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ARTIFICIAL INTELLIGENCE APPLICATIONS IN MODERN FASHION DESIGN

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ABSTRACT

Artificial intelligence (AI) is transforming modern fashion design by introducing innovative methods for creative development, textile design, trend forecasting, and fashion collection planning. AI-powered tools enable designers to generate new concepts, visualize garments, explore different styles, and improve the efficiency of the design process. This study aims to examine the major applications of AI in modern fashion design and analyze its influence on creativity, efficiency, and product development. A quantitative research approach is proposed, using a structured questionnaire to collect data from fashion designers, students, and professionals in the fashion industry. Descriptive statistics, correlation analysis, and multiple regression analysis will be used to examine the relationships between AI usage and perceived design outcomes. Previous research indicates that generative AI can support fashion concept development and creative exploration while presenting challenges related to originality, technical accuracy, and human control (Zhang & Liu, 2024; Ngai et al., 2025). The study is expected to provide insights into the opportunities and challenges associated with AI adoption and its potential contribution to innovation in modern fashion design.

KEYWORDS

Artificial intelligence, fashion design, generative AI, digital fashion, design innovation, creative technology, product development.

INTRODUCTION

Artificial intelligence has become an important technological development in the fashion industry, influencing the ways designers generate ideas, develop clothing collections, analyze trends, and visualize products. Traditional fashion design often requires considerable time for sketching, experimentation, material selection, and prototype development. AI-powered technologies can support these activities by generating design concepts, analyzing fashion images, suggesting color combinations, and producing digital garment visualizations. The integration of AI into fashion design provides opportunities to improve productivity while enabling designers to explore a wider range of creative possibilities. Zhang and Liu (2024) examined the use of Midjourney in fashion design and e-commerce, highlighting its potential to support visual concept development and creative experimentation.Generative AI technologies, including image-generation models and intelligent design systems, have expanded the possibilities for digital fashion creation. These technologies can produce visual concepts based on textual descriptions, design references, and specified fashion attributes. They can also support textile pattern development, silhouette exploration, and the visualization of fashion collections before physical samples are produced. Research on generative AI systems for fashion design has demonstrated their potential to support professional design workflows and facilitate creative development (Ngai et al., 2025). Similarly, research into AI-generated knitted textile designs has

explored how generative models can assist designers in creating and evaluating alternative textile patterns (An Application of Generative AI for Knitted Textile Design in Fashion, 2024).Despite these opportunities, the adoption of AI in fashion design also presents several challenges. AI-generated designs may contain inaccurate garment structures, impractical construction details, or visual similarities to existing designs. Designers must therefore evaluate generated concepts and adapt them to material requirements, manufacturing processes, and consumer preferences. Ryjov et al. (2024) discussed the potential of combining generative models with human intelligence to enhance fashion creativity while recognizing limitations in the interpretation of complex design requirements. Furthermore, the effective use of AI depends on appropriate prompts, fashion knowledge, and the ability to evaluate generated outputs critically.The growing use of AI in fashion design creates a need to understand its practical influence on creative performance, design efficiency, and product development. Although previous studies have explored individual AI tools and their applications, the perceived benefits and challenges of adoption may vary across designers, students, and fashion professionals. This study therefore proposes a quantitative investigation of AI applications in modern fashion design, focusing on their relationship with creativity, efficiency, and product development. The findings may help fashion businesses and educational institutions understand how AI can be integrated into design practices while maintaining human creativity and technical quality.

RESEARCH OBJECTIVES

1. To examine the major applications of artificial intelligence in modern fashion design.
2. To analyze the influence of AI tools on design creativity, efficiency, and product development.
3. To identify the major challenges and opportunities associated with AI adoption in fashion design.

RESEARCH QUESTIONS

1. What are the major applications of artificial intelligence in modern fashion design?
2. How do AI tools influence creativity, efficiency, and product development in fashion design?
3. What challenges and opportunities do fashion designers encounter when adopting AI technologies?

LITERATURE REVIEW

Artificial intelligence has emerged as an important tool for creative experimentation and digital product visualization in the fashion industry. Zhang and Liu (2024) examined the application of Midjourney in fashion design and e-commerce, demonstrating how generative AI can support the development of visual concepts and facilitate the exploration of different styles, colors, and garment designs. Their research highlights the potential of AI to assist designers during the early stages of creative development. However, AI-generated concepts require professional evaluation to ensure that they meet aesthetic, functional, and commercial requirements.Generative AI has

also been explored in textile design, particularly for producing alternative patterns and visual structures. An Application of Generative AI for Knitted Textile Design in Fashion (2024) investigated the use of generative adversarial networks for developing knitted textile design images. This research indicates that generative models can provide additional opportunities for textile experimentation and creative exploration. Nevertheless, designers must consider fabric construction, texture, production feasibility, and material characteristics when translating digital concepts into physical products.Ngai et al. (2025) developed and evaluated a generative artificial intelligence system for fashion design using a design science research approach. Their research examined the practical integration of generative AI into fashion design activities and considered its application within professional fashion settings. The study highlighted the potential of AI systems to support design development while identifying implementation challenges. These findings suggest that AI tools can be more effective when they are developed around the specific needs of fashion professionals and incorporated into existing design workflows.Chen and Ma (2025) investigated an intelligent generative method that combines fashion attribute knowledge with the Stable Diffusion model. Their approach addressed the generation of fashion designs using specific attributes, demonstrating the importance of combining domain knowledge with image-generation technologies. Fashion attributes such as garment categories, silhouettes, and design characteristics can help guide the generation process. This approach highlights the value of specialized AI methods for producing fashion concepts that better correspond to designers' requirements.Ryjov et al. (2024) examined the integration of generative models with hybrid intelligence to enhance creativity in fashion. Their research considered how generative technologies and human expertise can work together to support innovation and design exploration. The study also discussed limitations related to the interpretation of spatial relationships and complex design requirements. These findings indicate that human–AI collaboration may provide a more effective approach than relying entirely on automated design generation.

Ryu and Lee (2026) explored the use of ChatGPT and DALL-E for developing fashion design collections. Their research addressed the use of generative AI for design ideation, trend analysis, and collection development. The study highlights how text-based and image-generation tools can assist designers in organizing ideas and visualizing concepts. However, the usefulness of these tools depends on the clarity of prompts, the designer's fashion knowledge, and the ability to evaluate and refine the generated results.Bieńkowska (2025) examined the opportunities and challenges associated with artificial intelligence in the fashion industry, including its potential contribution to innovation and sustainable transformation. AI applications can support design development, production planning, personalization, and other fashion-related activities. However, the implementation of these technologies also requires attention to organizational readiness, technical limitations, and responsible use. Overall, the literature suggests that AI can support modern fashion design through concept generation, textile development, and collection planning. Further quantitative investigation is needed to examine how designers perceive these benefits and challenges across different professional and educational settings.

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METHODOLOGY

This study will adopt a quantitative research approach to examine the applications of artificial intelligence in modern fashion design. Primary data will be collected through a structured questionnaire distributed to fashion designers, fashion design students, and professionals working in the fashion industry who are familiar with AI-based design tools. The questionnaire will measure AI usage, perceived creativity, design efficiency, product development, and implementation challenges using a five-point Likert scale ranging from strongly disagree to strongly agree. Demographic information will also be collected to describe the respondents. Participation will be voluntary, and confidentiality will be maintained. The collected responses will be screened for completeness before statistical analysis.

RESEARCH DESIGN

A cross-sectional descriptive and correlational research design will be used to examine AI applications and their perceived effects on fashion design at a specific point in time. The target population will consist of fashion designers, design students, and relevant industry professionals. Convenience sampling may be used to recruit participants according to their accessibility and eligibility. AI usage will serve as the main independent variable, while perceived creativity, design efficiency, and product development will be examined as outcome variables. The study will investigate statistical relationships among these variables without assuming that observed associations establish causation.

DATA ANALYSIS

The collected data will be analyzed using SPSS or equivalent statistical software. Descriptive statistics, including frequencies, percentages, means, and standard deviations, will summarize participants' characteristics and responses. Cronbach's alpha will be used to evaluate the internal consistency of multi-item questionnaire scales. Pearson correlation analysis will examine the relationships between AI usage and perceived design outcomes, provided the relevant assumptions are satisfied. Multiple regression analysis will assess which factors significantly predict perceived creativity, efficiency, and product development effectiveness. Statistical significance will be evaluated at the 0.05 level, and relevant assumptions will be checked before interpreting the results. The final analysis will be based on the actual data collected from respondents.

FINDINGS

Based on the existing literature, AI applications are expected to support creative concept generation, textile pattern development, digital visualization, and fashion collection planning. Previous studies have highlighted the potential of generative AI to support design exploration and improve the development of fashion concepts (Zhang & Liu, 2024; Ngai et al., 2025). AI tools may also help designers explore alternative styles and organize design ideas more efficiently. However, challenges involving originality, technical accuracy, and the practical

feasibility of generated designs may influence their usefulness (Ryjov et al., 2024). The proposed statistical analysis will determine whether AI usage is significantly associated with creativity, design efficiency, and product development among the selected respondents. These statements represent anticipated findings based on previous literature, not measured results from the proposed study.

CONCLUSION

Artificial intelligence is creating new opportunities for modern fashion design by supporting creative exploration, digital visualization, textile development, and fashion collection planning. This study proposes a quantitative examination of AI applications and their perceived influence on creativity, efficiency, and product development. Through descriptive statistics, correlation analysis, and multiple regression, the research will investigate the relationships between AI usage and design outcomes. The study may contribute to a better understanding of the benefits and challenges associated with AI adoption among fashion designers, students, and industry professionals. It may also provide useful insights for fashion businesses and educational institutions seeking to integrate AI technologies into design workflows while maintaining human creativity, technical accuracy, and responsible design practices.

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