

Perceptions of Students Towards the Inclusion of AI in Design Studio Learning: Architecture and Interior Design

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ABSTRACT

Generative artificial intelligence (GenAI) is increasingly influencing architecture and interior design practice, yet its educational value depends on how it is integrated into studio learning. This study explores how architecture and interior design students experience and evaluate GenAI in relation to creative ideation, visualisation, learning processes, and responsible educational use. An exploratory qualitative design was employed with 30 upper-level students at the University of Technology Sarawak, Malaysia, comprising 20 Architecture and 10 Interior Design students. Participants used PromeAI to generate alternatives from perspectives of their previously completed studio projects and subsequently compared the AI-generated outputs with their original designs. Data were collected through six semi-structured focus groups and analysed using thematic analysis. Five interrelated themes emerged. Students perceived GenAI as valuable for expanding design possibilities, overcoming creative blocks, accelerating visualisation, and facilitating rapid comparison of alternatives. However, they also identified limitations involving prompt interpretation, spatial and functional logic, constructability, contextual understanding, and design control. Participants further cautioned that excessive reliance on GenAI could bypass research, conceptual reasoning, iteration, and independent creative development. Overall, students supported structured rather than unrestricted integration, with lecturers providing guidance and human judgement retaining authority over technical evaluation and final design decisions. The findings reveal an AI Design Studio Paradox: acceleration can enhance learning when it supports exploration but undermine learning when it substitutes for cognitively important design processes. The study therefore positions GenAI as a complementary, rather than substitutive, resource for responsible design studio education.

Keywords: Generative artificial intelligence; Design studio education; Architecture education; Interior design education; Human–AI collaboration.

INTRODUCTION

The rapid advancement of artificial intelligence (AI), particularly generative artificial intelligence (GenAI), is reshaping how design ideas are conceived, visualised, communicated, evaluated, and refined. Within architecture and interior design, this transformation is especially significant because design development is inherently iterative and depends on continuous cycles of exploration, representation, evaluation, and modification. Contemporary GenAI systems can process textual and visual inputs to generate multiple design alternatives within relatively short periods, enabling designers to explore architectural forms, spatial configurations, materials, styles, and visual possibilities more rapidly than through conventional workflows. Consequently, GenAI is increasingly moving beyond its initial role as a visualisation mechanism towards becoming an active component of early stage design exploration and decision making.

The significance of this capability is particularly apparent during conceptual design, where designers typically generate, test, reject, modify, and refine multiple possibilities before establishing a more resolved design direction. Fitriawijaya and Jeng (2024) demonstrate that multimodal GenAI can combine textual and visual information to facilitate rapid design generation, exploration, evaluation, and refinement during the early stages of architectural design. Their study indicates that GenAI can support nonlinear movement between alternatives, allowing designers to experiment with multiple ideas, obtain rapid feedback, and incorporate modifications more efficiently. Similarly, Qian et al. (2023) developed an AI based architectural design system capable of producing high rise building sketches according to user defined preferences, demonstrating the potential of AI to expand the solution space while retaining human influence over generated outcomes. The increasing capacity of AI to support rapid alternative generation therefore represents an important change in the relationship between computational technology and architectural creativity. This emphasis on conceptual exploration is consistent with research classifying AI techniques specifically for early architectural design stages, where different computational approaches can support distinct activities within the formative phases of design development (Vissers-Similon et al., 2025).

The potential of GenAI extends beyond architectural form generation into interior and spatial design. Shao et al. (2024) demonstrate that AI supported workflows can assist the generation of diverse interior design alternatives while reducing conventional tasks associated with textures, lighting, rendering, and visual presentation. Their approach was explicitly developed to improve both design creativity and efficiency. Likewise, Liu et al. (2025) found that GenAI generated interior design proposals performed strongly in creativity, aesthetics, functionality, and feasibility. Stable Diffusion achieved particularly strong results for creative exploration, whereas Midjourney produced highly polished aesthetic and functional outcomes, suggesting that different generative systems may provide distinct affordances across different stages of design development. Related interior design research demonstrates text driven image generation for efficient creative design and the use of GenAI for material texturing within three dimensional interior spaces, further illustrating the technology's expanding role in visual exploration and representation (Chen et al., 2023; Gallega & Sumi, 2024).

These capabilities indicate that GenAI is increasingly functioning not simply as a representation tool but as a potential cocreative design instrument. Fang et al. (2025), in their examination of collaboration between GenAI and humans in conceptual design, identify opportunities for GenAI to contribute across activities including brainstorming, concept generation, visualisation, evaluation, decision making, and iterative development. Their analysis further demonstrates that the emerging research agenda is shifting from understanding what AI can generate towards understanding how human designers and generative systems can interact effectively during creative processes. This shift is particularly consequential for design disciplines because architectural and interior design solutions cannot be evaluated exclusively through computational performance or visual attractiveness. They remain dependent on human interpretation, intentionality, contextual understanding, and judgement. GenAI has also been investigated as a means of enhancing interaction between virtual and real architectural environments, indicating that its role may extend beyond static image generation towards more interactive forms of architectural experience and evaluation (Chen et al., 2024).

The growing integration of GenAI into professional design processes inevitably carries important implications for architecture and interior design education. This development forms part of a broader digital transformation of higher education in which institutions are increasingly expected to adapt curricula, pedagogical practices, and learning environments to technological change. Bibliometric evidence on higher education and the Fourth Industrial Revolution identifies digital learning, curriculum reform, institutional transformation, and the integration of advanced technologies such as artificial intelligence as prominent components of this transition (Shahar et al., 2025). More specifically, the rapidly expanding AI and education literature increasingly associates AI with pedagogical transformation, curriculum development, learning outcomes, and new forms of educational innovation (Mohamad et al., 2026). Design education is not concerned solely with students' ability to produce visually attractive outcomes. It is fundamentally concerned with developing the capacity to investigate problems, construct design intentions, evaluate alternatives, justify decisions, integrate technical and contextual knowledge, and communicate design reasoning. The educational question is therefore not simply whether AI can produce design images, but how the technology influences the processes through which students learn to think and act as designers.

Recent empirical evidence suggests that this transition is already occurring. Jin et al. (2024), in an AI embedded architectural programming and design course, found that students associated AI with innovative capability and work efficiency, while the study also identified uncontrollable expression of architectural design outcomes and fragmented, insufficiently systematic AI use. Huh et al. (2025) found that architecture and interior architecture students generally viewed visual GenAI positively during early design stages and associated it with creativity and future professional competitiveness, while becoming more cautious during later stages where originality and critical judgement were considered more important. More recent evidence from interior design education similarly indicates that perceived creative enhancement and professional competitiveness are important drivers of students' positive expectations regarding AI, while responsible integration requires creative agency, critical reflection, and ethical awareness (Farran et al., 2026). Medel Vera et al. (2025) investigated architecture students' text prompts, corresponding AI generated images, and perceptions of GenAI as a creativity support tool. Their study conceptualised creativity not merely through final outputs but also through exploration, iteration, self expression, and user engagement with the creative process. Their findings indicate that GenAI can support exploratory and goal directed creativity, while the characteristics of students' prompts influence the resulting visual outputs. This suggests that AI mediated creativity does not arise independently from the technology but emerges through interaction between the student's conceptual intentions and the generative system. Earlier perception based architectural research also demonstrated interest in AI as a design tool through the evaluation of AI generated interpretations derived from Gaudí's works, contributing to the emerging discussion of how designers perceive the creative potential of artificial intelligence (Zhang et al., 2023).

This relationship places increasing importance on prompt literacy as an emerging design competency. Effective interaction with GenAI requires students to translate conceptual intentions into linguistic and visual instructions that can be interpreted computationally. Prompt formulation therefore extends beyond simply learning technical commands. It involves articulating design concepts, establishing parameters, communicating intended characteristics, interpreting generated outcomes, identifying discrepancies, and progressively refining the interaction. Korkmaz (2026) similarly reports that architecture students encountered difficulties with prompt interpretation despite recognising AI's value for ideation and visualisation, reinforcing the need for explicit instruction in prompt writing and critical management of generated outputs. Huh et al. (2025) likewise identify prompt literacy as a relevant component of responsible visual GenAI use in architectural education. The growing relevance of prompt construction consequently suggests that language itself may become an additional representational medium within design education, complementing conventional modes such as sketching, modelling, drawing, and visual composition.

At the same time, the educational implications of GenAI extend beyond prompt writing towards broader AI literacy. The wider transformation of higher education under advanced digital technologies has intensified attention to curriculum reform, digital competence, educational innovation, and the need for institutions to align technological adoption with meaningful pedagogical change (Shahar et al., 2025). Within the more specific AI and education literature, AI literacy, ethics, governance, and responsible implementation are increasingly prominent concerns (Mohamad et al., 2026). Future designers therefore require the capacity not merely to operate AI systems but to understand their capabilities and limitations, critically evaluate their outputs, recognise potential bias or error, and determine when AI generated suggestions should be accepted, modified, or rejected. AI literacy in design education should consequently be treated as a combination of technological competence, disciplinary judgement, ethical awareness, and critical reflection.

The relationship between human designers and AI can consequently be understood through the concept of hybrid or complementary intelligence. Pareschi (2024), through the concept of centaurian design, argues that human and artificial intelligence can be integrated to exploit their complementary strengths rather than treating technological development as a progressive replacement of human capability. Applied to design education, this perspective suggests that the central question should not be whether GenAI can perform creative activities previously undertaken by students, but how AI capabilities can be combined with human interpretation, critical reasoning, intentionality, and creativity to enhance learning.

This distinction becomes particularly important when considering the relationship between AI and creativity. Computational systems can generate large numbers of visually novel alternatives and increasingly demonstrate performance associated with creative production. Chen et al. (2025), for example, demonstrate that AI can

interpret important components of creative combinational designs, illustrating the growing capacity of computational systems to engage with aspects of creativity previously regarded primarily as human activities. Nevertheless, computational performance should not automatically be considered equivalent to human creative judgement. The expanding relationship between computational intelligence and creative production is also visible in research combining AI with robotic fabrication, where generative and automated systems have been used to transform discarded materials into creative design outcomes (Liu et al., 2024).

Evidence from Bart (2023) illustrates this distinction. In examining whether an AI supported chess engine could identify moves recognised by experts as highly creative, the study found that the system successfully identified seven of ten creative moves but did not identify all of them despite its considerable computational capability. Although the study was conducted within chess rather than architecture, its broader implication is relevant to creative design. Computational systems may recognise or generate many effective and novel solutions while still encountering difficulties with forms of creativity that depend on unexpectedness, subtlety, interpretation, or unconventional reasoning. In design education, where originality and intentionality are central to developing an individual design position, such distinctions remain important.

Accordingly, increased speed and visual productivity should not automatically be equated with improved design quality or deeper learning. Architectural and interior design problems involve complex interactions between spatial organisation, circulation, functionality, aesthetics, materials, ergonomics, environmental performance, technical feasibility, regulatory requirements, user needs, and cultural context. An AI generated image may therefore appear visually sophisticated while simultaneously failing to resolve important aspects of the underlying design problem. This distinction is evident in interior design research, where Liu et al. (2025) found that AI generated proposals achieved strong overall performance but still displayed limitations in specific functional arrangements, including inappropriate bathroom layouts.

Similar limitations have been identified in architectural GenAI workflows. Multimodal generative systems can substantially accelerate design generation and iteration, but challenges remain in maintaining accuracy, consistency, reliability, adaptability, and alignment between generated outputs and intended architectural requirements. Generative systems may also require new skills and workflows, while variability in output quality and limited customisation can constrain the designer's ability to maintain precise creative control. Consequently, visually persuasive AI outputs cannot be accepted uncritically as technically or conceptually valid design solutions.

These limitations establish an important distinction between design generation and design judgement. GenAI can increase the quantity, speed, and visual sophistication of alternatives available to students, but determining whether those alternatives are spatially coherent, functionally appropriate, contextually meaningful, technically feasible, and consistent with the intended design concept remains an evaluative responsibility. The educational value of AI therefore depends not merely on its ability to generate alternatives but on students' capacity to interrogate, compare, reject, modify, and justify those alternatives. In this respect, the student must remain an active participant in the design process rather than becoming a passive selector of machine generated outputs.

This issue has significant pedagogical implications. Research on higher education in the context of technological transformation increasingly identifies curriculum reform, teaching practices, educational innovation, and student learning as central concerns, indicating that digital adoption must be accompanied by pedagogical adaptation rather than treated solely as technological implementation (Shahar et al., 2025). If students can generate sophisticated visual alternatives before sufficiently engaging with problem definition, contextual analysis, conceptual reasoning, experimentation, and evaluation, technological efficiency may inadvertently bypass some of the cognitive processes through which design competence develops. Conversely, when GenAI is incorporated into carefully structured studio activities requiring students to evaluate, compare, explain, and refine generated alternatives, the technology may support deeper reflection and more extensive exploration. The pedagogical effect of GenAI therefore depends substantially on how the tool is positioned within the learning process.

Collaboration between humans and AI consequently represents a particularly important direction for design education. Rather than treating AI as either inherently beneficial or inherently detrimental, a more productive perspective is to examine the conditions under which collaboration between students and AI supports learning.

Fang et al. (2025) identify this as an important research direction, noting that GenAI research has concentrated considerably on technological advancement while user experience and the mechanisms underlying effective interaction between humans and AI require further investigation. Within design education, such interaction is especially important because the process through which students reach a design solution is itself an educational outcome.

Responsible AI use introduces an additional dimension to this pedagogical challenge. This concern is consistent with the wider AI education literature, which increasingly emphasises ethical deployment, transparency, governance, data privacy, and equitable implementation as central conditions for responsible educational innovation (Mohamad et al., 2026). Generative design raises questions regarding intellectual property, ownership, authenticity, authorship, data privacy, and the provenance of generated outputs. Research integrating multimodal GenAI with blockchain technology demonstrates that ownership, traceability, and authentication have already become substantive issues within AI mediated architectural production. Such systems have been proposed as mechanisms for recording provenance and protecting ownership of AI generated architectural assets. Although technological solutions may contribute to traceability, educational environments face an additional concern: determining the extent to which submitted work reflects the student's own intellectual and creative contribution.

Authorship and creative agency therefore become especially important within studio assessment. In conventional design education, students are generally expected to demonstrate not merely a final outcome but also the reasoning and developmental process through which that outcome was achieved. When GenAI becomes involved, the boundaries between student generated and machine generated contributions may become less distinct. Responsible pedagogical integration consequently requires students to understand how AI generated content should be acknowledged, evaluated, modified, and incorporated without compromising academic integrity or reducing their responsibility for design decisions.

Taken together, the existing literature reveals a fundamental tension surrounding GenAI within architecture and interior design education. On one hand, GenAI can accelerate visualisation, broaden creative exploration, facilitate rapid iteration, support divergent ideation, improve presentation, and expose students to alternatives that might not emerge immediately through conventional processes. On the other hand, the same capabilities raise concerns regarding technical accuracy, functional appropriateness, overreliance, originality, authorship, academic integrity, and the preservation of independent design judgement. The educational question is therefore no longer simply whether GenAI can produce compelling design outputs, but how its capabilities can be incorporated into studio learning without displacing the human cognitive and creative processes through which students learn to design.

Despite the rapidly expanding literature, an important empirical and pedagogical gap remains. At the broader field level, research on AI and education has grown rapidly and become increasingly interdisciplinary, with generative AI, AI literacy, ethics, and educational transformation emerging as important research directions (Mohamad et al., 2026). Within design education specifically, recent studies have examined students' perceptions of visual GenAI, creative agency, technology acceptance, technical limitations, academic integrity, and stage specific integration in architecture and interior design studios (Huh et al., 2025; Korkmaz, 2026; Farran et al., 2026; Elmoghazy et al., 2026). Earlier work has also argued for integrating AI into architecture and interior design education to improve efficiency, expand design exploration, and prepare students for increasingly digital professional practice (Almaz et al., 2024). Consequently, it is no longer sufficiently precise to claim that students' perceptions of GenAI within design education are generally unexplored.

Rather, a more specific gap concerns how architecture and interior design students experience, interpret, and critically evaluate GenAI when it is applied to design work that they themselves have previously conceptualised and developed. Existing studies have examined student perceptions following workshops, guided course integration, surveys, or AI use within active studio projects (Huh et al., 2025; Korkmaz, 2026; Farran et al., 2026; Elmoghazy et al., 2026). Comparatively less attention has been directed towards students' reflective evaluation of AI generated alternatives against their own previously completed studio designs, where they already possess knowledge of the conceptual reasoning, spatial intentions, aesthetic decisions, and functional

considerations embedded within the original work. This comparative arrangement creates a distinctive basis for examining what students believe AI adds to, alters, or potentially removes from an established design intention.

This comparative perspective is important because students who have developed the original design are uniquely positioned to assess what GenAI contributes to and potentially removes from their work. Rather than judging AI outputs exclusively according to visual attractiveness, students can evaluate whether generated alternatives preserve their original design intentions, introduce meaningful creative possibilities, resolve or create functional problems, and influence their perceptions of authorship and creative control. Such an approach therefore provides a more direct means of examining the relationship between AI generated possibility and human design judgement.

Against this background, the present study investigates the integration of generative AI into design studio learning among Architecture and Interior Design students at the University of Technology Sarawak (UTS). Rather than examining students' attitudes towards AI solely at an abstract or hypothetical level, the study is grounded in direct AI assisted design experience. Participants engage with PromeAI using an existing completed studio project, whereby perspectives from their original designs are used to generate AI assisted alternatives. Students subsequently compare the AI generated outputs with their original designs before reflecting on their experiences through semi structured focus group discussions. This approach positions students simultaneously as designers, AI users, and evaluators of AI generated alternatives, allowing their perceptions to emerge from direct engagement with their own design work.

Accordingly, this study aims to explore how architecture and interior design students experience and evaluate the integration of generative AI within design studio learning, with particular attention to creative ideation, design visualisation, learning processes, and responsible AI use. Rather than evaluating GenAI primarily according to technological performance or the aesthetic quality of generated outputs, the study focuses on students' experiences of engaging with GenAI as part of the design process. This student centred perspective recognises that the educational value of GenAI depends not merely on what the technology can produce but on how its use influences students' exploration of ideas, evaluation of alternatives, design decision making, and development of independent creative judgement. The study therefore addresses the following research questions:

RQ1: How do architecture and interior design students perceive the role of generative AI in supporting creative ideation and design development?

RQ2: What opportunities and challenges do students experience when using generative AI within design studio learning?

RQ3: How do students perceive the appropriate pedagogical and ethical integration of generative AI into future design studio education?

By addressing these questions, the study contributes to the emerging literature on AI assisted design education by moving beyond a predominantly technological understanding of GenAI towards an examination of its pedagogical role within architecture and interior design studio learning. This focus responds to the wider movement in AI education research towards understanding not only technological adoption, but also pedagogy, learning, ethics, AI literacy, and responsible implementation (Mohamad et al., 2026). More specifically, the study examines the tension between the capacity of GenAI to facilitate creative exploration, rapid visualisation, iterative experimentation, and design efficiency and the educational imperative to preserve independent design thinking, critical judgement, originality, authorship, and meaningful engagement with the design process. The educational value of GenAI should therefore not be determined solely by the sophistication or efficiency of its outputs, but by the extent to which it contributes to, rather than displaces, the cognitive and creative processes through which students develop design competence.

Ultimately, the study positions GenAI not as a replacement for human creativity and design reasoning, but as a potential complementary and cocreative learning resource whose educational value depends on how critically, intentionally, and responsibly it is incorporated into studio pedagogy. Through students' direct experiences and reflections, the study seeks to provide an empirically grounded understanding of how GenAI can support creative

exploration and design learning while simultaneously addressing concerns surrounding technical limitations, overreliance, originality, authorship, academic integrity, and responsible use. In doing so, the study provides a basis for a more pedagogically informed approach to GenAI integration in architecture and interior design education, one that harnesses the exploratory capabilities of generative technologies while preserving the human judgement, intentionality, critical reasoning, and creative agency fundamental to learning how to design.

METHODOLOGY

Research Design

This study employed an exploratory qualitative research design to investigate how architecture and interior design students experience and perceive the integration of generative artificial intelligence within design studio learning. A qualitative approach was considered appropriate because the study sought to understand students' experiences, interpretations, and reflections concerning the role of GenAI in creative ideation, design development, learning processes, and responsible integration into studio education. Rather than quantitatively measuring changes in creativity or objectively determining whether GenAI improves design performance, the study focused on how students interpreted the opportunities, limitations, and pedagogical implications associated with its use.

The research adopted a qualitative design based on direct student experience and comprised two sequential stages: an AI assisted design activity followed by semi structured focus group discussions. This structure enabled participants to reflect on GenAI following direct engagement with the technology rather than discussing its educational implications solely at an abstract or hypothetical level. During the first stage, participants applied GenAI to a previously completed studio project and generated AI assisted design alternatives. During the second stage, students reflected on and compared these outputs with their original designs before discussing their experiences in focus groups.

The research design was aligned with the three research questions: (1) how architecture and interior design students perceive the role of GenAI in supporting creative ideation and design development; (2) what opportunities and challenges students experience when using GenAI within design studio learning; and (3) how students perceive the appropriate pedagogical and ethical integration of GenAI into future design studio education. Accordingly, the design enabled the study to examine both students' immediate experiences of AI assisted design exploration and their broader reflections on the implications of GenAI for studio based learning.

Study Context

The study was conducted at the University of Technology Sarawak, Malaysia, involving students enrolled in the Architecture and Interior Design programmes. The design studio was selected as the empirical setting because studio based learning constitutes a central component of architecture and interior design education, where students progressively develop design competence through conceptualisation, exploration, visualisation, critique, refinement, and reflection.

GenAI is particularly relevant within this educational environment because image generative systems can rapidly produce visual alternatives based on textual and visual inputs. Such capabilities may expand students' opportunities for conceptual exploration and visualisation while simultaneously raising questions concerning independent ideation, design judgement, technical validity, creativity, and the learning process. The design studio therefore provided an appropriate context for examining how students negotiate the relationship between AI generated possibilities and their own design knowledge and judgement.

The empirical activity utilised PromeAI, an AI assisted visualisation platform that supports image to image generation. The platform enabled participants to use visual material derived from their own previously completed studio projects as input for generating alternative design interpretations. This approach provided participants with a familiar reference point from which to evaluate the AI generated alternatives against their existing design intentions, spatial considerations, functional requirements, and visual decisions.

Participant Selection and Sampling

Purposive sampling was employed to recruit participants who possessed direct experience with upper level design studio learning and were therefore able to provide information rich reflections on the integration of GenAI into the design process. Eligibility was restricted to students who had progressed to upper level studio courses and had already acquired fundamental knowledge and experience in design development. This criterion was important because meaningful evaluation of AI generated design alternatives required participants to possess an established foundation in design principles and prior experience in developing their own studio projects. This purposive, experience based selection is consistent with exploratory qualitative research in the built environment, where participants are intentionally recruited for their relevant expertise or experience and qualitative data are interpreted through thematic analysis (Silini et al., 2026).

A total of 30 students participated in the study, comprising 20 Architecture students and 10 Interior Design students. The Architecture participants were third year students, whereas the Interior Design participants were second year students. The smaller number of Interior Design participants reflected the relatively recent establishment of the Interior Design programme at the university and, consequently, its smaller available student cohort.

Participants were organised into six focus groups, with five students in each group. The relatively small focus group size was selected to facilitate active participation and provide each participant with sufficient opportunity to describe, compare, and reflect upon their experience of the AI assisted design activity. Given the experiential and reflective nature of the study, the sample was selected for its relevance to the research questions and participants' capacity to provide meaningful qualitative accounts rather than for statistical representativeness.

Table 1. Participant Profile

Characteristic	Description
Total participants	30 students
Architecture	20 students
Interior Design	10 students
Architecture study level	Year 3
Interior Design study level	Year 2
Sampling strategy	Purposive sampling
Eligibility	Students from upper-level design studios with fundamental design knowledge
Number of focus groups	6
Participants per focus group	5
Study location	University of Technology Sarawak, Malaysia
Discussion language	English

AI Assisted Design Activity

Prior to the focus group discussions, participants undertook an AI assisted design activity using PromeAI. The activity was structured around a previously completed studio project so that participants already possessed detailed familiarity with the design problem, conceptual development, design intentions, and final outcome. Using completed rather than ongoing projects also enabled participants to evaluate AI generated alternatives against work they had previously developed through their conventional studio design process.

Each participant selected one completed studio project and used a perspective drawing from the project as the visual input for PromeAI. Guided prompts were provided to support interaction with the platform and the generation of alternative visual interpretations. Participants subsequently examined the resulting AI generated alternatives in relation to their original work.

The activity was designed as an experiential basis for qualitative reflection rather than as an experimental intervention intended to determine whether GenAI improved design performance. Participants were encouraged to consider whether the AI generated alternatives introduced new creative possibilities, supported visualisation, altered their interpretation of the original design, accurately reflected their design intentions, or presented functional, spatial, technical, or aesthetic limitations. This procedure placed participants in the dual role of GenAI

users and evaluators. Because they were comparing AI generated outputs against projects that they had personally conceptualised and developed, they were able to evaluate not only the visual attractiveness of the generated images but also their relationship to the underlying design intentions and requirements.

Data Collection

Primary qualitative data were collected through six semi structured focus group discussions, each comprising five participants. The discussions were conducted face to face at the University of Technology Sarawak following completion of the AI assisted design activity. English was used throughout the focus group discussions. Focus groups were selected because they enabled participants to articulate their individual experiences while simultaneously responding to, comparing, and elaborating upon perspectives raised by other participants. This interaction was particularly appropriate for the study because participants had undertaken a comparable AI assisted activity but could experience and interpret the resulting design outputs differently.

The discussions were moderated by the researcher using a semi structured protocol. The protocol provided consistency across the six groups while allowing follow up questions to be used where clarification or further elaboration was required. Discussions addressed participants' experiences of AI assisted ideation, visualisation and design development; perceived workflow benefits; technical limitations; implications for creativity and learning; concerns regarding overreliance, originality, and academic integrity; and perceptions regarding the future integration of GenAI into design studio education. With participants' consent, the focus group discussions were documented using audio and video recording to support accurate capture of the discussions. The recorded discussions were subsequently transcribed into written form for qualitative analysis.

Focus Group Protocol and Research Question Alignment

The semi structured focus group protocol was designed around the three research questions. Rather than eliciting general opinions about artificial intelligence, the discussions encouraged participants to reflect on their direct experience of using GenAI with their own previously completed design work.

The first area of inquiry examined how GenAI influenced creative ideation, exploration, visualisation, and design development. The second examined opportunities and challenges encountered during GenAI use, including workflow efficiency, technical limitations, creativity, learning, and potential overreliance. The third explored broader pedagogical and ethical issues, including originality, authorship, academic integrity, lecturer guidance, and the appropriate future role of GenAI within design studio education.

Table 2. Alignment between Research Questions and Data Collection

Research Question	Focus of Investigation	Analytical Dimension
RQ1: How do architecture and interior design students perceive the role of generative AI in supporting creative ideation and design development?	Creative exploration, alternative generation, visualisation, and comparison with original design intentions	Creative and design support
RQ2: What opportunities and challenges do students experience when using generative AI within design studio learning?	Workflow efficiency, technical limitations, design control, learning, creativity, and overreliance	Opportunities and challenges
RQ3: How do students perceive the appropriate pedagogical and ethical integration of generative AI into future design studio education?	Originality, authorship, academic integrity, lecturer guidance, AI literacy, and future educational use	Responsible pedagogical integration

This alignment established methodological coherence between the research questions, experiential activity, focus group discussions, and subsequent analysis.

Data Analysis

Data from the six focus group discussions were analysed using thematic analysis. The analytical process was designed to identify recurring patterns of meaning across participants' accounts while remaining attentive to variations in individual experiences and perspectives. Analysis commenced with familiarisation with the qualitative dataset through repeated reading of the transcripts. Meaningful segments of participants' responses were then assigned initial codes reflecting their experiences and perceptions of GenAI assisted design. Codes expressing conceptually related ideas were compared and organised into broader categories. These categories were subsequently examined for recurring patterns and developed into candidate themes.

Candidate themes were reviewed in relation to both the coded extracts and the overall dataset to assess their internal coherence and distinctiveness. The themes were subsequently refined, defined, and named according to their central organising concepts. The final analytical stage involved interpreting the relationships among the themes in relation to the three research questions and the broader educational implications of GenAI integration. The analysis generated six overarching themes: (1) AI as a Tool for Creative Ideation; (2) AI for Visualisation and Workflow Efficiency; (3) Technical Limitations of Current AI Tools; (4) Concerns Regarding Learning, Creativity, and Overreliance; (5) Ethical and Academic Considerations; and (6) Future Integration of AI into Design Studio Education.

The analysis was interpretive rather than frequency driven. Consequently, the analytical importance of an issue was not determined solely by the number of times it was mentioned. Greater emphasis was placed on the relevance of participants' accounts to the research questions, the recurrence of patterns across the discussions, and their capacity to illuminate students' experiences of GenAI assisted studio learning.

Trustworthiness and Research Rigour

Several features of the research design supported the trustworthiness of the qualitative inquiry. First, participants' reflections were grounded in a common experiential activity involving direct interaction with GenAI. This reduced reliance on hypothetical perceptions and enabled participants to discuss opportunities and limitations they had personally encountered.

Second, participants used their own previously completed studio projects as the basis of the activity. This provided an established comparative reference because students were already familiar with the conceptual reasoning, design intentions, spatial considerations, and development process underlying their original work. Their evaluation of the AI generated alternatives could therefore extend beyond superficial visual preference to include reflection on whether the outputs remained consistent with their intended designs.

Third, data were collected across six separate focus groups rather than through a single group discussion. The use of multiple groups enabled recurring patterns and contrasting perspectives to be considered across the dataset. Audio and video recording further supported accurate documentation of participants' responses, while transcription established a textual record for systematic coding and thematic interpretation. Finally, representative participant quotations were retained in the reporting of the findings to maintain a visible connection between the empirical evidence and the researchers' interpretations. Together, these procedures strengthened the credibility, dependability, and transparency of the qualitative analysis.

Ethical Considerations

Participation was voluntary, and students were informed of the purpose of the study prior to data collection. Informed consent was obtained from participants, including consent for audio and video recording of the focus group discussions. Participants' identities were anonymised in the research reporting, and the collected information was treated confidentially and used solely for research purposes. Given that the study was conducted within an educational environment, particular attention was given to ensuring that students could express positive, negative, or critical perspectives concerning GenAI without their individual identities being disclosed in the reporting of the findings.

Methodological Framework

The methodological framework established a sequential connection between participant selection, direct engagement with GenAI, qualitative reflection, thematic analysis, and interpretation. Importantly, the study did not rely solely on participants' general attitudes towards artificial intelligence. Instead, students first interacted with GenAI using design work that they had personally developed before reflecting collectively on that experience.

Research Problem and Research Questions



Purposive Selection of Upper-Level Studio Students



30 Architecture and Interior Design Students



Selection of Previously Completed Studio Projects



PromeAI Assisted Design Activity



Generation and Comparison of AI Assisted Alternatives



Six Focus Groups with Five Participants per Group



Audio and Video Recording



Transcription



Coding and Thematic Analysis



Six Empirical Themes



Interpretation of Opportunities, Challenges, and Responsible Pedagogical Integration

The methodological sequence establishes direct alignment between the research questions, experiential activity, qualitative data collection, and thematic analysis. Rather than attempting to demonstrate that GenAI objectively improves creativity or design performance, the study provides an experience based qualitative assessment of how architecture and interior design students perceive GenAI as a creative, visual, and pedagogical resource. It

further identifies the opportunities and challenges students encounter and examines the pedagogical and ethical conditions they consider important for the responsible integration of GenAI into future design studio education.

RESULTS

Overview of Findings

The thematic analysis revealed five interrelated themes that capture how architecture and interior design students experienced and evaluated the use of generative artificial intelligence (GenAI) in design studio learning. Although the six focus group discussions were conducted separately, substantial convergence was observed in participants' accounts. Students generally perceived GenAI positively, particularly for generating initial ideas, exploring alternative design directions, accelerating visualisation, and reducing the time required to produce preliminary design representations. However, this positive perception was consistently accompanied by reservations concerning technical reliability, architectural validity, excessive dependence, originality, and the potential displacement of important learning processes.

The findings therefore reveal neither unconditional acceptance nor rejection of GenAI. Instead, participants articulated a conditional position in which the educational value of AI depended on where, how, and for what purpose it was used within the design process. AI was regarded as particularly valuable during ideation and visual exploration, whereas architectural reasoning, technical development, contextual evaluation, and final decision making were viewed as responsibilities that should remain with the student.

Five themes were identified: (1) AI as a Tool for Creative Ideation; (2) AI for Visualisation and Workflow Efficiency; (3) Technical Limitations of Current AI Tools; (4) Learning, Creativity, and Overreliance; and (5) Future Integration into Design Studio Education. Collectively, these themes indicate a progression from the immediate benefits of AI assisted design towards the conditions necessary for its responsible educational integration.

Table 3. Summary of Themes and Central Findings

Theme	Central finding
AI as a Tool for Creative Ideation	AI expands the range of ideas and supports exploration, particularly when students experience creative blocks.
AI for Visualisation and Workflow Efficiency	AI accelerates visual production, facilitates rapid comparison of alternatives, and supports design communication.
Technical Limitations of Current AI Tools	Visually compelling outputs may lack functional, contextual, spatial, and construction logic.
Learning, Creativity, and Overreliance	Excessive dependence may bypass research, reasoning, iteration, and independent creative development.
Future Integration into Design Studio Education	Students support structured integration governed by human judgement, lecturer guidance, transparency, and process-oriented assessment.

The themes should not be interpreted independently. Rather, they collectively reveal a recurring tension throughout the data: AI increases the capacity to generate and visualise design possibilities, but students continue to regard human judgement as necessary for determining whether those possibilities constitute meaningful and defensible design solutions.

AI as a Tool for Creative Ideation

Creative ideation emerged as one of the strongest perceived benefits of GenAI. Across the focus groups, participants frequently described AI as a source of inspiration during the conceptual stage, particularly when they encountered difficulty initiating or extending a design idea. Rather than describing AI as an autonomous designer, students generally positioned it as a mechanism for expanding the range of possibilities available for consideration.

"When I am stuck, I can get different creative ideas."

"It gives suggestions and expands our thinking. Sometimes it gives ideas that we never thought about before."

These accounts indicate that students valued AI primarily for its capacity to broaden exploration. The rapid production of alternatives exposed them to architectural forms, materials, spatial arrangements, and aesthetic treatments that might not have emerged immediately through their conventional design processes. Participants did not necessarily regard these generated alternatives as finished solutions. Instead, they described comparing, modifying, combining, or reinterpreting AI suggestions according to their existing design intentions.

The findings also suggest that students perceived AI assisted ideation as extending beyond visual generation. Some participants reported using conversational AI to organise fragmented ideas, strengthen conceptual narratives, and establish relationships among design concepts before progressing to visual development.

"ChatGPT helps me link scattered ideas and continue developing my design."

This indicates that students differentiated between complementary forms of AI assistance. Image generative systems were useful for visual exploration, whereas conversational systems could assist in organising and articulating conceptual thinking.

The theme therefore indicates that students perceived GenAI as a form of creative augmentation. Its value was associated with expanding the design possibility space, overcoming moments of creative stagnation, and stimulating experimentation, while creative ownership and judgement remained associated with the student. This interpretation is consistent with research showing that GenAI can support exploratory creativity and broaden conceptual possibilities in architectural and design learning (Maksoud et al., 2024; Medel Vera et al., 2025; Huh et al., 2025). Korkmaz (2026) similarly found that architecture students valued AI for generating diverse design ideas and accelerating ideation, while Farran et al. (2026) identified anticipated creative enhancement as a major factor underlying positive perceptions of AI in interior design education. Importantly, Sektani et al. (2026) provide a more qualified picture: AI refinement produced a modest overall increase in assessed creativity among architecture students, but the gains were concentrated in appropriateness, functional adequacy, structural feasibility, and environmental response rather than originality. This distinction supports the present study's interpretation that increased generative capacity should not automatically be equated with increased originality.

AI for Visualisation and Workflow Efficiency

Whereas the first theme concerned expansion of ideas, the second revealed the practical value students attached to AI for accelerating visualisation and design workflow. Participants frequently described the speed of AI generated imagery as one of its most immediate advantages.

"It doesn't waste time. You just type what you want and you can get different kinds of views."

"It saves a lot of time compared to doing rendering manually."

Students therefore perceived AI not simply as a means of reducing workload, but as enabling more alternatives to be examined within a limited period. Rapid generation allowed participants to compare different material palettes, architectural styles, facade treatments, environmental conditions, and other visual possibilities before deciding which direction warranted further development. Participants also valued the capacity of AI to enhance the visual communication of ideas that had already been developed.

"It helps me visualise the aesthetic of my design and makes it easier to see what the final building could look like."

"AI enhances the picture without changing my design."

These comments are significant because participants distinguished between developing a design and representing a design. For many students, AI's strongest contribution was not necessarily the generation of the underlying architectural concept but the rapid transformation of an existing concept into a more comprehensible and visually persuasive representation. Participants further suggested that rapid visualisation could support iteration.

Preliminary outputs could be generated quickly, reviewed, discussed during studio critiques, and subsequently refined. Some students with internship experience also observed that AI assisted visualisation was becoming relevant in professional practice, particularly where rapid concept images were needed to communicate with clients.

Nevertheless, students did not equate efficiency with design quality. They repeatedly emphasised that faster visual production did not remove the need to evaluate functionality, appropriateness, and feasibility. Consequently, the perceived advantage of AI was not simply that it allowed students to produce outputs more quickly, but that it could potentially redistribute time from repetitive visual production towards comparison, evaluation, and refinement, provided that the saved time was actually redirected towards those higher order design activities. This finding corresponds with studies demonstrating the capacity of generative systems to accelerate visual production, alternative generation, and iterative design exploration (Fitriawijaya & Jeng, 2024; Shao et al., 2024; Liu et al., 2025).

Technical Limitations of Current AI Tools

Despite recognising the benefits of GenAI, participants demonstrated considerable awareness of its technical limitations. These concerns were especially apparent when students evaluated generated alternatives from an architectural rather than purely visual perspective. A recurring difficulty concerned prompt interpretation. Participants reported that even carefully formulated instructions did not always produce the intended outcome.

"Sometimes it doesn't give what I want, even though I already typed the prompt clearly."

"AI can't really understand what you want to express."

Participants consequently recognised prompting as an emerging competency requiring experimentation and refinement. However, they also recognised that improved prompting could not eliminate all limitations because some problems originated from the AI system's inability to interpret design intention and architectural context adequately.

More importantly, participants repeatedly distinguished between visual plausibility and architectural validity. AI generated images could appear sophisticated while containing spatial, functional, or construction problems. Participants identified unrealistic circulation, disconnected spaces, impractical stairs, misplaced openings, and structural arrangements that would be difficult or impossible to construct.

"Sometimes the image doesn't make sense in real life."

"It only produces ideas, but not how to build them."

These observations represent an important finding. Students were not evaluating AI output solely according to aesthetic quality. Instead, they applied disciplinary knowledge to distinguish a convincing representation from a feasible architectural proposition. In this respect, an image could be visually persuasive while remaining architecturally weak. Limited user control constituted another difficulty. Participants reported that requesting a small modification could result in regeneration of the entire image, potentially altering elements they wished to retain.

"It would be better if we could just select one part of the image and change only that part."

Students therefore wanted more granular control over specific architectural components rather than repeated whole image regeneration. The findings consequently reveal an important boundary to AI assisted design. Current GenAI tools were perceived as capable of producing visual intelligence, in the sense of generating convincing representations and alternatives, but not necessarily design intelligence, understood here as the ability to reconcile spatial relationships, function, constructability, contextual requirements, user needs, and design intent. Similar concerns appear in prior research showing that AI generated design outputs can be visually strong while retaining limitations related to functional arrangements, design control, and architectural appropriateness (Kwon & Ahn, 2024; Liu et al., 2025). Jin et al. (2024) likewise identified difficulties associated with the

uncontrollable expression of architectural design outcomes, while Korkmaz (2026) reports student concerns regarding technical accuracy, prompt interpretation, architectural plans, and structural details. Huh et al. (2025) found greater caution towards GenAI in later design stages where technical knowledge, contextual specificity, originality, and human judgement become more important. The importance of preserving students' underlying spatial competence is also reinforced by Amro and Dawoud (2024), who identify spatial ability as a fundamental capability in architecture and interior design education and show the continuing importance of sketching, hand drawing, geometry, and related spatial learning practices.

Learning, Creativity, and Overreliance

Participants' concerns extended beyond technical shortcomings to the educational consequences of excessive AI dependence. Students did not generally question whether AI should be used; rather, they questioned what might occur when AI begins to substitute for activities through which design competence is developed. A central concern was the possibility of bypassing important stages of the studio process. Participants recognised that GenAI could produce visually impressive results quickly, potentially encouraging students to prioritise the final image over research, analysis, conceptual reasoning, experimentation, and iterative development.

"People will become lazy because they skip the learning process."

"Students don't really understand how the design was created. They only see the final product."

These comments reveal that participants differentiated producing an outcome from learning how to design. For them, design education involved the reasoning and development process through which an outcome was reached, rather than the visual sophistication of the final representation alone. Participants similarly expressed concerns about independent creativity. While AI could stimulate ideas, continuous dependence on generated suggestions could potentially influence students' conceptual directions and reduce opportunities to establish an individual design identity.

"If we keep depending on AI, eventually our own creativity will become weaker."

"AI helps with ideas, but the concept should still come from the student."

Participants also raised concerns about homogenisation. If students employ similar prompts or interact with comparable generative systems, their outputs may increasingly display similar visual characteristics. This concern extends beyond stylistic repetition because design visualisations communicate assumptions about spaces, users, and intended forms of occupation. McKenzie et al. (2025) demonstrate in interior architecture and design education that visual representations can reproduce narrow or stereotypical assumptions about users and argue that emerging AI generated visualisations should be critically examined for their potential to perpetuate or challenge social biases. This reinforces the need for students to evaluate generated images not only for aesthetic appeal but also for the assumptions and representations embedded within them.

"If everyone uses similar prompts, the outcomes will also become similar."

In addition, repeated exposure to AI generated alternatives could redirect students away from their original intentions, particularly when visually attractive suggestions were unrelated to the underlying design problem. A related concern involved research behaviour. Some participants feared that the immediate availability of generated suggestions might discourage students from undertaking precedent studies, site investigation, environmental analysis, examination of user requirements, and technical research.

"Students will not do the research because AI already gives them the answer."

The findings therefore reveal an educational paradox. The same acceleration that makes AI valuable can become pedagogically problematic when speed replaces engagement with the processes through which design knowledge is developed. Participants consequently favoured moderation rather than unrestricted adoption or prohibition. This tension is consistent with recent design education research that frames AI as valuable for creativity and collaboration when it augments, rather than displaces, students' own creative engagement (Medel Vera et al.,

2025; Petrova & Kuhnen, 2025). It also corresponds with concerns that unmonitored AI use may weaken students' analytical and critical thinking processes, obscure learning outcomes, and encourage dependence on generated products rather than design reasoning (Elmoghazy et al., 2026).

Future Integration into Design Studio Education

Despite the limitations and risks identified above, participants broadly supported the future integration of GenAI into architecture and interior design education. Their support, however, was conditional. Students consistently argued that AI should complement rather than replace established studio learning and that its role should vary according to the stage and purpose of the design process. Participants considered GenAI particularly appropriate for brainstorming, early concept exploration, precedent exploration, visualisation, and the generation of alternative possibilities. By contrast, design reasoning, technical development, contextual evaluation, and final decision making were expected to remain under student control. This stage sensitive position closely parallels Huh et al. (2025), who found stronger student acceptance of visual GenAI during concept design and greater caution in later stages where originality, technical knowledge, and critical judgement become more central. Korkmaz (2026) similarly concludes that AI is most effective in preliminary and conceptual phases as a tool for ideation and visualisation rather than as a substitute for human expertise. More broadly, the position is consistent with calls for structured curricular integration that develops creative agency, critical reflection, and responsible AI use (Farran et al., 2026).

"AI should be used when we are stuck, but the final design should still come from us."

"It is good for generating ideas, but students still need to understand the concept and why they designed it that way."

These statements reinforce a consistent position across the findings: students were willing to delegate certain generative tasks to AI but were reluctant to delegate design judgement. Participants also assigned lecturers an important mediating role. They expected educators to understand emerging AI technologies sufficiently to explain their strengths and limitations, establish appropriate boundaries, and encourage students to interrogate rather than passively accept generated outputs.

Responsible integration was also connected to transparency and academic integrity. Participants expressed uncertainty regarding acceptable AI use, particularly in studio submissions and assessment, and raised concerns involving originality, authorship, plagiarism, copyright, and the presentation of AI generated work as entirely student produced work. They therefore supported clearer institutional expectations concerning when AI could be used, how its use should be acknowledged, and what evidence students should provide to demonstrate their own intellectual and creative contribution. These concerns are strongly reflected in Huh et al. (2025), whose participants considered GenAI use more ethically acceptable when transparently acknowledged, and in Elmoghazy et al. (2026), who identify authenticity, academic integrity, learning outcome attainment, and fair assessment as central challenges in AI integrated interior design studios. Kurcusz et al. (2026) provide further architecture specific evidence, finding a strong preference among architecture master's students for AI as a supportive tool that augments rather than replaces human creativity and professional decision making. Their study also highlights privacy, bias, transparency, accountability, authorship, and overreliance as important ethical concerns, strengthening the case for explicit ethical guidance in architectural education.

Importantly, participants' recommendations extended beyond regulating AI use to reconsidering what should be assessed. Because GenAI can rapidly produce visually sophisticated outputs, students suggested that assessment should place greater emphasis on the design process. Evidence such as conceptual development, iterations, critical reflection, and justification of decisions could help demonstrate authentic student learning even where AI tools contribute to visual production. This recommendation is closely aligned with Elmoghazy et al. (2026), who argue for shifting studio assessment away from predominant emphasis on the final product towards analysis, design decisions, justification, critical thinking, and documented process. Huh et al. (2025) similarly recommend stage specific guidelines, transparent acknowledgement, prompt histories, and authorship safeguards to strengthen traceability and critical reflection.

DISCUSSION

The findings reveal a more nuanced relationship between GenAI and design studio learning than a simple distinction between acceptance and resistance. Students simultaneously recognised the capacity of GenAI to expand creative exploration and accelerate visual production while questioning its architectural reliability and its consequences for learning. This dual position suggests that the central issue for design education is no longer whether GenAI should be used, but how its generative capacity should be positioned relative to human design judgement, creative agency, and studio pedagogy.

GenAI as Creative and Operational Augmentation

The first major interpretation concerns the role of GenAI as an augmentative rather than substitutive technology. Students valued AI because it expanded the range of possibilities, they could encounter during early stage design and reduced the effort required to visualise those possibilities. This supports the emerging view of human and AI design as a complementary relationship in which computational generation expands the solution space while human designers retain responsibility for interpretation and selection (Fang et al., 2025; Pareschi, 2024).

This finding is particularly meaningful in the context of the study design. Participants were not evaluating unfamiliar AI generated designs in isolation. They applied GenAI to projects they had already conceptualised and developed, providing them with an existing design intention against which generated alternatives could be evaluated. Their responses therefore reflect comparison between their own prior design reasoning and subsequent AI generated possibilities, rather than general attitudes towards AI.

The findings suggest that GenAI may alter the economics of iteration within studio learning. When producing an additional visual alternative becomes substantially faster, students can potentially examine a broader possibility space before committing to a particular direction. This interpretation is supported by studies showing that GenAI can accelerate early design generation, exploration, and refinement while enabling designers to consider multiple alternatives (Fitriawijaya & Jeng, 2024; Qian et al., 2023; Fang et al., 2025; Almaz et al., 2024). Jin et al. (2024) similarly identify innovative capability and work efficiency as central contributors to the effectiveness of AI assisted architectural teaching. Student based evidence provides similar support: Korkmaz (2026) reports faster ideation and visualisation, while Huh et al. (2025) found particular enthusiasm for visual GenAI during early design stages. However, the pedagogical benefit does not arise automatically from generating more alternatives. It emerges when those alternatives become objects of comparison, criticism, selection, modification, and rejection. This is consistent with the broader design studio literature, which positions iterative testing, reflection in action, and active engagement with design artefacts as central to learning (Hettithanthri & Hansen, 2022; Chen et al., 2026). Consequently, GenAI's educational contribution can be understood as creative augmentation through expanded possibility coupled with operational augmentation through accelerated representation. The human contribution remains central because the educational act lies not only in generating alternatives but in determining why one alternative is more appropriate than another.

Visual Intelligence Does Not Necessarily Constitute Design Intelligence

One of the most important contributions of the findings is the distinction participants made between visual quality and architectural validity. Students repeatedly encountered AI outputs that appeared persuasive but contained unrealistic circulation, spatial inconsistencies, impractical architectural elements, or questionable constructability.

This suggests a critical distinction between what may be termed visual intelligence and design intelligence. Visual intelligence refers here to GenAI's capacity to generate coherent, attractive, and persuasive representations. Design intelligence requires a broader integration of function, space, context, constructability, user requirements, technical knowledge, and conceptual intention. The distinction is supported by evidence that generative systems can achieve strong aesthetic and creative performance while still producing weaknesses in specific functional arrangements and design requirements (Liu et al., 2025; Kwon & Ahn, 2024). It is reinforced by Korkmaz (2026), whose participants identified limitations in technical accuracy, architectural plans, structural

elements, and prompt interpretation, and by Huh et al. (2025), who report greater caution in later design phases requiring practical and technical judgement.

The distinction has important educational consequences. A visually sophisticated output may create an impression of design resolution before the underlying architectural problem has actually been resolved. If students or educators equate representational sophistication with design quality, GenAI could unintentionally shift studio evaluation towards appearance rather than reasoning.

At the same time, the participants' ability to identify these deficiencies provides evidence of an important pedagogical possibility. AI generated errors can themselves become learning materials. Students can be required to identify what is spatially, technically, environmentally, or functionally problematic in generated proposals and explain how those proposals should be revised.

Under such an approach, the weakness of GenAI becomes pedagogically productive. The educational objective changes from asking whether the student can generate an impressive AI image to asking whether the student can critically determine whether an AI generated proposition constitutes defensible design. This shifts AI literacy in design education beyond prompt writing proficiency towards critical disciplinary AI literacy, where students must be able to evaluate generated content against disciplinary requirements rather than merely operate the technology (Alshahrani & Mostafa, 2025; Medel-Vera et al., 2025).

The AI Design Studio Paradox: Acceleration versus Learning

The findings also reveal what may be conceptualised as an AI Design Studio Paradox. GenAI is attractive precisely because it compresses activities that traditionally require substantial time. Yet some of those time consuming activities form part of the educational process through which students develop design competence.

Participants' concerns about students skipping research, conceptual development, experimentation, and iterative reasoning demonstrate this tension clearly. Acceleration can enhance learning when it removes low value production burdens, but it can weaken learning when it removes cognitively valuable design processes.

Reducing time spent on repetitive rendering may allow students to devote more attention to evaluating alternatives and developing concepts. In this case, AI functions productively. Conversely, using AI to bypass site analysis, precedent research, conceptual reasoning, spatial development, or technical understanding eliminates activities through which design competence is constructed. The pedagogical question should therefore not be whether AI saves time. It should be what kind of time AI saves and what students subsequently do with that time.

This interpretation also helps reconcile apparently contradictory findings concerning creativity. Participants simultaneously stated that AI stimulated creativity and warned that AI could weaken creativity. These positions are not necessarily inconsistent. AI can expand creativity when generated alternatives stimulate further human exploration, yet constrain creativity when students become dependent on those alternatives or accept them without critical transformation. The effect therefore depends on the nature of human engagement with generated content. This conditional view aligns with research on individual and collaborative creativity in design education and with studies of GenAI as a creativity support tool in architectural learning environments (Petrova & Kuhnén, 2025; Medel-Vera et al., 2025).

Human Design Judgement as the Pedagogical Boundary

Across all five themes, one principle remained remarkably consistent: students wanted human judgement to retain authority over the design process. This provides a useful conceptual boundary for GenAI integration. Students were comparatively comfortable delegating generation but considerably less comfortable delegating judgement. AI could suggest, visualise, generate alternatives, and accelerate representation, but students repeatedly maintained that humans should interpret, evaluate, justify, modify, reject, and ultimately decide.

This distinction is particularly relevant to studio learning because design knowledge is developed through active engagement with problems rather than passive receipt of solutions. GenAI can support this process when

generated outputs become materials that students interrogate, compare, and transform. This interpretation is consistent with emerging architectural education research that emphasises critical engagement with AI rather than technological substitution (Alshahrani & Mostafa, 2025; Medel-Vera et al., 2025).

The findings therefore suggest that the central human competency in an AI supported design studio may increasingly shift from the capacity to produce every element manually towards the capacity to exercise informed design judgement over both human and machine generated possibilities. This does not diminish conventional architectural knowledge. It makes that knowledge more important because students require disciplinary competence to recognise when an AI generated proposal is visually attractive but functionally, technically, contextually, or conceptually inappropriate. This need for continuing human evaluation is also reflected in critical examinations of AI within building design and in research on complementary human and AI design relationships (Kwon & Ahn, 2024; Pareschi, 2024; Fang et al., 2025).

From AI Assistance to Responsible Design Intelligence

Taken together, the five themes can be synthesised into a higher order framework of Responsible AI Assisted Design Learning comprising four interconnected dimensions: Creative Augmentation, Operational Augmentation, Critical Design Judgement, and Responsible Pedagogical Integration.

Creative augmentation represents AI's capacity to stimulate ideas and expand the possibility space, consistent with evidence on GenAI supported creativity and brainstorming in architectural learning and conceptual design (Maksoud et al., 2024; Medel-Vera et al., 2025). Operational augmentation captures accelerated visualisation, iteration, representation, and workflow, capabilities also reported in generative architectural and interior design research (Fitriawijaya & Jeng, 2024; Shao et al., 2024). Critical design judgement constitutes the evaluative mechanism through which students determine whether generated possibilities satisfy architectural, functional, contextual, technical, and conceptual requirements. Responsible pedagogical integration establishes the educational conditions under which AI use remains transparent, guided, ethically appropriate, and aligned with learning outcomes. This dimension is consistent with broader evidence that the digital transformation of higher education requires changes in curriculum, teaching practices, institutional strategies, and digital competence (Shahar et al., 2025), while AI specific educational research increasingly emphasises AI literacy, ethical deployment, transparency, and governance (Mohamad et al., 2026).

The educational value of GenAI in design studio learning is determined not simply by what AI can generate, but by the extent to which AI generated possibilities remain subject to students' critical design judgement.

This proposition helps explain the apparently ambivalent perceptions reported by participants. Students were not simultaneously for and against AI. Rather, they differentiated between forms of AI use that augment human design capability and forms that substitute for the cognitive processes through which design competence is developed. This distinction closely reflects complementary intelligence perspectives in which human and artificial capabilities are combined according to their respective strengths rather than treating AI as a replacement for human expertise (Pareschi, 2024; Fang et al., 2025). The findings consequently suggest that successful integration should not seek maximum AI use. It should seek appropriate AI use, where technology expands exploration and efficiency while students retain creative agency, disciplinary reasoning, accountability, and ownership of final design decisions.

This interpretation also carries implications for assessment. As visual outputs become easier to generate, assessment based predominantly on final presentation quality may become less effective as evidence of student learning. The participants' emphasis on documenting concept development, iterations, critical reflections, and design justification therefore points towards a more process oriented assessment model. In an AI rich studio environment, the ability to explain why a design decision was made, how AI output was evaluated, what was rejected, what was modified, and how the final proposal evolved may become increasingly important evidence of authentic design learning. This argument receives particularly direct support from Elmoghazy et al. (2026), who propose shifting interior design studio assessment from final product emphasis towards procedural analysis, critical thinking, reasoning, design decisions, and justification. Huh et al. (2025) likewise recommend stage specific assessment criteria, prompt traceability, transparent acknowledgement, and authorship safeguards. More

broadly, this need to reconsider educational practice is compatible with evidence that technological transformation in higher education is increasingly accompanied by curriculum reform and pedagogical adaptation (Shahar et al., 2025).

CONCLUSION

This study explored how architecture and interior design students experienced and evaluated the integration of generative artificial intelligence into design studio learning. Based on thematic analysis of six focus group discussions conducted following an AI assisted design activity, the findings demonstrate that students perceive GenAI neither as an autonomous substitute for the designer nor simply as another visualisation technology. Instead, they understand it as a potentially valuable complementary resource whose educational contribution depends on how it is positioned within the design process.

Five interrelated findings emerged. First, GenAI supported creative ideation by expanding the range of design possibilities and assisting students during moments of creative stagnation. Second, it enhanced visualisation and workflow efficiency by enabling rapid generation and comparison of alternatives. Third, students identified substantial technical limitations, particularly in prompt interpretation, consistency, spatial logic, functionality, constructability, contextual understanding, and user control. Fourth, participants recognised that excessive dependence could weaken important learning processes by encouraging students to bypass research, conceptual reasoning, iteration, and independent creative development. Finally, students supported future AI integration provided that it remains guided by lecturers, governed by transparent academic expectations, and aligned with educational objectives that preserve human design judgement.

The study contributes to the emerging literature on GenAI in design education by moving beyond the question of whether students perceive AI positively or negatively. Its more significant contribution lies in demonstrating how students evaluate AI generated alternatives against design work they had already conceptualised and developed themselves. This comparative experience reveals a critical distinction between AI's capacity to generate visually convincing possibilities and the disciplinary judgement required to determine whether those possibilities constitute meaningful architectural or interior design solutions.

Conceptually, the findings suggest an AI Design Studio Paradox. The acceleration offered by GenAI can enrich learning when it reduces repetitive production demands and enables broader exploration, but the same acceleration can undermine learning when it replaces cognitively important activities through which students acquire design competence. Consequently, the educational value of GenAI should not be assessed solely in terms of efficiency or output quality. It should also be assessed according to whether students remain actively engaged in researching, interpreting, questioning, evaluating, modifying, and justifying design decisions.

For design educators, this implies that GenAI integration should focus on augmentation rather than substitution. AI may be particularly appropriate for brainstorming, alternative generation, exploratory visualisation, and iterative comparison, whereas responsibility for contextual interpretation, technical development, critical evaluation, and final design decisions should remain demonstrably with students. This recommendation is consistent with empirical evidence favouring stronger GenAI use during early conceptual stages and more cautious use during later design development. Sektani et al. further show that AI related creativity gains can be uneven and may strengthen practical appropriateness without necessarily increasing originality, while Kurcjuş et al. report a clear student preference for AI to augment rather than replace human creativity and professional judgement. The recommendation also aligns with calls for curricula that combine AI competence with creative agency, critical reflection, ethical awareness, and systematic instructor guidance. Assessment practices may consequently need to place greater emphasis on process documentation, design iterations, reflective evaluation, justification of decisions, and transparent disclosure of AI use rather than relying predominantly on the visual quality of final outputs.

The study nevertheless has limitations. It was conducted within a single institutional context and examined students' experiences and perceptions rather than objectively measuring changes in creativity, design quality, or learning performance. The findings should therefore be interpreted as qualitative evidence concerning students' experiences of AI assisted studio learning rather than causal evidence that GenAI improves or diminishes design

performance. In addition, rapidly evolving generative technologies mean that particular technical limitations identified by participants may change as AI systems develop.

Future research could extend the study across institutions, programmes, year levels, and GenAI platforms and examine whether different forms of pedagogical integration produce different learning experiences. Mixed method and longitudinal studies would also be valuable for examining whether AI assisted studio learning influences measurable outcomes such as creative exploration, design quality, critical judgement, AI literacy, and long-term professional competence. Particular attention should be given to the relationship between AI generated visual sophistication and students' underlying disciplinary understanding.

Ultimately, the future of GenAI in design studio education should not be framed as a choice between human creativity and artificial intelligence. The more consequential question is how AI can expand the possibilities available to students without displacing the reasoning through which they learn to become designers. The findings of this study indicate that GenAI is most educationally valuable when it broadens what students can explore while leaving them responsible for determining what constitutes good design.

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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