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Mapping The Research Landscape of Artificial Intelligence in Design Education: A Systematic Literature Review (2016–2025)

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Abstract
This study reviews the research landscape of artificial intelligence (AI) in design education from 2016 to 2025. In recent years, AI and generative AI tools have been widely used in design learning, design thinking, creativity training, and visual communication education. However, research on AI in design education is still developing, and a clear overview of its main trends and research structure is needed. To address this gap, this study uses a literature review and bibliometric analysis approach. Publications were collected from IEEE Xplore, Web of Science, and Scopus. After keyword searching, database comparison, duplicate removal, and manual screening of titles, abstracts, and keywords, 137 journal articles were included for analysis. VOSviewer was used to conduct co-authorship and keyword co-occurrence analyses. The results show that publications on AI in design education increased rapidly after 2022, with strong growth in 2024 and 2025. The co-authorship network shows that the field is still fragmented, with several small research groups but limited cross-group collaboration. The keyword analysis indicates that “artificial intelligence,” “design education,” “generative artificial intelligence,” “students,” “teaching,” “creativity,” and “design process” are important themes. The findings suggest that AI in design education has become an emerging research area, but more studies are still needed to examine how AI supports students’ design thinking, creative processes, and visual communication practice in real learning contexts.

Keywords: AI, Design Education, Systematic Review, Vosviewer

Introduction

Artificial intelligence (AI) is developing rapidly in education, especially in design education. In recent years, AI tools have been used to support design learning, creative thinking, visual communication, and design practice. Previous studies have shown that AI can help learners interact with digital learning environments and improve their learning engagement and learning performance (Hwang et al., 2022). Generative AI tools, such as ChatGPT, DALL-E, and Midjourney, have also become useful tools in design education. These tools can support knowledge learning, idea generation, visual exploration, and personalized learning support (Tsiydlo & Chele, 2023; Yin et al., 2023). However, the use of AI in design education also raises important concerns. Some researchers have pointed out that students may become too dependent on AI tools. If

students rely too much on AI-generated results, their design thinking, creativity, and critical thinking may be weakened (Chen & Liu, 2023; Jin et al., 2024; Zawacki-Richter et al., 2019). In design education, students need to understand problems, develop ideas, make design decisions, and reflect on their creative process. Therefore, AI should not be seen as a replacement for human creativity. Instead, it should be used as a supporting tool that helps students learn, think, and create.

AI has been applied in many areas of design education, including concept learning, design thinking training, creativity development, and collaborative creation. For example, AI-supported systems may help students improve their flow experience during collaborative creative work and support higher-level design thinking (Díaz-Rodríguez et al., 2023). In addition, AI can process large amounts of information and help students explore design problems from different perspectives. This may provide new opportunities for design learning and creative problem solving. However, researchers have also warned that AI-driven design environments need careful instructional design. If teachers do not guide students properly, AI may reduce students' active participation and deep thinking in the design process (Verhulsdonck et al., 2021; Lee et al., 2023).

Objectives

For this reason, it is important to review how AI has been studied and applied in design education. Although the number of studies has increased in recent years, this research area is still developing. There is still a need to understand its publication trends, major research themes, author collaboration patterns, and research gaps. A clearer overview of the field can help design educators understand how AI is being used in design learning and what issues still need further study. Therefore, this study reviews the research landscape of AI in design education from 2016 to 2025. It collects related journal articles from IEEE Xplore, Web of Science, and Scopus, and uses bibliometric analysis to examine publication trends, co-authorship networks, and keyword co-occurrence patterns. Through this analysis, the study aims to identify the main development trends, important themes, and future research directions of AI in design education. The findings can provide useful references for design educators, curriculum designers, and researchers who are interested in AI-supported design learning.

Methodology

This study used a literature review and bibliometric analysis approach to examine the research landscape of artificial intelligence in design education from 2016 to 2025. Bibliometric analysis is useful for reviewing many publications and identifying the development of a research field, including publication trends, research themes, and collaboration patterns (Donthu et al., 2021). Therefore, this approach was suitable for this study because AI in design education has grown rapidly in recent years, but its research structure still needs to be better understood. The data were collected from three academic databases: IEEE Xplore, Web of Science, and Scopus. These databases were selected because they cover different but related research areas. IEEE Xplore includes many studies in engineering, computing, and educational technology. Web of Science and Scopus are widely used citation databases, but their journal coverage is not exactly the same (Mongeon & Paul-Hus, 2016). Therefore, using more than one database can help reduce the limitation of using a single source. It can also help this study collect a broader and more reliable set of publications. In addition, previous research has suggested that academic search systems differ in their retrieval functions and search quality, so

researchers should carefully choose suitable databases and use clear search strategies (Gusenbauer & Haddaway, 2020). The search focused on studies related to artificial intelligence and design education. The main search terms included “artificial intelligence,” “generative AI,” “LLM,” “chatbot,” “intelligent agent,” “design education,” “design pedagogy,” “design studio,” “design teaching,” “design curriculum,” “art,” “creativity,” “design thinking,” and “learning outcomes.” These keywords were combined with Boolean search strategies to identify relevant publications. The initial search found 61 records from IEEE Xplore, 63 records from Web of Science, and 453 records from Scopus. In total, 577 records were collected at the first stage.

To improve the quality of the dataset, this study did not directly use all initial search results. Instead, a multi-stage screening process was conducted. First, only English journal articles were included, while conference papers and other document types were excluded. Second, duplicated records were removed by checking DOI, title, author names, and publication year across the three databases. Third, the titles, abstracts, and keywords of the remaining articles were reviewed manually. Articles were excluded if they included words such as AI, design, or education but were not actually related to design education. This manual checking process helped reduce irrelevant records and made the dataset more focused on the design education context. After these screening steps, 137 journal articles were included in the final dataset. These articles were used for further bibliometric analysis. VOSviewer was used to analyze co-authorship networks and keyword co-occurrence patterns. VOSviewer is a commonly used tool for constructing and visualizing bibliometric maps, and it is especially useful for showing relationships among authors, keywords, and research topics (van Eck & Waltman, 2010). Through this process, this study identified the main research structure and development direction of AI in design education.

Overall, the data collection process was not a one-time search. It included keyword design, database searching, document type screening, duplicate removal, manual topic checking, and bibliometric mapping. This process helped improve the quality of the final dataset and made the analysis more focused on AI applications in design education.

Analysis

Publication Trends from 2016 to 2025

The first part of the analysis examines the annual publication trend of AI-related research in design education from 2016 to 2025. Based on the final dataset of 137 journal articles, the number of publications was very limited before 2022. From 2016 to 2021, only one paper was identified in 2019, while no relevant articles were found in the other years. This result shows that AI in design education had not yet become a major research topic during this early period. A clear increase can be observed from 2022 onward. In 2022, the number of publications increased to eight papers. This suggests that researchers had begun to pay more attention to the role of AI in design education. This trend is also consistent with the broader development of AI in education. Previous studies have shown that AI-supported learning and online learning research have increased in recent years, especially in relation to intelligent learning systems, personalized learning, and educational technology (Hwang et al., 2022; Zawacki-Richter et al., 2019).

In 2023, which was an important year for the rapid development of generative AI, the number of publications rose to 15 papers. This growth may be related to the wider use of

large language models and generative AI tools in education. Kasneci et al. (2023) pointed out that large language models can support learning, teaching, feedback, and content generation, but they also require careful educational design. Therefore, the growth after 2023 may reflect not only the popularity of AI tools, but also the increasing need to understand their educational value and possible risks.

The growth became even more obvious in 2024, with 30 papers published. This increase may be related to the wider use of AI tools in creative practice, design learning, and design curriculum development. In 2025, the number of publications reached 83 articles, accounting for the largest proportion of the dataset. Although the publication trend in 2025 should be interpreted carefully, the sharp increase still shows that AI in design education has become an important and fast-growing research topic. The publication trend suggests that AI research in design education has moved from an early stage to a period of rapid growth. This result also reflects a larger change in education. AI is no longer discussed only as a technical tool. It is increasingly connected with learning support, teaching design, creativity development, and curriculum innovation. However, as Chen et al. (2020) suggested, AI education research still needs stronger links between AI technologies and educational theories. This point is also important for design education, because design learning is not only about using tools, but also about developing thinking, judgment, and creativity.

Co-authorship Network Analysis

The second part of the analysis examines the author collaboration network of AI research in design education. VOSviewer was used to conduct a co-authorship analysis. The unit of analysis was authors, and the counting method was full counting. From the 137 journal papers, a total of 475 authors were identified. To focus on more active contributors, the minimum number of publications per author was set at two. Based on this threshold, 38 authors were included in the final co-authorship network. Of these 38 authors, 47% were from China, 20% from Malaysia, and 11% each from the United States and Turkey. As shown in Figure 1, the co-authorship network is relatively scattered and consists of several small clusters. Although some authors have clear collaborative relationships, many groups are weakly connected with each other. VOSviewer also shows that the largest connected group includes only 10 authors. This result suggests that AI research in design education has not yet formed a highly centralized research community.

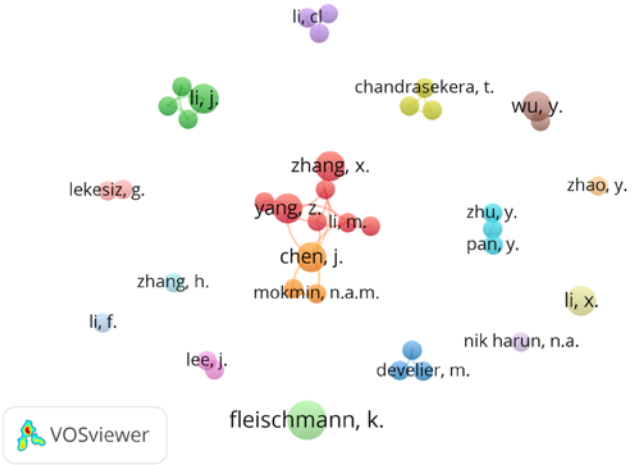

Figure 1: Subsets of AI

In the central part of the network, some authors, such as yang, z., zhang, x., li, m., chen, j., and mokmin, n. a. m., show more visible collaborative links. These authors may be regarded as part of a local collaboration core within the dataset. However, most other authors are located in smaller groups or isolated positions. This means that current research on AI in design education is still mainly developed by individual research teams or small collaborative groups. This scattered pattern also shows that AI in design education is still an emerging interdisciplinary field. Researchers may enter this field from different backgrounds, such as design education, educational technology, computer science, human-computer interaction, and creativity studies. This situation is like the broader development of AI in education, where researchers have explored AI from different technical and pedagogical perspectives (Chen et al., 2020; Hwang et al., 2022). However, in design education, stronger collaboration is still needed to build a more stable research community.

Findings and Discussion

The co-authorship network indicates that future studies may benefit from stronger cross-disciplinary and cross-national cooperation. For example, design educators can work with AI researchers to design more suitable AI-supported design learning environments. Educational technology researchers can help evaluate learning processes and learning outcomes. Human-computer interaction researchers can help improve the usability and learning experience of AI tools. Such collaboration could help the field develop a more integrated theoretical foundation and a clearer research direction.

Keyword Co-occurrence Analysis

The third part of the analysis focuses on keyword co-occurrence. The type of analysis was co-occurrence, the unit of analysis was keywords, and the counting method was full counting. From the 137 journal articles, a total of 799 keywords were identified. To focus on more important and repeated terms, the minimum number of keyword occurrences was set at five. Based on this threshold, 29 keywords were included in the final network, as shown in Figure 2. As shown in Figure 2, “artificial intelligence” and “design education” are the two most central keywords in the network. This result indicates that AI and design education form the main research focus of this field. These two keywords are closely connected with other terms, such as “students,” “teaching,” “learning,” “creativity,” “generative artificial intelligence,” “product design,” and “visual communication design.” This finding shows that current studies do not only discuss AI as a technology. They also examine how AI is used in design courses, student learning, teaching practice, and creativity development.

The cluster structure in Figure 2 shows several main research directions. First, “artificial intelligence” and “design education” are located at the center of the network. Their larger nodes and stronger links show that they are the main knowledge focus in this group of studies. Second, “generative artificial intelligence” is connected with “design process,” “product design,” and “design education.” This means that generative AI has gradually become a more specific research topic. It is no longer discussed only as a general AI issue but is increasingly connected with design processes and design teaching. This result is supported by recent studies on generative AI and design practice. For example, Yin et al. (2023) examined how Midjourney can be integrated into design systems and support future-oriented design innovation. Jin et al. (2024) also showed that generative AI tools can support early-stage design ideation and revision by providing rapid visual stimuli. These

studies suggest that generative AI may influence not only the final design outcome, but also the way designers generate, compare, and refine ideas.

Third, the cluster on the lower-left side includes keywords such as “students,” “teaching,” “curriculum,” “learning,” and “creativity.” This cluster shows that many studies are concerned with how AI affects student learning, instructional design, curriculum planning, and creativity development. For design education, this is an important direction because AI may influence not only the final design outcome, but also how students understand problems, develop ideas, and make design decisions. Fourth, the upper-left part of the network includes “visual communication design,” “design,” and “visualization.” This suggests that visual communication design and visualization have become important professional areas in AI-related design education research. However, compared with “artificial intelligence” and “design education,” “visual communication design” is still not a central keyword in the whole network. This means that visual communication design has received attention, but it has not yet become a major research focus in this field. Fifth, the right side of the network includes keywords such as “Midjourney,” “interior design,” and “interior design education.” This indicates that generative image tools and their applications in specific design fields are gaining more attention. These keywords also show that AI research in design education is moving from general discussion to more concrete design domains and practical teaching contexts.

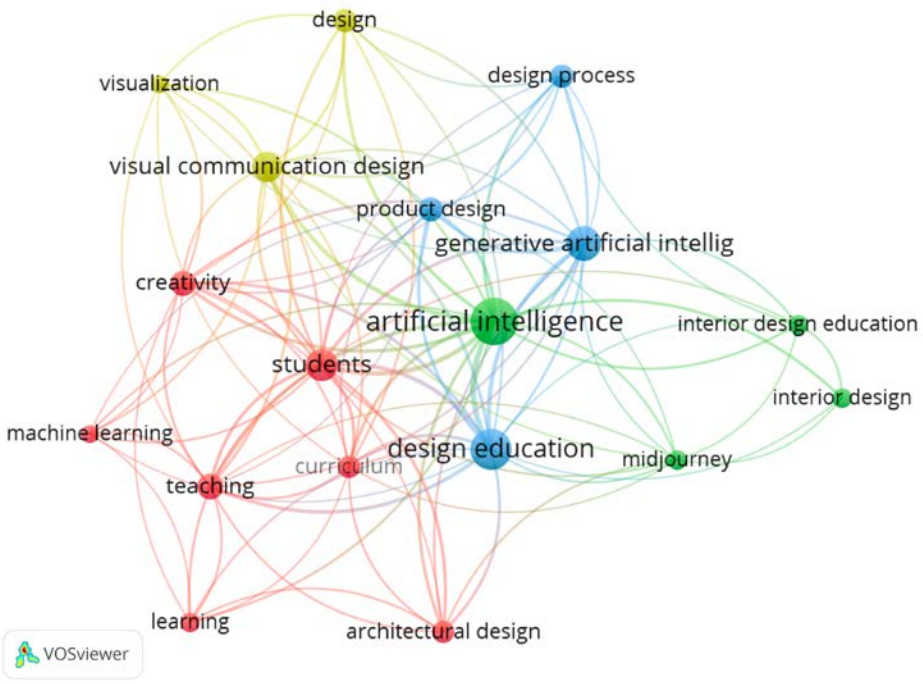

Fig 2: Keyword Analysis

This study reviewed the research landscape of artificial intelligence in design education from 2016 to 2025. Based on 137 journal articles collected from IEEE Xplore, Web of Science, and Scopus. The results show that AI in design education is not yet a fully mature research field, but it is becoming an important and fast-growing research area. The publication trend shows that research on AI in design education increased rapidly after 2022. This growth may be closely related to the wider use of generative AI tools in education and creative practice. AI is no longer discussed only as a technical tool. It has

gradually become connected with design learning, teaching practice, creativity development, design process, and curriculum design. The co-authorship analysis shows that the research community is still relatively fragmented. Although some small research groups have already formed, collaboration among different groups, institutions, and countries remains limited. This suggests that AI in design education is still in an early stage of academic development. Future studies may need stronger cross-disciplinary collaboration among design education, educational technology, artificial intelligence, human-computer interaction, and learning sciences.

Conclusion

The keyword co-occurrence analysis further shows that “artificial intelligence,” “design education,” “generative artificial intelligence,” “students,” “teaching,” “creativity,” and “design process” are important themes in this field. These keywords indicate that current research has started to move from general discussions of AI tools to deeper educational issues. Researchers are now paying more attention to how AI influences students’ learning, creative thinking, design decision-making, and teaching practice. However, the findings also show some important research gaps. Although creativity has appeared in the keyword network, it has not yet become the strongest central concept. This means that many studies may still treat creativity as a learning outcome, rather than examining how creative ideas are formed, revised, and judged during the design process. In addition, visual communication design has received attention, but it is still not a core theme in the overall network. This suggests that more research is needed to explore how AI affects concept development, visual expression, image translation, and communication in visual design education. Therefore, the contribution of this study is not to claim that AI has completely changed design education. Instead, this study shows that the field is now at a stage where the main research themes are becoming clearer, but many detailed learning processes still need further study. Future research should not rely only on bibliometric maps. It may also include course observations, student work analysis, interviews, and design process data. These approaches can help researchers better understand how students use AI in real design learning contexts.

References

Chen, H.-C., & Liu, Y.-C. (2023). Apply the project-based learning model to cultivate students’ design thinking research on generative AI. International Conference on Sustainable Design and Innovative Industries (ICSDII 2023), National Taichung University of Science and Technology, Taiwan.

Chen, X., Xie, H., Zou, D., & Hwang, G.-J. (2020). Application and theory gaps during the rise of artificial intelligence in education. Computers and Education: Artificial Intelligence, 1, Article 100002. doi: 10.1016/j.caeai.2020.100002

Díaz-Rodríguez, N., Del Ser, J., Coeckelbergh, M., de Prado, M. L., Herrera-Viedma, E., & Herrera, F. (2023). Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. Information Fusion, 99, 101896. https://doi.org/10.1016/j.inffus.2023.101896

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. Research Synthesis Methods, 11(2), 181–217. https://doi.org/10.1002/jrsm.1378

Hwang, G. J., Tu, Y. F., & Tang, K. Y. (2022). AI in online-learning research: Visualizing and interpreting the journal publications from 1997 to 2019. International Review of Research in Open and Distributed Learning, 23(1), 104-130. https://doi.org/10.19173/irrodl.v23i1.6319

Jin, Y., Yoon, J., Self, J., & Lee, K. (2024). Understanding Fashion Designers' Behavior Using Generative AI for Early-Stage Concept Ideation and Revision. Archives of Design Research, 37(3), 25-45. https://doi.org/10.15187/adr.2024.07.37.3.25

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., Stadler, M., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, Article 102274. https://doi.org/10.1016/j.lindif.2023.102274

Lee, G., Shi, L., Latif, E., Gao, Y., Bewersdorff, A., Nyaaba, M., Guo, S., Liu, Z., Mai, G., Liu, T., & Zhai, X. (2025). Multimodality of AI for education: Toward artificial general intelligence. IEEE Transactions on Learning Technologies, 18, 666–683. https://doi.org/10.1109/TLT.2025.3574466

Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: A comparative analysis. Scientometrics, 106, 213–228. https://doi.org/10.1007/s11192-015-1765-5

Tsidylo, I., & Chele, E., (2023). Artificial intelligence as a methodological innovation in the training of future designers: MidJourney tools. Information Technologies and Learning Tools, 97(5), 203-214. https://doi.org/10.33407/itlt.v97i5.5338

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Verhulsdonck, G., Howard, T., & Tham, J. (2021). Investigating the impact of design thinking, content strategy, and artificial intelligence: A “streams” approach for technical communication and user experience. Journal of Technical Writing and Communication, 51(4), 468-492. https://doi.org/10.1177/00472816211041951

Yin, H., Zhang, Z., & Liu, Y., (2023). The Exploration of Integrating the Midjourney Artificial Intelligence Generated Content Tool into Design Systems to Direct Designers towards Future-Oriented Innovation. Systems, 11, 566. https://doi.org/10.3390/systems11120566

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? International Journal of Educational Technology in Higher Education, 16(1), 1-27. https://doi.org/10.1186/s41239-019-0171-0.