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Promoting Cultural Awareness of Traditional Malay Costumes through Generative Artificial Intelligence: A Systematic Review

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ABSTRACT

This systematic review investigates previous studies on the transformative role of generative artificial intelligence (AI) in promoting cultural awareness and preservation of traditional Malay costumes, such as batik, songket, and tenun, which face existential threats from rapid modernization, globalization, generational shifts, and dwindling artisan skills, lack of cultural values, and inadequate documentation among youth. Employing PRISMA 2020 guidelines, peer-reviewed articles were identified across databases like Google Scholar (5,390 results), Scopus, Web of Science, IEEE Xplore (214), and ScienceDirect (156) using keywords such as "Traditional Malay Costumes AND Generative Artificial Intelligence," with duplicates removed, titles/abstracts screened, and six full-text studies selected for qualitative thematic synthesis. Findings reveal AI tools like Stable Diffusion V1.5 (for authentic batik replication), StyleGAN (Ulos motif variations), and Microsoft Copilot (design education) helps digital archiving, rapid visualization, global dissemination, and modern product integration, garnering strong public support (e.g., 80% for preservation, 90% for digitization in education). While enhancing creativity, accessibility, and intergenerational transmission, AI demands ethical safeguards against biases, over-reliance, and cultural dilution to sustainably fuse tradition with innovation. AI is a relatively new technology, which may explain why past studies on AI and traditional Malay costumes are still limited.

Keywords: *Cultural Awareness, Artificial Intelligence (AI), Traditional Malay Costumes.*

1 INTRODUCTION

Cultural awareness is defined as, emphasizing understanding of differences and commonalities between cultures, along with empathy and respect as key components. Several nonprofit sources describe it in equivalent terms as a foundational skill for effective intercultural communication and inclusivity (CultureAlly, 2025). Traditional Malay Costume, defined as *pakaian cara Melayu*, refers to the loose-fitting, geometric-shaped garments historically worn by both men and women, embodying cultural values of modesty, elegance, and regional diversity (Ismail, S. Z., 2006). Traditional Malay costumes, emblematic of Malaysia's rich cultural heritage, social norms, and national identity, face existential threats from rapid modernization, globalization, and shifting generational preferences, leading to their dilution, extinction of authentic designs, and loss of embedded cultural values among the youth who often prioritize contemporary fashion modifications over preservation. Compounding this vulnerability is the scarcity of skilled artisans, inadequate documentation of intricate patterns and techniques, and limited innovative tools to engage modern audiences, resulting in diminished awareness and appreciation that jeopardizes intergenerational transmission. Despite the potential of

generative artificial intelligence to digitally recreate, innovate, and disseminate these costumes through immersive experiences, a systematic synthesis of existing evidence on its applications remains absent, hindering effective strategies to safeguard and promote this heritage (Mohd Sham, 2024).

Artificial Intelligence (AI) is defined as one of the technological innovations that happened, to replace or complement the manual work that is done by humans in various fields. Artificial Intelligence is a branch of science and technology that creates intelligent machines and computer programs to perform various tasks which require human intelligence (Fathima, 2021). Artificial Intelligence (AI) is one of the most revolutionary technological advancements in many facets of life in the quickly changing digital age, according to (Russell & Norvig. 2020). AI refers to computer systems that can carry out speech recognition, decision-making, and data-driven learning that usually need human intellect. AI is becoming increasingly capable of making accurate predictions and decisions on its own as machine learning and deep learning technologies advance (Febriyani et al., 2025).

Generative Artificial Intelligence (AI) is defined as a branch of artificial intelligence capable of generating novel content, as opposed to simply analysing or acting on existing data, as expert systems do (Vaswani et al., 2017). Generative AI transforms fashion design by integrating traditional motifs with modern processes, enabling efficient creation, customization, and global dissemination of Malay costumes. Can Malay culture survive, thrive, and even serve as a model of morality and wisdom in contemporary technological advancements? (Sardar Z., 2021) argues that technology is never truly neutral because it always brings the beliefs and ideals of the socio-cultural environment in which it was created.

Despite the increasing need for effective cultural education, many current approaches lack interactive and visually immersive strategies, making it difficult to communicate complex cultural elements such as regional costume variations, textile craftsmanship, and symbolic meanings. While generative AI tools are increasingly applied in creative industries and educational contexts, there remains limited systematic research exploring their integration into cultural heritage education, particularly in relation to traditional malay attire.

In 2020, AI played a vital role in the global response to COVID-19, contributing to drug discovery, predicting virus transmission, and supporting accelerated vaccine development. The following year, OpenAI introduced GPT-3, a groundbreaking language model that dramatically advanced natural language processing and conversational AI. In 2022, the release of DALL·E 2 expanded the horizons of generative AI by enabling the creation of high-quality images from textual descriptions. This momentum continued in 2023 with the launch of GPT-4, which demonstrated substantial improvements in reasoning, multilingual understanding, and the generation of complex, context-rich text. By 2024, global governments and organizations began implementing more robust AI regulations, focusing on ethical considerations such as transparency, safety, and bias reduction. Together, these developments make the 2020–2025 range a crucial and highly relevant period for studying contemporary advancements and trends in artificial intelligence (Alalaq, A. S. 2024).

This study seeks to identify previous studies on the and analyse current trends in generative AI techniques used to promote cultural awareness of traditional malay costumes, and to evaluate the primary focus areas of these AI-driven approaches in fostering cultural appreciation and understanding. The research bridges a critical gap by systematically reviewing AI's role, fostering sustainable practices that enhance creativity while preserving authenticity.

2 MATERIALS AND METHODS

This study employed the PRISMA 2020 Statement (Page et al., 2021), which include three main stages: identification, screening, and included. In the identification stage, relevant studies were

collected from several academic databases. During screening, duplicates were removed and titles and abstracts were checked to exclude unrelated articles. In the eligibility stage, full-text papers were reviewed based on set criteria. The overall selection process is shown in the PRISMA 2020 flow diagram. Journals were selected between the 2020 until 2025 period because its years represent a transformative era in artificial intelligence due to rapid technological progress and significant global impact.

2.1 Identification

In developing the search strategy for this study, relevant keywords were first identified using the search keywords and online databases as recommended in systematic review. The main keywords refined for this research were “Traditional Malay Costumes” and “Generative Artificial Intelligence.” These terms were then applied across five major academic databases Google Scholar, Scopus, Web of Science, IEEE Xplore, and ScienceDirect using specific filters targeting peer-reviewed journal articles published between 2020 and 2025. For Google Scholar, the search terms “Traditional Malay Costumes” AND “Generative Artificial Intelligence” and “Costume” AND “Generative Artificial Intelligence” returned 5,390 publications between 2020 and 2025. In Scopus, using the TITLE-ABS-KEY query ("Traditional Malay Costume" AND "Generative Artificial Intelligence") and applying year filters (PUBYEAR > 2020 AND PUBYEAR < 2025) produced 1 publication. In Web of Science, the topic search TS=("Traditional Malay Costume" AND "Generative Artificial Intelligence") resulted in 2 publications within the same timeframe. IEEE Xplore, using journal-only filters and English-language limitations, identified 214 publications, while ScienceDirect, filtered for research articles published from 2020 to 2025, produced 156 publications. These results, summarized in Table 1, illustrate the variation in database coverage and highlight the importance of multi-database searching in capturing the interdisciplinary nature of research involving traditional cultural expressions and generative artificial intelligence.

Table 1 The search keywords and online databases.

Category	Description
Google Scholar	Search Terms: "Traditional Malay Costumes" AND "Generative Artificial Intelligence"; Years: 2020–2025 (2nd Quarter);
Scopus	TITLE-ABS-KEY ("Traditional Malay Costume" AND "Generative Artificial Intelligence"); ("Costume" AND "Generative Artificial Intelligence") AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND Filters: Peer-reviewed journal articles, 2020–2025 (2nd Quarter)
Web of Science	Search Terms: TS= ("Traditional Malay Costume" AND "Generative Artificial Intelligence"); ("Costume" AND "Generative Artificial Intelligence") Filters: Document Type = Article; Publication Years = 2020–2025 (2nd.Quarter); Open Access = All Search Link (customize search after login)
IEEE Xplore	Search Terms: "Traditional Malay Costume" AND "Generative Artificial Intelligence"; "Costume" AND "Generative Artificial Intelligence" Refinements: Content Type = Journals; Years: 2020–2025 (2nd Quarter); Language: English Search Link (customize filters manually)
ScienceDirect	Search Terms: "Traditional Malay Costume" AND "Generative Artificial Intelligence"; "Costume" AND "Generative Artificial Intelligence" Filters Applied: Years = 2020 to 2025 (2nd Quarter); Article Type = Research articles; Access type = Open Access preferred Search Link

2.1.1 Screening

The screening step in a systematic review is a critical and methodologically rigorous process

designed to filter the initially identified records and determine their suitability for inclusion in the review. This phase typically begins with the removal of duplicate entries using reference management tools (e.g., EndNote, Mendeley). Once duplicates are removed, the remaining records undergo title and abstract screening, where each study is assessed against predefined inclusion and exclusion criteria. These criteria often include factors such as language (e.g., English only), publication type (peer-reviewed articles, conference papers, or grey literature), publication date range (e.g., 2020–2025), study design, population characteristics, and relevance to the research question.

During this stage, studies that do not align with the research aims such as non-open-access articles when open-access is required, studies in unrelated domains, in-press or preprint papers if excluded by criteria, or articles lacking sufficient methodological rigor are removed. Studies that pass the title and abstract screening advance to the full-text review, where eligibility is reassessed in more detail. This systematic, multi-step filtering process ensures that only the most relevant, high-quality studies contribute to the final synthesis, improving the transparency, credibility, and reproducibility of the review.

2.2 Included

In the eligibility phase, the third step of the PRISMA 2020 systematic review process, 6 articles were selected from full-text screening for rigorous evaluation to confirm their suitability for inclusion. This stage entailed detailed full-text analysis to verify in-depth coverage of the core research keywords: cultural awareness, traditional Malay costumes, and generative artificial intelligence, ensuring direct alignment with the study's objectives on AI-driven cultural promotion and preservation. Eligibility hinged on predefined criteria, including substantive relevance to the research topic, unrestricted full-text access, and methodological rigor, excluding studies with peripheral discussions, paywalls, or insufficient depth on AI applications in Malay attire like Baju Kurung or Songket motifs. Only articles satisfying all criteria proceeded to qualitative synthesis, minimizing bias and enhancing the review's validity.

Table 2 The Inclusion criterion in searching.

Criterion	Inclusion	Exclusion
Timeline	2020-2025	Exclude any from the timeline
Relevance to the research topic	Relevant to Culture Awareness, Traditional Malay Culture and Generative Artificial Intelligence	Not related to the research keywords

3 RESEARCH DESIGN

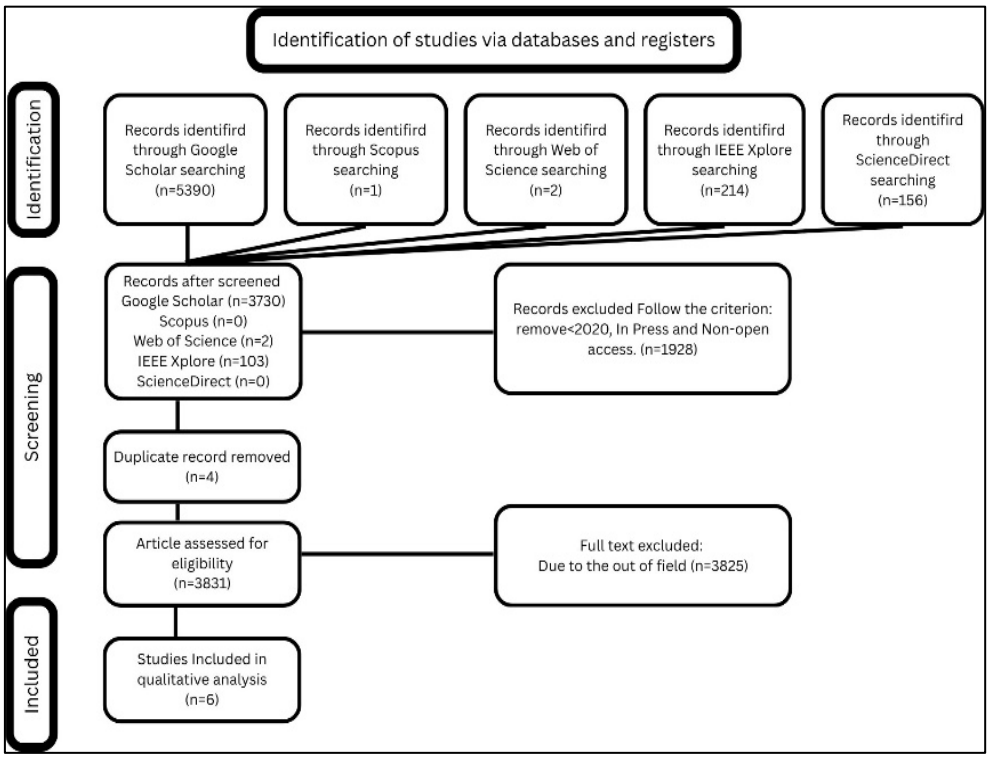

Figure 1 Diagrammatic illustration of research search methodology

4 FINDINGS

The studies reviewed collectively examine a diverse body of literature aimed at identifying how generative AI is being used to represent, reinterpret, and enhance traditional Malay costumes. This review evaluates the primary focus areas of AI-driven approaches that contribute to fostering cultural appreciation and understanding, specifically within the context of Malay cultural attire. By systematically synthesising recent research, the study addresses a significant gap by exploring how generative AI supports the documentation, visual reconstruction, and creative revitalisation of traditional Malay costumes. The findings highlight how these technologies can promote sustainable cultural practices, enrich creative expression, and preserve cultural authenticity, providing a strong foundation for the subsequent section on integrating traditional Malay costumes into generative AI applications.

5 Promoting Cultural Awareness

Promoting cultural awareness through generative artificial intelligence (AI) presents a transformative approach to sustaining Malay tangible cultural heritage in an increasingly digital world. Traditional Malay garments embody rich cultural narratives, social values, and aesthetic principles that reflect the identity and historical continuity of the Malay community. Generative AI enables these cultural elements to be visualized, reinterpreted, and disseminated through interactive and engaging digital formats, making heritage knowledge more accessible to contemporary audiences. By generating culturally informed garment designs, motifs, and visual simulations, generative AI enhances public understanding and appreciation of Malay traditions beyond physical boundaries, fostering both local and global cultural awareness. When guided by ethical frameworks and local cultural values, generative AI supports respectful cultural representation and counters the homogenizing effects of globalization. These outputs function not only as tools for preservation but also as mediums for cultural storytelling, allowing younger generations and digital-native communities to engage meaningfully with heritage.

Ultimately, generative AI serves as a catalyst for cultural awareness by bridging tradition and innovation. Rather than replacing cultural practices, it amplifies their relevance within modern contexts, encouraging cross-cultural dialogue and strengthening cultural identity. By embedding Malay values, aesthetics, and narratives into AI-driven systems, cultural heritage is not only preserved but actively communicated, ensuring its continued recognition and appreciation in the digital era.

Table 3 Summary of Promoting Cultural Awareness through Generative AI

Authors	Title	Methodology	Results	Advantages
Mustaffa Halabi, K. N., Yusof, S. A. M., & Abdullah, M. A. (2025).	Enhancing the Preservation of Malay Tangible Cultural Heritage through Garments Using Artificial Intelligence (AI): A Case Study in Malaysia.	This study explores the potential of AI in preserving Malaysian traditional textiles like batik and tenun by digitizing and modernizing designs. Using a mixed-methods approach, combining qualitative and quantitative methods, the research aims to provide a comprehensive understanding of AI's role in cultural heritage preservation and ensure reliable, valid findings.	The questionnaire showed strong support for AI in preserving cultural heritage, with 80% agreeing it can help (mean = 4.2). Only 50% were familiar with AI tools (mean = 3.0), highlighting a need for training. Most respondents (90%, mean = 4.8) felt traditional textile designs are under threat, and 70% (mean = 4.0) were willing to use AI platforms for preservation. Additionally, 95% (mean = 4.7) emphasized the importance of digitizing textiles for education, showing strong support for digital archiving.	AI offers many benefits for preserving and promoting traditional textiles. It enables digital documentation and archiving of patterns and techniques, safeguarding heritage from loss. AI also increases global visibility through online platforms, assists artisans with pattern recognition and cataloguing without replacing craftsmanship, and preserves authenticity. Additionally, AI-powered AR and VR create immersive educational experiences, support skill development, foster collaboration, and connect artisans to global markets for economic sustainability.

Authors	Title	Methodology	Results	Advantages
Febriyani, S., Riadi, H., Azman, W., & Suseno, S. (2025).	Malay Culture in Welcoming the Century of Artificial Intelligence Excellence.	This study uses a qualitative approach to examine how Malay culture interacts with AI. Data were collected through literature review, observations of digitized cultural activities, and interviews with cultural and industry experts. Thematic analysis identified key themes such as cultural preservation, digital literacy, and ethical AI, with triangulation and member checking ensuring validity. The study was conducted over six months in regions active in Malay culture and creative technology.	Islam has shaped Malay culture by instilling ethical, social, and intellectual values, uniting communities across Southeast Asia through shared language, traditions, and arts. In Indonesia, digitalization and AI are transforming education and cultural engagement, offering personalized learning, real-time feedback, and skill development. AI also provides opportunities to preserve and promote Malay cultural identity, but challenges like unequal access, digital literacy, and privacy require careful, culturally sensitive implementation. Overall, AI and digital technology offer a way to balance tradition and innovation in Malay culture.	Malay culture must adapt to the AI era, seeing technology as a tool to promote heritage globally rather than a threat. By integrating traditional values such as syarak customs, sharia principles, respect, and politeness, into AI development, innovation can be ethical and human-centred. AI can help preserve and revitalize language, literature, music, and customs, while governments, institutions, and communities support culture-based digital initiatives. Equipping younger generations with AI skills alongside traditional knowledge ensures Malay culture thrives in the digital age.

6 Traditional Malay Costume

Traditional Malay costumes into generative AI offers a unique opportunity to advance both cultural preservation and creative innovation, which aligns closely with the objectives of this study. By using AI techniques such as generative adversarial networks (GANs), diffusion models, and multimodal AI systems. These AI-driven approaches allow for the visualization, adaptation, and even innovation of traditional designs in ways that are scalable, interactive, and accessible to a global audience.

This study aims to systematically identify and analyse generative AI applications related to Malay costumes, focusing on how these technologies support cultural appreciation, education, and creative reinterpretation. By examining the literature, the research evaluates how generative AI facilitates sustainable cultural practices, ensures the intergenerational transmission of traditional knowledge, and maintains the authenticity of costume designs. For instance, AI-generated visualizations can serve as educational tools for younger generations, digital archives for documentation, and creative platforms for designers seeking to blend heritage with contemporary aesthetics.

Moreover, this study considers the socio-cultural implications of using AI in heritage preservation, recognizing that technology is not neutral and may reflect the values and biases of its creators (Sardar, Z. 2021). Overall, the integration of traditional Malay costumes into generative AI exemplifies a meaningful intersection between technology, creativity, and heritage preservation, directly addressing the research objectives of fostering cultural awareness, promoting sustainable practices, and exploring the potential of AI in supporting authentic cultural representation.

Table 4 Summary of Traditional Malay Costume through Generative AI

Authors	Title	Methodology	Results	Advantages
Nurul ', A., Sayuti, Afiq, A., Noor, M., Bin, M., Naser, M., Sommer, B., Kreatif, F., Warisan, D., Universiti, M., & Kelantan, M. (2024).	A Study on Songket Motifs, Familiarity, Preferences, and the Potential Application of Generative AI to Create Innovative Cultural Product Designs	This study used a mixed-methods approach to explore generative AI in cultural textile design. Songket motifs were analysed, digitally refined, and evaluated through an online survey. The findings informed AI-generated product designs, leading to conclusions and recommendations for future research.	The online survey of 219 Malaysian respondents showed generally positive attitudes toward the use of songket motifs in modern product design. Most respondents appreciated songket designs, though familiarity varied by education and work background. Flower motifs were the most preferred, followed by fauna motifs, while fruit motifs were less recognised without visual aids. Overall, more than half of the respondents supported incorporating songket motifs into everyday products, especially in fashion, home décor, and stationery.	Integrating songket motifs into modern products with AI offers several advantages. It preserves cultural heritage while creating practical, functional designs. AI allows rapid visualisation and idea development without physical tools or advanced software, saving time and cost. It also helps promote Malaysian cultural products globally, increasing visibility and market potential while maintaining authenticity, effectively bridging tradition and innovation.
Peter, A., Yonathan Purbo, S., & Gustav, A. (2025).	Enhancing the Traditional Batik Design Practices: An Approach to Batik Motif Design Using Artificial Intelligence. EBSCO.	This study used a quantitative experimental approach to identify the best Stable Diffusion model for generating batik patterns. Three models Version 1.5, Version 2.1, and SDXL generated images using structured prompts with random seeds to ensure diversity. Images were evaluated with Inception Scores for quality and diversity and CLIP Scores for alignment with prompts. LoRA fine-tuning was applied using a Bakaran batik dataset, and a VGG-11 classifier was trained to distinguish Bakaran from non-Bakaran motifs, providing robust validation of the models' ability to generate authentic batik patterns.	Evaluation of the three Stable Diffusion models showed distinct strengths. V1.5 had stable image quality and high CLIP Scores, aligning well with prompts like "butterfly" and "jasmine flower." V2.1 generated more diverse floral motifs, especially "orchid," but with lower prompt alignment. SDXL produced the most visually diverse animal motifs, like "dragon," and, after LoRA fine-tuning on Bakaran batik, had the highest probability of generating authentic patterns, followed by V1.5, while V2.1 performed poorly. Thus, V1.5 and SDXL are the most effective for different aspects of batik motif generation.	Stable Diffusion models offer key advantages for batik motif design and cultural preservation. V1.5 ensures consistency, prompt accuracy, and cultural authenticity, ideal for traditional motifs, while SDXL provides diverse and creative variations for exploring new designs. LoRA fine-tuning adapts models to local styles like Bakaran batik, and AI generation reduces time, cost, and reliance on physical tools, allowing rapid visualization and experimentation. These tools support heritage preservation while empowering designers with innovative capabilities.

Authors	Title	Methodology	Results	Advantages
Simanjuntak, H., Panjaitan, E., Siregar, S., Manalu, U., Situmeang, S., & Barus, A. (2024).	Generating New Ulos Motif with Generative AI Method in Digital Tenun Nusantara (DiTenun) Platform	An Ulos motif dataset from three Batak tribes (Toba, Karo, and Simalungun) was collected through weaver surveys and generated images, consisting of 20 motif types in PNG format with resolutions from 8×8 to 1024×1024. StyleGAN was trained using progressive growing and AdaIN to learn motif patterns and generate new Ulos designs. Six experimental settings were defined by varying image resolution, iterations, and batch size to evaluate their effects on image quality, sample generation, and training performance.	StyleGAN successfully generated new Ulos motifs that preserve the original motif characteristics while introducing variations such as pattern alteration, color blending, and motif merging. Higher resolutions, especially 1024×1024, produced clearer and higher-quality results. Among all experiments, scenario 4 using the Batak Karo dataset achieved the best performance with the lowest FID and KID scores, indicating the most realistic and diverse generated motifs. Expert feedback also confirmed visible motif changes in most generated samples.and motif combinations while preserving cultural identity. The use of progressive growing and style mixing improves image quality at high resolutions, and quantitative metrics (FID and KID) provide objective evaluation of results. Overall, this method offers a scalable and efficient tool for digital preservation, exploration, and innovation of traditional Ulos motifs.	The proposed approach demonstrates that StyleGAN can effectively learn traditional Ulos motif patterns and generate new designs without manual intervention. It enables controlled variation in patterns, colors,
Harun, N., Syed, M., & Abdullah, F. (2024).	Revolutionising costume design education: a case study on the impact of Microsoft Copilot.	This study uses a qualitative approach to explore the impact of Microsoft Copilot on costume design education. Data were collected through interviews and classroom observations with students and lecturers. The analysis examines how Microsoft Copilot supports learning, skill development, and student satisfaction alongside traditional teaching methods.	Microsoft Copilot improved students' efficiency, creativity, and engagement in costume design projects. Students used the tool mainly for brainstorming and early design stages, allowing them to generate multiple ideas quickly and overcome creative blocks. While most students adapted well and gained confidence, a small group showed over-reliance on AI-generated designs. Overall, Copilot supported richer class discussions, greater design variety, and higher confidence, with ethical concerns highlighting the need for balanced use.	Microsoft Copilot enhances costume design education by speeding up the design process, supporting idea generation, and encouraging experimentation. It helps students visualise concepts more effectively, increases engagement, and builds digital literacy and confidence in using technology. When combined with traditional design methods, Copilot serves as a valuable support tool that enriches learning while maintaining students' creative autonomy.

7 DISCUSSION

This systematic review explored the application of AI technologies in the preservation and promotion of traditional malay costume, particularly batik and tenun. The findings indicate strong support for AI as a tool to safeguard cultural heritage, with respondents recognizing the urgent threat to traditional textile designs and emphasizing the importance of digital archiving for education and long-term preservation. Although familiarity with AI tools remains moderate, the high willingness to adopt AI platforms highlights the need for targeted training and stakeholder engagement. AI-driven approaches such as pattern recognition, digital archiving, and immersive platforms can enhance authenticity, accessibility, and global visibility of traditional textiles. However, challenges related to technical expertise, cultural sensitivity, and authenticity must be carefully managed. Overall, this review concludes that responsible and strategic use of AI can effectively support the preservation, innovation, and global appreciation of Malaysia's textile heritage.

7.1 Promoting Cultural Awareness

Highlights positive public perceptions toward the appreciation and application of songket motifs in contemporary product design. The survey results indicate that most respondents value songket as a cultural element and support its integration into daily-use products, particularly in fashion, home furnishings, and stationery. Although familiarity with songket motifs is relatively high, the findings reveal that recognition is influenced by visual presentation and naming, as seen in the differing responses to flower, fauna, and fruit motifs. This suggests that clearer visual representation and contextual explanation are important for improving public understanding and appreciation of traditional motifs. The preference for nature-inspired motifs further reinforces the strong connection between songket design and natural elements, which remain central to Malay cultural identity. Overall, the study concludes that adapting songket motifs into innovative, functional, and practical designs can strengthen their relevance in modern contexts while preserving cultural value. The strong agreement among respondents supports the potential of songket for wider market integration, both locally and internationally. Additionally, the use of AI in early design development offers clear advantages by enabling rapid visualisation, cost and time efficiency, and broader creative exploration. While design preferences require further validation, this research affirms that combining traditional songket motifs with contemporary design approaches and AI technologies can enhance cultural sustainability and global recognition of Malaysian heritage products.

Historical influences have deeply shaped Malay culture, fostering ethical, social, and intellectual values that transformed the community from a myth-centred worldview to one grounded in rational, structured, and knowledge-based principles. Malay culture, spread across Southeast Asia, is united by shared language, traditions, arts, and core values such as respect, politeness, and cooperation. In Indonesia, rapid digitalization, widespread internet access, and the rise of AI are transforming education and cultural engagement by enabling personalized learning, adaptive curricula, real-time feedback, and digital skill development. While AI offers opportunities to preserve and promote Malay cultural identity through digital platforms, social media, and e-commerce, challenges remain, including unequal access, limited digital literacy, data privacy, and infrastructure gaps. Studies highlight the dual role of technology as both a vehicle for cultural preservation and a catalyst for change, allowing younger generations to engage with Islamic traditions and contemporary global culture. Government initiatives to improve connectivity and integrate AI into education support equitable access, curriculum adaptation, and ethical, culturally sensitive AI implementation. Overall, the intersection of Islam, Malay cultural values, and AI demonstrates the potential to balance tradition and innovation, ensuring that cultural identity is maintained while embracing the opportunities of the digital age.

7.2 Traditional Malay Costume

Different versions of Stable Diffusion offer unique strengths for generating batik motifs, with trade-offs between accuracy, creativity, and cultural authenticity. Stable Diffusion V1.5 performs best at producing motifs that closely match traditional batik designs, making it ideal for heritage-focused work. SDXL, on the other hand, creates more varied and imaginative patterns, especially for intricate animal designs, and works best when fine-tuned with local batik datasets, offering strong potential for creative experimentation. While V2.1 produces diverse outputs, it is less consistent and reliable for traditional batik designs. Overall, generative AI can effectively support both the preservation and creative evolution of batik, with V1.5 suited for authenticity and SDXL for innovation.

Demonstrates that StyleGAN is effective in generating new Ulos motifs that maintain essential traditional characteristics while introducing creative variations such as pattern alteration, color blending, and motif merging. Higher image resolutions, particularly 1024×1024 pixels, significantly improved visual clarity and motif quality. Among all experimental settings, scenario 4 using the Batak Karo dataset achieved the best results, with the lowest FID and KID scores, indicating higher realism and diversity in the generated motifs. Expert validation further confirmed that the generated motifs exhibited meaningful transformations while remaining recognisable as Ulos designs. Overall, the findings confirm the potential of StyleGAN for supporting digital innovation in traditional textile design, particularly for applications such as DiTenun. However, the fluctuating training performance suggests that further optimisation is needed due to the complex geometric nature of Ulos motifs. Future work should explore improved hyperparameter tuning, alternative network architectures, and other generative approaches such as diffusion models to achieve more stable and interpretable results. Importantly, ethical and cultural considerations must guide future development to ensure authenticity, inclusivity, and responsible use of generative AI in preserving and evolving Ulos heritage.

Microsoft Copilot positively influences costume design education by improving students' efficiency, creativity, and engagement, particularly during brainstorming and early design stages. The findings align with existing literature that positions AI as a supportive tool that enhances learning and creative exploration. Students were able to generate a wider range of design ideas, participate in richer discussions, and build confidence in their technical skills. However, the results also reveal challenges, including a learning curve for some students and the risk of over-reliance on AI-generated outputs, which may limit individual creative expression. These findings highlight the importance of structured guidance, technical support, and critical engagement with AI tools. Overall, the study concludes that Microsoft Copilot can significantly enhance learning outcomes in costume design when integrated responsibly. AI is most effective when it complements, rather than replaces, traditional design practices such as sketching and conceptual development. Ethical considerations, including originality, bias, and design homogenisation, must be addressed to ensure responsible use. This research contributes to the understanding of AI integration in creative education and recommends a balanced approach that combines technological innovation with foundational artistic skills, while encouraging future research on the long-term impact of AI on creative development.

Overall, this research demonstrates that 'AI' holds significant potential in supporting the preservation, innovation, and promotion culture awareness traditional malay costume across textiles and product design. The findings collectively show that 'AI' technologies can enhance cultural sustainability by enabling digital archiving, creative exploration, and wider market accessibility, while maintaining cultural identity when applied responsibly. From motif generation in batik, songket, and Ulos textiles to creative support in costume design education, AI proves most effective as a complementary tool that enhances human creativity rather than replacing it. However, successful integration requires careful attention to ethical considerations, cultural authenticity, technical literacy, and balanced human AI collaboration. By combining traditional knowledge with contemporary AI-driven approaches, this research concludes that AI can play a meaningful role in strengthening Malaysia's cultural heritage, ensuring its relevance, continuity, and global appreciation in the digital age.

CONCLUSION

This study demonstrates that artificial intelligence (AI) holds significant potential to preserve, innovate, and promote traditional Malay costumes across textiles and product design. AI can also be used as a creative instrument to assist designers in refining, enhancing, and modernizing traditional Malay costume motifs, making cultural heritage more accessible, relevant, and impactful in contemporary creative industries. Generative AI models, such as Stable Diffusion and StyleGAN, support the creation, adaptation, and revitalization of batik, songket, and Ulos motifs, balancing cultural authenticity with creative exploration. AI tools like Microsoft Copilot enhance costume design education by fostering creativity, efficiency, and engagement while complementing traditional practices. Public support for integrating traditional motifs into contemporary products highlights AI's role in promoting cultural awareness and sustainability. Successful implementation, however, requires attention to ethics, cultural sensitivity, technical skills, and equitable access. Overall, by combining traditional knowledge with AI-driven approaches, this research concludes that AI can meaningfully strengthen Malay cultural heritage, ensuring its continuity, relevance, and global appreciation in the digital age.

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AUTHOR CONTRIBUTIONS

Each author contributed equally.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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