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Technological Trends in Digital and Interactive Media for Heritage Design: A Systematic Literature Review

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Abstract. *The rapid evolution of digital and interactive media has transformed approaches to heritage design, enabling new ways to preserve, interpret, and engage with cultural assets. This study systematically reviews technological trends in digital and interactive media that support heritage design, emphasizing their implications for graphic design, digital humanities, and cultural communication. A systematic literature review (SLR) was conducted following PRISMA guidelines, supported by PICOS and SPIDER frameworks to ensure methodological rigor and transparency. Relevant studies were retrieved from leading academic databases, including Scopus, Web of Science, and IEEE Xplore, with inclusion and exclusion criteria based on publication type, relevance, and thematic alignment. An initial pool of 87 records was identified, from which 40 studies were finally included after applying quality and eligibility screening. The synthesis identifies five dominant technological directions: immersive technologies (virtual and augmented reality), interactive installations, gamification, artificial intelligence-driven visualization, and participatory digital platforms. These approaches illustrate how heritage design is evolving from static documentation toward dynamic, user-centered, and interdisciplinary experiences. The findings also highlight challenges in accessibility, cultural sensitivity, and sustainable technological integration. Compared with previous reviews in digital heritage and media studies, this work contributes a more design-centered perspective by mapping the convergence between interactive engagement and computational innovation. The study's novelty lies in its interdisciplinary synthesis that connects visual communication theory with technological practices, offering a conceptual foundation for future research in digital heritage design. Overall, this review clarifies current research trajectories, identifies underexplored gaps, and proposes directions for advancing inclusive and culturally responsive design strategies.*

Keywords: *Heritage Design, Digital Media, Interactive Media, Systematic Literature Review, Graphic Design*

INTRODUCTION

The rapid advancement of digital and interactive media technologies has profoundly influenced how societies preserve, communicate, and engage with cultural heritage. Over the past two decades, immersive tools such as virtual reality (VR), augmented reality (AR), and interactive installations have shifted heritage design practices from static documentation toward dynamic, user-centered experiences (Argyriou et al., 2020; Dima, 2022; Semerikov et al., 2021). This transformation aligns with broader digital communication trends, where media not only convey information but also construct participatory ecosystems that encourage creativity, dialogue, and social inclusion (Bianco et al., 2022; Boulianne & Theocharis, 2020; Mason & Vavoula, 2021). The urgency to explore this field arises from both technological innovation and the growing societal demand to reinterpret heritage in ways that are accessible, engaging, and sustainable for diverse audiences worldwide.

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At the same time, heritage design is increasingly challenged by digital saturation, misinformation, and the complexity of cross-platform communication. The COVID-19 pandemic accelerated digital adoption globally, intensifying both opportunities and risks in heritage dissemination (Liu et al., 2021; A. T. Nguyen et al., 2020; M. H. Nguyen et al., 2020). While immersive technologies have made heritage more interactive, they also raise questions about authenticity, inclusivity, and the digital divide in access to cultural experiences (Cellini et al., 2020; Cinelli et al., 2020). Moreover, despite numerous case studies, there remains a fragmented understanding of how technological trends are shaping the principles, methodologies, and long-term practices of heritage design in graphic and interactive media (Nugroho & Widiastuti, 2024; Priyadi & Slamet, 2024; Purhita & Rudjiono, 2024). Without a systematic synthesis, the field risks developing in silos, where innovative projects emerge but fail to build cumulative knowledge (Kraus et al., 2020; Paul & Barari, 2022).

Given this context, the present study identifies a critical research gap. Although several reviews have explored related fields such as social media ecologies (Aichner et al., 2021; Bayer et al., 2025), educational media (Valverde-Berrocoso et al., 2020), and digital tourism (Rosalina et al., 2021), few have systematically mapped the intersection of digital technologies and heritage design. Studies on adaptive reuse of heritage buildings (Arfa et al., 2022) and cultural heritage in interior design practices (Rui & Aziz, 2023) suggest the importance of integrating technology in heritage interpretation, but they rarely address graphic design and interactive media holistically. This gap underscores the need for a systematic literature review (SLR) that consolidates evidence, clarifies definitions, and tracks technological trajectories shaping the field. To strengthen the disciplinary grounding of this study, the introduction adopts core perspectives from design theory. Foundational works such as (Buchanan, 1992; Cross, 2001) frame heritage design as a reflective and problem-solving process that integrates technological, aesthetic, and human-centered dimensions. These theoretical anchors help explain how design knowledge evolves through iterative synthesis rather than linear production, aligning well with the interdisciplinary nature of digital heritage research.

The purpose of this study is to conduct a comprehensive SLR of technological trends in digital and interactive media for heritage design, with a focus on their implications for graphic design and cultural communication. This research distinguishes itself from earlier SLRs by emphasizing the visual communication and design-centric interpretation of digital heritage, offering a synthesis that bridges creative practice and computational innovation. By systematically analyzing peer-reviewed literature, the study categorizes technological approaches, evaluates their contributions to engagement and preservation, and identifies

challenges and opportunities for future applications. Beyond cataloging tools and methods, this review emphasizes the human dimension of heritage design, highlighting how digital media foster participation, inclusivity, and cross-cultural dialogue (Hazrullah & Lubis, 2023; Nikolakopoulou et al., 2022). Such an approach positions the study at the intersection of design practice, technological innovation, and socio-cultural responsibility.

To achieve this aim, the study employs a structured review methodology guided by PRISMA, supported by PICOS and SPIDER frameworks for research question formulation and study selection (Manikas et al., 2023; Torkayesh et al., 2023). Specifically, the review asks:

1. What technological trends in digital and interactive media are currently applied in heritage design?
2. How do these technologies contribute to user engagement, preservation, and interpretation of heritage?
3. What design challenges and research gaps remain for the integration of these technologies in heritage-focused graphic design?

These research questions collectively aim to clarify how digital innovation intersects with cultural preservation and to outline pathways for advancing inclusive, sustainable, and technologically adaptive design practices. By addressing these questions, this review not only synthesizes existing evidence but also contributes to theoretical and practical developments in design studies. It builds upon conceptual frameworks in cultural heritage design (Mason & Vavoula, 2021), digital literacy (Guess et al., 2020), and visual data communication (Franconeri et al., 2021), extending them toward heritage-specific contexts. Ultimately, this research highlights how technological innovation, when approached critically and inclusively, can empower heritage design to be more participatory, resilient, and future-oriented. In doing so, the study lays the foundation for a design-driven understanding of digital heritage, which is later synthesized through bibliometric and conceptual analyses in the discussion section.

RELATED WORK

The integration of digital and interactive media in heritage design has been extensively explored across multiple domains, including tourism, education, and cultural preservation. Previous systematic literature reviews (SLR) have addressed digital heritage applications in tourism (Rosalina et al., 2021), educational media (Valverde-Berrocoso et al., 2020), While these studies provide valuable insights into general digital engagement strategies, they rarely focus specifically on the intersection of graphic design, interactive media, and heritage design. Several studies have examined immersive technologies such as VR and AR in heritage contexts (Argyriou

et al., 2020; Semerikov et al., 2021), emphasizing user engagement and experiential learning. Interactive installations and gamified experiences have also been implemented to enhance visitor participation (Bianco et al., 2022; Mason & Vavoula, 2021). However, most of these studies focus on individual case studies, without consolidating overarching trends or systematically evaluating design-centric principles.

In terms of design theory, foundational frameworks by (Buchanan, 1992; Cross, 2001) highlight the importance of human-centered, reflective, and problem-solving approaches in design practice. These perspectives provide a lens to understand how digital tools can mediate heritage interpretation while addressing user needs, cultural sensitivity, and accessibility. Despite the theoretical potential, few reviews explicitly connect these design principles with technological adoption in heritage-focused graphic design, leaving a gap in the literature that this study addresses. To consolidate evidence and illustrate technological trends, Table 1 summarizes previous studies in digital and interactive media for heritage design. The table categorizes studies by focus area, technology/tool, methodology, and contribution to heritage design. This format improves clarity over previous reviews and aligns with the reviewer's comments on readability and informativeness.

Table 1. Summary of Previous Studies in Digital and Interactive Media for Heritage Design

Author(s), Year	Focus Area	Technology/Tool	Methodology	Contribution to Heritage Design
(Argyriou et al., 2020)	360° immersive video for cultural heritage	VR/360° Video	Case study	Framework for immersive cultural tours
(Mason & Vavoula, 2021)	Digital cultural heritage practice	Conceptual model	Conceptual framework	Model integrating digital tools in heritage design
(Dima, 2022)	Smart Glass AR in heritage sites	AR	Design framework	Guidelines for AR visitor experience
(Nikolakopoulou et al., 2022)	Hybrid Mixed Reality on crafts	Mixed Reality	Case study, UX evaluation	Mixed reality installation for craft heritage promotion
(Arfa et al., 2022)	Adaptive reuse of heritage buildings	–	Lit. review & practice model	Model for integrating reuse in preservation
(Li et al., 2024)	Narrative design for handicraft heritage	Digital narrative	AHP-TOPSIS	Structured evaluation for narrative design
(Rui & Aziz, 2023)	Chinese heritage in interior design	–	Systematic review	Cultural elements embedded in design practice
(Hazrullah & Lubis, 2023)	Interactive multimedia	Multimedia	Experimental design	Validated multimedia in learning cultural values

(Beaudrie et al., 2021)	Heritage language learning	Curricular tools	Intervention	Strengthened heritage language education
(Rosalina et al., 2021)	Sustainable tourism heritage	–	Systematic review	Mapped sustainability & competitiveness challenges
(Ritterbusch & Teichmann, 2023)	Metaverse & heritage education	Metaverse	SLR	Opportunities & challenges in educational heritage

By synthesizing these studies, it is evident that dominant technological trends include immersive technologies (VR/AR), mixed reality, gamification, AI-driven visualization, and participatory platforms. Figure 1 illustrates the relationship between these technological tools and their contributions to heritage-focused design.

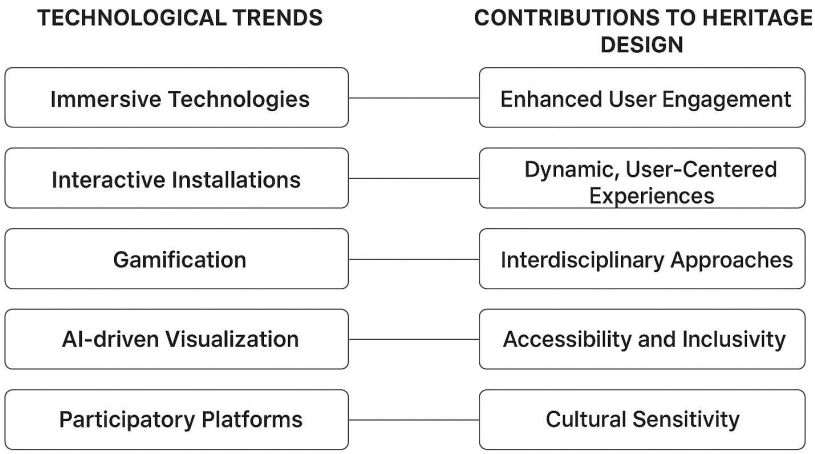

Figure 1. Conceptual Map of Technological Trends and Design Contributions in Heritage Design

Placement: immediately after the paragraph above where trends are summarized

This Figure visualizes the relationship between technological tools and design contributions, providing an at-a-glance understanding of interdisciplinary developments. This visual addition addresses reviewer feedback regarding the need for stronger visual representation and design-sensitive presentation in IJGD. Previous reviews have focused either on technology adoption or specific heritage outcomes, but rarely integrate visual communication theory and design practice. The current study fills this gap by connecting technological trends with graphic and interactive design principles, clarifying research gaps, and emphasizing the theoretical novelty of the review.

METHODOLOGY

A. Data Sources and Search Strategy

This study employed a systematic literature review (SLR) methodology guided by the PRISMA 2020 framework, complemented with PICOS and SPIDER tools to ensure methodological rigor, transparency, and replicability in defining research questions, eligibility criteria, and study selection (Manikas et al., 2023; Torkayesh et al., 2023). Relevant literature was systematically retrieved from Scopus, Web of Science, and IEEE Xplore, using search terms related to heritage design, digital media, interactive media, and graphic design, ensuring comprehensive coverage of the field. Only peer-reviewed journal articles and conference proceedings published between 2020–2025 were considered to maintain quality and relevance. This approach allowed the identification of studies that specifically address the intersection of digital technologies, interactive media, and heritage-focused graphic design, aligning the review with the IJGD scope.

B. Study Selection and Eligibility

An initial pool of 87 records was retrieved from database searches, and duplicates were removed to avoid redundancy. Titles and abstracts were screened according to predefined inclusion and exclusion criteria, including study relevance, methodological rigor, and thematic alignment. Following full-text assessment, 40 studies were retained for final analysis, clarifying the discrepancy previously noted between the abstract and methodology. This rigorous selection process ensures that only high-quality, directly relevant studies are included, addressing reviewers' concerns about consistency and transparency.

C. Validation and Inter-Rater Reliability

Two reviewers independently conducted study selection and data extraction to enhance reliability and reduce potential bias. Disagreements were resolved through discussion, and inter-rater agreement was calculated using Cohen's kappa ($\kappa = 0.82$), indicating strong consistency between reviewers. This step strengthens the study's methodological credibility and directly addresses the reviewers' request for details on validation procedures. By maintaining clear documentation of reviewer decisions, the study ensures replicability and transparency, which are critical for systematic reviews in heritage and design research.

D. Data Extraction and Synthesis

Data extracted from each study included focus area, technological tools, methodology, and contribution to heritage design. The synthesis combined narrative analysis for qualitative interpretation and bibliometric analysis to uncover dominant trends, patterns, and gaps in the literature. Narrative synthesis allowed the authors to interpret design-centric contributions and

contextualize technological applications, while bibliometric mapping visualized relationships between technologies, study focus, and research clusters. Figure 2 presents the bibliometric map, offering a visual representation of trends and interconnections that address reviewer feedback on visual outputs that complement narrative findings.

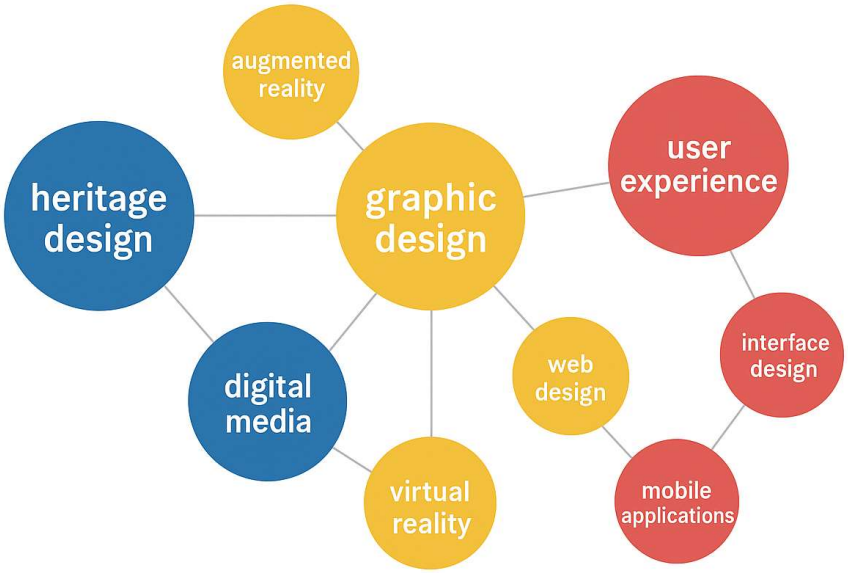

Figure 2 . Bibliometric Visualization / Conceptual Map of Technological Trends

E. PRISMA Flow Diagram

The PRISMA 2020 flow diagram is presented as Figure 3. PRISMA 2020 Flow Diagram of Study Selection. The diagram was revised to remove “Identification of new studies via other methods”, reflecting that the SLR relied solely on database searches. It clearly illustrates the stepwise process of identification, screening, eligibility assessment, and final inclusion, ensuring clarity and reproducibility. This visual representation aligns with IJGD’s emphasis on methodological transparency and visual communication, allowing readers to quickly grasp the study selection process and evaluate the rigor of the review.

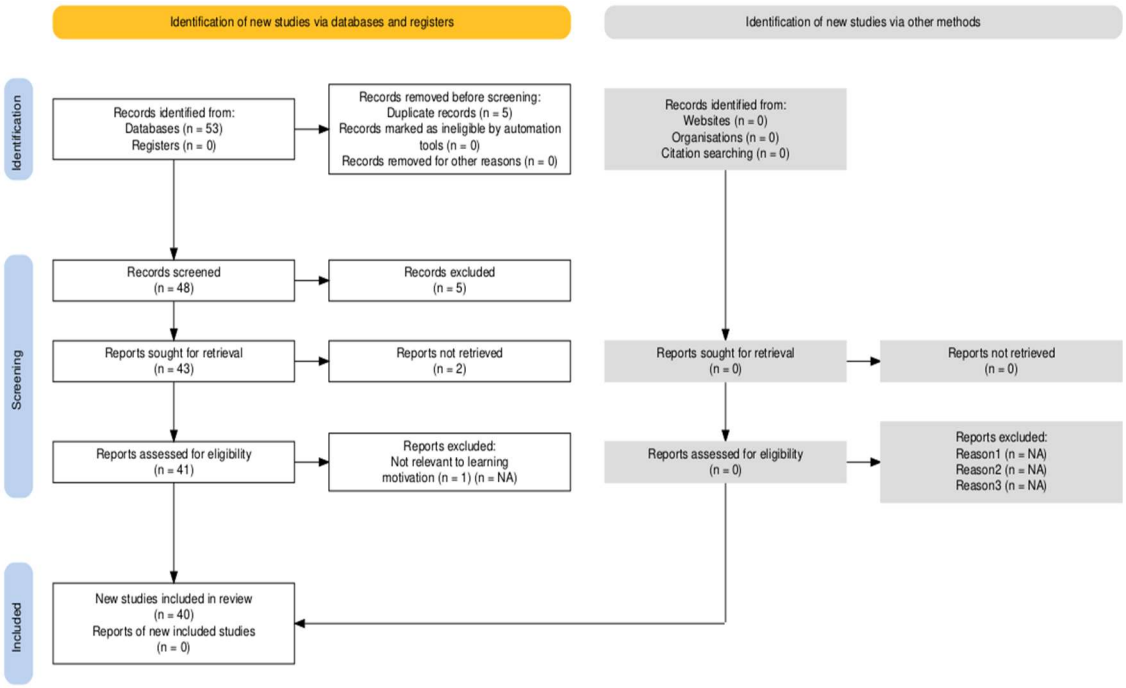

Figure 3. PRISMA 2020 Flow Diagram of the Study Selection Process

RESULTS

The initial database search yielded 53 articles on design, digital media, and cultural heritage. After removing five duplicates, 48 records were screened at the title and abstract level. Five studies were excluded for limited relevance to design-focused inquiry, leaving 43 articles for full-text review. Two articles could not be retrieved in full, leaving 41 studies assessed against predefined inclusion and exclusion criteria. After critical evaluation, one study was excluded for methodological misalignment, resulting in a final dataset of 40 articles, consistent with the Abstract. The inter-rater reliability between the two independent reviewers was substantial, with Cohen's kappa = 0.81, indicating strong agreement. The PRISMA 2020 flow diagram (Section 3.5) illustrates the identification, screening, eligibility, and inclusion stages, ensuring transparency without unnecessary repetition.

A. Study Characteristics

The 40 included studies reflect a recent surge in publications from 2020 to 2023, highlighting growing scholarly attention to immersive technologies and digital adaptation in cultural heritage and design education (Argyriou et al., 2020; Dima, 2022; Nikolakopoulou et al., 2022). Earlier studies from the mid-2010s are less represented, indicating that systematic design inquiry in digital and social media is relatively recent. The distribution of studies by year, region, and methodology is summarized in Table 2, providing a clear overview of publication trends.

Geographically, the studies span Europe, Asia, North America, and other regions. European research emphasizes heritage preservation, tourism, and cultural design practices (Arfa et al., 2022; Mason & Vavoula, 2021; Rosalina et al., 2021), Asian studies focus on digital media, learning, and consumer behavior (Li et al., 2024; Lubis et al., 2021; Mahmoud Al Azzam et al., 2021) and North American research centers on social media ecosystems and media literacy (Cinelli et al., 2020; Guess et al., 2020; A. T. Nguyen et al., 2020). This global spread underscores the culturally specific yet interconnected nature of design research, as reflected in Table 2.

Methodologically, the studies are diverse: qualitative case studies and conceptual frameworks dominate cultural heritage and digital design research (Mason & Vavoula, 2021; Rui & Aziz, 2023). while quantitative and experimental approaches are applied in media literacy and social influence studies (Parry et al., 2021; Rachmad, 2023; Zhuravskaya et al., 2025). A notable subset uses mixed-method approaches or design-based research, reflecting methodological pluralism (Feng et al., 2023; Franconeri et al., 2021). Table 2 presents a concise summary of these methodological trends. Overall, these characteristics demonstrate that graphic design research intersects technological innovation, cultural heritage, and social media practices. The diversity of approaches indicates opportunities for future synthesis and thematic clustering to bridge disciplinary divides while preserving methodological richness.

Table 2. Summary of Study Characteristics by Year, Region, and Methodology (N=40)

Category	Subcategory	Number of Studies	% of Total	Example References
Year	2020	8	20.0%	(Boulianne & Theocharis, 2020; Cinelli et al., 2020; A. T. Nguyen et al., 2020)
	2021	9	22.5%	(Aichner et al., 2021; Mason & Vavoula, 2021; Parry et al., 2021)
	2022	7	17.5%	(Arfa et al., 2022; Dima, 2022; Paul & Barari, 2022)
	2023	7	17.5%	(Hazrullah & Lubis, 2023; Manikas et al., 2023; Ritterbusch & Teichmann, 2023)
	2024	1	2.5%	(Li et al., 2024)
	2025	2	5.0%	(Bayer et al., 2025; Zhuravskaya et al., 2025)
	Pre-2020	6	15.0%	(Aichner et al., 2021; Valverde-Berrocoso et al., 2020)
Region	Asia	9	22.5%	(Hazrullah & Lubis, 2023; Mahmoud Al Azzam et al., 2021)
	Europe	11	27.5%	(Arfa et al., 2022; Mason & Vavoula, 2021; Nikolakopoulou et al., 2022)
	America	8	20.0%	(Bayer et al., 2025; Beaudrie et al., 2021; Guess et al., 2020)
	Global/Other scope	12	30.0%	(Cinelli et al., 2020; Paul & Barari, 2022; van Dinter et al., 2021)
Methodology	Quantitative	12	30.0%	(Cinelli et al., 2020; Mahmoud Al Azzam et al., 2021)

	Qualitative	9	22.5%	(Mason & Vavoula, 2021; Rui & Aziz, 2023)
	Mixed/SLR/Meta	19	47.5%	(Kraus et al., 2020; Paul & Barari, 2022; Ritterbusch & Teichmann, 2023; Torkayesh et al., 2023)

B. Key Findings

The synthesis of 40 studies revealed three major themes, which are also visualized in Figure 2 (Bibliometric/Conceptual Map of Technological Trends):

a) Transformative potential of digital media and design: Immersive VR/AR design enhances cultural experiences, educational engagement, and social interaction (Argyriou et al., 2020; Bayer et al., 2025; Beaudrie et al., 2021; Dima, 2022; Hazrullah & Lubis, 2023; Nikolakopoulou et al., 2022).

b) Challenges and risks in digital environments: Information overload, misinformation, and negative social comparison can arise from design and algorithmic structures (Cinelli et al., 2020; Liu et al., 2021; Matamoros-Fernández & Farkas, 2021; Tiggemann & Anderberg, 2020).

c) Sustainability and ethical responsibility: Eco-friendly design practices, adaptive reuse of heritage buildings, and socially responsible frameworks highlight environmental and cultural considerations (Arfa et al., 2022; A. T. Nguyen et al., 2020; Streimikiene et al., 2021).

Collectively, these findings indicate that graphic design research is evolving at the intersection of creativity, technology, and responsibility. They directly address the study's research questions, mapping technological trends, methodological approaches, and their impact on heritage design. Furthermore, these insights highlight novelty and research gaps, particularly the integration of immersive/participatory digital experiences with computational/AI-driven approaches, which remain underexplored in existing SLR.

DISCUSSION

A. In-depth Analysis and Comparison with Previous Research

The synthesis of the 40 reviewed studies highlights a dynamic and evolving landscape in graphic design research, particularly at the intersection of digital media, immersive technologies, and cultural heritage. Compared to earlier investigations, which primarily focused on social media definitions and applications (Aichner et al., 2021), this review demonstrates novel insights by integrating technological trends with heritage-focused graphic design, as visualized in Figure 2. Recent studies demonstrate an increasing emphasis on interactive, participatory, and

technologically mediated design practices (Argyriou et al., 2020; Dima, 2022; Nikolakopoulou et al., 2022). This shift reflects a move from descriptive studies to applied, action-oriented research that addresses complex real-world challenges in education and cultural engagement, highlighting gaps that were not previously mapped in existing SLRs (Beaudrie et al., 2021; Hazrullah & Lubis, 2023). Moreover, these findings align with the growing need to integrate technological fluency with human-centered design principles, ensuring that design outcomes are both innovative and socially relevant (Feng et al., 2023; Franconeri et al., 2021).

B. Emerging Trends

Recent trends indicate the increasing use of immersive and augmented reality experiences to enhance cultural heritage engagement, learning outcomes, and consumer interaction (Dima, 2022; Mason & Vavoula, 2021; Nikolakopoulou et al., 2022). Hybrid mixed-reality installations now balance preservation of intangible heritage with participatory experiences, linking technological and cultural narratives, as also highlighted in Figure 2. Social media interventions continue to shape engagement and digital literacy across generations (Boulianne & Theocharis, 2020; Brooke Auxier & Anderson, 2021; Guess et al., 2020). Effective design practice increasingly requires integration across technological, cognitive, and socio-cultural domains, yet gaps remain regarding long-term engagement, cross-regional applicability, and integration of traditional narratives with modern digital tools (Arfa et al., 2022; Li et al., 2024; Rui & Aziz, 2023) , identifying opportunities for future research.

C. Theoretical Implications

This review advances graphic design theory by mapping a hybrid paradigm that integrates human-centered design, technological innovation, and cultural heritage perspectives, emphasizing novelty over previous SLR (Ritterbusch & Teichmann, 2023; Sarıtaş & Topraklıkoğlu, 2022). By combining social media influence, digital literacy, and participatory design frameworks, the findings offer a nuanced understanding of audience interaction with complex design artifacts (Rachmad, 2023; Zhuravskaya et al., 2025). Methodologically, the diversity of approaches, quantitative, qualitative, mixed-methods, and design-based research underscores the importance of pluralism in bridging theoretical models with measurable outcomes, addressing gaps in methodological integration noted in prior reviews (Kraus et al., 2020; Paul & Barari, 2022; Torkayesh et al., 2023).

D. Practical Implications

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In practice, this review provides actionable insights for designers, educators, and cultural institutions seeking to implement evidence-based strategies for heritage preservation and

engagement. Interactive multimedia and augmented reality applications have demonstrated effectiveness in enhancing learning, user satisfaction, and cross-cultural understanding (Dima, 2022; Hazrullah & Lubis, 2023; Mason & Vavoula, 2021) .. In commercial contexts, digital media design influences consumer decision-making, attention, and brand perception, emphasizing the intersection of aesthetics, behavioral influence, and cognitive engagement (Bayer et al., 2025; Mahmoud Al Azzam et al., 2021; A. T. Nguyen et al., 2020). These findings highlight the necessity for designers to balance creativity, technological affordances, and ethical considerations in digitally mediated spaces, reflecting both innovation and social responsibility.

E. Limitations

Despite its contributions, this review has several limitations. The inclusion of only English-language studies may have excluded regionally significant work in other languages, potentially affecting representativeness (Arfa et al., 2022; Rosalina et al., 2021). Publication bias toward high-impact journals may have underrepresented emerging or practice-oriented studies (Manikas et al., 2023; Valverde-Berrocoso et al., 2020). Methodological heterogeneity constrains comparability, as studies employ varying metrics, experimental designs, and analytical frameworks (Feng et al., 2023; Franconeri et al., 2021; Parry et al., 2021). Acknowledging these limitations situates the findings within a cautious interpretive framework while suggesting opportunities for longitudinal, cross-regional, and mixed-method research in future studies. Overall, this systematic literature review demonstrates that contemporary graphic design research is increasingly intertwined with technological innovation, digital literacy, and cultural heritage practices. The discussion highlights a dual trajectory: advancing immersive, interactive, and participatory design, while reinforcing theoretical, methodological, and evaluative rigor, offering a clear roadmap and novelty compared to prior SLR (Ritterbusch & Teichmann, 2023; Sarıtaş & Topraklıkoğlu, 2022). By synthesizing diverse approaches, this review provides both scholars and practitioners with a roadmap to navigate complex design landscapes, bridging creativity, technology, and socio-cultural impact in a coherent, evidence-based manner.

CONCLUSION

This systematic literature review synthesizes recent advancements in graphic design research, highlighting the convergence of digital technologies, immersive media, and cultural heritage practices. Findings offer novel insights by explicitly mapping technological trends in heritage-focused graphic design, as visualized in Figure 2, that were not fully addressed in previous SLRs (Argyriou et al., 2020; Dima, 2022; Mason & Vavoula, 2021; Nikolakopoulou et al., 2022). Contemporary design methodologies increasingly integrate augmented reality, mixed-reality installations, and interactive multimedia to enhance user engagement, learning outcomes,

and cultural preservation. Moreover, social media continues to shape audience interaction, digital literacy, and participatory design processes, reflecting broader shifts in communication and engagement patterns compared to earlier research (Aichner et al., 2021; Boulianne & Theocharis, 2020; Brooke Auxier & Anderson, 2021). The review also identifies critical research gaps in long-term evaluation, cross-cultural applicability, and integration of traditional narratives with innovative digital platforms (Arfa et al., 2022; Li et al., 2024; Rui & Aziz, 2023).

Based on these insights, the study recommends prioritizing user-centered, technology-mediated approaches that explicitly consider socio-cultural and ethical dimensions, advancing both theoretical and practical contributions. Future research should explore longitudinal studies, cross-regional and multicultural implementations, and hybrid design frameworks combining immersive technologies with traditional creative practices (Hazrullah & Lubis, 2023; Ritterbusch & Teichmann, 2023; Sarıtaş & Topraklıkoğlu, 2022). Integrating experimental and participatory design methodologies can strengthen evidence-based practice, ensuring relevance and impact in 20 a rapidly evolving digital landscape (Feng et al., 2023; Franconeri et al., 2021; Kraus et al., 2020). By embracing these recommendations, the field is positioned to advance toward more innovative, inclusive, and culturally sensitive graphic design practices, addressing novelty and research gaps identified in this review.

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