other's creative perspectives. It encouraged open discussion and collective decision making, making our group projects more dynamic." (Participant 4)

Pre-service teachers identified improved collaboration in group design projects as a high opportunity in AI integration within fashion education (M=4.18, High). This quantitative result is further supported by qualitative data, where participants described how digital platforms enabled instant file sharing, real-time feedback, and collective decision-making that enriched group design dynamics. Both data sources confirm that AI-driven tools significantly enhance collaborative competencies among pre-service teachers, fostering teamwork and shared creativity essential for professional fashion industry group design practices and contemporary pedagogical development.

- Expanded creative and design concept exploration

Table 11. Expanded creative and design concept exploration results

No.	Item	category	Σfx	N	Mean	interpretation
6	Digital tools help me explore wider design concept possibilities	Opportunity	70	30	4.12	High

Pre-service teachers identified expanded creative and design concept exploration as a high opportunity in integrating AI-driven tools into fashion education (M=4.12, High). This finding indicates that digital tools significantly broaden students' capacity to investigate diverse design concepts beyond conventional methods. The high mean score reveals that AI platform integration considerably enriches creative exploration, suggesting that fashion education programs incorporating AI-driven tools effectively cultivate expansive design thinking among pre-service teachers, enabling them to develop innovative, multidimensional design concepts essential for thriving in the continuously evolving contemporary fashion design education.

This quantitative data supported by participants comment on interview as follow:

"AI expanded my creative thinking significantly. I can now generate multiple design variations within minutes, which pushes me to think beyond my usual design and explore more innovative concepts." (Participant 10)

Pre-service teachers identified expanded creative and design concept exploration as a high opportunity in AI integration within fashion education (M=4.12, High). This quantitative result is further supported by qualitative data, where participants described how AI-driven tools enabled rapid generation of multiple

design variations, pushing creative boundaries beyond conventional limitations. Together, both data sources confirm that digital platform integration significantly cultivates expansive design thinking among pre-service teachers, fostering innovative and multidimensional conceptual exploration essential for their continuous creative development and effective fashion design pedagogical practice.

The four opportunity dimensions produced a collective mean of 4.26, interpreted as Very High, marginally exceeding the challenge dimension mean of 4.15 and confirming that students' overall orientation toward digital and AI platform integration is strongly positive. The hierarchical ordering AI as a creative support and visual reference tool (M=4.47), Enhanced industry readiness and professional preparation (M=4.29), Improved collaboration in group design projects, Expanded creative and design concept exploration (M=4.12) shows that AI creative support and industry readiness are perceived as the most valuable dimensions, followed by creative exploration and collaboration. The opportunity dimensions collectively yielded a very high mean of 4.26, surpassing the challenge mean of 4.15, confirming pre-service teachers' strongly positive orientation toward AI integration in fashion education. AI creative support and industry readiness emerged as most valued, followed by collaborative improvement and expanded design exploration, collectively affirming AI-driven tools as transformative opportunities in contemporary fashion pedagogy.

B. Discussion

The findings of this study reveal a complex pedagogical landscape where pre-service fashion teachers simultaneously navigate barriers while recognizing transformative creative possibilities offered by AI-driven platform integration in the classroom.

Challenges of Integrating AI-Driven Tools into Fashion Design Pedagogy

The most critical challenge identified in this study which is difficulty mastering AI tools within course timeframes (M=4.65) aligns directly with Mishra and Koehler's (2006) TPACK framework, which emphasize that meaningful technology integration demands the simultaneous development of technological, pedagogical, and content knowledge. When course durations compress this learning into insufficient timeframes, students are forced to develop surface-level competences rather than deep competency, fundamentally undermining the TPACK model. Financial barriers represented by platform subscription costs (M=4.47) further expose systemic inequities embedded within fashion pedagogy. Kim et al's. (2025) diffusion of innovations theory establishes that perceived ease of use and accessibility are prerequisite conditions for successful technology adoption. When economic constraints restrict full platform access, the learning process is interrupted and it resulted in students cannot meaningfully evaluate, adopt, or internalize AI tools.

Academic integrity concerns (M=4.29) introduce a philosophically deeper dimension that distinguishes fashion education from other technology-integrated

disciplines. Unlike technical or financial barriers, originality anxieties reflect fundamental tensions between AI's generative capabilities and the creative authorship central to fashion design identity and creativity. The absence of institutional ethical frameworks leaves pre-service teachers navigating these boundaries independently, creating precisely the uncertainty that Kim et al. identified as an inhibitor of confident and sustained technology adoption among learners. Infrastructure limitations encompassing internet connectivity and hardware inadequacy ($M=3.82$) compound existing barriers by introducing unpredictable disruptions to learning continuity. Lecturer pedagogical readiness gaps ($M=3.53$), though ranking lowest among challenges, carry disproportionate instructional consequence, when educators lack sufficient AI platform competency, the entire pedagogical scaffolding surrounding technology integration collapses, leaving students without expert guidance precisely when navigating complex and unfamiliar tools. This finding corroborates the assertion that technological knowledge within instructors is non-negotiable for effective AI-integrated pedagogy, and suggests that professional development investment represents an urgent institutional priority (Lee & Suh, 2024; Sutanto et al., 2024; Tran et al., 2022). The five challenge dimensions collectively yielding a mean of 4.15 (Very High) establishes that these barriers are not a mere inconveniences but deeply systemic, near-universally experienced by the participants.

Opportunities of Integrating AI-Driven Tools into Fashion Design Pedagogy

Despite unavoidable structural challenges, the opportunity dimensions collectively surpassing the challenge mean ($M=4.26$ versus $M=4.15$) carries significant analytical weight, indicating that pre-service teachers maintain strongly positive orientations toward AI integration. The primacy of AI as creative support and visual reference ($M=4.47$) substantiates Cui's (2026) findings regarding AI's capacity to facilitate design innovation and visualization. However, this study extends their analysis by demonstrating that creative support functions not merely as a productivity enhancement but as a genuine pedagogical scaffold. This scaffolding function aligns with constructivist learning theory, wherein AI platforms serve as cognitive tools enabling learners to construct increasingly sophisticated design knowledge through exploratory.

Industry readiness emerging as the second strongest opportunity ($M=4.29$) reveals that pre-service teachers possess awareness of professional market demands, perceiving AI competency not as supplementary enrichment but as professionally indispensable preparation as future educator. This finding substantiates Lee and Suh's (2024) position that effective AI integration fosters innovation and prepares learners for evolving professional landscapes. Collaborative enhancement ($M=4.18$) and expanded design concept exploration ($M=4.12$), while ranking comparatively lower, collectively affirm that AI integration produces multidimensional pedagogical benefits extending beyond individual creative development. The collaborative dimension particularly reflects Sutanto et

al's. (2024) observation that technology adoption accelerates within social learning environments, suggesting that group-based AI design activities may serve as effective adoption pathways that simultaneously develop both technological and interpersonal professional competencies.

The findings of challenge and opportunity findings generates several critical pedagogical implications for fashion education institutions. First, curriculum restructuring must prioritize dedicated AI integration time, disaggregated from traditional design content delivery, ensuring pre-service teachers develop genuine platform competency. Second, institutions must establish institutional licensing agreements that democratize access to premium AI platforms, eliminating economic barriers that currently restrict equitable participation in technology-integrated learning. Third, comprehensive academic integrity policies specifically addressing AI-generated design work must be developed providing ethical frameworks that support.

IV. Conclusion

This study set out to examine the pedagogical framework surrounding AI-driven tool integration in fashion design education. The overall mean of 4.20 (High) does not simply reflect a statistical results, it captures the genuine tension that pre-service fashion teachers live daily: the pull between recognizing AI's transformative potential and facing the challenges that prevent them from fully realizing it. What the challenge findings reveal most powerfully is that the barriers to AI integration in fashion education are not rooted in student unwillingness or intellectual incapacity. The highest-ranked challenge: difficulty mastering tools within course timeframes (M=4.65), points directly to a curriculum architecture that didn't fully designed with AI complexity.

Fashion education programs were historically built around manual craft, long time, and require studio time. Inserting sophisticated AI-driven tools into this existing structure without restructuring the temporal and cognitive demands around them is hindering the full potentials of AI usage. Students are not failing to learn; they are being asked to learn too much, too fast, within systems that have not evolved to support them. The financial dimension adds another layer of challenges that cannot be dismissed as peripheral. When platform costs (M=4.47) determine whether a student can access the full learning experience. This is particularly consequential in vocational fashion education, where students often come from diverse economic backgrounds with limited disposable income for subscription-based software. The academic integrity dimension (M=4.29) deserves particular philosophical attention of the challenges. Unlike infrastructure problems, which can be solved with funding, the question of creative ownership in AI-assisted design touches something deeper: what it means to be a designer. When pre-service teachers question whether AI-generated work is authentically theirs, they are not simply worried about plagiarism

policies but they are grappling with professional identity formation at a critical stage of their development.

On the opportunity side, the fact that collective opportunity means marginally exceeded challenge means (4.26 versus 4.15) is analytically significant beyond its numerical modesty. It confirms that pre-service teachers are not resistant to AI, they are eager for it. They see in AI tools a pathway to broader creative horizons, stronger professional preparation, and more dynamic collaborative experiences. This intrinsic motivation is an strong support in utilizing AI-Driven technology to the classroom experiences.

For future research, several directions need to be explored. Longitudinal studies tracking pre-service teachers from AI-integrated training into their early professional practice would illuminate whether pedagogical confidence translates into effective classroom implementation. Comparative studies across different institutional contexts, various levels of schools, would reveal whether the challenges identified here are universal or context-dependent.

V. References

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