



CHOBE Special Interest Group Series
2023/2024

**Exploring Emergent Generative-AI
(Gen AI) Tools & Their Influences on
Architecture and Built Environment
Education**

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ABOUT CHOBE AND THE SPECIAL INTEREST GROUP (SIG) PROJECT

CHOBE supports and represents, with a voice of influence, those with strategic responsibility of the development and delivery of graduate and postgraduate education and research within the disciplines of construction property and surveying. CHOBE's objectives include

- Developing communities of practice in built environment education to support heads of department/schools (or nominees) in the UK and Ireland
- Influencing policy consultations through being the collective contact point for issues about built environment education for external stakeholders and Professional Statutory and Regulatory Bodies
- Providing a forum in which people can come together to network, share and address problems in a supportive and collaborative way
- Addressing the practical, day-to-day matters associated with learning, teaching and assessment
- Funding to initiate larger research projects that can have an impact on how we deliver our businesses

In June 2023 CHOBE invited proposals to establish Special Interest Groups (SIGs) for the forthcoming academic year. The purpose was to carry out small, targeted research into specific themes facing Built Environment educators. Each group was led by an expert in that particular field who will work in association with a number of interested academics to discuss and identify different forms of innovation and good practice. Four SIGs were supported with a grant of £2500 each.

ABOUT THE AUTHOR

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Executive Summary

The SIG report will explore the usage patterns of early adopters of Generative AI (GenAI), providing valuable insights into how this emerging technology impacts current practices. This research is interdisciplinary in nature and involves educators from the Schools of Computing, Art, Architecture and Built Environment at Robert Gordon University.

The effectiveness of teaching these tools in architecture schools and the development of long-term skills remain areas with insufficient research. Longitudinal studies within the same institution are necessary to track the development of design students' expertise over time. Focusing on students allows educators to identify preconceptions and assess the efficiency of these tools' applications. Historically, students' perceptions of digital tools, such as CAD or BIM, have been influenced by teaching methods and contexts, highlighting the subjectivity of the learning process.

The integration of AI into architectural education offers students powerful tools for innovative design exploration and enhancement of current processes. However, to successfully integrate GenAI, it is essential to develop suitable educational models and strategies that adapt to the rapidly evolving technological landscape. This integration presents both opportunities and challenges, requiring a balanced approach to harness its potential while mitigating risks. The influence of GenAI on visual literacy skills also needs further exploration, suggesting a potential shift in creative processes and societal norms. Further research in AI literacy assessment, particularly in AI ethics, will help both students and educators understand AI operations, applications, and ethical considerations. By strengthening digital and AI literacies, we can use AI more creatively and ethically.

Introduction and Background

Artificial intelligence (AI) is revolutionising the way we work and learn, making it essential to approach this transformative technology correctly. This what Education Secretary Gillian Keegan said:

“Artificial intelligence is here to stay and it’s already changing the way we work and learn. To take advantage of this transformative technology, it’s crucial we get our approach to it right.” (Department for Education, 2023).

However, a significant issue arises in architectural and built environment education as students increasingly use Generative AI (GenAI) tools, often surpassing their lecturers in adoption rates. In the UK, 74% of online users aged 16-24 have utilised a GenAI tool, with studies showing that between 14% and 67% of students employ GenAI for their schoolwork and studies (The Open Innovation Team and Department for Education, 2024).

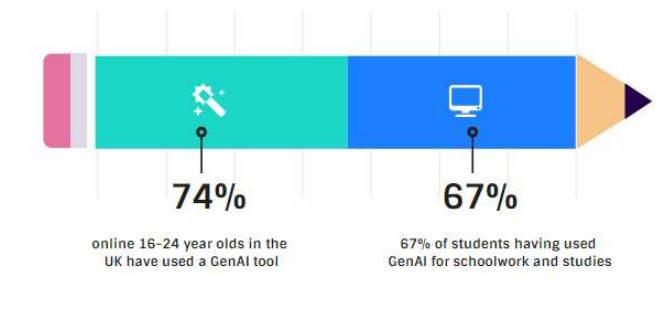


Figure 1. Students’ adoption of GenAI tools for their schoolwork and studies on UK.

This trend poses a challenge for universities, which require students to demonstrate independent thinking, creativity, and communication skills to earn their qualifications. The widespread use of GenAI tools raises concerns about students’ ability to meet these academic standards independently.

Studies such as Duong et al (2023) claimed that GenAI, such as ChatGPT and Midjourney, has seized the world by storm in many sectors, most notably within the educational spheres, due to its capacity to generate responses that appear to mimic human language and are contextually relevant. This has increasingly raised concerns among both practitioners and scholars about the potential impacts of OpenAI on students’ learning (Duong et al. 2023). Its user-friendly nature and capacity to address any textual or visual tasks make significant impact on both teachers and learners. However, the potential misuse by copying and pasting directly without comprehension is becoming a notable issue (Mizumoto 2023; Kohnke et al. 2023). On the other hand, Kanbach et al. (2023) view GenAI as potentially transforming skill requirements by shifting the human role from content creation to evaluation and editing. Human-AI interaction is an essential skill for facilitating empathy and allowing for social interaction (Feuerriegel et al., 2024). GenAI can promote communication skills by engaging students in dialogue and encouraging them to express their ideas and thoughts effectively (Villarreal et al., 2024; Yu and Guo, 2023). Despite leveraging deep learning models to create human-like content, the integration of GenAI into academic settings raises concerns regarding its potential impact on critical thinking (Villarreal et al., 2024). Villarreal et al. (2024) argue that the risk of overreliance on GenAI tools could negatively impact students’ critical thinking and problem-solving skills.

What is GenAI

In recent years GenAI has become a significant area of research. According to Lim et al (2023), Generative AI is “a novel AI technology that can produce new content automatically by utilising input data”. Currently, there are more than 700 GenAI tools, a type of AI that focuses on generating new

content. GenAI encompasses tools like Bard, ChatGPT, Midjourney, copilot and DALL-E, which can recall information nearly perfectly, similar to using a search engine on digital devices. GenAI has evolved from decades-old concepts based on simple observations about the brain. Unlike traditional software, CAD or BIM, GenAI produces results that are imprecise, adaptive, and emergent, making it feel human-like.

Historically, in 2015, Google transitioned from information retrieval to machine learning. By 2020, DeepMind developed machine learning for Google Maps to predict travel times and routes. In 2022, OpenAI launched generative models like ChatGPT for human-like text and DALL-E for image creation. According to Daniel Huttenlocher from MIT (2023), AI distorts the view of the world, splitting opinions between cautious and bold approaches. AI amplifies human behaviours, both good and bad, but lacks human values, intentions, motivations, emotions, morality, and judgment (Huttenlocher 2023). It can simulate these attributes misleadingly, often judged by human evaluation through a process called alignment, where (human) feedback is given to improve the models. AI represents a new kind of intellect, adding a third way, in addition to believes and reasoning, of understanding the world.

It is a type of innovative technology that is rapidly transforming and will continue to change our practices and education. Transforming education started with COVID-19 pandemic when it propelled a digital transformation in global education and work. Educational institutions and educators have 'pivoted' to online or blended learning models, a practice that has persisted even with the reopening of campuses (Holden et al., 2021). However, this transformation is far from perfect. A significant number of educators continue to depend on basic technologies such as online learning platforms (e.g., Moodle and Canvas) and videoconferencing tools (e.g., Microsoft Teams, Panopto and Zoom) to emulate physical lessons in a virtual environment (Lowenthal et al., 2020). These observations are crucial as they highlight two significant implications of; the transformation of the education sector is progressing at a slow pace, and the current state of transformative education is less than satisfactory (Lim et al., 2023).

GenAI in ABE Education

The impact of GenAI in Architecture and Built Environment (ABE) education is distinct from other disciplines, as both text and imagery play crucial roles in teaching students about architectural discourse and fostering creativity. The integration of GenAI in architecture and built environment education is a complex and multifaceted process, as highlighted by Mansour (2024). While AI can expand the pedagogical scope and enable students to engage with emerging concepts and techniques, it also raises concerns about human agency, creativity, and ethical implications. Sadek (2023) further explores the use of AI as a pedagogical tool in architecture education, emphasising the need for empirical evidence to measure its effectiveness in increasing creativity. This is echoed by Copper (2024), who supports the need for AI literacy and a collaborative approach to integrating AI into the curriculum, particularly in the role of architecture libraries and librarians in supporting this technology.

GenAI's ability to handle a variety of queries demonstrates its adaptability and versatility, promoting more personalised and inclusive educational experiences (Rejeb et al., 2024). Specifically, Chiu (2024) states that GenAI has several potential applications in higher education. These include the development of complex and personalised learning assessments, precise teaching and learning activities, feedback, asynchronous communication, personas, accuracy in research, cognitive offloading, and task delegation (Memarian and Doleck, 2023).

Research Aim and Objectives

Educators need to assess students' use of digital tools in design exploration and problem solving to gauge their students' literacies. The effectiveness of teaching digital tools in architecture schools and the development of long-term skills are areas that lack sufficient research. Longitudinal studies within

the same institution are necessary to track design students' expertise over time. By focusing on students, educators can identify preconceptions and assess the efficiency of these tools' applications. However, historically students' perceptions of digital tools, such as CAD or BIM, are influenced by teaching methods and contexts, highlighting the subjectivity of the learning process (Salman, 2011; Salman, Laing and Conniff 2014). Therefore, this research aims to:

1. Investigate the perceptions and attitudes of educators and students towards GenAI in the educational context.
2. Explore the potential pedagogical benefits of incorporating GenAI tools, such as Bard, Chat GPT, Midjourney, and DALL-E, into students' education.
3. Examine the impact of GenAI on the learning process, including collaboration and ethics.
4. Develop guidelines and best practices for educators to effectively integrate GenAI in educational settings.

The study adopts an exploratory approach to examine the impact of GenAI tools on learning from the perspectives of both students and educators (Cruz-Benito et al., 2019). Regardless of their computational skills, students find GenAI to be the most accessible and user-friendly form of AI. The examination employs two parallel approaches. The first approach involves a workshop, and a reflection on action questionnaire, and a survey to explore how students use GenAI in their studies. Simultaneously, an interdisciplinary dialogue is conducted to establish Special Interest Group (SIG). The group will include educators from the School of Computing, Gray's School of Art, and the Scott Sutherland School of Architecture and Built Environment, aiming to discuss their experiences with the use of GenAI.

Review of Challenges and Opportunities

Recent studies have highlighted the transformative potential of GenAI in the educational landscape. As institutions explore the integration of advanced AI tools, it becomes essential to understand both their benefits and challenges to optimise their impact on learning and teaching processes. In this context, the findings of various researchers provide valuable insights into how AI, specifically ChatGPT and Midjourney, is reshaping the educational experience.

Rejeb et al. (2024) found that ChatGPT has emerged as a critical educational tool, offering significant advantages for both educators and students. Students enhance their understanding of key concepts and benefit from the ability to quickly answer questions while developing their critical skills. Additionally, ChatGPT provides student-friendly and high-quality educational content (Boukher, 2023). Memarian and Doleck (2023) also explore and thematically analyse the limitations and challenges of ChatGPT in education, identifying prominent issues such as the potential for misuse and the need for technical expertise for appropriate use. To ensure students can benefit from emerging technologies and reduce inequalities in professional and educational opportunities, it is essential to equip them with the necessary competencies and skills for the workplace, thereby promoting social equity and creating a more level playing field (Dai et al., 2023). In discussing the advantages and disadvantages of AI, Chiu (2024) emphasised the need to involve students in achieving a comprehensive understanding of how GenAI can transform higher education.

Addressing Academic Integrity and Challenges of GenAI in Education

From Miao et al.'s (2023) perspective, the critical factor in preventing academic misconduct or plagiarism is not merely the use of AI tools by students, but the presence of clear guidelines through university policies (Memarian and Doleck, 2023). As it becomes increasingly difficult to distinguish original human writing from GenAI content, traditional methods of detecting cheating or plagiarism may become less effective (Perkins, 2023; Rejeb et al., 2024). Rejeb et al. (2024) call for updates to academic integrity policies and the development of new strategies to better regulate the use of AI

tools like ChatGPT. Ethical concerns, including copyright infringement and plagiarism, have also been raised regarding GenAI content (Tai et al., 2023; Liu et al., 2024).

According to Dai et al. (2023), such practices erode academic integrity and undermine the learning process, potentially leading to a decrease in academic standards. They argue that plagiarism detection software must be enhanced to effectively identify academic dishonesty, instances of plagiarism, or unauthorised use of intellectual property (IP) in writing. However, plagiarism detection tools alone cannot solve all issues related to academic dishonesty. Therefore, educators, students, and institutions must collaborate to promote a culture of ethical responsibility and integrity, fostering genuine learning while discouraging plagiarism (Dai et al., 2023). For some universities, banning ChatGPT for students while offering systematic training to teachers on the pedagogical use of AI reveals the challenges associated with these tools (Yau & Chan et al., 2023; Kohnke et al., 2023). Potential factual errors due to reliance on existing data, alignment with pedagogical principles, and educational goals for effective use present further challenges (Khennouche et al., 2024).

In response to these challenges, Dai et al. (2023) advise that higher education institutions hold the responsibility to ensure transparency, accountability, and supervision in the development and deployment of AI systems as ethical concerns around GenAI tools continue to grow.

Educators have reacted to GenAI in various ways, ranging from banning and evading to adapting and embracing it, as shown in Figure 2. This diverse spectrum of responses in higher education presents an interesting model for understanding how new technologies are integrated into academic environments.

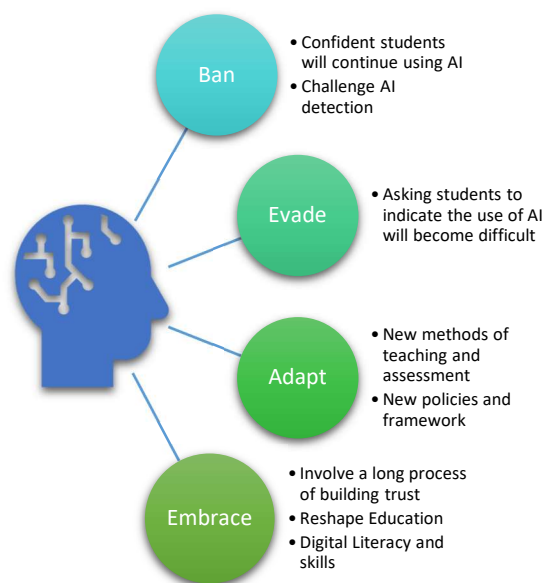


Figure 2: Educators' responses in higher education.

Academic integrity and ethics in educational contexts were recently discussed by Dr. Sarah Eaton, a professor and ethicist, she discusses the emergence of hybrid writing, co-created by humans and AI, which is becoming increasingly prevalent and is expected to become the norm. Eaton (2023) argues that attempting to distinguish between human and AI contributions is pointless. She also asserts that AI enhances, rather than threatens, human creativity, allowing humans to remain boundlessly imaginative while also being inspired by AI (Eaton 2023). Additionally, Eaton suggests that language barriers will diminish as technology advances, enabling more effective cross-language communication. However, she emphasises that while humans can relinquish control to AI tools, they must remain

responsible for fact-checking, verification, and maintaining the ethical use of these technologies. Responsibility for the accuracy and integrity of written content cannot be abdicated to AI (Eaton 2023).

However, the integration of GenAI tools can also elevate the standards of educational outcomes as traditional learning barriers dissolve. By leveraging GenAI effectively, educators and students can push the boundaries of knowledge and creativity, fostering an environment where higher standards and innovative approaches to learning are sought and achieved. The discussion highlights the dual impact of GenAI on academic standards which will need a careful management and critical considerations to ensure that the benefits are maximised while maintaining academic integrity.

Digital Literacies vs. Digital Skills

Digital literacies involve understanding the why, when, who, and for whom of technology use, not just the technical what and how (Bali, 2016). Bali (2016) and Ng et al (2021) studies advocate for teaching digital literacies progressively and within an authentic context to enhance students' understanding over time. In evaluating literacy, Dai et al. (2023) suggests that teaching students about ethical behaviour and academic integrity in terms of GenAI tools is imperative. It emphasises the importance of encouraging students to use technology critically, with an awareness of the risks and ethical implications of their digital presence and actions. It also suggests placing students in real-world situations where they must navigate cultural and linguistic differences and comprehend the power dynamics of digital platforms. In summary, digital skills focus on technical abilities to perform specific tasks using digital tools, whereas digital literacy encompasses a broader understanding and contextual use of these tools across various activities and disciplines.

As AI integration in education advances, cultivating AI literacy becomes crucial. Educational institutions are now examining teachers' and students' perceptions of innovative technologies and exploring adjustments to their practices to strike an optimal balance between leveraging benefits and addressing challenges. To conclude, the following framework is proposed for fostering AI literacy based on the adaptation of classic literacies in ABE education, as shown in Figure 3.

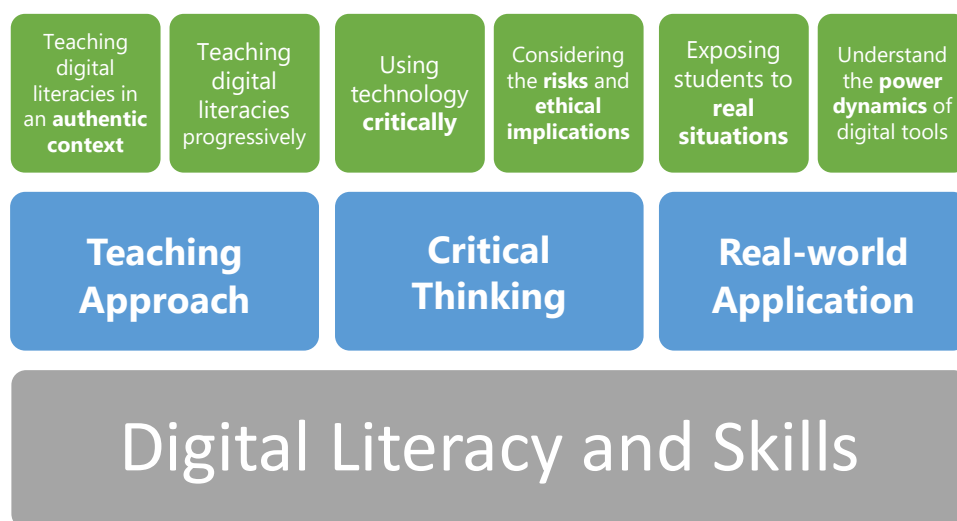


Figure 3: Digital (AI) Literacy Framework

Building upon the rapid emergence of GenAI in education, Kee, Kuys, and King's (2023) study explores the impact of GenAI technologies on architectural learning, particularly in fostering holistic competencies. These competencies encompass a range of essential skills, including communication, teamwork, problem-solving, creativity, time management, and digital literacy. Prior to the advent of AI, digital literacy enabled students to effectively apply technology for communication and use online

tools both at home and in the workplace. Enhancing digital literacy not only increases a student's value to prospective employers but also boosts their competitiveness in the job market.

Key findings and Discussion

This section presents the key findings and discussion from three primary data collections: the Workshop on Digital Literacies, the Students' Perspective Survey, and the Special Interest Groups (SIG) Roundtable Discussion focused on educators' perspectives. Each of these studies provided current and up-to-date insights into digital literacy, with a specific focus on GenAI in ABE educational settings, from both student and educator viewpoints:

Workshop: Digital Literacies

Midjourney was selected for the workshop, Midjourney "is an independent research lab exploring new mediums of thought and expanding the imaginative powers of the human species." (Midjourney 2023). It is an interesting definition using the term "new mediums of thought", we may ask the question: What exactly do these new mediums entail? Clearly defining these mediums would help educators grasp the tool's focal points more effectively. The claim of "expanding the imaginative powers of the human species" raises questions about the practical implications of this expansion. How does the lab intend to measure and validate the enhancement of imaginative capabilities? Providing evidence or instances would lend authority to this ambitious objective. To explore this further a workshop was designed with senior students.

The workshop group consisted of 8 senior students (Fifth- and Sixth-year Master of Architecture). They can be described as inexperienced users of GenAI. The students were asked to prompt Midjourney to create one compelling concept image using two different methods: 1. text prompts - users can generate images by typing descriptive text prompts, using the following command: `"/imagine [prompt]"` and, 2. blending two digital images - users can generate images by blending two selected images, using the following command: `"/blend [image1] [image2]"`. These commands allow users to create unique and personalised images using AI technology. Figure 4 shows the workflow of the workshop.

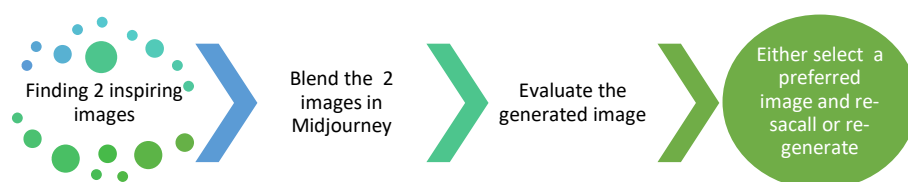











Figure 4: Midjourney Workflow flow.

The participating students expressed interest in learning more about the technology and its interface to integrate it into their design and digital workflows for rapid concept generation and for exceeding traditional methods. All participating students were added to a Discord server using individual channels and were allowed direct manipulation of text prompts with Midjourney. The brief was open-ended, and the results were not constrained by any academic requirements. Examples of GenAI (Midjourney) from the workshop are shown in table 1.

Table 1: Examples from the students' workshops, using two methods to generate personalised images, courtesy of the individual students.

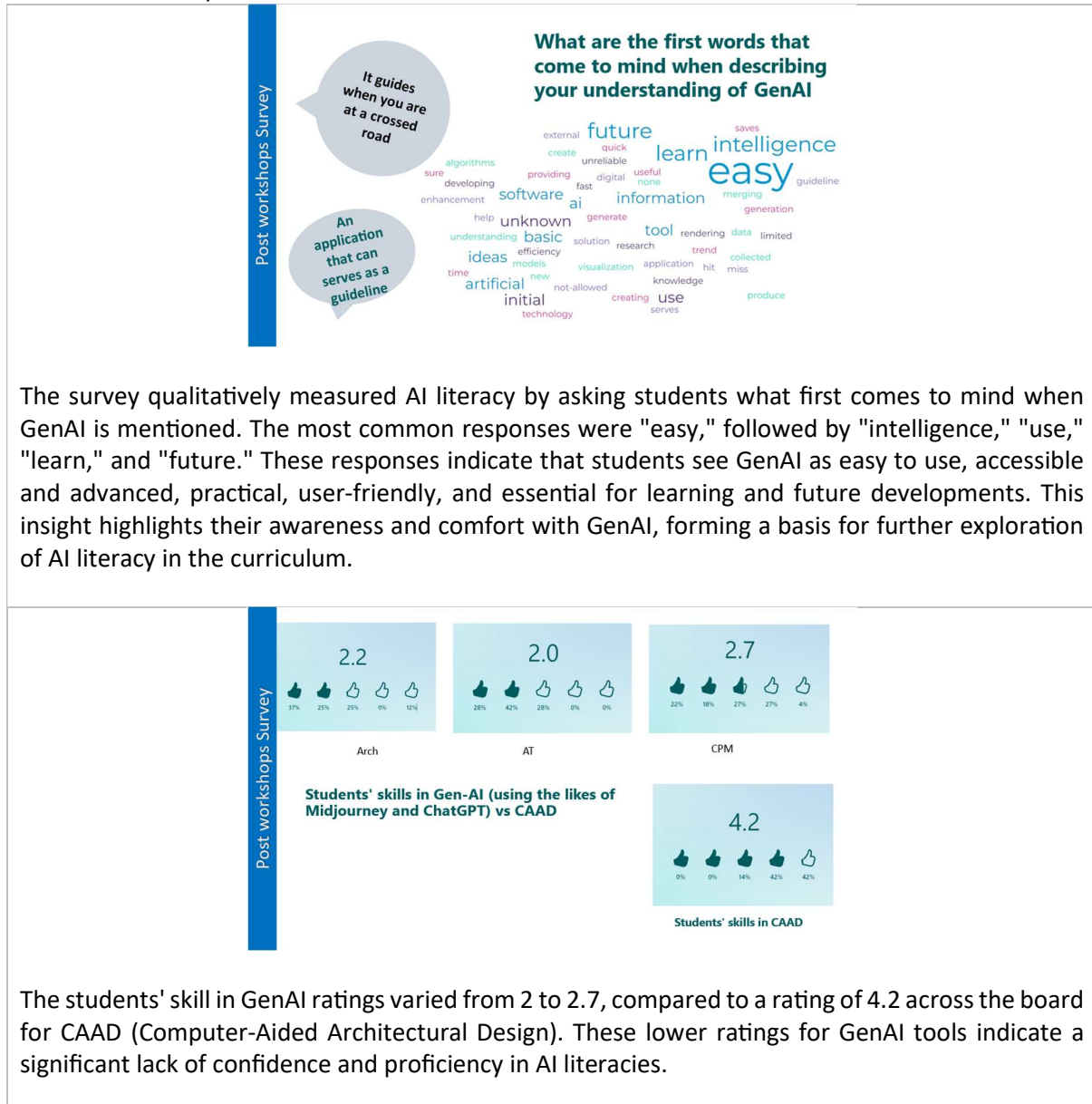
1. Using text prompts, command: /imagine [prompt]		2. Blending two digital images command: /blend [image1] [image2]	
Prompt	Generated Images	Chosen Images	Generated Images
/imagine a timber and aluminium building inspired by the shape of a boat --v 6.0			
Prompt	Generated Images	Chosen Images	Generated Images
/imagine A museum influenced by a greek temple made by Zaha Hadid, the building is on a hill, could be seen from the whole city and has a lot of glazing and is surround by water. --v 6.0			
Prompt	Generated Images	Chosen Images	Generated Images
/imagine a 1930s modernist building designed by architect kengo kuma --v 6.0			
Please note: Midjourney AI model interprets each word and its context to determine what to create. Different phrasing can emphasise different aspects, leading to variations in the style, content, and focus of the images produced. Using these text prompt may result in totally different results.			

The participants in this workshop valued the use of GenAI image generators through two different approaches: blending two images (dealt with in precedent studies) and text prompts to generate similar results. The workshop was useful for students to explore the use of GenAI, confirming its perceived value in concept development and highlighting the need for greater training and the development of an expanded workflow utilising latent diffusion in architecture. This research not only embraces this technology before it is imposed on educators and students but also demonstrates the necessity for greater transparency and control over its outputs. Many participants noted the challenge of distinguishing valuable ideas and knowing when to stop ideating. However, they expressed difficulty in generating predictable outcomes and emphasised that AI should be seen as a tool, not the sole source of concept generation. They also suggested the need for more comprehensive training guides for prompting and blending image inputs, and for such exercises to be part of the design thinking iterative processes and reflection.

Survey: Students perspective

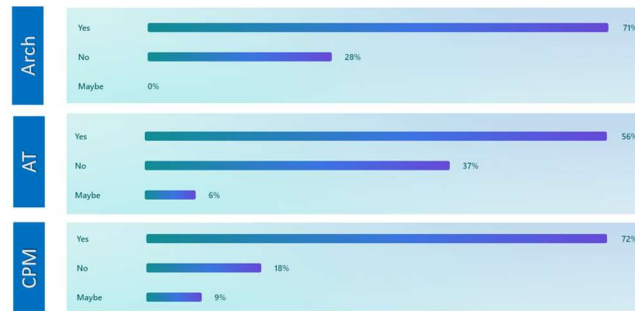
A questionnaire survey was designed and circulated online to three groups of students within the Scott Sutherland School of Architecture and Built Environment (SSSABE). These include Architecture (Arch), Architectural Technology (AT), and Construction Project Management (CPM). A total of 45 responses were received. The questionnaire took approximately 8-10 minutes to complete. The results are presented in following table 2.

Table 2: The survey results.



The students' skill in GenAI ratings varied from 2 to 2.7, compared to a rating of 4.2 across the board for CAAD (Computer-Aided Architectural Design). These lower ratings for GenAI tools indicate a significant lack of confidence and proficiency in AI literacies.

AI tools usage in the past 6 months –Jan 2024



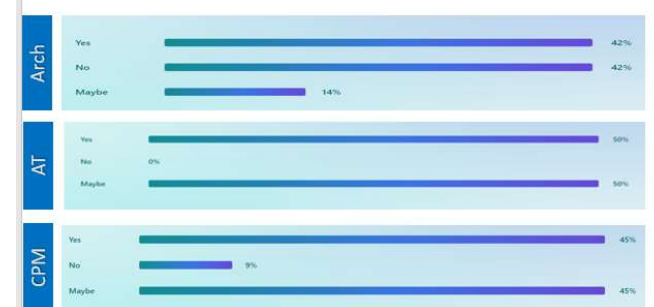
When asked about their usage of AI tools in the last six months, approximately 66% of students said yes, 28% said no, and 5% were unsure. This indicates that some AI features, in tools such as Grammarly and QuillBot, may be integrated in ways that students do not recognise them as AI-based, highlighting a need for greater awareness and understanding of AI applications in online tools.

Rate your proficiency level with GenAI

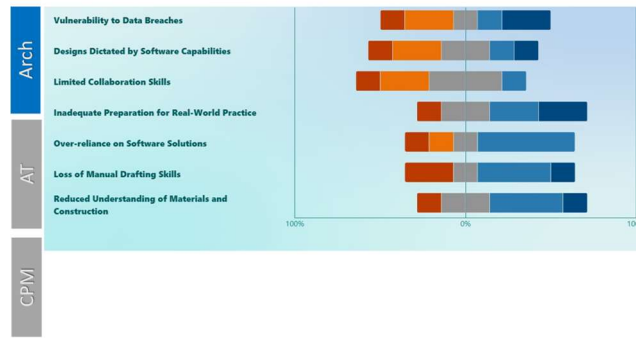


The students rated their proficiency in GenAI, with 26% of the three groups identifying themselves as novices, 40% to 57% as beginners, 33% as intermediates, and a very small percentage of 6% as advanced. CPM students showed a different trend in using GenAI.

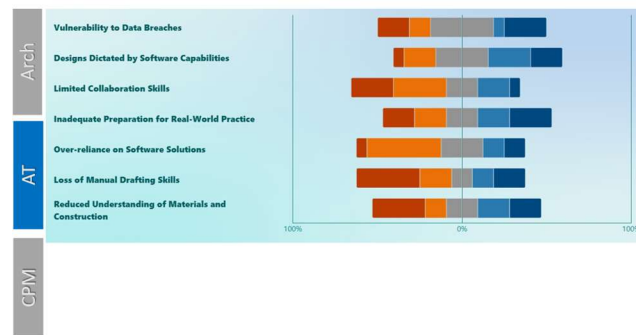
Using AI influenced your studying capability



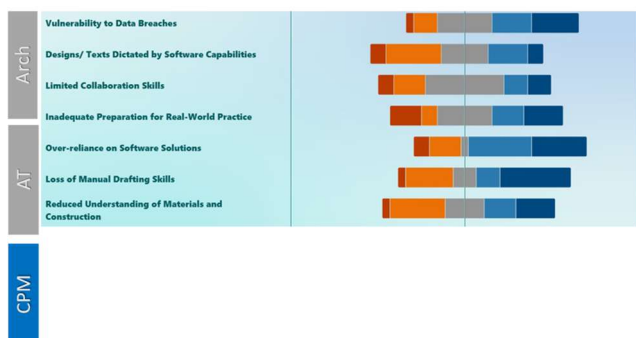
The students were asked if using GenAI influenced their studying capability. The responses varied significantly: in the Arch group, opinions were clearly split between yes and no (42%); in the AT group the split was between yes and maybe (50%); and in the CPM group, the split was also between yes and maybe (45%). A notable percentage (35%) of “maybe” among the three groups showing a significant level of uncertainty, perhaps because there is no method of assessment in place to measure their learning and determine if their GenAI use has influenced their capabilities, as the use of GenAI is subjective and personal without an educational context.



The survey asked Arch students to rate the challenges they faced while using GenAI. The responses revealed several key areas of difficulty: the group highlighted “Vulnerability to Data Breaches”, “Designs Dictated by software capabilities and Limited collaboration skills” as the least important challenge. Whereas “Inadequate Preparation for Real-World Practice, Loss of Manual Drafting Skills, “Over-reliance on Software Solutions”, “Reduced Understanding of Materials and Construction” as the most important challenges.



The survey asked AT students to rate the challenges they faced while using GenAI. The responses revealed several key areas of importance: the group highlighted “Designs Dictated by software capabilities” and “Inadequate Preparation for Real-World Practice” as the most important challenges. Whereas “Loss of Manual Drafting Skills, Reduced Understanding of Materials and Construction and Limited Collaboration Skills” as the least challenging.



The survey asked CPM students to rate the challenges they faced while using GenAI. The responses revealed several key areas of importance: the group highlighted “Vulnerability to Data Breaches”, and “Over-reliance on Software Solutions”, and “Loss of Manual Drafting Skills, as the most important challenges whereas “Reduced Understanding of Materials” and “Construction and Limited Collaboration Skills”, “Over-reliance on Software Solutions” as the least challenging aspects.



When asked about their awareness of the statement, "Copyright law is 'limited to the original intellectual conceptions of the author'. With no author, there is no copyright. In many cases, the photos used to create GenAI images/art have copyright licenses that weren't adhered to by the tool,". The responses varied significantly across different student groups. Arch students had the lowest average rating of awareness, AT students had a medium level of awareness, and CPM (international) students showed the highest awareness. These variations indicate societal and cultural differences in this type of literacy among the different groups of students and disciplines.

Examples of Students qualitative responses:

- "It doesn't affect but can make us understand things better. "
- "Can lead to plagiarism "
- "Limits thinking if not properly used. "
- "It reduces thinking capacity and creativity."
- "I think it's the future".
- "Make me aware of the content, but if you ethically use it, you can enhance your skills."
- "There is a tendency of loss of skill, loss of genuinity, skills not used efficiently".
- "Others who use this software will get better grades and I will not as I don't know how to use it and don't want to use it; it is risky and not beneficial compared to reading and discovering new information yourself."
- "It's a 50/50 affair. It could make you lazy or you can have a different mindset towards it and use it to boost your professional development. It all depends on how one decides to use it."
- "Could potentially repeat designs and takes away from own originality."

Since the students didn't learn and fully understand how GenAI application works or how their data is processed, they felt like they were uncertain about using it but willing to use it. The findings showed that students were aware of GenAI's capabilities, but not of certain risks and ethical concerns (Klimova et al., 2023). All higher education students should be required to gain new literacies, including AI, data, computational, algorithmic, digital, and media literacy. This is in line with global AI education initiatives by All (Chiu, 2021; Chiu et al., 2022). Here are some student feedback examples: "Others who use this software will get better grades and I will not as I don't know how to use it and don't want to use it, it is risky and not beneficial compared to reading and discovering new information yourself", "Could potentially repeat designs and takes away from own originality," and "Could potentially repeat designs and takes away from own originality".

The survey revealed that students generally view GenAI as easy and user-friendly, advanced, and essential for future learning, though their proficiency levels in GenAI were significantly lower than in CAAD tools. Approximately 66% reported using AI tools in recent months for studying, but confidence and proficiency varied, with many identifying as novices or beginners. Students expressed mixed opinions on whether GenAI influenced their study capabilities, with a notable percentage unsure due to the lack of assessment mechanisms. Key challenges identified included inadequate preparation for real-world practice, over-reliance on software, and loss of manual skills. Awareness of copyright and

ethical issues also varied, highlighting societal and cultural differences. Overall, while students see the potential of GenAI, there are concerns about its impact on critical thinking, originality, and the need for ethical use and proper integration into the curriculum. They highlighted the importance of ethical use, noting that responsible engagement with GenAI could boost skills and professional development, though misuse might hinder creativity and genuine learning.

SIGs Roundtable discussion: Educators perspective

The overall aim of the proposed SIG group is to engage educators and students in a dialogue to gauge their current experiences with GenAI. The interdisciplinary discussion involved educators from the Schools of Computing, Art, Architecture and Built Environment at Robert Gordon University.

The SIG discussion yield several similarities in the thinking of educators, for example the use and integration of AI tools in educational settings, emphasising their significance for various applications such as image generation, design augmentation, and word generation. They acknowledge that AI tools can enhance productivity and creativity, providing valuable assistance. However, ethics and responsibility are key themes, as the three disciplines stress the importance of acknowledging the use of AI tools and understanding their ethical implications. They highlight the need for students to use these tools responsibly, ensuring that they do not bypass the learning process or take shortcuts that hinder their development. Thematic coding involves identifying and categorising patterns or themes in qualitative data. Based on this study SIGs discussion the thematic codes that can be identified are listed in Table 3.

Table 3: The themes reflect the primary concerns, observations, and strategies related to the use of GenAI tools in educational settings as discussed by the three disciplines.

Themes	School of Computing	Gray's School of Art	Scott Sutherland School of ABE
Use of AI Tools in Education	<ul style="list-style-type: none"> - "Idea of how they're using these tools, and we're also doing some studies on the side to try and understand how students feel they should be using these tools." - "So I'm personally really interested in student's responsibility and ethics around the usage of generative." - "We encourage our students to fail and not get a fail grade just to fail and iterate and do better, and that's traditionally how computing is thought." 	<ul style="list-style-type: none"> -doing things in ways that seemed ridiculous a few years ago might now be viable -a case of traditional skills applied to new tech 	<ul style="list-style-type: none"> - "Most of the students I'm working with are at a senior level, so they were quite advanced, and they've got lots of experience of and self-driven learning." - "So the tools particularly working around image generation or design augmentation."
Student Perspectives and Usage	<ul style="list-style-type: none"> - "A lot of students feel that it should be OK to use these tools to do the groundwork." - "A lot of students are using it as a starting point." 	<ul style="list-style-type: none"> -The primary objective appears to be to familiarise students with AI tools, their applications, and their 	<ul style="list-style-type: none"> - "They were quite advanced and they've got lots of experience of and self-driven learning."

	<ul style="list-style-type: none"> - "We see a lot of students trying to use it to get to the answer without doing all the steps in between." 	<p>implications in various creative sectors.</p>	<ul style="list-style-type: none"> - "What my experience is at the moment has been working with them as they've been discovering these new tools and trying to find an appropriate way to use them in their work."
Ethics and Responsibility	<ul style="list-style-type: none"> - "Ethical implications... responsibility of students and ethics and probably that will also come under professionalism." - "We need to teach students how to use these tools properly." 	<ul style="list-style-type: none"> -data gathering needs to be factored into future skills learning as well as production schedules 	<ul style="list-style-type: none"> - "They must acknowledge where they've used it." - "The ethical consideration is that if a student uses AI to try to... because then something in terms of their own work, I think I've got a bit of a problem with that at the moment."
Teaching Strategies	<ul style="list-style-type: none"> - "There is research out there on it. So a lot of people in computing, there's someone in San Diego, for example, doing research on teaching introductory programming alongside prompt engineering." - "If you ignore it, they could run wild with it. They don't use it properly and they end up causing plagiarism misconduct." 	<ul style="list-style-type: none"> - "The mention of AI Week workshops and the provision of links to the course and session notes indicate a structured approach to workshops focused on AI integration." 	<ul style="list-style-type: none"> - "I have not precluded the use of AI in any sense." - "We need to consider how we design our course just to acknowledge AI."
Skill Development and Learning Process	<ul style="list-style-type: none"> - "My concern, I think, in my classes, is that if a student takes a shortcut enough times, they don't get to the place I need them to be at the end." - "The outcome of a student's journey is for them not only to learn a skill set but also to learn how to use it to navigate specific problems." 	<ul style="list-style-type: none"> -The ability to do things that seemed ridiculous a few years ago indicates a significant shift in what's possible with AI, making previously unviable approaches now feasible. 	<ul style="list-style-type: none"> - "AI is a valuable tool from a design perspective because it allows the creation of a degree of options." - "It seems clear to me that AI is here to stay at the moment. It's a new and developing field like we've gone through in many other fields, so I don't see it as a threat. I see it as an opportunity."

Collaboration and Interdisciplinary Work	<ul style="list-style-type: none"> - "If these tools are used properly... then yes, it can absolutely help students collaborate." - "The computer scientist can generate really quick sketches rather than just asking the designer to do all the legwork." 		<ul style="list-style-type: none"> - "Industry in many ways is already using it and so we need to catch up." - "They're looking for our students to come and show them the way that they can better use AI and to a better effect." - "AI can make things more collaborative." - "Collaboration is what... I mean, who, which profession will that?"
Risks and Limitations	<ul style="list-style-type: none"> - "The more you use these tools, the lazier you become and... over dependence on technology." - "The big risk is a student will get used to going straight to ChatGPT. This is my problem. Can you outline the process I need to follow?" 	<p>-I would guess that it changes how we think about our own generative processes and how we are influenced by mainstream society.</p>	<ul style="list-style-type: none"> - "The sophistication of those solutions at the moment is limited." - "When you interrogate it, this time that there are problems."
Access and Equity	<ul style="list-style-type: none"> - "My concern is then we're doing the opposite of democratising. We're actually putting in different barriers in place where limiting students based on how much they can afford." - "How do we deal with this problem when access to these tools is no longer equitable when no students are no longer on the same playing field?" 	<p>-front-end awareness and discussion of what Ais are, how they are trained, what they are and are not good for</p>	<ul style="list-style-type: none"> - "The potential of their revolution not changing roles." - "The skill set do we need to generate in our students to achieve that level of change?" - "I think you could argue that in many ways the world is an incredibly interesting place." - "The ethical consideration is that of a student uses AI to try to... because then something in terms of their own work."
Human Creativity and AI		<p>- "Needs more exploration".</p>	<ul style="list-style-type: none"> - "Technology is only for technology's sake. The human need for change and creativity

			and evolution and individuality." - "The reality is that it's becoming a commodity."
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Regarding skills development and the learning process, all interviewees emphasised the importance of developing students' skills and ensuring they achieve the necessary competencies by the end of their courses. They express concerns about over-dependence on AI tools potentially leading to a lack of critical thinking and creativity. Curriculum and teaching methods are also discussed, with a focus on the thoughtful integration of AI tools into the curriculum, including how and when to introduce these tools and setting clear boundaries for their use. They stress the importance of maintaining an open dialogue with students about the capabilities and limitations of AI tools. Findings are shown in Figure 5.

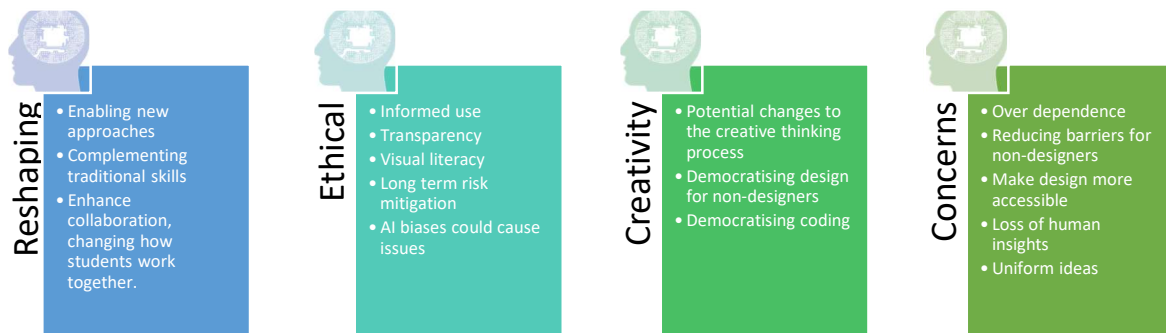


Figure 5: SIG discussion interdisciplinary themes.

Interviewees presented differing perspectives on AI in education and industry, focusing on various aspects. SoC emphasised the varying levels of student proficiency, highlighting the temptation for less confident students to over-rely on AI tools, while SSSABE and GSA works with advanced students who use AI to enhance their work. Soc underscores industry expectations for graduates to know when and how to use AI tools in real-world projects, whereas SSSABE and GSA discusses the industry's current AI usage and the expectation for graduates to optimise these technologies, citing specific industry statistics. SSSABE and GSA provide a detailed exploration of AI's current and future potential in design, whereas SoC focuses on educational implications and effective teaching of AI tools. Both recognise the importance of human creativity, but SSSABE delves into the philosophical balance between technology and creativity, while SoC addresses practical risks like reduced brain engagement. SSSABE and GSA also explored broader societal and ethical implications, such as the impact of AI on professional roles and ethical content considerations, whereas Soc centres on educational integrity and preventing AI misuse in learning. Together, these perspectives offer a comprehensive view of AI's integration, implications, and ethical considerations in education and professional practice.

Finally, all participants recognise the potential for AI tools to enhance collaboration and interdisciplinary work. They see AI as a means to facilitate communication and cooperation between different disciplines, providing a "common language" or starting point for collaborative projects. This is the first time when computational tools can be used without coding, and without the need to learn coding. This integration can level the "playing field" and promote a more inclusive and interdisciplinary and collaborative education and applications.

Conclusions and Emerging Opportunities

The incorporation of AI into architectural design and education provides students with powerful resources for exploring innovative design approaches and enhancing current design processes. However, in order to successfully integrate GenAI, it is crucial to create suitable educational models and strategies that can adapt to the swiftly evolving technological landscape.

Overall, the integration of GenAI in design education presents both opportunities and challenges, necessitating a balanced approach to harness its potential while mitigating its risks. Also, how GenAI influence the development of visual literacy skills needs more exploration. It suggests a potential shift in how individuals think about their creative processes and the influence of societal norms on these processes.

Recommendations

This report clarified the current effects of AI learning and understanding on the traditional context of the architectural studio and on the individual design process. This report concludes that GenAI will change how educators and students think about their own generative processes and how they are influenced by mainstream society. As a result, a number of recommendations are put forward:

- Highlight the potential of GenAI tools to enhance design development, allowing students to explore new paths in greater depth with iteration and reflection.
- GenAI interactions should be paired with design problem solving, and well contextualised in design exploration studies as a new language to complement students' digital skills.
- Encourage holistic examination of where GenAI fits in the ABE educational processes, promoting originality in design and problem solving.
- Assessing AI literacy is still in its early stages and requires further research.
- Encourage educators to explore and integrate AI applications across different disciplines. This broadens the scope of AI literacy and shows its relevance in various fields.
- Promote an environment where educators feel comfortable discussing the challenges and opportunities of using AI in education. Regular meetings and forums can facilitate this open dialogue.
- Provide educators with access to AI tools, software, and instructional materials. Ensuring they have the same level of awareness and resources as students allows for more effective teaching and support.
- Provide training programs and workshops for educators to familiarise them with AI tools, their applications, and ethical considerations. This ensures they have the necessary skills and knowledge to teach these tools effectively.
- Encourage collaboration among educators to share best practices, resources, and experiences related to GenAI integration. Creating a community of practice can help in addressing common challenges and improving teaching methods.
- Emphasise the importance of transparency and control over AI outputs in education and practice.
- Calls for further longitudinal pedagogical research.

Additionally, more research is needed in the field of AI literacy assessment, particularly in AI ethics and AI sub-fields. This will help students and educators understand how AI operates, its associated applications, and the ethical considerations involved. By strengthening digital and AI literacies and understanding of these issues, we can become more creative in the way we use AI ethically.

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