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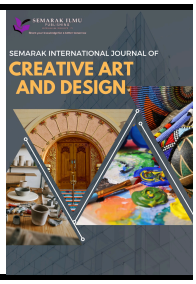

Exploring the Impact of Artificial Intelligence Creative Tools in Graphic Design Education: A Systematic Review

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ABSTRACT

Artificial Intelligence facilitates innovation, creativity, and the adoption of novel concepts. Human resources are constantly receptive to scientific and technological advancements and will readily adopt new technologies and use them to enhance communication, connection, and technology use through application and design. While promoting wider acceptance of AI, people have neglected the intellectual property and ethical issues of the application on generative artificial intelligence. The purpose of the systematic review was to investigate the effects of these acknowledged effects of AI on curriculum developers, facilitators, and students. The PRISMA guidelines (Preferred Reporting Items for Systematic Review and Meta-Analysis) are used in this systematic review. The review's conclusions show that rather than replacing humans, educators and students should view AI as a helpful tool. In order to guarantee that AI functions as a collaborative tool, participants from those studies stressed the necessity of radical transparency, informed consent, and unambiguous regulations. They also call for a cautious, critical, and ethical approach to AI integration.

1. Introduction

Given that the application of AI-driven tools in graphic design is a relatively new and dynamic idea, it is necessary to examine the state of graphic design today in order to comprehend the current circumstances [26]. AI promotes creativity, innovation, and acceptance of novel or innovative concepts. Human resources who stay up-to-date with science and technology are more likely to adopt and use technology to enhance connectivity, communication, and design [18].

Existing research in this domain has primarily focused on Generative AI (GenAI) and AI chatbot tools such as Chat GPT. While these studies have frequently demonstrated a preference for AI chatbots in light of a new AI feature that was released in 2022, however, they have lacked a comprehensive, long-term perspective. Furthermore, Elgendy *et al.,* [30] and Thomas *et al.,* [8] conducted critical research reviews and highlighted ethical and other challenges such as intellectual

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property issues, data bias, job displacement, privacy threats, and problems with transparency of source and influence.

Even though overall research efforts have identified both positive and negative aspects of AI, the precise impact of AI interventions on improving teaching and learning skills remains somewhat ambiguous due to the limited scope of available studies, particularly the impact on Graphic Design. The lack of significant findings has highlighted the need for strong evidence regarding AI's impact on graphic design. As a result, no systematic review has directly linked AI practices to graphic design outcomes and learning. Thus, the primary objective of this study is to examine the noteworthy influence of artificial intelligence (AI) in graphic design by examining how AI in higher education impacts the learning abilities of graphic design students.

The goal of the systematic review is to synthesize existing research, identify gaps, and uncover insights that can guide future studies and educational practices by highlighting a thorough investigation of the AI acquisition process in the context of graphic design. This review clarifies how AI can successfully support the development of engaging learning while fostering subject matter expertise through thoroughly examining instructional strategies, contextual factors, and the special circumstances brought about by AI. In summary, this study adds to the body of knowledge by synthesizing previous research on the function of instructors in higher education and attempting to describe the latest developments in the graphic design sector as seen by industry experts. Furthermore, this study presents a structured analysis process based on the following research questions:

i. **RQ 1**: What is artificial intelligence-based applications' positive and negative effects on students' learning design processes?
ii. **RQ 2**: What are the effects when the students practice generating prompts using artificial intelligence-based applications at the beginning of learning the design process and on the quality of the resulting design?
iii. **RQ3**: How might the integration of AI technologies impact graphic design processes, and what benefits, challenges, and ethical considerations arise?

2. Methodology

The PRISMA guidelines (Preferred Reporting Items for Systematic Review and Meta-Analysis) are used in this systematic review. This PRISMA protocol, which was created by Liberati *et al.,* [14], provides a thorough checklist intended to increase the accuracy and transparency of the review process. Furthermore, a particular protocol was used to guide the literature search following the goals of the review. The search terms, database to be used, and selection criteria are among the important details described in this protocol. Additionally, a specific protocol was to steer the literature search in alignment with the review objectives. This protocol outlines pertinent details, including search keywords, the database to be utilized, and selection criteria. For the search, four databases, Google Scholar (GS), ProQuest (PQ), EBSCO and Scopus, were chosen for their widespread use across diverse disciplines, given the continuous evolution of technology impacting information archiving and retrieval methods. To ensure a comprehensive yet current scope, the publication date range was confined from 2019 to 2024, encompassing the past five years and providing an overview of developments over the last 5 years based on the information in the selected papers. This ensures that the review is firmly grounded in the most up-to-date literature reflecting the current information and synthesis in the digital era.

2.1 Screening for Inclusion and Exclusion Criteria

Additionally, after carefully examining the abstracts of the (twenty-two) studies to assess their suitability concerning the research focus, which is a part of the strict methodology of systematic literature review. After this initial screening, researchers identified twenty-two studies as pertinent and procured the full-text articles for a comprehensive quality evaluation as shown in the Table 1.

Table 1
Inclusion and exclusion criteria of the systematic review

Characteristics of the Literature	Inclusion Criteria	Exclusion Criteria
Type of publication	Journal articles, conference papers, thesis	Reports, books, book chapters
Time	Only articles published in the 2019-2024	Journal articles published before 2019
Language	Articles are written in English	Articles are not written in English
Geography	No exclusion	No exclusion
Population groups	Higher education/Tertiary level students/ Graphic Designers	Secondary education and Primary education students
Type of policies/interventions in scope	Perceptions and evaluations regarding GenAI tools within graphical design: Image-Recognition/Image-Generation/ Creativity & AI	No intervention of Generative AI/ Image-Recognition/ Image-Generation/Creativity & AI

2.2 Quality and Eligibility Assessment

The author examined the full-text articles to assess their quality and suitability for inclusion in the study. The author regarded journal articles published by esteemed publishers as exemplars of high-quality research and incorporated them into the review process. Then, inclusion criteria were well-cited references. The search was conducted according to one of the research questions: (What are artificial intelligence-based applications' positive and negative effects on students' learning design processes). The inclusion and exclusion criteria were designed based on the PRISMA statement recommendations, study objectives and questions.

Adhering to the PRISMA protocol, the data collection process employed a systematic four-step screening procedure as shown in Figure 1. Initially, the identification phase generated 3,150 results from searches across three databases using the designated question. In the subsequent screening stage, duplicate entries were eliminated, and the application of inclusion and exclusion criteria further narrowed the number of relevant publications to 15. Moving forward to the eligibility phase, the complete articles of these publications underwent meticulous scrutiny to verify their alignment with the essential information outlined in the research questions, throughout this stage, strict adherence to inclusion and exclusion criteria was maintained. 25 articles were collected as the research sample in the inclusion step.

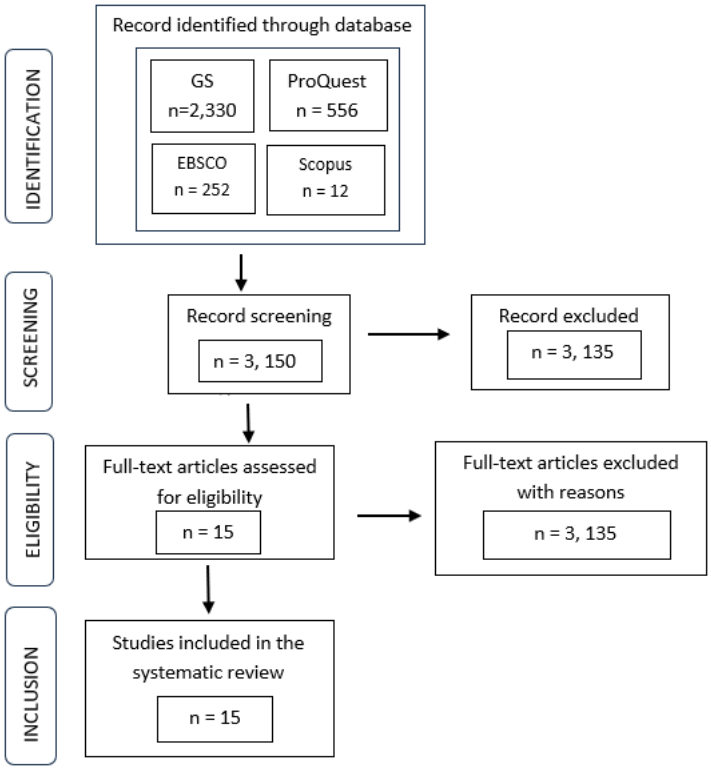

Fig. 1. Systematic four-step screening procedure

The study's objectives and stringent inclusion/exclusion criteria were met by a total of fifteen articles. A further explanation of how the article selection process was used is that there were four based of databases scientific journals: Google Scholar, ProQuest, EBSCO and Scopus. In addition to the data collection, 2,330 articles were found in Google Scholar based on keyword searches, while ProQuest was 556, EBSCO was 252, and Scopus was 12. Thus, the data obtained was summed up to produce 3, 150. However, in this stage, 22 articles were selected with provisions based on the criteria described earlier, including the requirements that were not included in the screening process. Finally, 15 screening articles' results based on keywords and researcher needs in answering research questions were taken to articulate and conceptualise.

The selected articles were specifically chosen to address targeted research questions and their findings are synthesized and presented in Table 2 for a comprehensive overview and detailed analysis. Each article was selected based on relevance to the study's objectives and adherence to rigorous inclusion criteria, ensuring that only the most pertinent and insightful research contributions were included. This structured approach facilitates a focused exploration of the research questions and provides a clear framework for comparing and interpreting the findings across the selected literature.

The Table 2 below provides an overview of selected results, offering new insights into creative AI tools in this context. Additionally, further research explores the impact of the AI on graphic design. In summary, all selected articles are relevant to the current research. For instance, one study discussed how AI influence graphic design and raises potential ethical concerns and challenges. This research employs a mixed-methods approach to investigate various facets of AI integration and its impact on graphic design. It also discoursed whether AI emerged in the field of graphic design as a powerful assistant or as a competitor to human designers. Notably, it also pointed out that the integration of AI in graphic design disrupts traditional understandings of intellectual property and

consent, leading to a significant gray area. These findings provided a foundation for conceptualizing the present research.

Table 2
The selected articles for a comprehensive overview and detailed analysis

Author (Year)	Title	Journals/Thesis
Elgendy *et al.,* (2024) [30]	Artificial Intelligence (AI) in Graphic Design: Identifying Benefits, Challenges, and Ethical Considerations	Thesis for Master of Design in Strategic Foresight and Innovation
Pchelnikova (2022) [29]	Artificial Intelligence (AI) in Digital Design	Thesis for Bachelor of Business Administration
Thomas (2024) [28]	Balancing Innovation and Integrity: Addressing Concerns of AI in Classroom Environments	Culminating Experience Projects / Graduate Research
Mujtaba (2024) [27]	Clarifying Ethical Dilemmas in Sharpening Students' Artificial Intelligence Proficiency: Dispelling Myths About using AI Tools in Higher Education	Journal of Business Ethics and Leadership
Bengtsson & Lindqvist (2024) [26]	Exploring Swedish Perspectives on Generative AI in Graphic Design: A Qualitative Study on Professional Perceptions	Master Thesis - Department of Informatics, Lund School of Economics and Management, Lund University
Sindhura & Abdul (2021) [25]	Virtues And Shortcomings of Artificial Intelligence in Graphic Design Arena	International Journal of Advanced Research in Engineering and Technology (IJARET)
Bhatt *et al.,* (2023) [24]	Artificial Intelligence in Current Education: Roles, Applications & Challenges	3rd International Conference on Pervasive Computing and Social Networking (ICPCSN)
Habib *et al.,* (2024) [23]	How does generative artificial intelligence impact student creativity?	Journal of Creativity
Chan & Hu (2023) [4]	Students' voices on generative AI: perceptions, benefits, and challenges in higher education	International Journal of Educational Technology in Higher Education
Pogoh *et al.,* (2024) [18]	The Impact of Artificial Intelligence on Today's Student Life	Journal Syntax Admiration
Roy *et al.,* (2022) [20]	Evaluating the Intention for the Adoption of Artificial Intelligence-Based Robots in the University to Educate the Students	IEEE Access: The Multidisciplinary Open Access Journal
Abdullah & Zaid (2023) [22]	Perception of Generative Artificial Intelligence in Higher Education Research	Innovative Teaching and Learning Journal
Fleischmann (2024) [6]	Generative Artificial Intelligence in Graphic Design Education: A Student Perspective	Canadian Journal of Learning and Technology
Muji *et al.,* (2023) [16]	Engaging With Artificial Intelligence in Graphic Design Education	IEEE Xplore
Hsieh & Wu (2023) [10]	Identification Assessment of Applying Artificial Intelligence Image Generation Techniques in University Computer Graphics Courses	IEEE: 2023 7th International Conference on E-Society, E-Education and E-Technology (ESET)

3. Discussion

This review seeks to provide an extensive summary of current research on the impact of AI on graphic design. The outcomes, illustrated in Table 1 and 2, revealed extensive investigations of AI

influence within graphic design industries and education. Numerous researchers have investigated diverse prospects of how AI influences industries, education, and the challenges. For example, according to Elgendy *et al.,* [30], AI in graphic design offers substantial potential for cost savings and profit growth. GenAI has the potential to increase productivity and creativity for billions of workers, producing trillions of dollars in economic value, thanks to developments in AI models, data accessibility, and processing power.

In contrast, Pchelnikova *et al.,* [29] identified two drawbacks of AI, including privacy invasion. Even though using AI to track us is advantageous today, it could result in even greater privacy loss. The loss of human jobs is yet another weakness. The primary goal of AI is to assist most people in completing their tasks more quickly and effectively, but as AI develops, it will eventually replace human labour in certain occupations. In addition, Thomas *et al.,* [28] emphasized that as AI becomes more commonplace in classrooms, it is critical to consider how its application affects students' cognitive development and sense of ownership over their education.

Students may become dangerously dependent on technology for answers rather than growing in their capacity for analysis and problem-solving if AI tools are utilized in the classroom primarily without encouraging critical thinking skills [21]. This could undermine democratic values that are essential to contemporary society, like informed citizenship and civic engagement, by leading to a shallow comprehension of ideas and a lack of in-depth learning.

Young adults leaving academic institutions may be vulnerable to AI tools used for manipulation, disinformation, and exploitation if they lack the necessary critical thinking skills to assess information critically and hold authorities accountable [8]. If concerns about a lack of critical thinking and accountability in AI-driven classrooms are not addressed, educational standards may erode, and the standards on which educational institutions rely to prepare students for adulthood may decline, resulting in lower academic achievement and global competitiveness [5]. The world is becoming increasingly digital and interconnected; as a result, people who lack critical thinking skills are more vulnerable to misinformation, propaganda, and conspiracy theories.

Artificial intelligence has been discussed for more than a half-century [27]. Nonetheless, it became a rapidly growing reality in 2023 in modern technologies like Meta AI, Open AI, and ChatGPT, raising some ethical concerns. A few respondents are still unsure due to a lack of clear guidelines from professors and the institution. By delving deeper into the use of AI, Bengtsson *et al.,* [26] discover that, while GenAI has been adopted for certain repetitive tasks in the design process, respondents do not see it as a replacement for human creativity or expertise. Their research seeks to understand the personal opinions and valuations of actual graphic designers regarding the use of AI-driven tools in their profession. Qualitative, semi-structured interviews were chosen as the primary data collection method. Most respondents see AI as a complementary tool that improves efficiency and expands creative possibilities.

Bengtsson *et al.,* [26] study sheds light on the evolving relationship between GenAI and graphic design. Emphasizing the importance of being able to work with and without technology as it evolves. [9] and Abdul *et al.,* [25] provide another example, stating that designers must complete the design process with high creativity and speed. Today, anyone without a design background can create a logo or a website design online using AI-powered software and tools developed by various companies. But the foundation of graphic design is the human brain's capacity for creativity, which artificial intelligence lacks. Furthermore, AI-driven software that received inputs such as name, company, reference, colors, symbols, and so on was unable to present ethical reasoning for the provided designs.

On the other hand, Bhatt *et al.,* [3] highlight the importance of AI in the education system by incorporating machine learning to ensure that the curriculum is tailored and personalized to an

individual's needs, fostering acceptance and retention, improving the learning experience, and enhancing overall learning quality. AI systems can customize content for each student. Furthermore, it can grade their exams and make recommendations for improvement. This reduces instructors' workload and allows them to focus more on improving student performance. Such a system will be able to handle high enrollment numbers while also giving instructors more time to focus on important tasks such as attendance, exam and assessment grading, and so on.

Habib *et al.,* [8] emphasize that, while AI has the potential to significantly support creative thinking, it can also have a negative impact on creativity and confidence. AI's ability to generate "new" ideas is questioned, as it relies on pre-existing data. This raises ethical concerns about intellectual property and plagiarism. Furthermore, Fleischmann *et al.,* [6] stated that there is little guidance on how to systematically integrate GenAI into design studio practice while remaining critical of the ethical issues that have been raised.

Students enjoyed brainstorming and idea generation because AI provided a variety of detailed answers in less than a minute—from login to answers [8]. However, Fleischmann *et al.,* [6] believed that students who use GenAI may be avoiding the essence of the creative process, which entails grappling with conceptual challenges, experimenting with diverse ideas, and confronting obstacles in translating abstract concepts into concrete visual forms. They may miss out on more in-depth learning experiences and lack the confidence that comes with navigating to find their creative voice. For example, Looka (an online software with premade design templates) generates a variety of logotypes for users to edit. The ease and speed with which logos can be generated using fill-in forms and colour palettes effectively eliminates the rigorous and iterative process that students go through when creating graphic design projects.

Kelly *et al.,* [11] express a similar concern regarding the use of AI in design education, pointing out that ambiguity and uncertainty are key components of design education, which is defined by encouraging students to overcome design obstacles, navigate anomalies, and improve their ideas through ongoing experimentation and critique. Students will lose their capacity for original thought once they have become overly dependent on AI to produce their design work, making them vulnerable to AI replacing humans in the workforce.

Consequently, some students voiced concerns about AI replacing human thought processes, fearing that AI would stifle their unique (human) creative thinking and, consequently, their confidence [8]. Without these tools, new design students in particular might not be mature enough or able to critically learn how to carry out specific processes [6]. Therefore, design educators must assist students in developing a critical eye to challenge the veracity of GenAI-generated text and images and, above all, see it as a digital collaboration tool rather than a production facility for finished goods [6]. This reveals a similar concern which is when assessing AI-generated content, facilitators should teach students the fundamentals of critical thinking [16].

However, a few companies are now using GenAI, especially in iterative processes (e.g., Wernersson & Persson, 2023), so students should be aware of its fundamental applications. In the meantime, Kumar *et al.,* [12] explores the impact of AI on education. His examination of AI-generated answers to academic writing prompts reveals that, while largely unique and pertinent to the subjects, the text output lacked personal viewpoints and inappropriate references, which are typically beyond the capabilities of AI. If such elements are present in the dataset used to train a model, GenAI content may be biased, erroneous, or harmful [9]. For instance, images produced by AI may be used maliciously, such as for deepfakes, and may contain nudity or profanity [47]. Because GenAI tools cannot evaluate the accuracy of the content or identify whether the output they produce contains errors or misinformation, human oversight is necessary when using them [15]. It is challenging to tell

if a piece of writing is the author's original work because most plagiarism checkers are unable to identify AI-generated output [17].

Pongoh *et al.,* [18] also discovered that students can complete their coursework and solve problems with the aid of modern technology. However, because these technological advancements make it very easy to work without much thought, they can harm people's mindset and enthusiasm for learning. Furthermore, students who use ChatGPT the most may become less critical thinkers and lose their problem-solving skills because they are more likely to be lazy and not work hard enough to finish assignments. Users will become lazy and less independent as a result of this technology. As a result, using ChatGPT, or AI, calls for accurate comprehension rather than hyperbole.

Roy *et al.,* [20], on the other hand, highlight the crucial role of AI in education and highlight that in order to stay relevant and make a bigger impact, the field of AI in education needs to adapt to the shifts in the conventional teaching methods by introducing the newest, most innovative techniques. At the level of higher education delivery in India, Roy *et al.,* [20] emphasized the urgent need for a fundamental change in the teaching-learning environment and administrative responsibilities. Additionally, their study answered their first research question since both teachers and students have a positive attitude regarding the use of AI-based robots in the classroom.

Furthermore, Abdullah and Zaid *et al.,* [1] investigate how the adoption of generative AI in higher education research is impacted by both its potential advantages and difficulties. According to their findings, the majority of participants incorporated generative AI into their research, indicating a high level of engagement with AI adoption. Nonetheless, there were differences in adoption readiness, which indicated varying degrees of zeal and readiness. Participants' opinions varied from acknowledging the practicality of generative AI to raising worries about possible drawbacks like growing unduly dependent. Additionally, ethical issues are covered, enabling researchers to responsibly handle concerns about bias, transparency, and privacy. Addressing possible concerns and promoting wider acceptance also require raising awareness of the advantages and moral application of generative artificial intelligence.

Leahy *et al.,* [13] also raises the debatable point that when AI is given an example, it encourages divergent thinking and less fixation on a solution, which eventually fosters creativity and innovative thinking. Designers can undoubtedly boost their productivity and free up more time for their creative processes by critically utilizing AI, but this may not be the case for design students. Beginner design students are susceptible to developing creative ideas during their early learning stages because they lack the fundamental design concepts that professional designers possess. How are novice designers going to compete in the industry if they are being denied the chance to experiment with creative ideas at the start of their education? Particularly when human jobs are soon to be replaced by AI.

Moreover, students are less sceptical about incorporating AI into their learning process [10]. Especially students from the Alpha generation, who expect tasks to be finished quickly and effortlessly and whose attention to new technologies has become ingrained in their daily lives. Young people like them would therefore be favourably accepted and inclined to use AI in their learning processes if research were focused on the user experience of AI. "If I had six hours to chop down a tree, I would spend the first four hours sharpening my axe," said Abraham Lincoln, the 16th President of the United States, in the 1860s. President Lincoln's underlying message was, of course, that it would be extremely inefficient to cut down a tree with a dull axe. Since cutting down the tree can be completed in two hours or less, it is therefore wiser to sharpen the axe first. To adapt to the newest artificial intelligence technologies, today's workforce requires the "sharpening of their axes and saws." [27].

Instead of developing their own analytical and problem-solving skills, students may become dangerously dependent on technology if AI tools are used in the classroom primarily without

encouraging critical thinking [21]. This could lead to a shallow comprehension of ideas and a lack of in-depth education, undermining democratic values that are essential to contemporary society, like civic engagement and informed citizenship. Young adults leaving academic institutions may be vulnerable to AI tools used for manipulation, disinformation, and exploitation if they lack the critical thinking skills necessary to assess information critically and hold authorities accountable [8].

If the issues surrounding the absence of critical thinking and accountability in AI-powered classrooms are not resolved, educational standards could deteriorate, which would lower academic achievement and competitiveness globally [5]. Educational institutions rely on these standards to prepare students for adulthood. People without critical thinking abilities are more vulnerable to disinformation, propaganda, and conspiracy theories since the world is becoming a more digital and connected place [8].

Nonetheless, as AI technology develops, it will become more crucial than ever to be able to use the tools and resources at hand efficiently. Bengtsson *et al.,* [26] stated that people and organizations must embrace AI, incorporate it into their work, and use its capabilities to navigate the rapidly evolving technological landscape if they want to remain successful and competitive. Given that big companies have not yet fully embraced AI, the respondent from the Bengtsson *et al.,* [26] study emphasizes the significance of learning how to use AI effectively. They think that using AI in conjunction with human skills can increase productivity more than using AI alone. Therefore, eloquent collaboration with AI can effectively produce more productive tasks, rather than worrying about AI replacing human jobs.

Feuerriegel *et al.,* [46] propose that AI's output should influence human prompts as it develops into co-creation. Feuerriegel *et al.,* [46] assertion may hold true for text-to-text AI models like ChatGPT, but it might not hold true for text-to-image generators like Dall-E 2 and Midjourney [26]. Because students who use GenAI might be avoiding the core of the creative process, which entails overcoming conceptual difficulties, trying out various ideas, and overcoming barriers to converting abstract ideas into concrete visual forms. They might lose out on more in-depth educational opportunities and lack the self-assurance that comes from figuring out how to express themselves creatively.

4. Result

The data presented studies conducted between 2019 and 2024, focusing on AI in various contexts as shown in Table 3. These studies explored different aspects of AI, including in industries and education. Significant studies done by Elgendy *et al.,* [30], Pchelnikova *et al.,* [29], Fleischmann *et al.,* [6] and Muji et *al.,* [16] highlighted the most relevant topic. Nevertheless, it is sad that those studies are still lacking, focusing more on other aspects based on the table above. This was also supported by the evidence that most occurrences related to the previous research found very little relevance to the topic of creative AI tools used in graphic design, but ChatGPT and general AI context were the highest when scholars researched the same topic. Therefore, the present study's position was relatively new and contributed to previous research.

Table 3
Distribution of relevant articles based on Google Scholar

Authors	Title	Year	GSRank	CitiesPer Year
Chan & Hu [4]	Students' voices on generative AI: perceptions, benefits, and challenges in higher education	2023	77	895

Pogoh *et al.,* [18]	The Impact of Artificial Intelligence on Today's Student Life	2024	23	0
Roy *et al.,* [20]	Evaluating the Intention for the Adoption of Artificial Intelligence-Based Robots in the University to Educate the Students	2022	266	90
Mujtaba [27]	Clarifying Ethical Dilemmas in Sharpening Students' Artificial Intelligence Proficiency: Dispelling Myths About Using AI Tools in Higher Education	2024	24	2
Wu & Yu [31]	Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis	2023	101	241
Stige *et al.,* [32]	Artificial intelligence (AI) for user experience (UX) design: a systematic literature review and future research agenda	2024	58	86
Pacheco-Mendoza *et al.,* [33]	Artificial Intelligence in Higher Education: A Predictive Model for Academic Performance	2023	97	25
Fan & Zhong [34]	Artificial intelligence-based creative thinking skill analysis model using human–computer interaction in art design teaching	2022	79	75
Ipek *et al.,* [35]	Educational Applications of the ChatGPT AI System: A Systematic Review Research	2023	17	167
Nguyen *et al.,* [36]	Ethical principles for artificial intelligence in education	2023	112	685
Roy *et al.,* [20]	Evaluating the Intention for the Adoption of Artificial Intelligence-Based Robots in the University to Educate the Students	2022	266	90
Wang & Chen [37]	Exploring Designer Trust in Artificial Intelligence-Generated Content: TAM/TPB Model Study	2024	165	6
Elal & Özsoy [38]	Investigating The Effects of Using Artificial Intelligence in The Conceptual Design Phase of The Industrial Design Process.	2024	18	2
Qian [39]	Research on Artificial Intelligence Technology of Virtual Reality Teaching Method in Digital Media Art Creation	2022	27	79
Grassini [40]	Shaping the Future of Education: Exploring the Potential and Consequences of AI and ChatGPT in Educational Settings	2023	97	798
Chan & Hu [4]	Students' voices on generative AI: perceptions, benefits, and challenges in higher education	2023	77	895
Zawacki-Richter *et al.,* [41]	Systematic review of research on artificial intelligence applications in higher education – where are the educators?	2019	77	3620
Kelly & Oviedo-Trespalacios [42]	What factors contribute to the acceptance of artificial intelligence? A systematic review	2023	84	494
Sy *et al.,* [43]	AI-driven analysis: optimizing tertiary education policy through machine learning insights	2024	16	0
Hurst *et al.,* [44]	Digital Art and the Metaverse: Benefits and Challenges	2023	74	26
Wahba [45]	The impact of ChatGPT-based learning statistics on undergraduates' statistical reasoning and attitudes toward statistics	2024	47	6
Taktak *et al.,* [23]	Use of ChatGPT in Education: Future Strategic Road Map with SWOT Analysis	2024	17	1

In Table 4 and Figure 2 below, AI-related research showed the most extensive, followed by terms or links to higher education and students. The terms that were available to be chosen for VOSviewer were very limited, as the VOSviewer collects data focusing on scientific literature and data collection was also limited to Web of Science, Scopus and PubMed databases. Therefore, the current study showed a not significant contribution level after data processing using VOSviewer. As the terms such as; graphic design which is supposed to include in the clusters but due to the limited of literatures where can find in those scientific literatures was an example of research that was still rarely done, therefore, there is a space for the present research to update the literature or a more suitable software which can construct and visualize bibliometrics networks in social science database.

Table 4
The most term used, occurrence and score per/year in Vos Viewer tools

ID	Term	Occurrences	Relevance Score
1.	Artificial intelligent	0.4375	0.9453
2.	Higher Education	0.1605	0.93
3.	Student	2.2857	0.9238
4.	Generative artificial intelligence	0.4583	3.3611
5.	ChatGPT	0.3556	2.6074
6.	Artificial intelligence in education	0.1667	1.2222
7.	Curricula	3.5835	0.6624
8.	University Students	1.1667	1.2222
9.	Three-dimensional computer graphic	6.8333	0.8333
10.	Virtual reality	5.75	0.6597

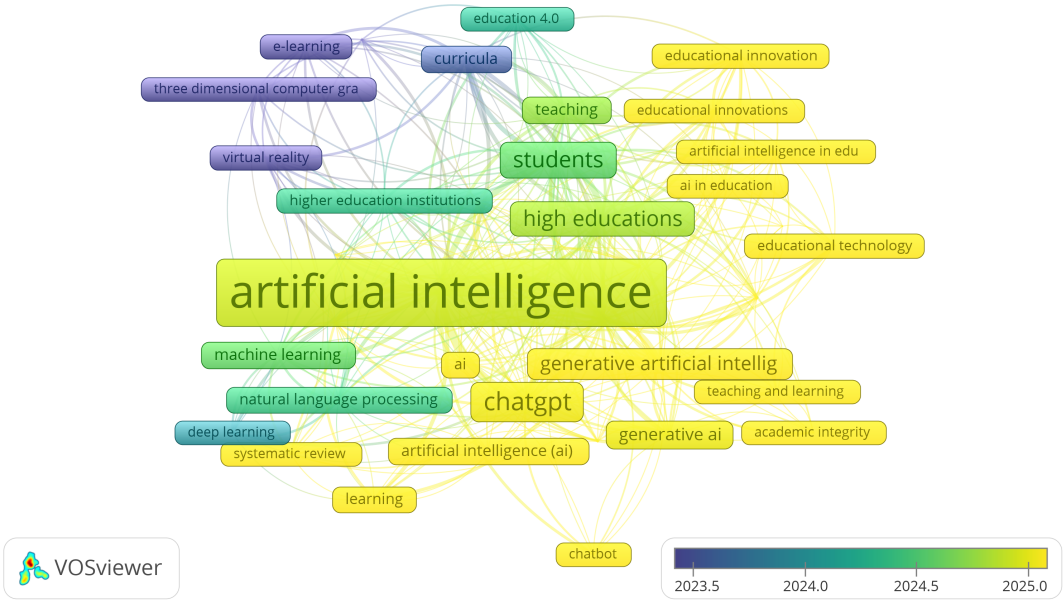

Fig. 2. Overlay visualisation of VOSviewer results

Although some studies have explored the impact of AI on higher education, not many studies have discussed the influence on graphic design education. For instance, Thomas *et al.,* [8] and Mujtaba *et al.,* [27] studies have discussed AI Tools in Higher Education, but only covering general education, not specifically in graphic design. In contrast to Elgendy *et al.,* [30], they found that GenAI's ability to make design tools and capabilities more accessible to non-designers could democratize graphic design by increasing the number of people who can produce visually appealing content.

However, Stüssy Tschudin, the Creative Director and Co-Founder of the Canadian firm Forge Media & Design, also emphasized that excessive use of AI without critical assessment and editing could dilute the quality of design. Elgendy *et al.,* [30] further contended that as AI-driven graphic design software and programs gain traction, designers utilizing them must be knowledgeable about design principles and guidelines; otherwise, these programs will lead to "pollution in design." For example, because AI (Looka) is less expensive than hiring a graphic designer and allows people with no graphic design experience to produce professional-quality work by simply entering text into a designated textbox, some customers might be interested in using it for simpler tasks like creating a logo [26].

At the same time, Catherine Charbonneau, a Quebec, Canada-based publication designer, observes that AI systems may use sensitive data to produce responses for other users without the original author's knowledge or approval. For instance, deepfakes are sophisticated audiovisual counterfeits made with artificial intelligence (AI) that use artificial neural networks, which are sophisticated systems that identify patterns in data [7,30]. This phenomenon creates non-consensual content by faking a person's face onto explicit material, which is a serious privacy violation that can result in harassment, blackmail, and defamation. the importance of deepfakes, emphasizing their capacity to sway public opinion, particularly when considered in the context of political disinformation. Thus, Rahul Bhogal, the Principal Creative Director of Nothing Design Studio in Canada. stress the necessity of thorough data protection laws and moral business conduct in order to safeguard users' rights and privacy.

In summary, the foundation of graphic design is the human brain's capacity for creativity, which is absent from artificial intelligence. With inputs such as name, company, reference, colors, symbols, etc., AI-driven software was unable to provide moral justification for the designs that were supplied, and the machines had not yet acquired the capacity to possess unique creativity and imagination [25]. Furthermore, it is believed that human interaction is essential to a student's development; therefore, eliminating all human interaction from a classroom may have unintended consequences. Accordingly, some education experts contend that AI education should prioritize soft skills like creativity, critical thinking, and problem-solving, Bhatt *et al.,* [3].

Habib *et al.,* [8] found that some study participants struggled to generate ideas beyond the AI's suggestions, indicating a risk of cognitive fixation and decreased self-efficacy. Furthermore, Habib *et al.,* [8] shared a student's concern that there is a negative impact on creativity, stating:

> "Some people may rely too much on AI technologies to generate ideas, causing them to lose the capacity or willingness to think for themselves."

5. Conclusion

The study concludes by investigating the consequences of these recognized AI impacts on educators, students, and curriculum developers. It provides useful information on practical strategies for improving AI acquisition in higher education. These identified trends have far-reaching implications for the new era of AI-based learning and teaching design curricula, teacher training programs, and instructional practices. The need for continuous efforts to provide appropriate guidelines and rules and regulations for using AI in protecting intellectual property and avoiding plagiarism is highlighted by this collective insight, which helps to foster and enhance AI acquisition in graphic design higher education.

AI should be viewed by educators and students as an aid, not a substitute. Participants stress the need for radical transparency, informed consent, and unambiguous regulations to guarantee that AI

functions as a collaborative tool and support a cautious, critical, and ethical approach to AI integration. Another significant risk associated with AI's ability to alter images and produce realistic-looking but fictitious scenarios is misrepresentation, whether deliberate or accidental [30].

Although universities around the world are still in the early stages of fully integrating AI into their curricula, students at universities that have not officially used AI-based learning may feel left behind when compared to students at more advanced universities [18]. However, institutions should not rush into the AI phenomenon without first providing facilitators and students with clear and appropriate guidelines for using AI.

Meticulous works of literature have highlighted some intricate facets inherent in AI, such as the fact that AI-generated information should not be taken for granted because it has been documented that it can produce both accurate data and completely invalid data, also known as artificial hallucinations [2]. It has highlighted the nuances embedded in teaching strategies, the incorporation of AI, and the resulting impact on students' learning experiences. For example, design educators must help students develop a critical eye to question the authenticity of GenAI-generated images and text, and, most importantly, view it as a digital collaboration tool rather than a manufacturing hub for finished products [6]. Recent research has emphasized the importance of providing proper guidance on issues such as plagiarism, copyright violations, and the perpetuation of racial stereotypes that threaten the unbridled integration of GenAI [19].

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