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# Ethical Threads: Exploring Generative Artificial Intelligence in Fashion Education

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## Abstract

This study explores the rapidly evolving intersection of artificial intelligence (AI) and fashion, spotlighting the ethical challenges that come with integrating Generative Artificial Intelligence (GAI) into the classroom. As GAI reshapes creative industries, it promises exciting new possibilities—yet also raises pressing questions around bias, ownership, and the future of human-AI collaboration. To address these complexities, this research developed and tested a fashion-focused ethics intervention aimed at preparing students not just to use GAI tools, but to engage with them thoughtfully and responsibly.

Through a quasi-experimental mixed-methods design, the study investigated how an ethics lesson influenced students' perceptions of text- and image-based GAI tools. Results underscore the essential role of ethics education in helping future professionals navigate AI's challenges with integrity. These insights offer valuable guidance for educators seeking to equip students with both the technical skills and the ethical mindset needed to thrive—and lead—in an AI-driven creative landscape.

**Keywords:** Generative AI; Fashion education; AI ethics; Design pedagogy; Bias and representation; Intellectual property; Experiential learning

## Introduction

The emergence of ChatGPT has heightened interest in a powerful branch of Artificial Intelligence (AI) known as Generative Artificial Intelligence (GAI). Described as an "ongoing revolution transforming science and society altogether" [1], GAI refers to AI models designed to autonomously generate original content—such as images, text, audio, and video—without direct human input [2,3]. This innovation has made advanced technology more accessible and user-friendly across disciplines, opening new possibilities for both consumers and industries.

In the fashion industry, GAI is rapidly transforming how products are designed, marketed, and produced [4-6]. Tools like ChatGPT and DALL-E are increasingly used to streamline design ideation, prototyping, and content creation [7,8]. However, this shift also introduces ethical concerns, including algorithmic bias, intellectual property rights, and labor displacement [9,10]. Moreover, over-reliance on AI tools may undermine the development of critical thinking and creativity, particularly among students still building foundational skills [11,12].

As industries demand graduates who are both technically proficient and ethically aware, it is essential that fashion students learn to evaluate and navigate the complexities of AI [13,14]. This paper responds to that need by developing and accessing an AI ethics lesson tailored to fashion product development. The goal is to ensure students are prepared to engage with emerging technologies responsibly, avoiding the perpetuation of past injustices and mitigating future ethical dilemmas [15,16].

### GAI Technology

Text-based models, such as ChatGPT, a generative pretrained transformer software, use supervised learning to generate coherent and contextually appropriate responses based on extensive datasets [2]. They predict text continuations, enabling human-like content creation for tasks such as customer support, marketing, and publishing [17,8]. These models often extend beyond text generation to create multimedia content, including videos and audio, demonstrating their versatility in creative industries [8].

Image-based GAI, such as DALL·E, utilizes models like Generative Adversarial Networks (GANs) to produce realistic images in response to text prompts or other input data [3,18]. These models iteratively refine their outputs through optimization processes until they align with the intended prompts. For instance, GANs can generate fashion designs or promotional visuals based on a brand's existing imagery. Despite their utility, these models face challenges. Outputs are often influenced by biases in the training data, leading to underrepresentation of certain races, body types, or genders [19,20]. This is particularly concerning in fashion, where visual representation plays a critical role.

## Literature Review

Generative AI (GAI) technologies are designed to replicate core aspects of human cognition—including learning, problem-solving, decision-making, and perception—through advanced techniques such as machine learning, deep learning, natural language processing, and computer vision [2]. These capabilities enable GAI systems to process vast amounts of data and produce content that closely mirrors human output, offering new opportunities for creativity, innovation, and efficiency across sectors, including fashion. However, as these tools become more embedded in design and communication workflows, scholars have raised critical concerns about their ethical implications. Emerging literature highlights several key issues—including bias and representation, technological limitations, and copyright and ownership—that shape how GAI is perceived and applied in creative industries. The following section reviews these concerns, establishing a foundation for understanding their relevance to fashion education and practice, with specific attention to ethics education strategies, preparation for AI integration, pedagogical research gaps, and relevant theoretical frameworks.

### Bias and Representation

GAI systems are trained on vast datasets that often mirror and amplify societal biases. Research has shown that image-generation tools perpetuate stereotypes, particularly in representations of race and gender [21,19]. For example, StyleGAN's outputs frequently sexualize women and underrepresent minority groups, reflecting deeply rooted societal prejudices present in the data used to train such systems [19]. These biases are not limited to image generation; text-based tools can also perpetuate stereotypes through biased language or cultural assumptions embedded in their training data.

Addressing these biases is essential for fostering diversity and inclusion in fashion, a field already criticized for its lack of representation and cultural sensitivity. Without intervention, AI systems risk reinforcing exclusionary practices and limiting the industry's potential to serve diverse audiences. Promoting ethical practices in AI development, including curating diverse and inclusive datasets, is a vital step toward creating tools that reflect a broader spectrum of human experiences. This is particularly important in fashion, where equitable representation in designs, campaigns, and branding is a key driver of innovation and inclusivity.

### Technological limitations

AI-generated images often exhibit technical flaws such as distorted proportions, incorrect textures, or unrealistic lighting, which pose challenges in the fashion industry where precision is vital. Similarly, AI-generated fashion text, like product descriptions or marketing copy, can include inaccuracies or fail to align with brand identity, requiring significant human refinement [22]. In 2022, Google and Meta introduced video-generation systems but withheld public release due to concerns about their potential misuse, such as spreading disinformation efficiently [23]. This highlights the risks of GAI enabling the creation of undetectable misinformation, complicating efforts to verify online content. As AI advances, balancing its benefits with ethical and societal responsibilities is essential. Ensuring fairness, transparency, and accountability in AI systems is crucial for fostering diversity and inclusion in fashion. Educators must guide students to recognize these limitations, encouraging the use of GAI as a tool to enhance, rather than replace, human creativity [18].

### Copyright and ownership

Copyright and design ownership pose challenges in using GAI for fashion product development. In an industry driven by trends, distinguishing between inspiration and infringement is complex. Unlike human designers, GAI relies on datasets, often generating designs that closely resemble existing work, increasing the risk of unintentional replication [10].

To mitigate this, fashion professionals should modify AI-generated outputs and maintain an audit trail of design alterations [13]. Using proprietary datasets—such as a brand's own archives—can also prevent copyright issues. For example, if Chanel uses its design archives to generate new creations, no copyright conflict arises. However, if GAI generates near-identical designs based on publicly available Chanel pieces, infringement concerns emerge.

U.S. copyright laws currently protect only human-created works, leaving AI-generated designs in a legal gray area [24]. This

uncertainty complicates authorship attribution and intellectual property rights in fashion [10]. Understanding these complexities is essential for students to develop ethical and legally sound design practices.

## Ethics Education Strategies for Emerging Technologies

Research across disciplines emphasizes the need for ethics education in preparing students to address challenges posed by emerging technologies. In media and computer science education, case studies, experiential learning, and interactive discussions have proven effective in fostering ethical awareness and critical thinking related to issues like bias, justice, and data privacy [25,26]. For example, students exposed to real-world or hypothetical scenarios involving algorithmic bias develop a stronger ability to evaluate ethical risks and propose responsible solutions.

In design education, values-based frameworks are recommended to help students navigate conflicting priorities such as sustainability, cost-effectiveness, and innovation. Hiort af Ornäs and Keitsch [11] found that students often experience cognitive dissonance when balancing ethical ideals with practical constraints. These tensions are particularly pronounced in fashion, where creative decision-making frequently intersects with cultural representation, authorship, and intellectual property concerns.

Within the fashion domain, Marcketti, et al. [27] revealed a disconnect between students' attitudes as creators and consumers regarding plagiarism and design copying. This highlights the importance of teaching students to critically assess originality, ownership, and ethical responsibility in creative work. Similarly, Padhi [28] and Nolan [29] emphasize the value of using legal case studies, such as the Adidas vs. Thom Browne trademark dispute, to help students grasp the fine line between inspiration and infringement. In this case, Adidas claimed that Thom Browne's use of four parallel stripes was too similar to its iconic three-stripe mark. Examining such disputes enables students to better understand intellectual property boundaries and the legal implications of design choices in the fashion industry.

## Preparing Fashion Students for AI Integration

As AI and GAI reshape the fashion industry, fashion education must adapt to prepare students not only for technical engagement but also for ethical decision-making. Curricula have increasingly emphasized skill development in AI-assisted sustainability, 3D design, and creative collaboration [21,30-35]. Van, et al. [36] [43] (2024) highlighted how technologies like AI, virtual reality (VR), and machine learning (ML) enhance operational efficiency, trend analysis, and prototyping. However, they also note ongoing challenges in sustainability and workforce adaptation.

Despite these advances, AI's integration presents unresolved ethical issues. GAI-generated outputs often lack the cultural nuance, emotional depth, and context-sensitive decision-making that human designers contribute [37,18]. Additionally, biases embedded in training data can perpetuate exclusionary practices if left unexamined [19]. Concerns around intellectual property, authorship, and the blurred lines between original and AI-generated content further complicate the design process.

AI also impacts consumer-facing aspects of fashion, from personalized marketing to automated styling and trend forecasting [4]. These applications raise important concerns related to transparency, data privacy, and consumer autonomy [1], underscoring the need for ethical frameworks that extend beyond the design studio.

## Opportunity for Research and Pedagogical Innovation

Despite widespread adoption of GAI tools in industry, little research has investigated their pedagogical impact in creative disciplines such as fashion. Most existing literature centers on technical functionality [30,21] or professional guidelines [3,33], overlooking the crucial role of education in shaping future practitioners' ethical awareness. This study addresses that gap by developing and evaluating an experiential learning intervention that integrates hands-on GAI engagement with structured ethical reflection. This reflection exercise explores students' evolving perceptions of bias, authorship, collaboration, and copyright in the context of AI-assisted design.

Drawing from best practices in ethics education, this approach emphasizes interdisciplinary learning, real-world application, and critical reflection. As Mhlanga [38] suggests, GAI offers opportunities to create more inclusive, interactive learning environments that promote 21st-century skills. Rather than replacing instructors, AI technologies can enhance their role by supporting guided inquiry and ethical exploration [39,38].

The growing presence of AI in fashion marks a paradigm shift toward data-informed, collaborative design. While AI can assist with creativity and efficiency, it lacks self-regulation, making human oversight essential [26]. Curriculum development should prioritize not only technical fluency but also students' ability to evaluate the authenticity, reliability, and implications of AI-generated outputs [16]. The rise of AI ethics guidelines [9,1] further reflects the urgency of integrating ethical training into design programs. To prepare students for this new landscape, fashion education must combine technical proficiency with ethical literacy, ensuring that future professionals are not only capable of using AI effectively but also of doing so responsibly.

## Theoretical Frameworks

Research from other AI domains suggests that ethical intentions alone are insufficient [40]. Integrating a values-based framework and fostering ethical norms in education can help students internalize design ethics and critically assess ethical challenges in their field [11]. It is also essential to distinguish between acting ethically and making ethical decisions, recognizing potential unintended consequences [40].

Kolb's Experiential Learning Theory [41] provides a structured approach to teaching AI ethics by emphasizing learning through active engagement, reflection, and critical analysis. His four-stage model—concrete experience, reflective observation, abstract

conceptualization, and active experimentation—allows students to interact directly with GAI tools, evaluate ethical dilemmas, and develop strategies for responsible use. In fashion education, this means students not only work hands-on with AI-driven design tools but also reflect on issues like algorithmic bias, labor implications, and intellectual property concerns. By applying theoretical concepts to real-world scenarios, students build a deeper understanding of the ethical dimensions of AI in fashion.

Mhlanga's [38] framework for ethical AI use complements Kolb's model by emphasizing key principles such as transparency, accountability, and inclusivity in technological practices. Transparency ensures that AI-generated outputs are explainable and traceable, reducing the risk of misinformation or unethical decision-making. Accountability requires users to take responsibility for AI-driven outcomes, reinforcing the need for human oversight in creative industries. Inclusivity highlights the importance of diverse perspectives in AI development and deployment, ensuring that GAI does not perpetuate biases embedded in training datasets. Furthermore, Mhlanga [38] underscores the need for interdisciplinary collaboration and stakeholder engagement, essential in fashion's dynamic, globalized environment where AI impacts design, production, marketing, and sustainability.

Together, Kolb's Experiential Learning Theory [41] and Mhlanga's AI framework [38] provide a foundation for integrating GAI into fashion education. These approaches not only enhance students' technical proficiency with AI tools but also cultivate critical thinking and ethical reasoning, preparing them to navigate the evolving intersection of fashion and artificial intelligence responsibly.

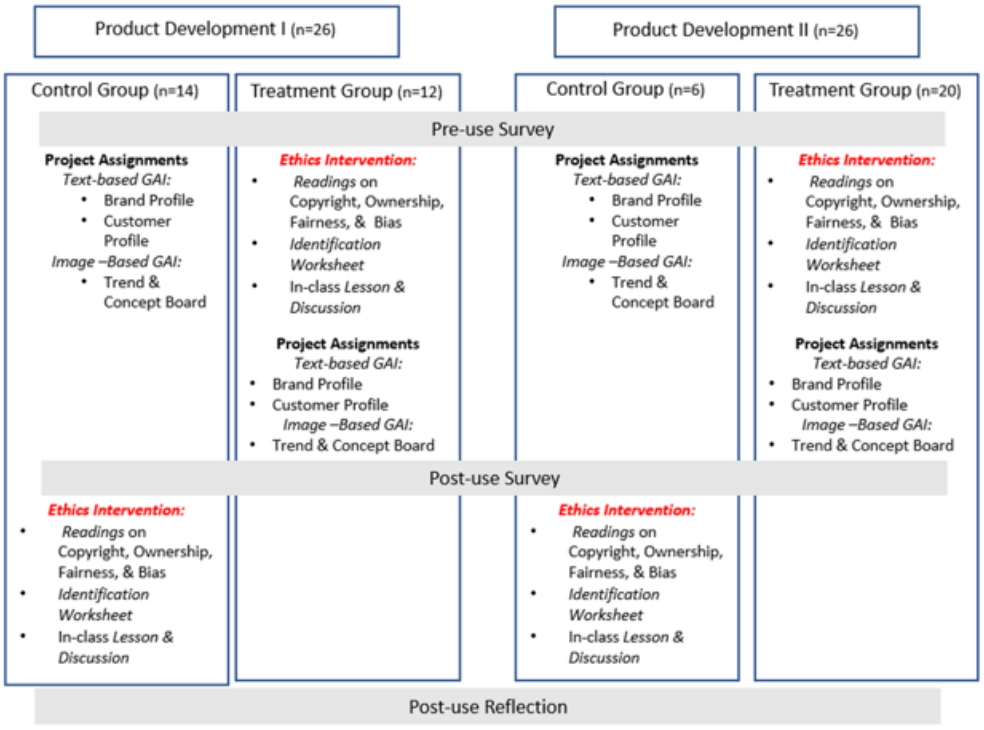
## Research Methodology and Methods

This study employed a quasi-experimental design [43] to examine fashion students' perceptions of GAI ethics and evaluate the impact of an ethics-focused educational intervention. Decisions about how to incorporate GAI into the learning environment were guided by established AI education frameworks [38,15], while prior research on students' ethical reasoning in design contexts [11,40] informed the content of the intervention.

The study was conducted across junior-level Product Development (PD I) and senior-level Product Development (PD II) courses. Each course level included both a treatment group and a comparison group to enable meaningful analysis. All students began by completing a pre-survey assessing their perceptions before any exposure to GAI tools.

Students in the treatment sections (combined n = 32) first participated in an ethics lesson that included assigned readings, a lecture, and an in-class discussion on ethical concerns surrounding GAI and the fashion industry. They then applied these concepts through hands-on assignments using free GAI tools—ChatGPT 3.5 for generating brand and customer profiles, and Bing Image Generator (based on DALL·E) for creating customer visuals and inspiration images [2,3]. After completing both the ethics intervention and GAI-based assignments, these students took a post-use survey.

In contrast, students in the comparison sections (combined n = 20) engaged with the same GAI tools and assignments first. They completed the post-use survey immediately after their experiential work and only then received the ethics lesson.




**Note:** Structure and timeline of the research by treatment group and course level.
**Figure 1:** Research Map for Ethical Intervention.

By structuring both PD I and PD II courses to include treatment and comparison groups, the study assessed how the timing of ethics instruction—before versus after using GAI tools—affected students' critical engagement with ethical issues such as bias, copyright, and human-AI collaboration within a product development context (Figure 1).

## Educational Intervention

This study introduces a fashion-specific educational intervention that integrates experiential learning with structured ethical reflection to address the unique challenges posed by GAI technologies. The intervention was designed to bridge the gap between theoretical understanding and practical application by engaging students in hands-on work with generative tools—such as ChatGPT and Bing Image Generator—and prompting critical discussions on ethical issues such as bias, authorship, copyright, and collaboration.

Building on Chan and Hu's [42] research into student perceptions of AI tools like ChatGPT, the intervention focused on key ethical concerns influencing students' reasoning and professional development. Students explored free, accessible GAI tools through assignments involving brand and customer profile generation and visual inspiration development, encouraging them to assess the implications of AI-generated content within a product development context.

Ethical reflection was scaffolded through carefully curated readings on topics such as copyright, diversity and inclusion in fashion, and technological bias. These materials, selected for accessibility and relevance, were delivered through the course's online platform. Students first engaged with the readings individually, identifying core ethical themes and connecting them to real-world fashion examples and AI-related concerns. In the following session, students collaborated in teams to synthesize their findings into shared slide decks, which served as a springboard for class-wide discussions.

By combining practical use of AI tools with interdisciplinary analysis and collaborative reflection, the intervention aimed to deepen students' ethical awareness and prepare them to navigate the evolving technological landscape of the fashion industry responsibly.

## Participants

The research was conducted at a mid-size university located in the southwestern United States during the fall 2023 semester. Students who qualified for participation in this study were required to be undergraduates in fashion at the institution involved and enrolled in either the PD I or PD II courses. Students in these courses ranged in age from 19 to 23, with all but one identifying as female. All students included in the study consented to participate based on the informed consent protocol approved by the institution's IRB.

Researchers typically adhere to a guideline suggesting a minimum of 20 participants per group for each dependent variable when employing MANCOVA for data analysis. However, it's crucial to acknowledge that researchers encounter practical constraints, including recruitment feasibility and available resources, when determining an adequate sample size for a study. In the context of this specific study, the control group comprised 20 participants, while the treatment [intervention] group consisted of 32 participants. This allocation of participants allowed for a robust examination of the effects of the intervention while considering the logistical and resource-related limitations inherent in the research process.

## Data Collection

To evaluate the effects of an educational ethics intervention, a mixed-method approach with an explanatory sequential design was used. First, a quasi-experimental design collected quantitative data via pre- and post-test five-point Likert surveys. The nonrandom assignment of students to course sections categorizes this research as quasi-experimental [43]. These surveys, adapted from Chan and Hu's [42] study on GAI ethics in education, measured students' initial and post-intervention perceptions of GAI in fashion, including biases, copyright concerns, and content ownership. Cronbach's alpha (0.821) confirmed the scale's reliability.

Post-intervention, all students completed qualitative reflection assignments on GAI's role in education and fashion. Combining surveys and reflections clarified how ethical instruction influenced perceptions, demonstrating the synergy of quantitative and qualitative data in addressing complex educational issues.

## Data Analysis

A mixed-methods approach was employed to evaluate shifts in students' ethical perceptions and anticipated professional impacts. Quantitative analysis included a multivariate analysis of covariance (MANCOVA) conducted using SPSS to assess differences in responses to Likert-scale survey items across treatment and control groups. To enrich these findings, a qualitative thematic analysis was conducted using an inductive approach based on Terry, et al. [44].

The qualitative dataset consisted of 52 student reflections—32 from the intervention group and 20 from the control group—each averaging approximately 1,200 words. The analysis began with open coding to identify recurring themes and patterns [44], followed by axial coding to refine and organize themes into cohesive categories [45]. The coding process was conducted using Excel and adhered to Nowell et al.'s [46] six-phase framework to ensure trustworthiness and rigor.

The writing prompts asked students to reflect on their use of ChatGPT in developing the brand profile and customer profile assignments. Specifically, they were asked: "Would you use GAI again to create a brand profile or customer profile? Why or why not?" To encourage critical thinking about authorship and accountability, students were also asked: "Who owns or should be credited with the GAI output?" In addition, they were prompted to consider ethical dimensions with the question: "Did you identify any ethical issues with the text-based GAI output (brand profile or customer profile)? If yes, please describe the issue(s) you identified." This final question was intentionally open-ended to explore what students might define as ethical concerns following the instructional intervention. Students responded to the same prompts regarding their use of Bing Image Creator in creating trend and inspiration boards.

To further explore students' perspectives on GAI, the prompts also included three future-oriented questions: "How do you imagine using GAI in future fashion projects in your education?", "What are your biggest concerns with using GAI in your education?", and "How do you imagine using this tool in the future?" These questions provided insight into students' evolving attitudes, ethical awareness, and envisioned applications of GAI in both academic and professional contexts.

The resulting key categories—inappropriate/biased output, unclear ownership, concerns regarding authenticity, and concerns regarding dependence—are closely aligned with themes from prior ethics research and the conceptual framework guiding the intervention. These categories offered a clear lens through which students' reflections could be analyzed concerning broader ethical discourse in technology-integrated education.

To enhance reliability and reduce coder bias, two researchers independently coded the dataset. Interrater reliability, measured using Cohen's kappa, yielded a score of 0.78, indicating substantial agreement. Any discrepancies were resolved through collaborative discussion.

Trustworthiness of the findings was further supported through peer debriefing, during which an external researcher critically reviewed the coding process and thematic structure to ensure analytical rigor and validity [46]. Additionally, member checking was conducted by presenting preliminary findings to a subset of participants, allowing them to verify whether the themes accurately reflected their experiences and perspectives.

Finally, quantitative and qualitative findings were integrated to develop a comprehensive understanding of students' responses. This mixed-methods triangulation provided a more nuanced and robust interpretation of the data, surpassing the limitations of single-method approaches [46]. Through this synthesis, the study aimed to generate evidence-based conclusions to guide ethical and effective integration of GAI in fashion education [48].

## Results

### Quantitative results

The MANCOVA analysis for both text-based and image-based GAI tools revealed statistically significant effects for the treatment condition on the combined set of dependent variables. These included students' recognition of inappropriate or biased outputs, concerns about collaboration in AI-assisted tasks, and their ability to evaluate issues related to copyright and authorship. Specifically, the intervention led to notable increases in students' awareness of ethical considerations, particularly in relation to collaboration dynamics and the ownership of GAI-generated content. These results suggest that deliberate, ethics-focused instruction can meaningfully enhance students' critical thinking about the responsible use of GAI in fashion education.

For text-based tools, the Wilks' Lambda result, $F(4, 43) = 5.127$, $p = .002$, partial $\eta^2 = .323$, suggests a moderate effect of the intervention, explaining 32.3% of the variance in the dependent variables. This suggests that the intervention influenced participants' concerns related to collaboration and copyright/ownership in the context of text-based tools. Concerns about collaboration, [$F(4, 43) = 8.584$, $p < .001$, partial $\eta^2 = .444$], were a significant factor contributing to the difference between the two groups, with the treatment explaining 44.4% of the variance in collaboration concerns. This suggests that the treatment group had stronger concerns about collaboration with AI when using text-based tools compared to the control group. Concerns regarding copyright/ownership of the content, [$F(5, 40) = 3.252$, $p = .02$, partial $\eta^2 = .232$], also revealed significant differences between the groups, accounting for 23.2% of the variance explained by the treatment condition. This suggests that the treatment group had more concerns regarding intellectual property issues than the control group.

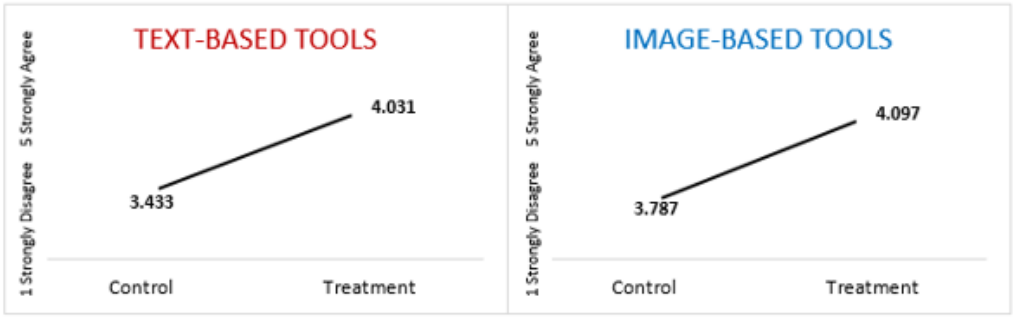
For image-based tools, the intervention group also demonstrated a significant effect on the combined set of dependent variables. The Wilks' Lambda result indicates a strong effect, with the intervention explaining 54.1% of the variance in the dependent variables: $F(4, 43) = 12.683$, $p = .026$, partial $\eta^2 = .541$. This indicates that the treatment significantly influenced participants' concerns regarding collaboration and copyright/ownership in the context of image-based tools. Concerns about collaboration, $F(4, 43) = 4.612$, $p = .003$, partial $\eta^2 = .300$, showed a significant difference between the treatment and control groups, with the intervention explaining 30% of the variance in collaboration concerns. This suggests that participants in the treatment group were more concerned about human-AI collaboration in image-based tools than those in the control group.

Post-test scores for participants varied significantly between the intervention and control groups regarding concerns about inappropriate/biased output for both text-based GAI (control $M = 3.433$, treatment $M = 4.031$; $p < .001$) and image-based GAI (control $M = 3.787$, treatment $M = 4.097$; $p = .006$). These results indicate that participants in the treatment group reported greater concerns about inappropriate or biased output than those in the control group. Figure 2 illustrates these differences, showing higher mean scores for the treatment group and visually emphasizing the impact of the ethics intervention on students' awareness of bias in GAI outputs.

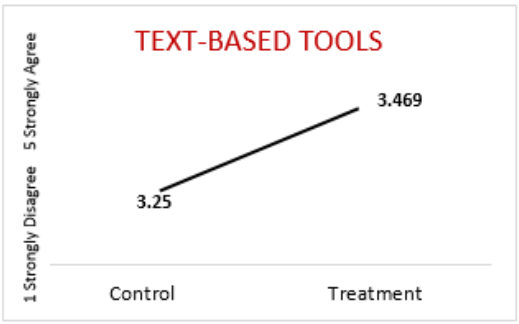
For concerns about copyright and ownership, a statistically significant difference was found between the control and intervention groups for text-based tools (control $M = 3.250$, treatment $M = 3.469$; $p = .02$), but not for image-based tools. The treatment group expressed more concerns, indicating that the intervention raised awareness about the complexities of copyright and ownership issues when using text-based GAI tools. Figure 3 visually depicts these group differences, highlighting the increased sensitivity to copyright and authorship concerns among students who received the ethics intervention.

A statistically significant difference was found between the two groups concerning collaboration between humans and AI for text-based tools (control $M = 2.617$, treatment $M = 2.792$; $p = .02$),

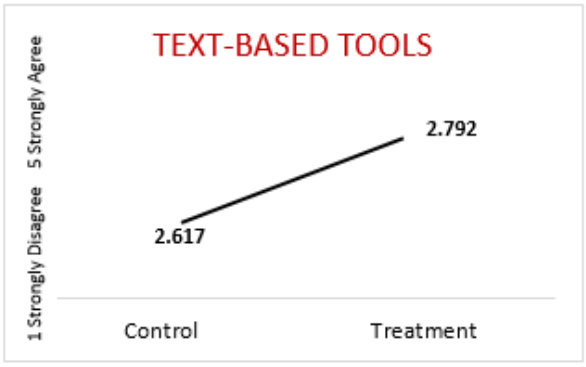
suggesting that the intervention group expressed more concerns about text-based collaboration between humans and AI than the control group. This indicates that the treatment raised participants' awareness of potential issues in human-AI collaboration within the context of text-based tools. No statistically significant difference was found for image-based tools, suggesting that other factors may be at play regarding these concerns when using image-based GAI tools. Figure 4 presents a comparison of mean scores between the control and treatment groups for concerns about collaboration between humans and AI when using text-based tools, highlighting the heightened awareness in the treatment group following the ethics intervention.




**Note:** This figure illustrates the mean differences between control and treatment groups in students' concerns about inappropriate or biased output generated by text-based and image-based generative artificial intelligence tools.
**Figure 2:** Mean Comparisons for Concerns About Inappropriate or Biased Output.




**Note:** This figure displays the mean differences between control and treatment groups regarding students' concerns about copyright and content ownership related to text-based generative artificial intelligence tools.
**Figure 3:** Mean Comparisons for Concerns About Copyright and Ownership (Text-Based Tools Only).




**Note:** This figure displays the mean differences between control and treatment groups regarding students' concerns about human-AI collaboration related to text-based generative artificial intelligence tools.
**Figure 4:** Mean Comparisons for Concerns About Collaboration Between Humans and AI (Text-Based Tools Only).

In summary, the treatment group expressed more concerns regarding inappropriate outputs, collaboration, and copyright/ownership than the control group. However, some concerns, such as collaboration and copyright/ownership in image-based tools, did not show significant differences.

## Qualitative Results

The qualitative analysis revealed four central themes reflecting students' ethical concerns and perspectives regarding the use of generative AI (GAI) in fashion education across both the groups: Inappropriate/Biased Output, Unclear Ownership, Concerns Regarding Authenticity, and Concerns Regarding Dependence. These themes were shaped by students' engagement with ethics instruction and their hands-on use of GAI tools, offering valuable insight into how educational interventions influence ethical reflection. Table 1 provides both representative quotes and the corresponding quantitative support as evidence of the themes found.

**Table 1:** Qualitative Theme Examples.

| Theme | Description | Representative Quotes | Quantitative Support |
|---|---|---|---|
| Inappropriate/ Biased Output | Students expressed concern about biased outputs from GAI tools, particularly related to race, body type, and social representation. | Participant A [Control]: No, I didn't identify any ethical issues with the image-based GAI output. I just didn't use it to create my trend board.<br><br>Participant B [Intervention]: When I tried to get a photo of a child playing I was only shown images of white children. I had to type in a race to get some diversity. This does not seem right, and I ended up using a different stock image because I was so annoyed by GAI for this.<br><br>Participant C [Intervention]: "The images that GAI created were not societally acceptable... they did not include other races and other body types." | Significant differences between groups:<br><br>Text-based GAI: Control M = 3.433, Treatment M = 4.031 ($p < .001$)<br><br>Image-based GAI: Control M = 3.787, Treatment M = 4.097 ($p = .006$) |
| Unclear Ownership | Students were unsure who owns GAI-generated content—responses varied from user-owned to AI/platform-owned, reflecting confusion about IP rights. | Participant D [Control]: "My group owns the brand profile... I think it is valid to feel that AI deserves some credit... it should be credited along with the person using it."<br><br>Participant E [Intervention]: "I think no one owns it... ChatGPT combines the general idea... for the person's point of view."<br><br>Participant F [Intervention]: "I think Bing owns the images because it is creating the images." | Significant difference for text-based ownership concerns:<br><br>Control M = 3.250, Treatment M = 3.469 ($p < .05$)<br><br>No significant difference for image-based ownership. |
| Concerns Regarding Authenticity | Students questioned the originality and creative value of work produced using GAI tools. | Participant G [Control]: "My biggest concern is losing authenticity and creativity by using GAI."<br><br>Participant H [Intervention]: "GAI can produce wonderful and realistic images... it would make me question the truth behind it." | Small but significant difference:<br><br>Text-based GAI collaboration concerns:<br><br>Control M = 2.617, Treatment M = 2.792 ($p < .05$)<br><br>No significant difference for image-based GAI collaboration concerns. |
| Concerns Regarding Dependence | Students feared becoming overly reliant on GAI, potentially undermining learning and critical thinking skills. | Participant I [Control]: "People could become extremely dependent on AI... they will just become completely dependent on AI to do things for them."<br><br>Participant J [Intervention]: "Once I began using AI, I wanted to use it to help me with every assignment... there should be a balance." | Concerns evident across both groups, with ethics instruction appearing to promote greater self-awareness. |

## Inappropriate/Biased Output

Students in the intervention group—those who completed ethics-based instruction prior to using GAI—demonstrated a heightened awareness of algorithmic bias. Their reflections often emphasized concerns about the exclusion of racial and body-type diversity in GAI-generated content. Many questioned the appropriateness of relying on biased systems in an industry such as fashion, which places increasing emphasis on inclusivity and representation. In contrast, students who used GAI tools without prior ethical framing were less likely to recognize or critique bias in the outputs. These differences suggest that structured ethical learning activities can enhance students' ability to critically evaluate the social impact of AI technologies.

### Unclear Ownership

Across both groups, students expressed uncertainty about who holds the rights to content generated using GAI. Some believed that ownership should belong to the user or creative team, while others attributed it to the AI tool or the platform itself. This inconsistency highlights a broader gap in students' understanding of intellectual property rights in the context of emerging technologies. Those who received ethics instruction appeared more reflective, although sometimes more uncertain, as they grappled with the complexities of authorship, attribution, and originality in AI-assisted work. These findings emphasize the need for clearer guidance and instruction on copyright and ownership issues in design education.

### Concerns Regarding Authenticity

Many students voiced concerns about the impact of GAI on the authenticity of creative work. They questioned whether content generated with AI could retain the same value or originality as work produced solely through human effort. This theme was consistent across both control and intervention groups, suggesting a shared apprehension about the influence of automation on creative identity. Students expressed discomfort with the perceived ease of GAI use, associating it with a potential loss of creative rigor and depth.

### Concerns Regarding Dependence

Closely related to authenticity, students also raised concerns about becoming overly reliant on GAI tools. They described how easy it was to fall into patterns of using AI to complete academic tasks, and they worried about the long-term effects on their learning, problem-solving abilities, and critical thinking. These concerns were present among students in both groups, but those in the intervention condition more often framed their reflections within an ethical context, recognizing the importance of maintaining a balanced relationship with the technology.

Together, these themes illustrate how students are negotiating the ethical implications of GAI in creative practice. Ethics-based instruction played a critical role in shaping their awareness, especially in recognizing bias and cross-examining issues of authorship and authenticity. As generative AI becomes increasingly integrated into fashion and design workflows, it is essential for educators to equip students not only with technical skills, but also with the critical tools needed to navigate emerging ethical challenges. These insights highlight the importance of embedding ethics education early and intentionally within AI-integrated curricula.

See Table 1 for a summary of themes and their descriptions.

## Discussion

This study explored how an ethics-focused educational intervention shaped fashion students' perceptions of generative artificial intelligence (GAI). Results indicated that the instructional module significantly increased students' awareness of ethical concerns, particularly regarding bias, authorship, and human-AI collaboration. These outcomes reinforce prior research suggesting that early, structured exposure to ethical frameworks can promote critical thinking and responsible technology use in design education [25,26].

One of the most notable insights emerged from students' reflections on GAI's influence on creativity. Participants in the treatment group expressed stronger concerns about the loss of originality and the risk of overdependence on AI tools. These concerns reflect broader industry debates about the creative autonomy of human designers in an increasingly AI-mediated landscape [11,39]. Students acknowledged AI's value in enhancing productivity but emphasized the need to preserve human-driven ideation and craftsmanship, affirming the pedagogical importance of framing GAI as a collaborator rather than a replacement.

Confusion regarding ownership and copyright of AI-generated content was another consistent theme. Students voiced uncertainty about who holds the rights to outputs from platforms like ChatGPT, aligning with the ongoing legal ambiguities surrounding intellectual property in AI-assisted design [24]. While these concerns were frequently cited, topics such as collaboration and copyright in image-based tools did not show significant variation across responses. Many students expressed frustration with the unpredictable and often low-quality outputs of image-based tools, which diminished their perception of the content as original or ownership-worthy. This likely reduced the significance they placed on authorship and copyright questions regarding image generation.

The intervention's use of Kolb's [40] experiential learning theory and Mhlanga's [37] ethical AI framework proved effective in helping students grapple with both the technical and moral dimensions of AI. Students reported gaining a stronger sense of how their design decisions carry social implications, supporting the development of interdisciplinary skills that are increasingly valuable in industry settings. These findings underscore the importance of embedding ethical reflection into technical instruction to foster critical, socially aware design practices.

## Conclusions

This study provides evidence that ethics-focused instruction can significantly influence fashion students' understanding of generative AI, particularly in relation to bias, authenticity, and intellectual property. As AI becomes increasingly embedded in areas such as trend forecasting, digital marketing, and product development, fashion educators must prepare students to navigate its creative, legal, and societal implications responsibly.

These findings further highlight the need for stronger collaboration between academia and industry to co-develop ethical standards and instructional strategies for emerging technologies. Embedding real-world case studies and industry-informed projects into curricula can bridge the gap between theory and practice, equipping students to confront ethical complexities in professional environments. In doing so, education can play a vital role in shaping a design workforce capable of leading innovation with integrity in an AI-driven fashion landscape.

From a pedagogical standpoint, this research supports the value of mixed-method approaches to evaluating instructional interventions in design education. It also affirms the need for curricula that cultivate both technical fluency and ethical literacy, ensuring students are not only proficient in AI tools but also thoughtful in how they apply them. Practical skills must be taught alongside ethical reasoning to prepare future designers for real-world complexities—including those surrounding sustainability, labor impacts, and cultural representation.

## Limitations and Future Research

While the study offers valuable insights, it is limited by its relatively small and homogenous sample, drawn from a single institution. The intervention's short-term scope also restricts conclusions about long-term changes in student attitudes or behavior. Future research should explore how sustained exposure to ethical frameworks impacts students over time and across diverse educational settings. Comparative studies across institutions, disciplines, and student demographics could yield more generalizable findings. Additionally, further exploration into how students engage with more advanced or industry-grade AI tools would help clarify the evolving relationship between GAI literacy and ethical awareness.

In conclusion, fashion education must continue to evolve to meet the demands of an AI-enhanced industry. Structured interventions that integrate experiential learning, critical reflection, and interdisciplinary perspectives can play a pivotal role in preparing students to lead with integrity in a technology-driven future.

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## Conflict of Interest

Authors declare no conflict of interest.

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