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Generative AI in Design Thinking Pedagogy: Enhancing Creativity, Critical Thinking, and Ethical Reasoning in Higher Education

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Abstract

This study investigates how generative AI (GenAI) integration within Design Thinking pedagogy transforms undergraduate students' creativity, critical thinking, and ethical reasoning. Using mixed methods analysis of 112 student reflections from a 12-week course, we examined experiences with GenAI tools such as ChatGPT and DALL·E across Design Thinking's five stages. Thematic analysis revealed four key themes: Perceived Benefits (enhanced creativity and accessibility), Ethical Concerns (bias and authorship ambiguity), Hesitance & Acceptance (evolution from scepticism to strategic adoption), and Critical Validation (development of epistemic vigilance). Sentiment analysis showed 86% positive responses, though ethical concerns generated significant negative sentiment (62%). Findings demonstrate that GenAI, when pedagogically scaffolded, augments rather than replaces human judgment. Students evolved from passive users to critical evaluators, developing strategies for bias detection and source validation. The study challenges traditional cognitive taxonomies and calls for reimagining AI literacy as a multidimensional competence encompassing creativity, ethics, and critical reasoning essential for navigating AI-mediated learning environments.

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Practitioner Notes

1. Educators should treat GenAI as a co-creator in the learning process, not just a productivity tool, to support deeper student engagement.
2. Critical thinking with GenAI requires teaching students to evaluate, question, and verify outputs rather than passively accept them.
3. Embedding GenAI in Design Thinking pedagogy can enhance creativity and ethical reasoning when scaffolded with reflective and team-based learning.
4. AI tools must be introduced with discussions on algorithmic bias and ownership to prevent ethical blind spots in student learning.
5. Faculty development should focus on equipping educators to design GenAI-integrated learning environments that promote agency, not automation.

Keywords

Generative Artificial Intelligence (GenAI), Design Thinking Pedagogy, Creativity and Critical Thinking, Ethical Reasoning, Constructivist Learning Theory

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Introduction

The rapid growth of generative artificial intelligence (GenAI) tools such as ChatGPT and DALL·E has created significant changes in higher education. These technologies offer new opportunities to increase access to creativity, speed up idea generation, and support complex problem-solving tasks (Berg et al., 2023). However, their integration into teaching environments creates tensions between efficiency and educational integrity. For educators, the challenge involves adjusting teaching strategies to maintain the cognitive and ethical standards of learning while incorporating these new tools. GenAI's ability to produce text, code, and visuals has changed educational work, particularly in subjects that focus on creativity, critical reasoning, and design thinking. Many scholars and educators worry that students' growing dependence on GenAI may weaken essential cognitive skills such as argumentation, synthesis, and ethical reasoning (Zhai et al., 2024; Lee et al., 2025). Rather than replacing these skills entirely, GenAI appears to reshape them. It moves critical thinking from problem-solving to response integration, and from idea generation to task management. This change reflects broader automation trends where users shift from execution to supervision roles (Lee et al., 2025).

This shift represents a cognitive change in how students interact with knowledge. Instead of practising intellectual independence, many students now work with GenAI outputs as editors and curators (Verhoeven & Rana, 2023b). They verify responses, refine prompts, or apply AI-generated content with limited examination (Lee et al., 2025). Over time, such practices may reduce deep learning and increase automation bias, especially among learners with low confidence in the subject matter (Zhai et al., 2024; Baker & Hawn, 2022). Additionally, biases in training data risk strengthening dominant knowledge systems while marginalising non-Western or Indigenous ways of knowing (Rana, 2024). These educational challenges occur within outdated teaching structures that emphasise standardisation, content mastery, and pre-digital skills. Traditional learning environments, designed for one-way knowledge transmission, struggle with dynamic, multimodal, and interactive AI tools. In contrast, the constructivist approach underlying design thinking offers a flexible framework. Based on experiential learning theory (Kolb & Kolb, 2005), design thinking positions students as active participants who generate ideas, repeat processes, and empathise within real-world contexts (Brown, 2008; Carlgren et al., 2016). When combined with GenAI tools, this teaching model can potentially enhance rather than replace student agency, provided proper safeguards are established.

However, integrating GenAI into design thinking pedagogy requires careful consideration. It carries risks of introducing algorithmic opacity, data colonialism, and cultural standardisation. For example, while DALL·E may speed up prototyping during the ideate phase, its training data often reflects Eurocentric aesthetics. This sidelines Indigenous knowledge systems and maintains Western design standards (Rana, 2024). Similarly, ChatGPT's apparent fluency can encourage students to skip ethical consideration or critical examination, particularly when its biases remain hidden (Baker & Hawn, 2022). Our conceptual framework uses constructivist principles, drawing from Vygotsky's (1978) social development theory, Kolb's experiential learning model (Kolb, 1984), and Dewey's pragmatist view of education as reflective action (Dewey, 1933). In the design thinking process (empathise, define, ideate, prototype, and test), each phase provides opportunities where GenAI can be used not just for output, but as a partner in inquiry, critique, and value formation. For instance, the empathise phase may benefit from GenAI-assisted persona generation yet requires educators to address ethical concerns about representational bias and data sources (Carlgren et al., 2016; Rana, 2024). Rather than treating GenAI as a neutral productivity tool, we view it as a contested socio-technical factor whose capabilities must be critically managed.

The aim is not to automate human creativity but to enhance it through structured AI-human collaboration. This requires teaching designs that develop AI literacy alongside ethical reasoning and reflective judgement (Zhai et al., 2024). Our study uses a mixed-methods approach, including thematic and sentiment analysis of student reflections, to capture both the cognitive changes and emotional responses that shape students' interactions with GenAI across the design thinking process. This study responds to these pedagogical and epistemological challenges by embedding GenAI tools within a design thinking curriculum and asking: How does GenAI reshape creativity, critical thinking, and ethical reasoning across the stages of design thinking? What pedagogical safeguards can help reduce risks such as automation bias or cultural standardisation? By exploring how GenAI changes creativity, critical thinking, and ethics within a human-centred pedagogy, this research offers practical insights for educators, instructional designers, and institutional leaders seeking to prepare higher education for both technological opportunities and epistemological challenges.

Literature

Theoretical Framework

Design thinking, a human-centred methodology developed by Brown (2008), and constructivist learning theory (Kolb & Kolb, 2005) together form the theoretical foundation of this study. Their combination is particularly relevant in the context of generative artificial intelligence (GenAI), where structured creativity must be grounded in experiential, learner-driven processes. Design thinking provides a structured, iterative model for engaging with real-world challenges, while constructivism emphasises the learner's role as an active creator of knowledge. Together, they position GenAI not simply as a tool, but as an integrated component in a dynamic learning environment that supports both creative and critical thinking development.

Design thinking's five stages (empathise, define, ideate, prototype, and test) put constructivist principles into practice. Rather than receiving information passively, students learn through a cycle of doing, reflecting, and iterating (Doorley et al., 2018). Constructivism suggests that knowledge develops through reflective engagement with one's environment (Piaget, 1936; Vygotsky, 1978), a theory that closely matches with the design process. The empathise stage requires students to understand stakeholder needs by adopting their perspectives. This phase develops moral reasoning and socio-technical awareness through direct engagement with real-world contexts. Carlgren et al. (2016) found that engineering students working on empathy-driven design challenges developed a better understanding of ethical and contextual complexities, reinforcing constructivist goals of social learning and critical inquiry by connecting abstract concepts to lived experiences. The empathise stage, therefore, serves as a foundation for ethical reasoning that continues throughout the design process. Students often struggle initially with stepping outside their assumptions, but this discomfort becomes productive as they learn to see problems from multiple perspectives.

The define stage requires students to clarify the problem space through reflective analysis. This mirrors Schön's (1992) concept of the reflective practitioner, where problem formulation emerges from dialogue between experience and theory rather than following a linear path. Students learn to question assumptions and reframe challenges, which enhances their critical thinking capacity. During the ideate phase, GenAI tools most commonly enter the design process. Students can use brainstorming with ChatGPT to broaden their creative boundaries and explore possibilities beyond their initial thinking. However, this phase requires careful pedagogical guidance to ensure that AI assistance enhances rather than replaces creative thinking. Students must learn to evaluate AI-generated ideas critically and integrate them with their insights. The challenge lies in maintaining creative ownership while leveraging AI capabilities. Some students become overly dependent on AI suggestions, while others reject them entirely, missing opportunities for enhanced creativity.

The prototype stage allows GenAI to accelerate experimentation. DALL·E, for example, helps visualise concepts quickly, enabling students to test ideas rapidly without high material costs (Verhoeven & Rana, 2023). This form of low-stakes iteration teaches adaptability and encourages risk-taking. The test stage brings reflection full circle by engaging students with feedback, failure analysis, and design refinement. Kolb's (1984) experiential learning cycle, comprising concrete experience, reflective observation, abstract conceptualisation, and active experimentation, is clearly embodied in this phase. The act of testing and refining closes the learning loop and supports metacognitive growth. Students develop the ability to learn from failure and use feedback constructively, though many initially resist negative feedback and view failure as a personal shortcoming rather than a learning opportunity. This stage ensures that learning extends beyond the immediate project to develop transferable skills for future challenges. Constructivism enhances design thinking by emphasising collaboration and context as essential elements of learning. Vygotsky's (1978) social development theory suggests that peer interaction is crucial to learning, and this principle is actively realised in group-based design thinking projects. The social dimension of constructivist learning helps students develop communication skills and appreciate diverse perspectives.

Generative Artificial Intelligence

The proliferation of generative AI (GenAI) technologies in educational contexts has catalysed a re-examination of foundational pedagogical constructs, particularly creativity, critical thinking, and ethical reasoning. Creativity, traditionally regarded as a human-centred process of ideation, synthesis, and novelty, is being fundamentally reconfigured through GenAI-supported platforms. Generative tools like ChatGPT and DALL·E enable rapid content generation across modalities, including text, image, and code, raising critical questions about the locus of creativity in co-production processes. According to Vhatkar et al. (2024), GenAI fosters divergent thinking and supports multimodal creative tasks such as writing, music composition, and digital art, particularly in collaborative and project-based learning environments. However, creativity in these contexts becomes entangled with automation bias and algorithmic normativity, whereby the originality of student outputs risks being supplanted by stylistically fluent but epistemologically shallow content. Lee et al. (2025) identify a shift from creative ideation to response integration, suggesting that students increasingly engage with GenAI as curators rather than creators. They note that task confidence significantly mediates this shift, where students with lower confidence tend to offload ideation to AI, while those with higher confidence engage in more critical and creative refinements of AI outputs. These observations are reinforced by empirical work on progressive prompting methods, which indicate that structured interaction with GenAI can scaffold foundational conceptual mastery while maintaining learner agency. In particular, Li et al. (2025) found that the

GenAI-supported progressive prompting (PP) model facilitated learner creativity by sequencing prompting, verification, and reflective engagement, thus enhancing both personalisation and metacognitive awareness in content creation.

Critical thinking, a cornerstone of constructivist pedagogy, is undergoing a transformation in GenAI-mediated environments. Traditionally conceptualised through Bloom's taxonomy as encompassing analysis, synthesis, and evaluation (Lee et al., 2025), critical thinking now involves new cognitive demands such as AI content verification, task stewardship, and bias detection. Lee et al. demonstrate that while GenAI reduces the cognitive burden of recall and synthesis, it simultaneously requires new forms of evaluative oversight. Users must assess the relevance, coherence, and ethical validity of AI-generated outputs, a skillset distinct from traditional problem-solving. Nonetheless, the risk of cognitive complacency remains acute. Empirical findings show that increased trust in GenAI correlates with decreased critical engagement, particularly when tasks are perceived as low-stakes or outside one's professional scope (Lee et al., 2025). Moreover, Baker and Hawn (2022) caution that automation may subtly displace critical judgment, especially in repetitive tasks or environments with ambiguous accountability structures. These concerns resonate with critiques from the critical pedagogy tradition, which warn against the instrumentalisation of education for neoliberal ends. As Burbules and Berk (1999) argue, critical thinking should not only be about skill acquisition but must involve ideological critique and action-oriented learning. This view shifts the pedagogical emphasis from internal cognitive strategies to social transformation, positing that students should be trained not merely to evaluate arguments but to interrogate the socio-political forces embedded in educational technologies.

GenAI's integration into Design Thinking pedagogy offers a promising yet contested frontier for addressing the above dilemmas. Design Thinking's iterative model, empathise, define, ideate, prototype, test, aligns well with constructivist and experiential learning theories (Kolb & Kolb, 2005; Carlgren et al., 2016). When appropriately scaffolded, GenAI can augment each phase. For example, AI-assisted persona generation can enhance empathy-building; automated image generation can accelerate prototyping; and chat-based ideation tools can diversify problem framing (Verhoeven & Rana, 2023). However, these affordances also risk embedding epistemic bias into student cognition. As Rana (2024) observes, AI tools trained on predominantly Western datasets often reproduce Eurocentric aesthetics and marginalise Indigenous or non-Western epistemologies, especially during the ideate and prototype stages. This highlights the necessity for epistemic vigilance and the intentional design of curriculum that interrogates the cultural provenance of AI outputs. Carlgren et al. (2016) further emphasise that the empathise stage, when supported by GenAI, demands heightened attention to ethical representation. While AI-generated personas can broaden student perspectives, they also risk essentialising or stereotyping identities if the training data lacks representational depth. Thus, pedagogy must not merely adopt AI tools but embed ethical reasoning and bias awareness within every stage of the design process.

The literature also highlights the ethical terrain of AI in education. Baker and Hawn (2022) provide a comprehensive taxonomy of algorithmic bias in education, distinguishing between statistical, societal, and design-based sources of inequity. Their review shows that algorithmic harms are often amplified in educational systems that rely heavily on predictive modelling for assessments, admissions, or instructional personalisation. Moreover, concerns around data colonialism, privacy, and lack of transparency have been raised across multiple sources. For instance, the bibliometric analysis by Vhatkar et al. (2024) calls for robust governance frameworks to ensure AI is used equitably across socio-demographic groups and does not replicate historical injustices in new technological forms. Rana and Azeez (2025) introduce the concept of Indigenous data sovereignty as an ethical and epistemic imperative in higher education. They argue that without confronting colonial legacies in data governance, GenAI will reproduce extractive knowledge practices that marginalise First Nations people. Their work challenges educators to embed Indigenous knowledge systems and data governance protocols into GenAI curricula, not as peripheral add-ons, but as central to decolonial pedagogy. To mitigate these risks, ethical AI literacy must be treated not as a technical add-on but as a core curricular objective. This includes not only teaching students how to use GenAI but also why and when to challenge its outputs, an epistemological stance deeply rooted in critical pedagogy and constructivist reflection.

Method

Context

This study was conducted within a 12-week undergraduate Design Thinking course at a metropolitan Australian university. The course was designed to explore how generative AI (GenAI) tools could be embedded within human-centred design pedagogy to cultivate creativity, critical thinking, and ethical reasoning. A total of 112 students participated, drawn from business (60%, n = 67), education (19%, n = 21), law (12%, n = 13), and interdisciplinary programs (9%, n = 11). None of the students had prior formal training in Design Thinking or GenAI, which provided a relatively consistent baseline for observing how students engaged with the technology throughout the course. The curriculum was structured around the five stages of the Design Thinking framework (Brown, 2008): Empathise, Define, Ideate, Prototype, and Test, with specific GenAI tools integrated at each phase. These tools were not simply used to replace traditional activities but were purposefully incorporated to support and provoke student inquiry, allowing for experimentation and reflection across both individual and team-based tasks. Table 1 outlines how GenAI tools were positioned in relation to each stage and their pedagogical function.

Table 1

GenAI Integration in Design Thinking Stages

Stage	GenAI Tool	Pedagogical Purpose
Empathise	ChatGPT	Simulate stakeholder personas; enhance empathy
Define	AI Summarisation	Identify pain points; refine problem statements
Ideate	DALL·E, ChatGPT	Generate diverse concepts; stimulate creativity
Prototype	DALL·E	Visualize ideas; accelerate iteration
Test	AI Analytics	Analyse feedback; inform refinements

Paradigm

This study adopted a mixed-methods approach guided by a constructivist epistemology to investigate the impact of generative AI (GenAI) integration within design thinking pedagogy on undergraduate students' creativity, critical thinking, and ethical reasoning. The chosen methodology integrated inductive thematic analysis with computational sentiment analysis, emphasising transparency, rigour, and contextual relevance. The study utilised 112 anonymised reflective entries from students enrolled in a 12-week undergraduate design thinking course. Participants responded to structured reflective prompts designed to provoke detailed insights regarding their experiences with GenAI tools. The prompts included: "How did GenAI tools challenge or enhance your creativity?", "Describe an ethical dilemma you encountered while using AI, and how you resolved it", and "What critical thinking strategies did you apply to evaluate AI-generated content?".

Analysis

The qualitative analysis employed Braun and Clarke's (2006) established six-phase framework for thematic analysis due to its systematic yet flexible capacity for capturing nuanced meanings. Two researchers conducted the analytical process through iterative immersion in the data corpus, working independently to ensure rigour. NVivo 14 software facilitated systematic coding, code tracking, and thematic development throughout the analysis process. Initial coding was performed inductively, identifying preliminary conceptual categories such as AI-aided ideation, ethical dilemmas, and strategies for validating AI outputs. The researchers met regularly for peer debriefing sessions with two independent analysts to support thematic refinement and ensure intersubjective verification. Consensus was established to resolve interpretative discrepancies, reinforcing thematic robustness and coherence. Intercoder reliability was assessed using Cohen's Kappa statistic on a representative 20% subsample of reflections ($n = 22$), yielding $\kappa = 0.82$, thus confirming high reliability (Campbell et al., 2013). The identified themes underwent systematic cross-validation against constructivist theory and relevant prior literature to ensure theoretical contextualisation and validity. This process helped connect emerging themes to established educational frameworks while maintaining sensitivity to novel insights that emerged from the student experiences.

To quantitatively capture emotional valence, sentiment analysis was implemented using a structured, rigorous analytical protocol. Preprocessing standardised the textual data by converting all text to lowercase, removing punctuation, and eliminating stopwords using the Natural Language Toolkit (NLTK) English corpus (Bird et al., 2009). Lemmatisation was applied to ensure semantic consistency, effectively reducing word variations to their root forms (Porter, 1980). DistilBERT (Sanh et al., 2019) was selected for its computational efficiency and demonstrated effectiveness on textual data from educational contexts. To ensure the model could accurately detect sentiment in student reflections about generative AI, it was fine-tuned using a pre-existing training dataset of 1,000 student reflections from analogous educational environments where students had reflected on technology use in learning. This training dataset was entirely separate from our study data and was used exclusively for model training purposes, not as part of the 112 reflections analysed in this study. After fine-tuning, the model was applied to classify sentiment in our dataset of 112 student reflections. Model performance was validated through 5-fold cross-validation, yielding an accuracy rate of 89% and an F1 score of 0.85, ensuring methodological soundness and reliability.

Textual sentiment was classified into positive, negative, or neutral categories using predefined softmax probability thresholds: positive sentiment (≥ 0.65), negative sentiment (≤ 0.35), and neutral sentiment (0.35 < sentiment < 0.65). These thresholds were established based on benchmark standards in sentiment analysis literature (Jurafsky & Martin, 2023). Two validation strategies ensured the accuracy and reliability of the sentiment analysis. Manual coding was independently conducted on a subsample of 100 excerpts, demonstrating an 88% concordance rate with DistilBERT classifications. Additional consistency checks were performed using the established VADER lexicon (Hutto & Gilbert, 2014), providing further assurance against algorithmic biases and misclassifications.

Results

Thematic analysis of 112 student reflections revealed four central themes, each elucidating distinct dimensions of generative AI (GenAI) integration within the Design Thinking pedagogy. These themes, Perceived Benefits, Ethical Concerns, Hesitance & Acceptance, and Critical Validation, were triangulated with sentiment analysis, which quantified emotional valence (86% positive, 13% negative, <1% neutral). Below, we define each theme, detail its prevalence, and present exemplar narratives to contextualise findings.

Perceived Benefits of GenAI in Learning

The most frequently occurring theme (n=94) reflected students' recognition of GenAI as a tool that enhanced creativity, broadened ideation, and increased accessibility to design practices they may have otherwise struggled to engage with. While the overall sentiment was strongly positive (86%), the reflections reveal a spectrum of nuanced and critically informed experiences. These experiences were shaped not just by disciplinary training or digital fluency, but by how students reconceptualised their own creative agency in relation to AI.

Across disciplines, many students positioned GenAI as a catalyst for divergent thinking and idea generation, particularly during the ideation stage of the Design Thinking process. One design student noted, "ChatGPT pushed me beyond my usual ideas. It suggested sustainable materials I'd never considered for our urban design project" (DES-9). Here, the student frames GenAI as extending their cognitive reach, prompting novel thinking rather than simply providing answers. The notion of "pushing beyond" resonates with Vygotsky's (1978) concept of the Zone of Proximal Development, wherein learners achieve more with mediated tools than alone. Notably, the student maintains ownership over the output; what is augmented is possibility, not authorship. Students from other disciplines echoed similar views, with emphasis on empowerment and accessibility. One student shared, "I think the introduction to AI support in this course was fantastic, and this topic deserves to be shared more widely across the entire university. AI can help students find the confidence they need to get through their topic" (EDU-21). This comment reveals how GenAI was experienced not just as a functional tool but as an affective partner, bolstering students' self-efficacy and reducing the intimidation of academia. The call for wider institutional adoption also reflects the perception that GenAI can help democratise access to complex tasks, particularly for students lacking confidence in their creative or linguistic capabilities.

However, the benefits of GenAI were rarely seen as automatic. Students repeatedly emphasised the need for intentional and reflective engagement. As one student from education described, "I use ChatGPT to benefit my understanding and skills while being able to engage in divergent thinking, which I feel has been valuable to experience." (EDU-1). This reflection points to self-directed learning and the development of metacognitive awareness. Rather than outsourcing thought to the tool, the student describes how their skills were extended through purposeful interaction with AI. The perceived value of GenAI lies not in its outputs alone, but in how it facilitates the student's internal cognitive processes. Crucially, students also reflected on the limits of GenAI and the risks of cognitive over-reliance, adding critical nuance to otherwise positive sentiment. For example, "DALL·E gave us an image to start with, but it wasn't enough. We still had to think critically about how that image matched the user needs we defined" (BUS-30), and "Using ChatGPT was like having another team member. But sometimes it led us off track with too many irrelevant ideas we had to figure out how to filter" (EDU-10).

These insights reveal that students were not passive recipients of GenAI output. Instead, they assumed the role of evaluators and editors, treating AI-generated suggestions as raw material that required contextual refinement. The metaphor of GenAI as "another team member" suggests that students developed a relational model of collaboration, one that preserved human judgment at the centre of the process. The theme of "Perceived Benefits" highlights a pattern of emergent cognitive partnerships where learners did not simply use AI but engaged with it in dynamic and recursive ways. The benefits of GenAI were most deeply felt when students were positioned as co-creators and when the tool was scaffolded through pedagogy that encouraged judgement, creativity, and critical reflection. These findings emphasise that GenAI's potential in learning is not in replacing human capability, but in activating and amplifying it if, and only if, students remain epistemically engaged and pedagogically supported.

Ethical Concerns

Ethical concerns surfaced in 66 student reflections (59%) and were marked by considerable moral complexity and introspective depth. While 62% of reflections expressed negative sentiment, this was not rooted in rejection of GenAI per se but in students' active engagement with questions of bias, authorship, and accountability. These dilemmas were not abstract; they were woven into students' reflections on their own practice, raising critical questions about the values underpinning GenAI and their implications for education, design, and society. A central concern was algorithmic bias, especially the replication of historical and cultural stereotypes. One education student reflected, "DALL·E kept generating male engineers and female nurses. It made the team question about the biases of AI we are feeding it" (EDU-17). This comment reveals the student's recognition of not only the AI model's biased outputs, but also their own participation in shaping those outputs through their prompts. The phrase "about the biases of AI we are feeding it" reflects a growing awareness of how AI systems are trained on societal assumptions and how users, consciously or not, may reinforce them. This aligns with Noble's (2018) critique of algorithmic oppression and suggests an emergent understanding of AI as a socio-technical system, not a neutral tool.

Ethical unease also manifested around the issue of intellectual ownership and authorship, particularly in team-based assessment contexts. A law student described, "Who owns the ideas if AI helps? Our group debated this after ChatGPT drafted our proposal" (LAW-08). This quote highlights the epistemic ambiguity introduced by co-creating with AI. The act of debating ownership reveals not just legal uncertainty, but also a deeper pedagogical tension of how learners claim authorship in collaborative human-machine settings. The fact that this prompted group-level discussion highlights the distributed nature of ethical reasoning in GenAI-enhanced learning environments, where boundaries between creator, collaborator, and tool become increasingly blurred. This was especially seen in the reflections of law students. For instance, another law student described, “My team read an article in the newspaper that someone was sued in America for presenting ChatGPT work as their own, and they argued that they had the right to own their work as they were the ones who skillfully prompted the outcome, which is very confusing, who really owns the outcome of ChatGPT” (LAW-13)?

Beyond issues of bias and ownership, students questioned AI’s epistemic authority and potential to displace human agency. One student stated, “While using AI, we always kept in mind the ethical considerations that need to be accounted for, as it does not always provide information that is correct” (BUS-21). Here, the use of the collective “we” suggests that these were not isolated concerns but shared reflections, likely discussed within teams. Importantly, the student does not reject the use of GenAI but highlights a proactive stance toward information validation, which is key to developing epistemic vigilance. Another student articulated this concern even more explicitly: “As learners, we need to understand that AI is only a tool. AI is not something we can rely on to produce all our work for us and to generate all our ideas for us” (BUS-27). The statement draws a boundary between tool assistance and tool dependency, suggesting students are grappling with their roles in maintaining intellectual integrity. The student positions the challenge not in the technology itself, but in how it is used and pedagogically framed, a concern that mirrors critiques of automation bias and the de-skilling of judgment.

Additionally, ethical discomfort extended into real-world legal and policy contexts, especially among law students: “Some of the challenges that are around using artificial intelligence are the ethical implications; this has even entered the legal world with some companies suing ChatGPT for copyright infringement” (LAW-11). This comment shows how students were thinking beyond the classroom, connecting their lived experience of using GenAI with wider societal debates about regulation and ownership. It reflects the internalisation of disciplinary ethical frameworks, particularly in law, business and education, which foreground responsibility, evidence, and social accountability. In sum, ethical concerns in this cohort were not superficial acknowledgements of “AI bias,” but reflected deeper ontological, epistemological, and professional tensions. Students actively questioned who holds power, who bears responsibility, and what it means to create, teach, and learn in a GenAI-mediated landscape. These insights reinforce the need for explicit, sustained AI ethics pedagogy not as a compliance-driven add-on, but as a foundational thread across design, education, and assessment. When scaffolded appropriately, ethical discomfort can catalyse critical consciousness, enabling learners to interrogate not only what AI can do, but what it ought to do and for whom.

Hesitance and Acceptance

This theme, documented in 56 reflections (50%), traces a developmental arc from initial scepticism to conditional and strategic acceptance of GenAI. While sentiment analysis revealed a 72% positive orientation by the end of the course, this outcome contradicts the complex emotional, cognitive, and ethical negotiations students underwent. For many, the process of accepting GenAI was neither automatic nor wholehearted, it required critical engagement, peer dialogue, and pedagogical scaffolding that enabled students to recalibrate their relationship with the technology. Early expressions of hesitance were often grounded in a desire to protect intellectual independence. As one student noted, “Personally, I was initially hesitant to rely on AI, as I wanted to foster my independent thinking and creativity” (EDU-5). Here, the act of resisting GenAI was not a matter of technophobia, but a principled stance rooted in a pedagogical ideal of self-generated thought. The student's choice of words, “foster my independent thinking,” suggests that reliance on AI might interrupt the internalisation of critical or creative reasoning. This value-based resistance appeared repeatedly, especially among students from disciplines where authentic voice and individual judgment were core to professional identity.

Even as students began to use GenAI more frequently, several continued to express residual discomfort: “While more accustomed to the format now, I still hesitate to use it to prompt myself” (DES-3) and

> “I am still a little hesitant in regard to the power and ease that AI has to take over from jobs commonly done by humans, especially in creative industries, but after this course, I can definitely understand the purpose that it holds and how useful it will be to other industries” (BUS-19).

These reflections indicate that scepticism was not entirely resolved by increased familiarity. The former quote highlights a lingering emotional resistance, where students feared that prompting via AI might lead to a loss of cognitive agency. The latter situates this discomfort within broader socioeconomic anxieties about automation and the future of work, especially in fields traditionally associated with human creativity. This illustrates that hesitance is not just personal but also ideological, reflecting wider concerns about technological displacement and the commodification of creativity. Nonetheless, the course structure appeared instrumental in transforming some of this hesitation into reflective use.

One student described how their perception shifted through group work: “I doubted AI at first, it felt like cheating. But after using it to brainstorm with my team, I saw its value as a tool, not a crutch” (EDU-12). The phrase “felt like cheating” reveals an important emotional framing of AI use early on, one that connects to traditional academic norms of merit and originality. However, the subsequent shift, seeing AI as a “tool, not a crutch”, suggests a key pedagogical moment where AI is no longer viewed as a shortcut but as a collaborative partner in ideation.

The team-based activity appears to have provided both social validation and a safe space to renegotiate norms. Similarly, another student reflected, “Initially, I feared AI would produce similar designs for everyone. Now, I use it to spark ideas, then tweak them to be uniquely mine” (DES-07). Here, the student initially associates AI with a fear that AI-generated outputs would produce standardised, undifferentiated work. Yet, by shifting their practice to use GenAI as a stimulus rather than a solution, the student asserts their creative authorship. The move from fear to finesse illustrates the development of a hybrid creative process, one that blends machine-generated content with human curation and intentionality. Instructor-led scaffolding played a pivotal role in enabling this transition. As one student put it, “Initially hesitant about AI as everyone was banning them, I was introduced to its capabilities by our instructor, which ultimately transformed my perspective” (BUS-60). This quote directly attributes the shift in mindset to pedagogical intervention. It reinforces the argument that students' acceptance of GenAI does not emerge from exposure alone, but through intentional guidance, critical framing, and structured experimentation. Without this, students may either avoid using AI altogether or adopt it uncritically, missing the opportunity for reflective learning.

These reflections demonstrate that acceptance of GenAI is best understood not as passive acceptance but as an adaptive learning process, deeply shaped by students’ values, disciplines, and classroom environment. Students moved from suspicion to strategic use, not by abandoning their concerns, but by contextualising and managing them. This process required support systems that acknowledged both the ethical stakes and emotional dimensions of GenAI integration. Ultimately, the theme of Hesitance & Acceptance reflects not a binary opposition but a continuum of engagement, one where students learn not just to use GenAI but to decide when, how, and why it should be used. This evolution is pedagogically significant: it signals a shift from compliance or avoidance to agency and discernment, preparing students to engage with AI critically, both within and beyond the university.

Critical Validation

This theme, identified in 41 reflections (37%), captured how students moved beyond using GenAI tools passively to engaging in active interrogation of AI outputs. This included fact-checking, bias auditing, prompt adjustment, and the development of personalised or collaborative strategies to ensure the credibility, fairness, and appropriateness of AI-generated content. While largely positive in sentiment (78%), these reflections represented not complacency, but empowerment through critical skill development.

For many students, the turning point came through exposure to GenAI's limitations, particularly its factual inconsistencies. One business student shared, "I fact-checked ChatGPT's market data against peer-reviewed journals. It was wrong about renewable energy stats!" (BUS-22). Rather than rejecting the tool outright, the student responded by triangulating sources and asserting evaluative authority. This instance marks a critical epistemic shift where GenAI is no longer positioned as an expert to be trusted, but a suggestive converser to be scrutinised. The student's response aligns with Paul and Elder's (2006) model of critical thinking, which emphasises the disciplined application of evaluative standards to claims, regardless of their source.

Students also addressed cultural and representational biases, particularly in visual outputs from tools like DALL·E. A law student described their team's proactive approach, "We created a bias checklist for DALL·E outputs. If it gives too much Western output, we adjust prompts to include Global South contexts" (LAW-9). This reflection signals an advanced form of design justice awareness. The creation of a "bias checklist" exemplifies the kind of structured metacognitive strategy that enables students to surface and mitigate embedded inequities in algorithmic outputs. Rather than simply observing bias, students moved to intervene, transforming awareness into deliberate corrective practice. Several students linked this emerging capability directly to the structure of the course and the opportunities it provided for experimentation and feedback. One student reflected, "Our ability to assess and validate AI tools improved through training" (DES-4). This quote emphasises that validation is not instinctive, but it is a learned competency, one which must be intentionally scaffolded through pedagogical design. This is echoed in another reflection, "The biggest point I have taken from this training in the use of AI is to only use it to support my arguments, not make them, and to always critically assess the information it provides" (BUS-57). This distinction between support and substitution is essential. The student articulates an ethic of intellectual integrity, recognising that while GenAI can offer helpful scaffolding, the responsibility for reasoned argumentation must remain with the human author. This suggests that training focused not just on "how to use GenAI," but also on why and when to use it, was pivotal in cultivating critical autonomy.

Some students reported applying validation strategies within creative and prototyping tasks. For example, "Exploring training and the development of AI as a learning tool, we used AI predominantly to help us come up with our imagination of a glass classroom for our prototype" (EDU-8) and "In our pursuit of training and developing AI as a learning tool, we seamlessly integrated AI platforms into the process, employing the capabilities of both ChatGPT and Bing Chat" (DES-10). These reflections demonstrate that validation extended beyond text-based outputs to include design ideation, cross-platform evaluation, and workflow calibration. The mention of "seamless integration" indicates a growing fluency, but also a capacity to maintain oversight across tools. Another student insightfully remarked:

> "Before, I used to accept search results without asking where this output was coming from, what might be missing. Now I ask where this information is coming from, and what might be left out? AI made me more suspicious in a good way" (BUS-45).

Suspicion here is not framed as cynicism but as epistemic vigilance, a critical disposition necessary for navigating post-truth digital environments. The student's shift in behaviour, from passive acceptance to questioning provenance and omissions, reflects the internalisation of critical digital literacy extending far beyond the course. Importantly, this form of critical engagement was often described as collaborative rather than individualised. Teams developed shared protocols for validation, reframed prompt structures, and discussed failures as learning opportunities. GenAI, in this context, became not just a technological layer but a social artefact around which new critical practices could be co-constructed. In summary, Critical Validation represents a pedagogically and ethically significant outcome. Students did not simply learn how to use AI; they learned how to interrogate it. Through training, reflective discussion, and iterative experimentation, they developed strategies that foreground human judgment, ethical awareness, and context-sensitive use. These findings demonstrate that when learners are supported to think critically about AI rather than just through it, they do not become dependent on the technology; they become better thinkers because of it.

Sentiment and Thematic Intersections

As shown in Table 2, sentiment polarity closely aligned with the four emergent themes, offering a layered understanding of students' emotional and cognitive engagement with GenAI. Positive sentiment was most prevalent in reflections associated with Perceived Benefits (86%) and Critical Validation (78%), where students described experiences of creative expansion, confidence-building, and skill mastery. These responses frequently included keywords such as "innovative," "efficient," "verified," and "audited," reflecting students' perception of GenAI as a valuable tool for augmenting both creativity and evaluative judgment.

Table 2

Sentiment-Thematic Matrix

Theme	Positive Sentiment	Negative Sentiment	Exemplar Keyword
Perceived Benefits	86%	9%	"Innovative," "Efficient"
Ethical Concerns	14%	62%	"Bias," "Ownership"
Hesitance & Acceptance	72%	38%	"Adapted," "Empowered"
Critical Validation	78%	12%	"Verified," "Audited"

In contrast, Ethical Concerns showed the highest proportion of negative sentiment (62%), highlighting students' discomfort with issues of bias, authorship ambiguity, misinformation, and accountability. Keywords like "bias" and "ownership" were common in these reflections, especially from students in disciplines that emphasise ethical scrutiny, such as law and education. The theme Hesitance & Acceptance exhibited a mix of sentiments, 72% positive and 38% negative, indicating that while many students ultimately embraced GenAI as a supportive tool, hesitations around creative authenticity and trust in AI persisted. Keywords such as "adapted" and "empowered" signalled students' evolving confidence, though the co-existence of positive and negative descriptors suggests that acceptance was complex and conditional. Overall, the sentiment-thematic patterns presented in Table 2 highlight that student engagement with GenAI was not uniformly enthusiastic or dismissive. Instead, emotional responses reflected critical negotiation with the affordances and limitations of the tools, reinforcing the importance of scaffolded reflection and structured ethical inquiry in GenAI-integrated learning environments.

Discussion

This study explored the integration of generative AI (GenAI) within a constructivist Design Thinking pedagogy to understand how it reconfigures student creativity, critical thinking, and ethical reasoning. The results suggest that GenAI, when scaffolded intentionally, holds the capacity to augment rather than erode cognitive and ethical engagement. Yet, this potential is conditional, relying heavily on pedagogical framing, disciplinary norms, and students' evolving relationships with the technology. The high prevalence of positive sentiment associated with the theme Perceived Benefits (86%) indicates that students largely experienced GenAI as a valuable partner in enhancing creativity, particularly during the ideation phase of the Design Thinking process (Berg et al., 2023). Across disciplines, students described how GenAI tools like ChatGPT and DALL·E served to broaden their creative boundaries, exposing them to novel perspectives and materials they may not have considered independently (Lee et al., 2025). Importantly, students did not treat GenAI outputs as authoritative; instead, they assumed roles as curators and evaluators, reframing, iterating, and applying content selectively (Zhai et al., 2024). This aligns with Vygotsky's (1978) theory of the Zone of Proximal Development, where cognitive tools mediate higher order thinking and scaffold learners beyond their unaided capabilities.

However, students' engagements with GenAI were not universally enthusiastic. The theme Hesitance & Acceptance, which captured a mixed sentiment profile (72% positive, 38% negative), revealed a developmental trajectory from scepticism to strategic adoption. Initial hesitation was often motivated by a desire to safeguard intellectual autonomy and creative authorship, especially in disciplines like education and law, where independent judgment and originality are pedagogical cornerstones (Lee et al., 2025; Schön, 1992). For many students, GenAI appeared to threaten core academic values. Yet over time, as classroom activities foregrounded collaborative brainstorming, prompt refinement, and iterative experimentation, many reinterpreted GenAI as a creative ally rather than a substitute for their cognitive labour (Kolb, 1984; Brown, 2008). Acceptance did not emerge passively but was actively negotiated through instructor guidance and team-based projects that allowed students to recalibrate their ethical and epistemic frameworks.

This process of recalibration is most evident in the theme Critical Validation, where students described fact-checking, bias auditing, and reflective prompt design as key aspects of their AI engagement. While 78% of reflections in this theme expressed positive sentiment, these responses were rooted in active critique, not complacent trust. Students consistently identified the limitations of GenAI tools, whether factual errors in ChatGPT's market data or Eurocentric imagery generated by DALL·E, and responded by applying evaluative strategies (Rana, 2024; Baker & Hawn, 2022). For example, the creation of a "bias checklist" to address representational disparities in visual prototypes demonstrates an emerging ethic of design justice (Rana, 2024). This movement from passive use to critical oversight suggests the development of what might be called "epistemic vigilance," a disposition that enables learners to interrogate, rather than merely consume, digital content (Lee et al., 2025). Notably, students did not view validation as a solitary exercise. Reflections highlighted the collaborative dimensions of GenAI use, with teams co-developing strategies for source triangulation, prompt calibration, and ethical deliberation. Such collective epistemic practices reflect the social learning principles central to constructivist theory (Vygotsky, 1978; Kolb & Kolb, 2005). They also highlight the extent to which GenAI became not just a technological artefact but a shared object of inquiry, around which new norms of trust, scepticism, and critical engagement could be co-constructed (Carlgren et al., 2016).

The theme Ethical Concerns introduced the most consistent expressions of discomfort, with 62% of responses coded as negative in sentiment. These reflections focused on algorithmic bias, authorship ambiguity, and the opacity of GenAI outputs. Students from education and law backgrounds, in particular, articulated unease about how training data reproduces stereotypes, such as the frequent pairing of men with engineering roles and women with caregiving professions, thereby reinforcing problematic social scripts (Rana, 2024). This mirrors the broader critique of algorithmic oppression in educational technologies (Baker & Hawn, 2022). At a practical level, students debated issues of intellectual ownership, especially when co-creating content with GenAI for assessment tasks. Such reflections echo the concerns raised by Lee et al. (2025), who argue that AI-enabled collaboration blurs traditional boundaries between human and machine agency, making authorship increasingly ambiguous.

Yet ethical reflection extended beyond representational fairness and ownership. Several students described an erosion of trust in AI-generated information, which catalysed a shift from passive acceptance to active interrogation. This transformation, from reliance to reflexivity, suggests the emergence of ethical reasoning as an integrated habit of mind. One student's remark, "AI is only a tool. It cannot produce all our work or ideas for us," epitomises this shift. Here, the learner asserts not only intellectual sovereignty but also moral responsibility for knowledge claims. Such reflections align with Dewey's (1933) conception of education as reflective action, where learners are tasked not simply with acquiring knowledge, but with engaging in continual ethical and epistemic evaluation.

Collectively, these themes demonstrate that the integration of GenAI into a Design Thinking pedagogy can activate deeper learning when critical safeguards are in place. The iterative structure of Design Thinking, empathise, define, ideate, prototype, test, served as a scaffold for students to explore GenAI across diverse stages of problem-solving and creative development (Brown, 2008; Carlgren et al., 2016). GenAI was most effective when used not to replace human judgment but to provoke it through suggestion, challenge, or even error. In this sense, the technology functioned as what Dewey (1933) might describe as a problematic situation, prompting inquiry, iteration, and reflective action. At the same time, the results point to the risks of uncritical adoption. When not accompanied by ethical framing, structured experimentation, and critical reflection, GenAI tools may encourage automation bias, epistemic shallowness, and dependency

(Zhai et al., 2024; Baker & Hawn, 2022). The implication for educators is clear: GenAI is not a neutral enhancement to learning; it is a socio-technical actor that requires intentional pedagogical orchestration. The emotional and cognitive ambivalence reported by students, particularly in the Hesitance & Acceptance and Ethical Concerns themes, emphasises the necessity of treating GenAI as both a pedagogical opportunity and a site of ethical contestation.

In conclusion, this study suggests that students are capable of engaging with GenAI not merely as users but as reflective practitioners. When GenAI is embedded within constructivist pedagogical frameworks that emphasise ethical awareness, collaborative inquiry, and critical validation, it can enhance creativity and critical thinking rather than displace them. The findings point to the urgent need for faculty development, curricular redesign, and institutional investment in AI literacy, not just as a technical skillset, but as a multidimensional competence encompassing creativity, ethics, and judgment. Ultimately, GenAI's educational value lies not in its ability to generate content but in its capacity to generate reflection about the nature of knowledge, the boundaries of authorship, and the future of learning itself.

Implications for Theory and Practice

The findings of this study offer a significant rearticulation of how generative artificial intelligence (GenAI) intersects with pedagogical theory and practice. Far from being a mere technical add-on, GenAI emerges here as a catalyst for redefining foundational educational constructs, creativity, critical thinking, and ethical reasoning within a Design Thinking pedagogy underpinned by constructivist and experiential learning theories (Kolb & Kolb, 2005; Vygotsky, 1978). The implications unfold across three interlocking domains: the conceptual foundations of learning theory, the ethics and equity of AI in education, and the pragmatics of curriculum and instructional design. At a theoretical level, this study challenges the sufficiency of traditional cognitive taxonomies, such as those proposed by Bloom et al. (1956), in capturing the new kinds of epistemic labour that GenAI demands. As Gonsalves (2024) argues, the linearity of Bloom's original framework is poorly suited to educational environments where knowledge is co-constructed through interaction with AI systems. Students in this study did not follow a simple progression from understanding to evaluation; rather, they cycled recursively between ideation, reflection, critique, and redesign in partnership with GenAI tools. This iterative interplay aligns more closely with constructivist and pragmatist models of learning, particularly Dewey's (1933) notion of education as reflective action, than with content acquisition frameworks.

This reframing necessitates a broader theoretical conception of agency. Students were not merely using GenAI; they were negotiating with it, sometimes resisting, collaborating, and often interrogating its limitations. Such behaviour complicates conventional views of learners as autonomous agents and situates them instead as relational actors embedded in socio-technical assemblages (Larson et al., 2024). As students toggled between accepting, editing, and contesting AI outputs, their agency became distributed across the human-machine interface, thereby exemplifying "hybrid cognition." This insight points toward the need for educational theorists to move beyond binary frameworks of tool-user relations and toward models that recognise the mutual shaping of cognition by both human intention and algorithmic suggestion (Baker & Hawn, 2022). Moreover, this distributed model of agency calls for a revision of metacognitive scaffolding in pedagogy. Findings from Li et al. (2025) illustrate how progressive prompting models that integrate GenAI can support learner autonomy while still enabling deep engagement. When students are prompted not only to consume but also to critique and refine AI outputs, they begin to develop epistemic vigilance, a skill foundational for critical thinking in the digital age. As the study revealed, this critical capacity was not automatic but cultivated through scaffolded instructional designs that encouraged dialogue, peer reflection, and validation processes.

While the cognitive benefits of GenAI are well established, this study foregrounds a less explored but equally urgent dimension: the ethical and cultural implications of AI-enhanced learning. Students' concerns around algorithmic bias, authorship, and misinformation, particularly those raised by law and education students, are not peripheral issues but central to the pedagogical efficacy and integrity of GenAI systems. Baker and Hawn (2022) provide a comprehensive taxonomy of algorithmic bias in educational settings, emphasising the societal and systemic risks embedded in AI training datasets. Similarly, Rana (2024) problematises the dominance of Eurocentric knowledge systems within GenAI outputs and calls for an explicit engagement with Indigenous epistemologies and data sovereignty. The current study echoes these calls, revealing students' discomfort with stereotypical outputs (e.g., male engineers and female nurses) generated by DALL·E and the ethical ambiguity surrounding co-authored content produced with ChatGPT. These findings necessitate a fundamental shift in how ethical reasoning is integrated into the curriculum. Rather than relegating AI ethics to one-off modules or compliance exercises, educational institutions must embed ethical deliberation throughout the entire design process. Each stage of the Design Thinking framework, empathise, define, ideate, prototype, and test, offers opportunities to confront the moral and epistemic implications of GenAI usage. Furthermore, ethical concerns in this study were not only individualised but also socially negotiated, often emerging through collaborative debate. This aligns with the sociocultural view that ethical reasoning is dialogic and socially constructed (Nguyen et al., 2023). As such, pedagogical strategies that foster team-based ethical inquiry, such as collaborative bias audits or group-authored AI policies, could serve as powerful vehicles for ethical engagement and intercultural understanding.

The practical implications of these insights are extensive. First, instructional design must pivot from teaching "how to use AI" to cultivating "how to think with and against AI." This subtle but crucial distinction shifts the focus from technical fluency to critical literacy, from automation to augmentation. The findings suggest that students derive the most benefit from GenAI when they are positioned as curators, editors, and questioners rather than as passive recipients of AI-generated content. Pedagogical practices that support this positioning include structured reflection prompts, source validation activities, and guided experimentation with prompt engineering. Second, the curriculum should explicitly incorporate GenAI literacy as a transversal competency, not limited to technology courses but infused across disciplines. As the literature affirms, critical thinking in AI-rich environments requires cross-domain fluency, technical, ethical, epistemological, and contextual (Giannakos et al., 2024; Gonsalves, 2024). Business students evaluating market data, law students debating AI authorship, and education students navigating stereotype reinforcement all point to the universality of these competencies. This necessitates a reconfiguration of faculty development, ensuring that educators across domains are equipped to facilitate GenAI-enhanced learning environments with critical and ethical acuity.

Finally, at an institutional level, there is a pressing need for the development of AI governance frameworks that move beyond surveillance or risk mitigation. As the UNESCO guidelines for ethical AI in education suggest (Nguyen et al., 2023), institutions must create participatory structures where students, educators, and AI developers co-design ethical norms and decision-making protocols. These might include AI impact assessments for new educational technologies, student-led GenAI ethics boards, or the inclusion of Indigenous knowledge holders in data governance discussions. This participatory turn also has implications for how institutions assess learning. Traditional assessment formats may fail to capture the depth of critical engagement demonstrated in GenAI-mediated learning. Alternative assessments, such as reflective portfolios, co-authored design logs, and ethical case analyses in classrooms, may better align with the dispositions and competencies this pedagogy seeks to foster. Such formats not only validate diverse ways of knowing but also resist the reductive logic of automation in educational evaluation.

Limitations and Future Research

While this study offers valuable insights into the pedagogical integration of generative artificial intelligence (GenAI) within Design Thinking pedagogy, several limitations must be acknowledged. These limitations not only delimit the scope of the present findings but also chart directions for future research. The study's findings were derived primarily from student reflections. While these qualitative narratives capture nuanced cognitive and emotional responses, self-report methods have inherent validity concerns. As documented by Porter, S.R. (2011), student surveys are prone to social desirability bias, retrospective reconstruction, and weak correlations with actual learning outcomes. These methodological weaknesses mean that conclusions drawn from reflective entries alone must be interpreted cautiously. Future research should triangulate reflections with direct assessments of learning outcomes, such as performance-based tasks or standardised measures like the Collegiate Learning Assessment (CLA) (Klein et al., 2007) or Major Field Tests (Campbell, 2015).

The study took place in a single course within a single institution. Contextual and institutional variables, such as faculty attitudes toward AI, digital infrastructure, and curricular autonomy, are known to mediate how technology adoption unfolds (O'Dea, 2024). These factors may limit the generalisability of findings to other educational settings with different governance structures or disciplinary orientations. The literature urges caution here, as Giannakos et al. (2024) note, large-scale AI deployment in education requires rigorous longitudinal validation before it can be confidently scaled. Although the study explored students' perceptions of critical thinking and creativity, it did not quantitatively assess learning gains. This stands in contrast to studies like those by Li et al. (2025), which use pre- and post-intervention testing to measure the effect of GenAI-supported learning on achievement and cognitive load. The lack of objective outcome measures limits the ability to validate student claims of enhanced creativity or ethical reasoning. Longitudinal assessments of learning retention and skill transfer would strengthen claims about GenAI's educational efficacy.

While the sentiment analysis revealed some affective trends, the study did not deeply examine how emotional responses (e.g., anxiety, empowerment, confusion) shape students' engagement with GenAI tools. As noted in the AI education literature, emotions such as frustration, mistrust, or over-reliance on AI significantly influence learning behaviours and epistemic trust (Giannakos et al., 2024). Future studies should integrate affective computing methods or multimodal analytics to capture the emotional landscape of GenAI-mediated learning. In sum, future research must expand methodologically, contextually, and temporally to deepen our understanding of GenAI's role in shaping higher education. A broader research agenda should explore longitudinal effects, identity-mediated differences, and the interplay between AI literacy and metacognition in learning environments increasingly shaped by intelligent technologies.

Conclusion

This study has shown that the integration of generative AI (GenAI) within a constructivist Design Thinking pedagogy holds both promise and peril. In addressing the research question, how GenAI reshapes creativity, critical thinking, and ethical reasoning across the stages of design thinking, we found that GenAI can indeed amplify student engagement, provided its use is pedagogically scaffolded and ethically contextualised. Students widely acknowledged GenAI's capacity to broaden creative exploration and support iterative design, particularly in the ideate and prototype stages. However, this enhancement was not automatic; it emerged only when students retained epistemic agency, critically evaluated AI outputs, and applied them with intentionality. Through structured reflection, students learned not only how to use GenAI but how to think with and against it, ultimately developing what we term "epistemic vigilance."

At the same time, the study highlights several tensions that must be managed. The most significant among these was the ethical unease expressed by students, especially around algorithmic bias, ownership, and cultural representation. These reflections highlight that GenAI does not enter the classroom as a neutral tool, but as a socio-technical artefact laden with historical, cultural, and epistemological assumptions. Our findings suggest that ethical reasoning is not peripheral but central to effective AI integration, requiring more than policy compliance; it demands dialogic, participatory, and critically reflexive pedagogies. While many students transitioned from hesitance to strategic use, this evolution depended on intentional instructional design and collaborative learning environments. Without such support, students risk either rejecting GenAI entirely or embracing it uncritically, both of which curtail deeper learning.

Ultimately, this research invites educators, curriculum designers, and institutions to reimagine AI not as a content generator but as a catalyst for reflective learning. GenAI's most transformative potential lies not in what it produces, but in the cognitive and ethical practices it can provoke, if designed thoughtfully. We conclude that for GenAI to truly enhance education, it must be embedded within pedagogical models that foreground human judgment, social responsibility, and critical engagement. The study answers its central inquiry with a conditional affirmation: GenAI can reconfigure creativity, critical thinking, and ethical reasoning, but only when learning environments are designed to treat students not as passive users of AI, but as co-constructors of knowledge in an increasingly algorithmic world.

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References

Baker, R. S., & Hawn, A. (2022). Algorithmic bias in education. *International Journal of Artificial Intelligence in Education, 32*(4), 1052–1092. https://doi.org/10.1007/s40593-021-00285-9

Berg, J. M., Raj, M., & Seamans, R. (2023). Capturing value from artificial intelligence. *Academy of Management Discoveries, 9*(4), 424–428. https://doi.org/10.5465/amd.2023.0106

Bird, S., Klein, E., & Loper, E. (2009). *Natural language processing with Python: Analyzing text with the Natural Language Toolkit*. O'Reilly Media. https://tjzhifei.github.io/resources/NLTK.pdf

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. Longman.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, T. (2008). Design thinking. *Harvard Business Review, 86*(6), 84–95. https://hbr.org/2008/06/design-thinking

Burbules, N. C., & Berk, R. (1999). Critical thinking and critical pedagogy: Relations, differences, and limits. In T. S. Popkewitz & L. Fendler (Eds.), *Critical theories in education* (pp. 45–65). Routledge. https://www.taylorfrancis.com/chapters/mono/10.4324/9780203826256-11/critical-thinking-critical-pedagogy-relations-differences-limits-thomas-popkewitz-lynn-fendler

Campbell, C. M. (2015). Serving a different master: Assessing college educational quality for the public. In M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research* (Vol. 30, pp. 525–579). Springer. https://doi.org/10.1007/978-3-319-12835-1_12

Campbell, J. L., Quincy, C., Osserman, J., & Pedersen, O. K. (2013). Coding in-depth semistructured interviews: Problems of unitization and intercoder reliability and agreement. *Sociological Methods & Research, 42*(3), 294–320. https://doi.org/10.1177/0049124113500475

Carlgren, L., Rauth, I., & Elmquist, M. (2016). Framing design thinking: The concept in idea and enactment. *Creativity and Innovation Management, 25*(2), 38–57. https://doi.org/10.1111/caim.12153

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. D.C. Heath. https://bef632.wordpress.com/wp-content/uploads/2015/09/dewey-how-we-think.pdf

Doorley, S., Holcomb, S., Klebahn, P., Segovia, K., & Utley, J. (2018). *Design thinking bootleg*. Hasso Plattner Institute of Design at Stanford University. https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/5b19b2f2aa4a99e99b26b6bb/1528410876119/dschool_bootleg_deck_2018_final_sm+%282%29.pdf

Giannakos, M., Azevedo, R., Brusilovsky, P., et al. (2024). The promise and challenges of generative AI in education. *Behaviour & Information Technology*, 1–27. https://doi.org/10.1080/0144929X.2024.2394886

Gonsalves, C. (2024). Generative AI's impact on critical thinking: Revisiting Bloom's taxonomy. *Journal of Marketing Education*. https://doi.org/10.1177/02734753241305980

Hutto, C. J., & Gilbert, E. (2014). VADER: A parsimonious rule-based model for sentiment analysis of social media text. In *Proceedings of the Eighth International Conference on Weblogs and Social Media (ICWSM-14)* (pp. 216–225). https://ojs.aaai.org/index.php/ICWSM/article/view/14550

Jurafsky, D., & Martin, J. H. (2023). *Speech and language processing* (3rd ed.). Draft version. Stanford University. https://web.stanford.edu/~jurafsky/slp3/

Klein, S., Benjamin, R., Shavelson, R., & Bolus, R. (2007). The Collegiate Learning Assessment: Facts and fantasies. *Evaluation Review, 31*(5), 415–439. https://doi.org/10.1177/0193841X07303318

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall. https://carleton-wp-production.s3.amazonaws.com/uploads/sites/313/2022/12/Experiential_Learning_Experience_As_The_Source_Of_-1.pdf

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education, 4*(2), 193–212. https://doi.org/10.5465/amle.2005.17268566

Larson, B. Z., Moser, C., Caza, A., Muehlfeld, K., & Colombo, L. A. (2024). Critical thinking in the age of generative AI. *Academy of Management Learning & Education, 23*(3), 373–378. https://doi.org/10.5465/amle.2024.0338

Lee, H. P., Sarkar, A., Tankelevitch, L., Drosos, I., Rintel, S., Banks, R., & Wilson, N. (2025). The impact of generative AI on critical thinking: Self-reported reductions in cognitive effort and confidence effects from a survey of knowledge workers. In *CHI Conference on Human Factors in Computing Systems (CHI '25)* (pp. 1–22). ACM. https://doi.org/10.1145/3706598.3713778

Li, C. J., Hwang, G. J., Chang, C. Y., & Su, H. C. (2025). Generative AI-supported progressive prompting for professional training: Effects on learning achievement, critical thinking, and cognitive load. *British Journal of Educational Technology*. 1–23. https://doi.org/10.1111/bjet.13594

Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism*. New York University Press. https://doi.org/10.2307/j.ctt1pwt9w5

Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B. P. T. (2023). Ethical principles for artificial intelligence in education. *Education and Information Technologies, 28*, 4221–4241. https://doi.org/10.1007/s10639-022-11316-w

O'Dea, X. (2024). Generative AI: Is it a paradigm shift for higher education? *Studies in Higher Education, 49*(5), 811–816. https://doi.org/10.1080/03075079.2024.2332944

Paul, R., & Elder, L. (2006). *Critical thinking competency standards*. Foundation for Critical Thinking. https://www.criticalthinking.org/resources/PDF/CT-competencies%202005.pdf

Piaget, J. (1936). *Origins of intelligence in the child*. Routledge https://ia601709.us.archive.org/14/items/in.ernet.dli.2015.458564/2015.458564.The-Origin-Of-Intelligence-In-The-Child.pdf

Porter, S. R. (2011). Do college student surveys have any validity? *Review of Higher Education, 35*(1), 45–76. https://doi.org/10.1353/rhe.2011.0034

Porter, M. F. (1980). An algorithm for suffix stripping. *Program, 14*(3), 130–137. https://doi.org/10.1108/eb046814

Rana, V. (2024). Indigenous data sovereignty: A catalyst for ethical AI in business. *Business & Society, 64*(4), 635–640. https://doi.org/10.1177/00076503241271143

Rana, V., & Azeez, G. K. (2025). Indigenous data sovereignty in Australian higher education: Paving the way for First Nations' self-determination. *Journal of Higher Education Policy and Management*, 1–9. https://doi.org/10.1080/1360080X.2025.2469920

Sanh, V., Debut, L., Chaumond, J., & Wolf, T. (2019). DistilBERT, a distilled version of BERT: Smaller, faster, cheaper and lighter. *arXiv Preprint*. https://arxiv.org/abs/1910.01108

Schön, D. A. (1992). *The reflective practitioner: How professionals think in action* (1st ed.). Routledge. https://doi.org/10.4324/9781315237473

Verhoeven, B., & Rana, V. (2023a, April 4). How to use generative AI creatively in higher education. *LSE Impact Blog*. https://blogs.lse.ac.uk/impactofsocialsciences/2023/04/04/how-to-use-generative-ai-creatively-in-higher-education/

Verhoeven, B., & Rana, V. (2023b, June 2). Knowledge work and the role of higher education in an AI era. *LSE Impact Blog*. https://blogs.lse.ac.uk/impactofsocialsciences/2023/06/02/knowledge-work-and-the-role-of-higher-education-in-an-ai-era/

Vhatkar, A., Pawar, V., & Chavan, P. (2024). Generative AI in education: A bibliometric and thematic analysis. In *2024 8th International Conference on Computing, Communication, Control and Automation (ICCUBEA)* (pp. 1–6). IEEE. https://doi.org/10.1109/ICCUBEA61740.2024.10774819

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments, 11*(28), 1–37. https://doi.org/10.1186/s40561-024-00316-7