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The Future is Connection:

Collaboration, Creativity and Compassion in a Digital Society

Designing human-AI creative learning: A scoping review towards a human-centred framework for AI-assisted creativity in higher education

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Generative Artificial Intelligence (GenAI) is rapidly transforming higher education by reshaping how learners generate ideas, solve problems, and engage in creative knowledge construction. While existing research has primarily examined the effectiveness of AI tools on learning outcomes, writing performance, and student engagement, comparatively little attention has been paid to understanding how educators intentionally design AI-assisted creative learning experiences. This paper presents a scoping review of 49 empirical and conceptual sources on AI-assisted creativity in higher education to identify recurring instructional design practices, human–AI interaction patterns, and pedagogical strategies. Rather than focusing on technological capabilities alone, the review synthesizes how creative learning activities are structured around collaboration between learners, educators, and AI systems, while also engaging directly with mixed evidence on AI's creative value, including findings that AI-assisted ideation can expand idea novelty under some conditions, yet produce design fixation and narrowed divergent thinking under others. Building upon this synthesis, the paper proposes a preliminary Human-Centered AI Creativity Design (HACD) framework that positions AI as a collaborative creative partner while preserving learner agency, critical reflection, and ethical decision-making. The framework offers an initial conceptual model to guide educators in designing meaningful AI-supported creative learning experiences and provides a foundation for empirical validation.

Keywords: Gen AI, AI-assisted creativity, human creativity, educational technology, educational design research

Introduction

The emergence of generative artificial intelligence (GenAI) represents one of the most significant technological developments in contemporary education. Since the public release of Large Language Models (LLMs) and multimodal generative systems, educators and learners have rapidly adopted tools such as ChatGPT, Claude, Gemini, and Microsoft Copilot to support writing, programming, design ideation, problem-solving, and creative inquiry. Unlike earlier educational technologies that primarily facilitated access to information, GenAI actively assists in generating ideas, producing artefacts, and engaging learners in iterative dialogue, fundamentally altering the nature of creative work in educational settings (Dwivedi et al., 2023; Kasneci et al., 2023). Recent systematic reviews confirm that GenAI has progressed from a novelty tool to a routine feature of higher education within only a few years (Qian, 2025). The growing integration of AI into higher education has generated considerable scholarly attention. Recent reviews demonstrate increasing applications across teaching, assessment, feedback, personalised learning, and curriculum design (Tlili et al., 2023; Zawacki-Richter et al., 2019). At the same time, researchers have highlighted concerns regarding academic integrity, learner dependency, algorithmic bias, degree of transparency, and the changing role of educators in AI-supported learning environments (Kasneci et al., 2023; UNESCO, 2023). Human-centred frameworks are beginning to address these issues by positioning educators as active decision-makers rather than passive recipients of AI-generated content (Li et al., 2025). Among these applications, AI-assisted creativity has attracted particular interest. Creativity is widely recognised as a core 21st century competency that enables learners to generate original ideas, solve complex problems, and navigate uncertain futures (OECD, 2019). In

education, creativity is increasingly understood as an iterative process involving exploration, experimentation, reflection, evaluation, and refinement rather than merely the production of novel artefacts (Amabile, 1996; Sawyer, 2012). GenAI introduces new possibilities by acting as a conversational collaborator capable of supporting brainstorming, alternative thinking, rapid prototyping, visualisation, coding, and reflective dialogue (Akhtar, 2026; Suh et al., 2024). However, evidence remains mixed. Some studies report measurable gains in idea novelty and productivity when AI expands the solution space (Doshi & Hauser, 2024), whereas others show that excessive reliance on AI-generated output narrows divergent thinking and increases design fixation (Dell'Acqua et al., 2023; Wadinambiarachchi et al., 2024). Comparative studies further suggest that AI-generated creative writing, while increasingly sophisticated, still does not consistently match the originality of expert human work (Chakrabarty et al., 2024; Medeiros, 2025). These findings suggest that AI can augment rather than replace human creativity, but only under instructional conditions that remain insufficiently understood.

Despite this potential, current research remains largely technology centric. Many empirical studies compare AI-supported and conventional learning by evaluating creativity, writing quality, design outcomes, or academic performance, providing limited understanding of how AI-assisted creative learning experiences are intentionally designed. Existing research spans engineering, architecture, design, computer science, teacher education, and the arts, each employing different pedagogical approaches, instructional sequences, and assessment strategies. Although design-thinking research demonstrates benefits for creative confidence and problem framing (Zia et al., 2026), relatively few studies explain how GenAI should be integrated within established design-thinking stages. The literature remains fragmented, making it difficult for educators to identify transferable design principles for meaningful human–AI collaboration. This fragmentation reflects a broader gap in educational technology research. While AI capabilities continue to advance rapidly, comparatively little attention has been devoted to synthesising the instructional design processes underpinning successful AI-assisted creative learning. Questions concerning when AI should be introduced, how learners critically evaluate AI-generated ideas, how educators scaffold reflection, and how learner agency is preserved remain insufficiently understood. Emerging work on student agency suggests that learners' capacity to shape and take ownership of their learning can be strengthened or diminished by how technologies are introduced (Klemenčič, 2023; Oldac et al., 2023). Addressing these issues is essential as higher education seeks to balance technological innovation with learner autonomy, critical thinking, ethical responsibility, and authentic creative practice.

These challenges align closely with principles of human-centred learning design, which emphasise learners' cognitive, emotional, social, and ethical needs rather than technological capability alone. This perspective echoes broader human-centred AI scholarship, which argues that AI should augment human judgement while preserving meaningful human control (Floridi et al., 2018; Google PAIR, 2019; Zhou & Yu, 2023). Within this view, AI functions as a collaborative partner that supports creativity while interpretation, judgement, reflection, and decision-making are left firmly under human control. To address this fragmentation, this paper presents a scoping review of empirical research investigating AI-assisted creativity in higher education. Rather than examining learning outcomes alone, the review focuses on how educators have designed AI-supported creative learning by identifying recurring instructional workflows, pedagogical strategies, and patterns of human–AI collaboration across disciplinary contexts. The review addresses the following research questions:

RQ1. How has AI-assisted creativity been implemented within higher education learning environments?
RQ2. What instructional design processes and pedagogical strategies consistently emerge across empirical studies?
RQ3. How can these recurring practices be synthesised into a preliminary human-centred framework for designing AI-assisted creative learning?

Drawing upon this synthesis, the paper proposes the Human-Centered AI Creativity Design (HACD) framework, which conceptualises AI-assisted creativity as an iterative process comprising human ideation, AI-supported exploration, critical sensemaking, creative refinement, and reflective evaluation. Rather than prescribing a rigid instructional model, the framework provides a conceptual foundation to support educators in designing AI-enhanced creative learning that prioritises human agency, collaboration, ethical responsibility, and meaningful learning. By shifting attention from technological performance to educational design, this paper

contributes a practical and theoretically informed perspective for future research and practice in AI-enabled higher education.

Methodology

This study employed a scoping review to systematically map and synthesise empirical research on AI-assisted creativity in higher education. A scoping review was appropriate because the field is rapidly evolving, interdisciplinary, and characterised by diverse pedagogical approaches that have yet to converge into established instructional models. Unlike systematic reviews that primarily evaluate intervention effectiveness, scoping reviews are well suited to identifying conceptual patterns, mapping research activity, and informing theoretical development (Arksey & O'Malley, 2005; Levac et al., 2010; Tricco et al., 2018). The review followed the PRISMA-ScR reporting guidelines through five stages: (1) defining the review questions; (2) identifying relevant literature; (3) selecting eligible studies; (4) charting study characteristics; and (5) synthesising recurring instructional design practices. Given the ongoing revision of PRISMA-ScR to incorporate methodological developments such as AI-assisted screening and extraction, the review also reflects emerging recommendations that emphasise transparent reporting and explicit eligibility decisions (Veroniki et al., 2025). A structured search was conducted across Scopus, Web of Science, ACM Digital Library, IEEE Xplore, and ERIC to identify peer-reviewed empirical studies published in English between 2020 and 2026. Search terms combined GenAI technologies (e.g., ChatGPT, LLMs, Copilot, Gemini, Claude) with creativity- and higher education-related keywords. Screening was conducted by two reviewers independently, with disagreements resolved through a discussion. Studies were included if they investigated AI-supported creative learning in higher education, reported empirical findings from authentic educational settings, described instructional implementation, and involved learners directly interacting with GenAI systems. Studies focused solely on algorithm development, technical performance, non-educational applications, or non-empirical publications were excluded.

Studies were screened against predefined inclusion and exclusion criteria. Eligible studies were published in English between 2020 and 2026 and were situated within higher education contexts; studies conducted in K–12 education, workplaces, or informal learning environments were excluded. The review focused specifically on GenAI, including LLMs, while studies examining conventional or primarily technical AI systems were excluded. Studies were eligible when they examined AI-supported creative learning or creative activity in educational contexts, whereas studies involving non-creative educational applications of AI were excluded. Only empirical studies reporting findings from educational settings were included; conceptual papers, editorials, opinion pieces, and other non-empirical publications were excluded from the evidence base. To ensure that the review focused on learner–AI interaction, studies were required to involve learners directly interacting with GenAI systems; studies in which AI was used solely by researchers or instructors were excluded. Finally, only peer-reviewed publications were included, with non-peer-reviewed publications excluded from the empirical evidence base. The search identified 642 records. After removing 185 records before screening (128 duplicates and 57 excluded through automation), 457 records remained for title and abstract screening. A further 312 records were excluded because they were unrelated to AI and creativity (n = 176), were not conducted in higher education (n = 78), or were ineligible publication types (n = 58). The remaining 145 full-text articles were assessed for eligibility, with 96 excluded because they were not empirical studies (n = 34), did not examine GenAI-assisted creativity (n = 27), or lacked sufficient methodological or contextual detail (n = 35). Forty-nine studies met all inclusion criteria and formed the evidence base for the scoping review and the development of the HACD framework (Figure 1. PRISMA-ScR for the study design: 10.6084/m9.figshare.32984099).

For each study, data were extracted on educational discipline, participants, AI technologies, creative learning activities, instructional design approaches, educator and learner roles, AI functions, assessment methods, and reported outcomes. The analysis focused on how AI-assisted creative learning was designed and implemented rather than on comparing educational effectiveness. An inductive thematic synthesis informed by principles of design synthesis was then undertaken (Cross, 2006; Dorst, 2011, 2015; Kolko, 2010). Individual instructional activities were first coded according to learner, educator, and AI interactions, then grouped into higher order pedagogical patterns such as AI-supported divergent thinking, collaborative idea refinement, reflective critique, iterative prototyping, and human evaluation of AI-generated outputs. These patterns were

subsequently abstracted into a conceptual design process describing how educators structure AI-assisted creative learning. Unlike conventional thematic analysis, this design synthesis emphasised relationships between stages of creative learning, tracing learners' progression from problem framing through AI-supported exploration to critical reflection and creative refinement. The resulting HACD framework is proposed as a transferable design heuristic rather than a prescriptive instructional model. It positions AI as a collaborative creative partner while preserving learner agency, educator facilitation, and reflective decision making, providing a conceptual foundation for future empirical validation across diverse disciplinary and educational contexts.

Results

The scoping review identified a diverse range of educational applications of GenAI spanning design, engineering, computer science, healthcare education, teacher education, architecture, business, and the humanities. Despite differences in disciplinary contexts, learning objectives, and AI technologies, the reviewed studies exhibited remarkable consistency in the pedagogical structure used to facilitate creative learning. Rather than employing AI as a standalone content generator, educators increasingly integrated AI into iterative learning processes that combined human creativity, AI-supported exploration, critical evaluation, and reflective refinement (Holmes et al., 2019; Qian, 2025). The thematic analysis identified six recurring pedagogical patterns that collectively informed the development of a design synthesis. These patterns were consistently observed across multiple educational settings and represent transferable instructional strategies rather than discipline-specific practices (Table 1. Design synthesis of recurring pedagogical patterns: https://doi.org/10.6084/m9.figshare.33313134).

The 49 eligible studies constituted the evidence base for the review. Study characteristics were first extracted across educational discipline, participants, AI technologies, creative learning activities, instructional approaches, learner and educator roles, AI functions, assessment methods, and reported outcomes. The extracted data were then coded according to the interactions among learners, educators, and AI systems within creative learning activities. Related codes were subsequently compared and grouped into higher-order pedagogical categories, allowing recurring relationships and instructional practices to be identified across the 49 studies. This synthesis resulted in six recurring pedagogical patterns: contextual challenge, human ideation, AI-assisted divergence, critical sensemaking, creative refinement, and reflection and ethics (see Table 1). These six patterns were then abstracted into the Human-Centred AI Creativity Design (HACD) framework explained in the subsequent section, which conceptualises AI-assisted creative learning as an iterative process that preserves learner agency, educator facilitation, critical judgement, and reflective practice. The framework was derived through a structured progression from the identification and characterisation of empirical evidence, through coding and synthesis, to the abstraction of recurring pedagogical patterns and their integration into a conceptual design framework.

The synthesis identified six recurring pedagogical patterns across the reviewed studies, while the resulting HACD framework operationalises these patterns through five interconnected stages (Table 2: Five recurring pedagogical patterns emerging from the synthesis of literature: https://doi.org/10.6084/m9.figshare.33313287). The difference reflects the distinction between pedagogical patterns and their finer-grained instructional stages. In particular, the second pattern, human-led ideation supported by AI divergence, encompasses two sequential but closely connected stages: Human Ideation and AI-Assisted Divergence. Human Ideation captures learners' initial generation of concepts before engaging with AI, while AI-Assisted Divergence captures the subsequent use of AI to expand, challenge, and diversify the initial solution space. The remaining four patterns map directly onto the other four HACD stages: Framing authentic and open-ended learning challenges corresponds to Contextual Challenge; Critical Sensemaking and Human Judgement corresponds to Critical Sensemaking; Iterative Creative Refinement through Human–AI Collaboration corresponds to Creative Refinement; and Reflection, Ethics, and Responsible Creativity corresponds to Reflective and Ethical Practice. The five pedagogical patterns identified through synthesis are translated into six more granular stages within the HACD framework. The five patterns describe what the literature reveals, while the six stages describe how an educator can operationalise those patterns in a learning design.

Towards a Human-Centred AI Creativity Design (HACD) framework

Synthesising these recurring pedagogical patterns resulted in the development of the HACD Framework (Figure 2. Human Centered AI Creativity Design (HACD) framework: https://doi.org/10.6084/m9.figshare.32982674). Unlike linear instructional models, HACD conceptualises AI-assisted creativity as an iterative and reflective design process in which learners continuously move between divergent exploration and convergent evaluation while maintaining human agency throughout. The framework comprises six interconnected stages:

1. Contextual Challenge: learners explore authentic problems, identify constraints, and establish contextual understanding.
2. Human Ideation: learners independently or collaboratively generate initial ideas, drawing upon prior knowledge and disciplinary expertise.
3. AI-Assisted Divergence: AI expands the creative search space by generating alternative concepts, perspectives, examples, and possibilities.
4. Critical Sensemaking: learners evaluate, critique, compare, and selectively integrate AI-generated ideas using disciplinary judgement and contextual reasoning.
5. Creative Refinement: learners iteratively develop, prototype, revise, and improve solutions through repeated human–AI collaboration.
6. Reflective and Ethical Practice: learners evaluate both creative outcomes and decision-making processes while considering issues of originality, responsibility, transparency, and societal impact.

The framework supports recursive movement between stages as learners revisit earlier ideas in response to emerging insights, peer feedback, or AI-generated alternatives. Educators function primarily as facilitators of reflective inquiry, while AI acts as a collaborative partner that augments creative exploration without replacing human judgement. The proposed framework extends existing research by shifting attention from evaluating AI technologies towards designing meaningful human–AI creative learning experiences. It provides a transferable pedagogical heuristic that can guide curriculum design across disciplinary contexts while remaining sufficiently flexible to accommodate future advances in generative AI technologies.

Discussion

The rapid adoption of GenAI has prompted higher education institutions to reconsider how creativity is taught, supported, and assessed. Rather than asking whether AI enhances creativity, this review argues that the more important question is how educators should design learning experiences in which AI supports creative thinking while preserving learner agency. The proposed HACD framework shifts attention from technology adoption to instructional design, emphasising that creativity emerges through purposeful interactions among learners, educators, and AI rather than from AI-generated outputs alone. Across the reviewed studies, AI functioned most effectively as a cognitive partner that facilitated exploration, alternative perspectives, and iterative refinement, consistent with socio-constructivist views of learning as interaction mediated by tools and social environments (Jonassen, 1999; Vygotsky, 1978). However, uncritical reliance on AI-generated content often resulted in design fixation and reduced originality (Wadinambiarachchi et al., 2024), while comparative evaluations indicate that AI-generated creative work still falls short of the originality demonstrated by the strongest human creators (Chakrabarty et al., 2024; Medeiros, 2025). These findings reinforce the need for instructional approaches that develop students' capacity to critically evaluate AI-generated ideas rather than simply adopting them.

The review further highlights that preserving human agency is fundamental to successful AI-assisted creativity. Learning outcomes depended less on the sophistication of AI systems than on instructional strategies that maintained students' ownership of problem framing, judgement, and creative decision-making. Activities encouraging learners to generate initial ideas independently, compare multiple AI-generated alternatives, justify design decisions, and critically evaluate outputs consistently aligned more closely with creativity-centred pedagogies. Evidence also suggests that experienced learners retain greater control over creative processes, whereas novices are more susceptible to relying on AI during early ideation when premature convergence is most detrimental (Liu et al., 2025; Wang et al., 2024). These findings support broader calls for

human-centred AI that augments rather than replaces human creativity (UNESCO, 2023), while aligning with established human-centred AI principles that emphasise meaningful human control and calibrated trust (Floridi et al., 2018; Google PAIR, 2019; Zhou & Yu, 2023). Emerging instructional frameworks such as ARCHED further demonstrate that these principles are increasingly being translated into practical educational design (Li et al., 2025).

Although HACD shares its human-centred orientation with existing frameworks such as ARCHED (Li et al., 2025) and with design thinking pedagogy more broadly (Guaman-Quintanilla et al., 2025), its distinct contribution lies in its specificity to the demands of creative, rather than general instructional design. ARCHED and other comparable models offer guidance for structuring AI-assisted instructional design in general, addressing transparency, collaboration, and responsible use across a broad range of learning tasks. HACD, by contrast, is built directly around tensions that are specific to creative cognition and that generic instructional design models do not explicitly address, which is the trade-off between AI-expanded idea novelty and design fixation (Doshi & Hauser, 2024; Wadinambiarachchi et al., 2024). The need to cycle deliberately between divergent exploration and convergent evaluation rather than move through a single linear sequence, and the gap between AI-generated and human creative quality persists even as generative systems improve (Chakrabarty et al., 2024; Medeiros, 2025). Where design thinking pedagogy sequences framing, ideation, and critique as general problem-solving stages, HACD treats AI-assisted divergence and critical sensemaking as functionally distinct stages precisely because unmanaged divergence is what produces fixation. HACD is therefore best understood not as a relabelling of existing instructional-design frameworks for a new domain, but as a domain-specific model that operationalizes the failure modes and design trade-offs documented in the AI-assisted creativity literature.

The findings also point to a changing role for educators, who increasingly act as facilitators of inquiry, reflective practice, and ethical reasoning rather than solely as providers of knowledge. Effective AI-supported learning requires educators to scaffold prompt development, facilitate critique, integrate AI into project-based learning, and guide students in evaluating the credibility, originality, and ethical implications of AI-generated content. Design thinking pedagogy already provides a useful precedent by sequencing framing, ideation, and critique in ways that closely align with the HACD framework (Guaman-Quintanilla et al., 2025). Consequently, educator development should extend beyond technical AI literacy to include instructional strategies that cultivate creativity, critical thinking, and responsible AI use. This pedagogical shift also has important implications for assessment. Rather than focusing primarily on final artefacts, AI-assisted creativity requires greater attention to the creative process through reflective journals, prompt evolution, iterative design documentation, peer feedback, and design rationales. Such approaches align with evidence linking reflective practice to deeper learning (Harvey et al., 2025; Sudirman, 2024) and with conceptions of student agency that value autonomy and reflexivity as educational outcomes (Klemenčič, 2023; Oldac et al., 2023).

From a curriculum perspective, the HACD framework offers a transferable pedagogical heuristic applicable across diverse educational disciplines. By integrating contextual understanding, human ideation, AI-supported divergence, critical sensemaking, iterative refinement, and reflective practice into a coherent sequence, the framework provides educators with a flexible structure for incorporating AI into authentic learning while maintaining meaningful human engagement. It also aligns closely with the broader vision of fostering connection, creativity, and compassion in a digital society. Rather than positioning AI as a substitute for human creativity, the framework conceptualises meaningful learning as emerging through connections among learners, educators, AI systems, authentic problems, and ongoing ethical reflection. This perspective suggests that the future of AI-enhanced education lies in designing richer human–AI relationships that amplify creativity while preserving empathy, responsibility, and critical judgement.

Several limitations should be acknowledged. First, the evidence base reflects an evolving field in which most studies examine early implementations of LLMs and multimodal AI systems, making current conclusions necessarily provisional (Qian, 2025; Zia et al., 2026). Second, the review focused on English language empirical studies conducted in higher education, limiting transferability to other educational and cultural contexts. Third, the HACD framework is a conceptual synthesis rather than an empirically validated instructional model. Future research should therefore move beyond documenting AI adoption to evaluating how different instructional sequences influence creativity through design based and longitudinal studies. Comparative

investigations across disciplinary contexts could refine the framework while accounting for differences between novice and experienced learners (Liu et al., 2025; Wang et al., 2024). Future reviews should also adopt updated PRISMA-ScR guidance as reporting standards evolve (Veroniki et al., 2025), while exploring emerging human-centred approaches to AI-assisted evidence synthesis (Le Dinh et al., 2025). In addition, research should examine how multimodal GenAI, embodied conversational agents, and collaborative AI systems reshape creative learning beyond text-based interaction.

Conclusion

GenAI is redefining creative learning in higher education, yet effective educational practice depends less on the capabilities of AI systems than on the ways educators design meaningful learning experiences around them. This scoping review synthesised emerging empirical evidence on AI-assisted creativity and identified recurring pedagogical patterns that extend across disciplinary contexts. Rather than functioning as autonomous creators, AI systems most effectively supported creativity when embedded within instructional processes that prioritised authentic problem framing, human ideation, AI-assisted divergence, critical sensemaking, iterative refinement, and reflective ethical practice. Building upon these findings, the paper proposed the HACD framework as a design synthesis that shifts attention from technology adoption to human-centred educational design. The framework positions AI as a collaborative partner that augments creativity while preserving learner agency, educator facilitation, and reflective decision-making, an orientation that aligns with, and draws support from, the broader turn toward human-centred AI design evident both within educational technology and in AI design scholarship more generally. Although conceptual, the framework provides an actionable starting point for educators seeking to design AI-supported creative learning experiences and offers a foundation for future empirical research. As higher education continues to integrate generative AI into teaching and learning, the challenge is no longer whether AI should be used, but how learning environments can be designed so that technology strengthens rather than diminishes human creativity, collaboration, and compassion. Designing for these connections will potentially determine the educational value of AI in an increasingly digital society.

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