



# The Impact of AI on design students' cognitive learning

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## Abstract:

The learning process of students in the field of design education has the potential to be revolutionised by Artificial Intelligence (AI). It opens new possibilities for them to interact and collaborate with AI to support and enhance their cognitive learning process. The ethical implications of AI in design education must be closely monitored and a balance between the use of AI and students' intrinsic creative thinking abilities should be maintained.

With the rising integration of AI in the field of design, it is critical to know, how AI technologies can improve the cognitive skills required for design thinking that involves visualisation, special reasoning, pattern recognition, and the decision-making process. The focus of the study is to investigate the role of AI in assisting design students' cognitive learning. The paper further provides recommendations to incorporate AI tools and techniques that optimise cognitive learning and foster creative and critical thinking abilities.

A research strategy using mixed methods is employed for primary data collection. The quantitative data collected using survey questionnaires helped to formulate the qualitative methods to test the focus of the research using focus groups and interviews with design students and educators. The mixed methods provided valuable insights into AI-assisted cognitive learning in design. The paper concludes with the preconditions to implement an AI system that does not adversely impact the students' analytical, exploratory, and creative thinking abilities.

**Keywords:** Artificial intelligence, Design education, cognitive learning, creative thinking

## Introduction

AI is an integral part of the fourth revolution in education with the potential to revolutionise education. The use of AI supports the students with individualised instruction and learning through a tailored learning plan, based on their needs and current learning scenario offering an immersive learning environment and implementing intelligent learning tracking (Dishon, 2017). Based on big data and machine learning, AI can thoroughly assess students' performance on assignments and tests and offer individualised teaching recommendations. According to the book "The Fourth Education Revolution Reconsidered" (Seldon, 2020), AI can harm students' cognitive and emotional development. He argues that AI-driven learning platforms can lead to a lack of critical thinking skills, reduced creativity, and poor emotional regulation and suggests that students who rely on AI for learning may struggle with problem-solving and decision-making in the long run.

According to (Westman, 2021) the overreliance on AI can lead to a decrease in cognitive skills, including critical thinking and problem-solving abilities. This can be attributed to the fact that AI often provides students with pre-packaged solutions, which can limit their ability to think creatively and critically. (Kirschner et.al, 2013) found that the overreliance on technology in education can limit students' ability to learn independently and develop critical thinking skills, which could have long-term effects on their future academic and career success.

(Zhao,2020) argues the use of AI in education may have limitations in terms of students' brain development and long-term effects. The use of AI may limit students' critical thinking and problem-solving skills. In a study conducted by the University of Cambridge, researchers found that students who use AI-based learning systems tend to rely more on the system's answers, rather than thinking critically about the problem themselves. The above literature suggests the use of AI may limit students' ability to think critically and independently, which could have long-term effects on their academic and professional success.

Recent studies have suggested that the use of AI in education may have both positive and negative long-term effects. For example, AI technologies may improve students' retention of information by providing personalised feedback and adaptive learning experiences (Friedman, 2016). On the other hand, the use of AI may lead to a reduction in creativity and innovation, as students may rely too heavily on technology for problem-solving (Seldon,2020)

Technology plays a significant role in shaping the future of design. We are moving fast into a digital era where Artificial Intelligence, Machine Learning, Deep Learning, Big Data, the Internet of Things, Blockchain, Spatial Computing, and several other technologies are becoming part of the designers' lexicon. The designers' roles are evolving, and the touchpoints they need to consider are growing in complexity. Integrating AI developments with User-Centered Design and User Experience Design is becoming challenging.

Aspects of design education, such as design thinking, the design process, and design evaluation are changing because of artificial intelligence (AI). To help design students advance their abilities, knowledge, and creativity, AI tools and technologies are being deployed. The impact of AI in design education on student learning outcomes has been examined in several research. For instance, a study (Razzouk & Shute, 2012) examined the use of AI-based simulations in design education and discovered that it enhanced students' capacity for critical thought and problem-solving. In a similar vein, Huang and Rust (2018) conducted a literature study on the application of AI in design education and emphasised its potential for fostering students' originality and design thinking.

AI has been used to enhance creativity in design students by generating design ideas, providing inspiration, and expanding the design space. Generative Adversarial Networks (GANs) and Recurrent Neural Networks (RNNs) have been employed to generate novel design concepts, colour palettes, and typography suggestions, stimulating design students' creativity and encouraging them to explore new design possibilities (Mazzone and Elgammel, 2019). AI has been used to rate the work of design students and offer tailored criticism. Based on predefined criteria or design principles, AI algorithms have been used to autonomously evaluate design artifacts such as design prototypes, wireframes, and graphic designs (Gangadharbatla, 2022 & Li et.al, 2020). It is made possible for students studying design to get quick and helpful feedback, which helps them develop their design abilities and deliver high-quality design outcomes. AI is used to support design students in various aspects of the design process and foster their creativity. AI-powered design tools and software utilize machine learning algorithms to assist designers in generating design ideas, creating prototypes, and automating repetitive tasks (Liu et al., 2018). These tools provide real-time feedback and suggestions, helping design students to iterate and refine their designs more efficiently. Additionally, AI algorithms can analyse vast amounts of design data, trends, and patterns to inspire students' creativity and offer new design possibilities (Peterson, 2023). Student learning experiences in design are becoming more individualised because of AI. To customise learning resources, activities, and content for each student depending on their requirements, preferences, and learning styles, adaptive learning platforms use AI algorithms. These platforms monitor students' development, performance, and engagement to produce tailored suggestions and modify learning pathways as necessary. Students majoring in design can learn at their own pace, get individualised feedback, and improve their learning outcomes as a result. AI is utilized in virtual and augmented reality (VR/AR) applications to create immersive learning experiences for design students. VR/AR environments powered by AI can simulate real-world design scenarios, allowing students to practice design skills in a safe and controlled environment (Aydin & Aktaş, 2020). Students can experiment with different design options, test their designs in virtual environments, and receive real-time feedback, enabling them to develop practical skills and gain confidence in their design abilities.

While the students learn through interacting with AI, AI also learns and improves over time through interaction with students (Self, 1998). Here the growth in student learning and AI goes hand in hand, which indicates that AI is more than a supporting tool for students' cognitive development.

Following the review of existing literature, the study acknowledges the potential of AI and seeks a better understanding of the considerations for the implementation of AI in design education. The focus of the paper is to explore the student's perspective on AI-based learning systems and their impact on their cognitive interaction. The data collection methods include survey questionnaires and focus groups with design students and finally, the results are tested using structured interviews with Fashion Design and Communication Design Professors at Pearl Academy, Mumbai and Delhi. The study received ethical approval from the institution's Research Cell review board and informed consent from all participants.

## Methods

A survey was conducted with design students across PG and UG design programmes to understand the level of student AI interactions in their learning process:

- Approximately 91.2% of the participants reported using AI-based learning systems for academic purposes, indicating a widespread adoption of AI tools like Canva (user-friendly interface for design element recommendations), Pixlr (for creative filters and transforming images), adobe (illustration and image editing), Crelo (for engaging social media posts and presentations) and Figma (as a cloud-based design tool).
- Around 67.6% of the participants, expressed knowledge and familiarity with artificial intelligence (AI) and its uses in the design industry.
- 70.6% of the respondents said that AI has had a positive impact on their academic performance highlighting benefits such as personalized learning, time savings, enhanced critical thinking, assistance with assignments, and generating new ideas.
- Around 20.6% who highlighted negative impacts include dependency on AI, loss of creativity, and a potential decrease in creative thinking due to AI making tasks easier.

The findings from the survey formulated the questions for focus groups and two focus groups of eight participants conducted with UG and PG students of Fashion Design and Communication Design programmes. The focus group is transcribed and thematically coded under three topics.

Table 1: Focus group thematic coding

Positive and negative impact of AI on the learning process	Potential long-term effects of AI	AI systems in use
AI has a positive effect since it delivers effective and personalised learning experiences and provides lifelong learning by providing access to educational resources.	There are concerns about the long-term effects of using generative AI leading to misinformation, plagiarism, and privacy concerns on personal information.	AI systems are used in design software to suggest design elements and generate layouts automatically and in design research to analyse large amounts of data and identify patterns and trends.
AI-based systems may restrict the ability to think critically and solve problems, reducing creativity.	It may lead to a lack of critical thinking and problem-solving skills limiting their natural creativity and innovation.	AI-powered virtual assistants and chatbots that answer their questions and provide learning resources quickly and efficiently.

It depends on how conventional classroom learning is combined with AI to achieve a vivid and higher learning experience	There is no limitation in using AI technology and students are increasingly dependent on AI tools which may lead to creative redundancy in the future.	To take inspiration and ideas for designing websites or mobile apps.
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The students consider AI as a tool to support their creativity and enhance their learning experience in an engaging way. Their thought process is maintained with technology to widen their creativity to new levels of explorations supported by generative AI, also, they are aware of the drawbacks and the risks involved in overindulgence with technology.

The findings from the survey and focus groups with students helped to formulate the structured interview with the Design Professors at Pearl Academy. Three themes are generated under the research question: what is the future of AI in design education?

### **Adaptation of technology in design education**

Education has always evolved alongside technology, and technology plays a crucial role in supporting students' cognitive skills. AI may support student learning, but technology should not replace or outperform students' natural cognitive and biological capacities. For example, the importance of referencing in assignments and research papers, encouraging students to add a personal touch and restate facts to represent their own ideas. Innovations like chatbots and image-creation tools like Dalle as benefits that might encourage students' original thoughts and help them come up with fresh ideas.

### **Student- AI interaction**

AI is a potent tool that may provide design students with inspiration and suggestions. While some may fear that AI could replace human designers, the creative process, and the ability to generate truly original ideas are unique to human beings as AI cannot create originality and innovation. AI is a supportive tool that can enhance the work of design students rather than take away their thinking abilities. It is a valuable tool for designers, rather than a threat. AI tools can help to organise collated information and link their existing knowledge to generate innovative ideas.

### **Fear of unemployment**

AI existed since 20<sup>th</sup> century and has influenced many facets of the digital world. Although it is difficult to predict whether AI has a positive or negative impact, early signs direct to the fact that it is a valuable tool to support designers. The example of computers and job losses shows historical scepticism towards new technologies; however, the value lies in thinking through the bigger picture and avoiding making any conclusions. Presently there are concerns about unemployment, but new job opportunities arise, where AI is a supporting tool for natural creativity. AI adoption will not lead to unemployment because the human brain is far more advanced than Artificial Intelligence and it should be seen as a tool that enhances human abilities rather than replacing them.

### **Conclusion:**

The study provided a better understanding of the role of AI in assisting design students' cognitive learning under three dimensions: encouraging critical thinking & collaboration, understanding the application of AI in real-world scenarios through case studies, and process-oriented feedback. Nonetheless, the study findings are preliminary to understanding the application of AI in design learning under the Pearl Academy context for better students' meaningful learning.

The findings highlight that AI should be developed to supplement or support the student's cognitive functions like critical, analytical, explorative, and creative thinking abilities.

Collaborative learning happens through features like shared document editing, communication channels, and task management tools helping students in group projects, debates, and peer evaluations supporting creative thinking and problem-solving abilities. Also, AI tools for designers promote creativity through image and video

editing, customisable templates, animated elements, a library of images, and videos for developing AI-generated design concepts and creating engaging social media posts and presentations.

Further, there is a strong need for teachers to monitor the use of AI by the students because AI lacks emotional intelligence. The guidance by the teachers and peer learning is an essential factor supporting cognitive learning. Human interaction in the learning environment helps them to think independently and develop empathy as an integral part of their design thinking, which is enhanced and supported by AI.

The present study provides insight into the subject with a limited amount of data sampling, future studies can expand this area of research by analysing the current learning design with the support of AI technologies in design education in a larger context. This leads to the research question for future research on how education needs to adjust to meet the changes driven by AI and how it can be applied to benefit future design students.

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