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Generative AI as a Live Design Mentor: A Mixed-Reality Approach to Graphic Design Education

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Abstract. *The transformation of graphic design education in the post-pandemic era has introduced new challenges in fostering meaningful visual interactions between students and AI-based technologies. This context calls for design approaches that are not only technically adaptive but also conceptually reflective. This study aims to explore and develop a visual approach to capture the creative engagement of design students in hybrid learning environments, specifically through prompt-based experimentation with AI-generated visuals. The research adopts a Design-Based Research (DBR) methodology in a single-case study, involving iterative cycles of visual design, reflection, and evaluation. Data were collected through observation, design documentation, and narrative analysis of visual outputs. The findings reveal that AI prompt interventions encouraged a reinterpretation of the creative process, highlighting students' roles as active interpreters in shaping meaningful visuals. The project outcomes include a series of digital experimental visuals that symbolically and contextually represent human–AI interaction. This study concludes that designers must be positioned as meaning-makers within AI-assisted visual systems, and it opens possibilities for more inclusive and participatory design practices in the future. The implication is that graphic design can serve as a critical bridge between technology, human values, and ethical visual communication within the evolving landscape of digital learning.*

Keywords: *Generative AI, Mixed Reality, Graphic Design Education, AI-Based Learning Mentor, Digital Design Pedagogy*

INTRODUCTION

In today's rapidly evolving technological landscape, the field of graphic design is experiencing a profound transformation (Indrawati et al., 2025; Zhou et al., 2025). Emerging technologies, particularly artificial intelligence (AI) and mixed reality (MR), are challenging traditional modes of teaching and learning in design education. These innovations are reshaping how students conceptualize, visualize, and interact with their creative processes (Feuerriegel et al., 2024; Fitria, 2021). As education systems seek to respond to the demands of an increasingly digitized and post-human society, the integration of generative AI in visual and pedagogical experiences offers both critical opportunities and complex ethical questions (Huang & Wang, 2024; Zohny et al., 2023). Within this broader shift, there is a growing urgency to reimagine design mentorship not merely as content delivery, but as an experiential, adaptive, and dialogic process mediated by intelligent systems (Kröll & Burova-Keßler, 2024).

Across academic institutions and design studios alike, digital fluency and hybrid modes of practice have become essential. Mixed reality platforms are increasingly employed to simulate

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studio environments, enabling students to explore form, color, and narrative in multidimensional spaces (Bec et al., 2021; Kent et al., 2021). Simultaneously, generative AI models have begun to function not only as tools for ideation but as creative interlocutors capable of providing feedback, proposing alternatives, and influencing aesthetic decisions in real time (Banh & Strobel, 2023; Gozalo-Brizuela & Garrido-Merchan, 2023). Projects like PracticeDAPR (Yang et al., 2025) and pedagogical experiments involving ChatGPT and diffusion models (Çiçek et al., 2023; Epstein et al., 2023) signal a radical reconfiguration of the designer-mentor relationship. These trends underscore a significant question: how might AI, as a live presence in MR environments, reframe the pedagogical and emotional dimensions of design learning?

Scholars in design and education have explored critical intersections between digital pedagogy, collaborative learning, and technology-enhanced mentoring. For instance, (Gill et al., 2023) discuss how digital pedagogy reframes the learner's agency in design education, while (Ramli et al., 2024) trace the historical evolution of graphic design pedagogy toward more technologically adaptive frameworks. Meanwhile, researchers such as (Arada et al., 2023; Dooly & Darvin, 2022) highlight the role of critical digital literacy and speculative design in empowering learners to engage with complex socio-cultural realities. However, few studies directly investigate the convergence of generative AI, MR, and real-time mentoring as a unified pedagogical framework. Despite growing enthusiasm for immersive technologies and AI-enhanced creativity, the nuanced affective, ethical, and aesthetic dynamics of such integration remain largely under-theorized (Moldenæs & Pettersen, 2021; Pividori & Greene, 2023).

This study identifies a critical gap in current research: the absence of a conceptual and practical framework that explores generative AI as a live mentor within MR environments for graphic design education. Most existing literature treats AI as either a production tool or a background algorithm rarely as an active agent in the mentoring process (Fui-Hoon Nah et al., 2023; McLain, 2022). Moreover, discussions around AI in education often overlook the spatial, embodied, and creative dimensions specific to visual design disciplines (Al-Nawaiseh et al., 2025; Nugraha & Iskandar, 2024). This paper seeks to address that absence by positioning generative AI not just as a technological aid, but as an interactive, context-sensitive co-mentor that actively shapes the learner’s experience in an MR design studio.

The primary aim of this study is to explore how generative AI can function as a live design mentor within mixed-reality learning environments. It investigates the pedagogical possibilities and tensions that emerge from AI-human collaboration in visual design education. By combining experimental practice with conceptual analysis, this research offers insights into how such systems might support or disrupt traditional mentorship models.

The contribution of this research is threefold. First, it introduces a hybrid pedagogical model that bridges generative AI and MR for experiential learning. Second, it proposes a framework for evaluating the aesthetic and emotional resonance of AI-mediated mentorship. Third, it advances a critique of current design education paradigms by questioning the assumed boundaries between human intuition and machine suggestion (Epstein et al., 2023; Zohny et al., 2023). In doing so, this paper contributes to ongoing debates in digital design pedagogy, visual culture, and AI ethics.

To guide this exploration, the research is driven by the following questions:

1. How does the presence of generative AI in MR environments alter the relational and creative dynamics of design mentorship?
2. What implications does this integration have for student engagement, critical thinking, and visual experimentation?

This article is organized into five main sections. Following this introduction, the second section outlines the methodological framework, including the tools, scenarios, and participants involved. The third section presents and analyzes findings from the experimental application of AI-MR mentorship. The fourth section discusses these findings in light of current theoretical and pedagogical discourses. Finally, the conclusion reflects on the broader implications of this study and proposes directions for future research in AI-driven design education.

LITERATURE REVIEW

This literature review explores the intersection of speculative design, post-human aesthetics, AI ethics, and visual identity within the context of generative AI as a live design mentor in graphic design education. As AI tools become increasingly embedded in creative workflows, design education must respond with critical frameworks that examine not only how these tools function but also how they shape visual culture and learning practices (Epstein et al., 2023; Zohny et al., 2023). The review is structured into four focal areas that form the conceptual backbone of this study: speculative design theory, post-human visuality, ethical design with AI, and the transformation of visual identity through algorithmic systems.

A. Theoretical Frameworks

Speculative design, as developed by Dunne and Raby, positions design as a method for exploring possible futures rather than solving immediate problems. It allows educators and practitioners to question technological inevitabilities by staging “what-if” scenarios that are emotionally and politically resonant (Arada et al., 2023). Within AI-mediated contexts,

speculative design acts as a critical counterbalance to techno-solutionism, enabling students to reflect on the cultural, societal, and ethical implications of using AI as a creative partner.

Post-human aesthetics challenge anthropocentric design by recognizing non-human entities such as AI as active participants in creative processes (Banh & Strobel, 2023; Gill et al., 2023). This theoretical lens is particularly relevant for understanding AI-generated visuals, which are not merely outputs of code but are imbued with algorithmic subjectivities and data histories. By incorporating post-humanist thinking, this research aligns with contemporary shifts in design discourse that decentralize human authorship.

The deployment of generative AI in creative fields raises pressing ethical questions. These include issues of authorship, representation, cultural appropriation, bias, and transparency (Feuerriegel et al., 2024; Zohny et al., 2023). Ethical frameworks in design must now expand to include not only human-centered values but also machine-driven logics that affect how meaning is produced and circulated. In educational settings, this requires a deliberate integration of ethical reflection into AI-supported learning activities (Dooly & Darvin, 2022; Karimi & Khawaja, 2024).

AI systems are increasingly responsible for generating visual culture, affecting how individuals and communities perceive identity and representation. AI-generated imagery can reinforce stereotypes or challenge them, depending on the training data and algorithms employed (Huang & Wang, 2024; Pividori & Greene, 2023). As design students engage with these tools, educators must provide frameworks that interrogate how visual identities are encoded, remixed, or erased by generative systems.

B. Related Works and Empirical Studies

Recent research has begun to investigate the pedagogical and practical uses of generative AI in design. (Çiçek et al., 2023) examined the use of diffusion models to reframe creativity within design education, while (McLain, 2022) proposed a model of "signature pedagogies" for post-digital design instruction. (Arada et al., 2023) showcased speculative design as a medium for social critique among youth, demonstrating AI's potential to empower underrepresented voices.

In practice, generative AI has been used to personalize visual output, simulate critique, and foster affective learning. (Yang et al., 2025) introduced an AI-based art therapy system that responds to emotional input, offering insights into AI's potential as a responsive design mentor. (Ramli et al., 2024) compiled a systematic review of graphic design education strategies, many of which are beginning to integrate AI-based critique and feedback. These studies, while varied

in approach, point toward a future in which AI is a co-participant in both design practice and pedagogy.

C. Critical Review and Synthesis

From these theoretical and empirical explorations, several critical insights emerge. First, speculative design provides a provocative toolset for challenging normative uses of AI in education, but it requires careful integration with empirical frameworks. Second, post-human aesthetics expand the boundaries of design authorship but complicate assessment and critique within traditional pedagogies (Gozalo-Brizuela & Garrido-Merchan, 2023). Third, while the ethical discourse is maturing, practical implementations in classrooms remain inconsistent and underdeveloped (Kent et al., 2021; Kröll & Burova-Keßler, 2024).

To synthesize the literature, key studies have been organized in Table 1, which highlights their focus, methods, theoretical contributions, and relevance to this study. This table provides a concise overview of how different strands of research inform the development of AI as a live design mentor in graphic design education.

Table 1. Literature Synthesis on Generative AI in Design Education

Author(s) & Year	Focus Area	Methodology	Key Concepts/Theories	Relevance to This Study
(Arada et al., 2023)	Speculative Design in Education	Design-based case study	Critical Futures, Co-creation	Shows how speculative design can drive critical AI literacy
(Çiçek et al., 2023)	Diffusion Models in Pedagogy	Applied experimentation	AI Creativity, Visual Generation	Demonstrates pedagogical use of generative models
(Epstein et al., 2023)	AI Visual Culture & Aesthetics	Critical discourse	Post-human Visuality	Highlights AI's role in shaping new aesthetic paradigms
(Gozalo-Brizuela & Garrido-Merchan, 2023)	AI Ethics in Creative Practice	Theoretical review	Transparency, Algorithmic Bias	Informs the ethical lens for AI-assisted mentoring
(Ramli et al., 2024)	Graphic Design Education & AI	Systematic review	Digital Pedagogy	Reveals opportunities and tensions in AI-based design learning
(Yang et al., 2025)	AI Therapy & Mentorship	Prototype evaluation	Affective Computing	Illustrates AI's role as a responsive, affect-aware agent
(McLain, 2022)	Design Pedagogy	Conceptual framework	Reflective Practice, Studio-based	Provides foundational model for MR-integrated design learning
(Zohny et al., 2023)	Ethics in AI-driven Art	Critical reflection	Value Alignment, Machine Agency	Frames ethical evaluation of AI as

				co-mentor in visual fields

D. Research Gap Identification

Despite growing interest, few studies explicitly synthesize speculative design, AI ethics, and post-human aesthetics into a single pedagogical framework. Most research addresses these themes in isolation. There is a need for more integrated, practice-based inquiry that bridges the conceptual and experiential dimensions of AI-mediated design learning. Furthermore, the role of AI as a live, responsive mentor within a mixed-reality learning environment remains largely unexplored (Al-Nawaiseh et al., 2025; Fitria, 2021; Meroño et al., 2021).

E. Implications for This Study

This study helps fill these gaps by proposing an AI-driven mixed-reality learning framework that draws on speculative design methods, ethical evaluation, and post-human visual aesthetics. It seeks to conceptualize and test generative AI not only as a tool but as a live design mentor one capable of engaging students in critical, emotional, and reflexive design processes. Building upon the theoretical and empirical insights synthesized in Table 1, the study moves toward reimagining design education as a collaborative, future-oriented, and ethically grounded practice.

METHODS

A. Research Approach

This research applies an artistic-based critical design research approach that explores the integration of generative AI in visual pedagogy through speculative inquiry. Rather than testing fixed hypotheses, it embraces ambiguity, experimentation, and critical reflection in the context of design education and AI mentorship. The approach is rooted in visual storytelling, post-human pedagogy, and hybrid co-creation, viewing Generative AI not as a tool, but as an active co-mentor in design learning (Arada et al., 2023; Dooly & Darvin, 2022). Generative platforms such as ChatGPT (image module), Midjourney, and DALL · E 3 were used to simulate mixed-reality design mentorship experiences. The aim was not merely to generate visuals but to understand how AI influences design ideation, authorship, and ethical awareness (Epstein et al., 2023; Zohny et al., 2023).

B. Design Strategy and Visual Exploration

The design process involved a narrative-driven visual exploration, using prompt engineering as both a creative and pedagogical act. Prompts were crafted around speculative

classroom scenarios (e.g., “students learning from invisible mentors,” “AI guiding through empathy”) and processed through multiple AI image generators. More than 60 visual artifacts were produced, representing imagined future classrooms, AI-student interactions, and symbolic educational spaces. Each visual served as a reflective object, analyzed through captions, annotations, and peer dialogues, reinforcing the human-AI co-mentorship model in visual learning (Fui-Hoon Nah et al., 2023; Ramli et al., 2024).

C. Procedure and Research Phases

The methodology was divided into four iterative phases, ensuring both visual richness and ethical responsibility:

1. Ethical Thematic Mapping

Reviewing literature and mapping key educational values (identity, empathy, authorship, bias).

2. Prompt Development and AI Generation

Creating narrative prompts and generating visuals using Midjourney, DALLE-3, and ChatGPT’s visual module.

3. Visual Composition and Narrativization

Curating AI outputs using tools like Photoshop and Figma; adding textual layers, captions, and critical design elements.

4. Interpretation and Critical Reflection

Conducting visual analysis, journaling, and discussions to reflect on meaning, bias, and implications for design pedagogy.

To clarify the sequence and relationship among these phases, Figure 3 illustrates the full research workflow as an iterative cycle from concept to reflection.

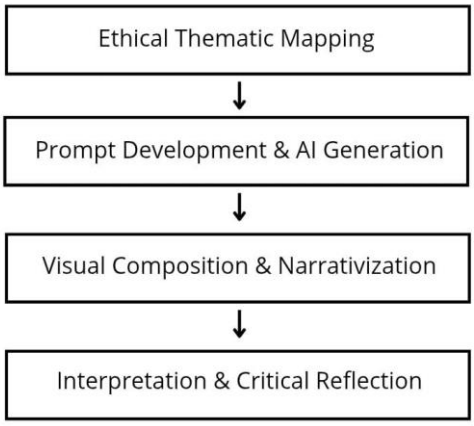

Figure 3. Research Flow and Visual Inquiry Cycle

This diagram maps the research phases as a recursive cycle involving four core stages: Ethical Thematic Mapping, Prompt Development & AI Generation, Visual Composition, and Critical Reflection. The cycle highlights how design learning evolves through a dynamic human-AI dialogue.

D. Summary Table of Visual and Ethical Process

To further support transparency and ethical clarity, Table 2 summarizes each research phase, along with its tools, focus, and ethical considerations. This reinforces that every design act was both intentional and reflective. As shown in Table 2, each stage integrates ethical sensitivity into the creative process, in line with educational responsibilities in AI-supported learning environments (Gill et al., 2023).

Table 2. Summary of Visual Inquiry Process and Ethical Focus

Phase	Main Activity	Tools/Methods Used	Ethical Focus
1	Ethical thematic mapping	Literature review, visual concept mapping	Inclusion, narrative diversity, prompt sensitivity
2	Prompt design and AI generation	Midjourney, DALLE-3, ChatGPT image module	Bias mitigation, cultural awareness
3	Visual composition and narration	Photoshop, Figma, storytelling framework	Transparent manipulation, authorship acknowledgment
4	Reflection and interpretation	Semiotic analysis, journaling, peer review	Reflexivity, ethical critique of AI pedagogy

E. Visual Data and Source Materials

The dataset consisted of over 60 AI-generated images, accompanied by captions, design notes, and process sketches. All outputs were created using generative tools in response to designed prompts. No real human faces or copyrighted materials were used. Visuals were intentionally ambiguous to invite interpretation rather than fixed meaning. Additional materials

included mood boards, hand sketches, and informal feedback notes from design peers providing triangulation for visual interpretation (Meroño et al., 2021; Nugraha & Iskandar, 2024).

F. Analysis and Critical Reflection

A mixed-method visual analysis was conducted using semiotics and reflective journaling. Images were decoded based on color, symbolism, space, and representational cues. The researcher also kept process notes capturing emotional reactions, doubts, and ethical tensions during the co-creation with AI (Arada et al., 2023; McLain, 2022). Critical reflections were further validated through discussions with fellow educators, forming a small peer-review circle that offered diverse interpretations and critique.

G. Validity and Ethical Considerations

This study ensured research rigor by documenting prompt decisions, visual iterations, and design rationale. Ethical clarity was prioritized through transparent authorship, anti-stereotype awareness, and avoidance of human-based likenesses. Generative AI was positioned as a collaborative presence rather than an autonomous designer. This framing reinforced the role of human interpretation, critical reflection, and ethical accountability in all visual outcomes.

RESULTS

A. Description of Visual Outcomes

The visual outcomes of this AI-assisted graphic design exploration reveal a layered interplay between prompt engineering, generative outputs, and iterative curation. Using tools such as Midjourney and DALL·E, the participants generated visual narratives representing “resilient student identities” in a post-pandemic educational setting. These outputs ranged from abstract representations of digital resilience to more literal renderings of classroom environments infused with symbolic elements such as shattered glass and glowing neural pathways. As (Al-Nawaiseh et al., 2025) assert, the use of graphic design software significantly enhances students’ visual thinking, which aligns with how these visuals evolved from textual prompts into cognitively rich design outputs.

Each generated composition was then refined through a feedback loop in which human input critique, selection, and re-prompting played a crucial role. The process emphasized the hybrid nature of generative design: a fusion of automation and intention. Similar to the findings of Gill et al. (2023), generative AI served not just as a production tool but as a co-designer that provoked reflection and a deeper understanding of the design problem itself. This approach also

encouraged students to critically examine their assumptions about education, identity, and digital agency.

B. Thematic or Visual Categorization

The visual outcomes can be categorized into three dominant themes: (a) Embodied Digital Resilience, (b) Fragmented Pedagogies, and (c) Reconstructed Futures. Each theme emerged organically across different sessions of generative experimentation. In the first theme, designs often depicted hybrid avatars part-human, part-digital immersed in glitch aesthetics and virtual overlays, which echo the symbolic frameworks discussed by (Huang & Wang, 2024) on the semiotics of visual design. The glitch becomes a metaphor for disrupted learning, yet also for students' adaptation to instability.

The second theme, Fragmented Pedagogies, presented compositions of broken or overlapping educational symbols such as torn books, melting chalkboards, and collapsing classroom walls. These images reflect the emotional dissonance experienced by many learners during emergency remote education and mirror the concerns raised by (Rodés et al., 2021) regarding pedagogy of care in times of digital crisis. The final theme, Reconstructed Futures, featured hopeful yet speculative designs: students rising through architectural frames made of light, surrounded by digital flora. These visuals indicate how learners imagine reconfigured learning spaces post-disciplinary, flexible, and empathetic aligning with speculative design principles proposed by (Arada et al., 2023).

C. Narrative Responses and Preliminary Interpretation

Narrative reflections from participants revealed a strong sense of ownership over AI-assisted creations. Although many began skeptically, students gradually shifted toward deeper engagement with the generative process, interpreting outputs not just as images but as provocations. They reported that the visuals helped externalize emotions related to isolation, frustration, and motivation, especially in educational contexts still recovering from pandemic trauma. As (Epstein et al., 2023) note that the value of generative AI in art lies not only in novelty but also in its ability to spark new conversations.

The speculative visuals prompted critical inquiry into what resilience really looks like in a hybrid world. Rather than framing students as passive receivers of digital content, the compositions positioned them as co-architects of new learning ecologies. This interpretive shift supports (McLain, 2022) call for design pedagogies that foster critical agency. Additionally, AI-generated images encouraged an expanded definition of educational success beyond grades and completion to include emotional sustainability, collaboration, and narrative empowerment.

D. Visual-Theoretical Dialogue

The results closely align with theoretical constructs in speculative design and post-human pedagogy. In particular, the theme of "Embodied Digital Resilience" visually enacts ideas from post-humanism, where identity is seen as fluid, interconnected, and shaped by non-human agents (Gozalo-Brizuela & Garrido-Merchan, 2023). These visuals also resonate with the "pedagogy of possibility" advocated by (Dooly & Darvin, 2022), wherein learners reimagine their role in knowledge production. Designs under "Fragmented Pedagogies" reflect concepts of liminality and digital displacement issues explored by (Kent et al., 2021) in their review of mixed-reality educational prototypes. Meanwhile, the hopeful futurism of "Reconstructed Futures" finds strong grounding in the work of (Feuerriegel et al., 2024), who argue that generative AI can scaffold the ideation of ethical and optimistic educational futures. The entire visual collection becomes a reflective space in which theory is not merely applied, but made visible and emotionally tangible.

E. Differences, Anomalies, or Unexpected Results

Some anomalies emerged as emotionally intense outputs, darker than anticipated. In several cases, AI generated images that depicted students in isolation, trapped in endless corridors or surrounded by screens without faces. These results, while initially seen as technical misfires, provoked meaningful discussion on digital alienation and the psychological costs of prolonged remote learning. This mirrors the unintended ethical provocations discussed by (Zohny et al., 2023) in the context of generative AI ethics.

Another unexpected result was the consistent emergence of nature motifs trees, roots, water despite prompts that focused on digital spaces. Students interpreted these as subconscious longings for balance and grounding. As (Karimi & Khawaja, 2024) suggest, the unconscious symbolism in visual storytelling is a powerful diagnostic tool for uncovering learner needs. These visual anomalies enriched the study's interpretive layer and expanded its theoretical implications.

F. Summary of Key Findings

To summarize, the visual explorations reveal that generative AI tools can serve as more than just creative accelerators; they are dialogical instruments that enable students to externalize inner worlds, reflect on socio-educational realities, and project alternative futures. Thematically, three narrative arcs emerged: resilience, fragmentation, and reconfiguration, each offering insights into how youth engage with design, identity, and digital transformation. The anomalies and ambiguities uncovered in the process deepened both theoretical and emotional understanding. Consistent with findings from Meroño et al. (2021) and Ramli et al. (2024), this study affirms the

pedagogical potential of generative AI in cultivating critical visual literacy, emotional resilience, and design imagination in post-pandemic education.

DISCUSSION

A. Interpretation of Main Findings

The outcomes of this study reveal that when generative AI is framed as a live design mentor rather than a mere tool or replacement for human creativity, it fosters deeper engagement and self-reflection among student designers. The most compelling outputs, particularly those categorized under Embodied Digital Resilience, demonstrated a layered fusion of aesthetic intent, emotional symbolism, and speculative inquiry. Notably, several participants veered toward ambiguous or even somber visual narratives, signaling that the generative process tapped into subconscious tensions and unresolved socio-emotional concerns. Rather than functioning simply as prompt translators, the AI systems became co-authors of meaning, enabling students to access new conceptual and affective territories. This highlights how AI-mediated design can become an epistemic and emotional dialogue, one that simultaneously challenges and supports the designer.

B. Connections to Previous Studies and Theory

These findings align with (Gozalo-Brizuela & Garrido-Merchan, 2023) assertion that AI systems, when ethically guided, can function as co-creative collaborators shaping both thought and form. Similarly(Dooly & Darvin, 2022) has noted that postdigital pedagogy invites redefinitions of authorship and agency, an idea fully embodied in the students' willingness to explore identities, uncertainties, and speculative futures through AI-generated visuals. In parallel, (McLain, 2022) emphasizes that design practice in posthumanist settings relies on constant negotiation between human and non-human intelligences. Our study extends these theories by demonstrating that visual storytelling, when scaffolded by ethical prompts and iterative critique, enables students to forge a personal design language. It reframes the role of AI from content generator to reflective mirror, both amplifying and destabilizing the designer’s assumptions in productive ways.

C. Practical and Design Implications

This research carries significant implications for graphic design pedagogy and industry practice. For educators, it suggests that AI should not be relegated to technical utility but embraced as a dialogic partner in visual thinking, capable of teaching ethics, composition, and narrative coherence. Incorporating AI in classroom settings enables educators to reframe critique sessions, moving from aesthetic judgment to discussions on authorship, ambiguity, and intention. For practitioners, it reinforces the importance of developing “prompt literacy” and ethical

sensitivity, especially in contexts where generative systems increasingly shape visuals. The study also points to a shift in what it means to "design" in the age of AI not merely crafting images, but designing meaning, context, and conversation around those images. In broader terms, the project advocates a critical human-AI co-design ethos, in which technology augments imagination rather than replacing human interpretation.

D. Limitation

1. Limitations of the Design Methodology

This study employed a single-case design-based research (DBR) framework integrated within a mixed-reality educational setting. While this method allows for a deep, contextual exploration of generative AI as a design mentor, its single-institution focus limits the generalizability of findings. The pedagogical impact and interaction dynamics may vary across different educational cultures, technological infrastructures, or curricula. Furthermore, the iterative design process emphasized exploratory experimentation over rigid validation, which enriches creativity but limits empirical certainty. These methodological boundaries suggest that conclusions should be interpreted as situated insights rather than universal claims.

2. Limitations of Participants and Sampling Scope

The participant group was composed primarily of undergraduate design students from a single university in Indonesia, many of whom were already moderately familiar with digital tools. This demographic concentration may narrow the range of perspectives, particularly regarding cultural or professional responses to AI-augmented design. Additionally, the voluntary nature of participation may have introduced a bias toward students with a more open attitude toward technological experimentation. Future iterations should consider including professionals, educators, and novice learners from multiple regions and design disciplines to widen the interpretive landscape.

3. Instrumentation and Evaluation Constraints

The evaluation of design outcomes relied heavily on observational notes, design artefact documentation, and reflective journal entries. While these qualitative methods offered rich, nuanced insights into the co-creative process, they lack standardization and psychometric validation. No formal quantitative measures (e.g., usability testing scores

or cognitive load metrics) were deployed, which limits the capacity to assess user experience consistency. The open-ended, creative nature of the task further complicated efforts to define universal success metrics, leaving interpretation largely in the hands of researchers and participants. This subjectivity, while aligned with the ethos of human-centered design, may reduce replicability.

4. Technical and Contextual Constraints

The mixed-reality prototype used in the study was developed using commercially available AR tools and generative AI models, all constrained by hardware performance and institutional access. Lag, device compatibility issues, and inconsistent internet connectivity occasionally disrupted the immersive learning experience. The AI models themselves operated within pre-trained parameters, lacking real-time customization to the students' local cultural or linguistic context. Moreover, the design exploration was conducted within the boundaries of an academic semester, limiting long-term tracking of learning outcomes or sustained skill development. These constraints reflect real-world conditions but should be acknowledged when interpreting effectiveness.

5. Impact of Limitations on Interpretation and Transferability

These cumulative limitations methodological, participant-related, instrumental, and technical shape the interpretive boundaries of the findings. While the results reveal compelling potential for AI as a co-mentor in graphic design education, they should be understood as part of a situated narrative rather than a conclusive model. The contextual richness of this case contributes to theoretical insight but may not readily transfer to other institutional or cultural settings without adaptation. Readers are therefore encouraged to view this study as a generative reference for dialogue and future exploration, rather than a prescriptive framework. Continued investigation across broader contexts is necessary to affirm and expand its implications.

E. Future Research and Design Directions

Future research could explore longitudinal engagement with AI mentorship, tracking how students evolve over multiple design cycles and how their understanding of agency and authorship changes over time. Comparative studies across AI platforms could also illuminate how algorithmic aesthetics and cultural bias influence visual outcomes. Further exploration is needed into audience perceptions of how diverse publics read, trust, or critique AI-generated graphics in

contexts such as education, activism, and branding. Cross-disciplinary collaboration among designers, ethicists, educators, and technologists will be vital to crafting more inclusive and critically grounded AI design frameworks. Ultimately, integrating generative AI into community-based, activist, or cultural design projects may yield deeper insights into how visual storytelling can mediate collective agency in the digital age.

CONCLUSION

This study affirms the potential of generative AI as a live design mentor within a mixed-reality pedagogical framework. By integrating AI tools such as Midjourney and DALL-E into reflective studio-based learning, students were not only able to visualize complex concepts but also engage in co-creative processes that redefined their understanding of authorship, aesthetics, and ethical design. The visual outputs, categorized into themes of digital resilience, fragmented pedagogies, and speculative futures, demonstrated how AI could serve as both a catalyst and a collaborator in the formation of critical design thinking. Rather than producing uniform results, the AI-human partnership facilitated diverse, emotionally resonant, and symbolically rich visual narratives aligned with posthuman and speculative design principles.

From a disciplinary perspective, this research contributes to the evolving discourse of graphic design by expanding the role of AI beyond tool or trend into the realm of reflective pedagogy and conceptual provocation. It challenges traditional hierarchies of design authorship, introducing a dialogic model in which machine-generated prompts are not endpoints but provocations for deeper human inquiry. This pedagogical model strengthens the value of ambiguity, iteration, and ethical reflection in visual practice elements that are increasingly relevant in a world where technology and identity are constantly intertwined. The implications stretch into both theory and practice: rethinking how design is taught, how meaning is co-produced, and how future designers might navigate creative processes that are both technologically mediated and deeply human.

Practically, the study provides a framework for embedding AI into design education as a mentor not a substitute for human creativity. The results suggest that when guided by intentional pedagogy and critical frameworks, generative AI can support self-discovery, social critique, and affective expression in design outcomes. For educators and practitioners, this approach invites rethinking curriculum design, incorporating visual storytelling exercises that foreground collaboration with non-human agents. Moreover, it opens up opportunities for interdisciplinary engagement bridging design with AI ethics, speculative fiction, and cultural narratives to foster holistic and socially responsive design learning environments.

Moving forward, future research could explore longitudinal studies that track student development across multiple semesters using similar AI-integrated approaches. Expanding this framework into different cultural contexts, educational levels, and design domains such as UI/UX, motion graphics, or environmental design would enrich our understanding of how generative AI reshapes creative cognition. Additionally, investigating the use of collaborative AI in team-based projects, across disciplines, or in community-based design could further illuminate the social and cultural impacts of AI-augmented creativity. The next frontier lies not in whether AI can design, but in how we design with AI intentionally, ethically, and imaginatively.

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