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Does AI Help? A Review of How AIGC Affects Design Education

Zhujun Dai

[1]School of Art and Design, Changzhou Institute of Technology, Jiangsu, 213012, China
*Corresponding author: daizj@czu.cn

Abstract:

With the rising advancement of Artificial Intelligence Generated Content (AIGC) tools such as Midjourney, ChatGPT, Meta and Luma, the design industry is undergoing a new shift. Thus, the great influence of the AIGC application has taken place in the design education area, followed by the question, "How does AIGC integration impact design education"? This study aims to uncover the latest progress and identify the research gap in the design pedagogy area, despite the lack of research on how AIGC integration affects design education in contrast to the explosive growth of ChatGPT research. This study explored impactful and most up-to-date articles for systematic analysis. It reveals that AIGC can enhance students' design efficiency by empowering ideation, prototyping and personalization. However, further study is called for developing strategies for seamlessly integrating AIGC into design curricula and pedagogical practice and the educational ethics and parity issues during the AIGC integration in design education.

Keywords: AIGC; Artificial Intelligence Generated Content; Design; Design education.

1. Introduction

There has been explosive growth in research on ChatGPT globally since OpenAI upgraded ChatGPT to a 4.0 version, which has stronger reasoning ability and creativity that can support input and analysis of the images and understand more complex instructions. The relevant Artificial Intelligence Generated Content (AIGC) tools have expanded rapidly in the design area, such as Meta, Midjourney, Stable Diffusion, Sora and Luma. The unveiled new functions and features have brought new opportunities to the industry. However, the gap between customer requirements and the actual integrated result is noteworthy. How effective is integrating AIGC into design? How does AIGC integration impact the design education? These are the questions waiting to be answered.

However, compared to the research on ChatGPT, there is not enough research on AIGC in design education (See Table 1). So, this article is supposed to provide a comprehensive understanding of the influence of AIGC in design pedagogy, including uncovering the latest progress and identifying the research gaps by systematically analyzing the current research in relevant fields. The findings of this study may help scholars and educators in design education.

Article Publications since 2020					
Keywords / Database	ChatGPT	ChatGPT, Education	AIGC/GenAI	AIGC/GenAI, Education	AIGC/GenAI, Design Education
CNKI	2962	881	1251/1026	259/647	20/7
Google Scholar	12500	1070	271/256	15/38	3/1
ERIC	340	217	1/30	27	216
SpringerLink	3173	1371	64/115	30/65	28/49

Table 1. Article publication numbers with keywords occurred in the title of the article since 2020

This study is based on 14 publication selections, with the majority of which originated from the Q1-Q3 zones of "Social Sciences Citation Index" and "Sciences Citation Index". Additionally, it also incorporates some of the latest

publications, which may not have garnered high impact or citation but were highly relevant to this topic. So that this study can provide a thorough and up-to-date analysis of the most recent research situation. The keywords used in exploring include "AIGC, GenAI, AI" as well as "design education".

2. Literature Review

2.1 The Development of AIGC

AIGC refers to the content facilitated by artificial intelligence technologies like ChatGPT and Midjourney, which can improve students' learning experiences through knowledge recognition, personalized support and gap-filling [1]. In some contexts, researchers use Generative AI (GenAI) to indicate the subfield of Artificial Intelligence (AI) that generates content like texts, images, music and videos [2,3]. The fundamental components are essentially analogous, so this research will just use "AIGC" to refer to any AI-based content-generating tools and technologies, including but not limited to AIGC, GenAI, AI-assisted content, Chatbot, AI-generated, etc.

The rapid development of AIGC has greatly impacted the design industry, and AIGC is regarded as "the next stage of content generation" after professionally developed content (PGC) and user-generated content (UGC) [4]. On the one hand, it has transformed design processes by introducing new creative spaces and opportunities and enhancing creativity and efficiency in areas such as character and scene design, storyline construction, and scriptwriting [1]. These advancements have reshaped user experiences and product service frameworks, leading to a fundamental shift in aesthetics and design practices. On the other hand, this technology has diversified and personalized users' design requirements, developing new evaluation methods for product styling design and enhancing market competitiveness through computer-aided optimization of product shapes [5]. These changes have created new opportunities for more innovative, personalized, and effective designs.

2.2 Artificial Intelligence in Education (AIEd)

Researchers have explored various dimensions of applying AI to education, such as personalized learning pathways and the industrial implications and academic advancements. Before the widespread public attention of ChatGPT, researchers had been exploring the potential of AI systems to match the effectiveness of personalized one-on-one tutoring [6]. In higher education, scholars propose strategies for AIGC integration, emphasizing the necessity to navigate challenges and leverage opportunities in teaching and learning practices, which aims to address problems like bias, inaccuracy and limited access to AI resources. Moreover, other researchers such as Kim, Lee and Cho [7] have been investigating student-AI collaboration, highlighting the importance of AI in anticipating learning difficulties and enhancing subject knowledge.

2.3 AIGC in Design Education

In the realm of design, AIGC technologies have transformed design processes by introducing new creative spaces and opportunities and enhancing creativity and efficiency in areas such as character and scene design, storyline construction, and scriptwriting. These advancements have reshaped user experiences and product service frameworks, leading to a fundamental shift in aesthetics and design practices. Moreover, the technology has diversified and personalized users' design requirements, leading to the development of new evaluation methods for product styling design and enhancing market competitiveness through computer-aided optimization of product shapes [2]. These changes have created new opportunities for more innovative, personalized, and effective designs.

In response to these changes in the industry, the goals of design education are required to be updated. For instance, certain traits such as creativity and collaboration need to be cultivated and enhanced, while some other skills become obsolete. However, there is a lack of academic research on the key skill sets required under the impact of AIGC. Therefore, there is no consensus regarding integrating AI curricular content and delivery methods. Moreover, despite the increasing interest in incorporating AI into educational settings, studies have identified barriers that hinder effective AI integration efforts in design education. For example, Tsai & Chai [8] found intrinsic obstacles linked to teachers' pedagogical views, technology beliefs, and resistance to change, impeding the effective technology integration in classrooms. This barrier still exists in the AI era. The varying levels of AI literacy among faculty in designing curricula and the lack of infrastructure to integrate AI into the current curriculum may also affect AI integration in design education.

3. Opportunities and Challenges of AIGC Integration in Design Pedagogy

3.1 Difference between the Two Models

The typical design process, which takes product design for granted, normally consists of five states:

(1) The Research stage, including information and insight gathering and user demand analysis, which refers to the key design requirement;

(2) The Ideation & Concept Design stage, which involves interpreting diverse conceptual ideas through recombination, transformations and combination, providing a struc-

tured framework to assess and compare varied creative outputs;
(3) The Refinement & Engineering stage, which refers to the detailed design and finalizing of the concept sketch, followed by engineering drawings, rendering, production plan and so on;
(4) The Prototyping & Testing stage, building physical or virtual prototypes and conducting usability tests in order to ensure the final product meets the function, ergonomic, and aesthetic requirements as well as all other relevant needs that were discovered in the first stage [9].
(5) The Presentation stage, showing the development process and the final effect in the format of the portfolio, exhibition board, ppt, etc.

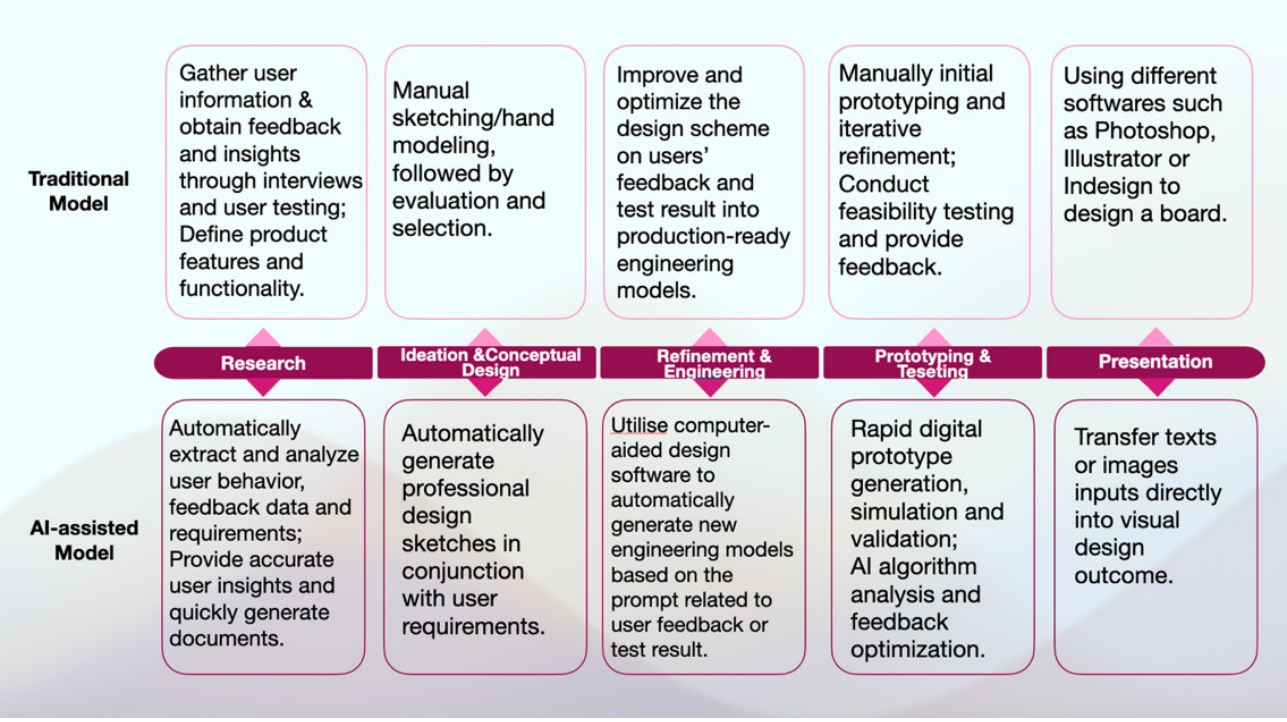

Figure 1. Difference between the AI-assisted design model and the traditional design model

As can be seen from Figure 1, an AI-assisted model uses machine learning technology to quickly generate documents, ideation sketches and design schemes. AIGC can be applied in every step of design, which makes a different path from the traditional process.
In the new design process, the AIGC tools can serve as on-demand domain experts to address student queries, reflecting the interdisciplinary nature of the design. Moreover, the AI algorithm can rapidly generate models and digital prototypes, offering solutions and helping designers create innovative and expressive designs. The AI art-generating technologies such as Midjourney, Sora and Luma can transfer texts/images into multiple images/videos as visual outcomes. Thus, the AIGC approach streamlines the design process and greatly improves efficiency. It unlocks new design opportunities and challenges and sparks design ideas and creativity, which leads to extraordinary design outcomes.

3.2 Opportunities in Design Education

Firstly, AIGC helps utilize self-efficacy to enhance student creativity. The ideation of design is complex, with uncertain and unpredictable challenges, which is highly dependent on students' creative capabilities. Zhao's research shows that AIGC can empower students to explore new creative avenues, generate innovative design schemes and foster creativity and innovation in the design learning process [10].
Secondly, AIGC can develop design efficiency and accelerate the ideation process. For example, by rapidly generating a wide array of various concept hand-drawings, AIGC sparks inspiration in a matter of minutes that broadens students' innovative horizons and ignites designers' novel ideas, resulting in enhanced design schemes. It allows students to cast a wide net and uncover creative directions they might not have considered independently. Moreover, AIGC technologies allow students to generate ideas, concepts, and prototypes more efficiently. On the one hand, AIGC tools offer students greater flexibility in time and location, reducing communication costs and enhancing efficiency. On the other hand, by automating certain design tasks, students can dedicate more time and effort to the complex and creative part of the design pro-

cess, leading to productivity increasing.

Thirdly, an intelligent artificial chatbot like ChatGPT can serve as an on-demand domain expert to address student queries, reflecting the interdisciplinary nature of the design. AIGC can facilitate collaboration between design students and professionals from other disciplines, fostering interdisciplinary creativity and innovation. By incorporating AIGC technologies into design education, students can work collaboratively on projects that require diverse skill sets and perspectives. Engaging with AIGC tools, students can also develop their overall skill set through digital literacy, critical thinking, and problem-solving.

Finally, from the course teaching view, the AIGC application in the design class can greatly enrich the course content, aligning it more closely with genuine practices and providing students with the latest information and knowledge. However, the current literature lacks thorough investigations into the nonterminating impact of AIGC on design pedagogical outcomes and student learning experiences. While initial studies have demonstrated the immediate benefits of AIGC tools in enhancing instructional design and supporting personalized learning experiences, there is a gap in understanding how these technologies influence students' critical thinking skills, creativity, and overall design proficiency over an extended period [11]. A research gap also exists exploring the ethical considerations and implications of integrating AIGC in design education. As AIGC tools become increasingly popular in education, it is essential to address ethical concerns around algorithmic bias, data privacy, and the accountable application of AI technologies in design learning [12]. Understanding the ethical challenges and developing frameworks for ethical AI integration in design education is critical for ensuring equitable and transparent learning environments.

3.3 Challenges in Design Learning

However, AIGC did not excel over the traditional education approach regarding assessment quality. For example, "algorithmic bias" means the systematic errors or unfair discrimination which might occur in AI systems can impact the quality and fairness of students' work. Designers and design students may also face challenges in co-creating with the current AIGC technologies, such as the difficulties of comprehending and adapting AI-assisted outputs and providing goals of design [13]. Moreover, integrating AIGC in design learning demands a robust ethical framework to guide teachers and students through challenges like data privacy and algorithmic bias. It is crucial to consider the ethical inference of applying AI-chatbot in higher education, emphasizing the need to tackle moral issues when introducing new AIGC tools in pedagogical contexts. Additionally, integrating AIGC in design education may favor students with prior exposure to technology and digital skills, potentially marginalizing those lacking access to such resources, such as those from less developed countries underrepresented in higher education already [14].

Although the previous research has pointed out the potential benefits of integrating AIGC into design education, there is a lack of comprehensive investigation addressing the challenges and limitations of this integration. In particular, there is a need to examine the motion from nourishing students' AI usage to enhancing their AIGC knowledge to ensure the successful empowerment of AIGC products learning. Research is also required to explore how AIGC tools can promote cooperation and interdisciplinary education in design. While AIGC technologies have shown promise in developing individual learning experiences, there is a gap in understanding how these tools can facilitate group projects, peer feedback, and cross-disciplinary interactions among design students. Investigating the role of AIGC in promoting collaborative learning environments and supporting diverse learning styles in design education is essential for advancing pedagogical practices.

4. Conclusion

To sum up, the existing research gap regarding the influence of AIGC in design pedagogy highlights the necessity for further studies to explore the factors influencing effective AIGC utilization, the long lasting impact of AIGC integration on students' learning achievements, the ethical considerations linked to AIGC integration, and the role of AIGC in promoting collaboration and interdisciplinary learning. It is imperative to instruct technical interventions such as equitable dataset frameworks and enhanced algorithmic transparency, to guarantee the training data repositories for AIGC tools are representative and impartial.

In the meantime, there is a call for improved training and support mechanisms to facilitate seamless collaboration between designers and AIGC tools in design education. Educators and policymakers are suggested to consider whether the students are equipped to engage with these technologies responsibly to ensure students' privacy and information security are safe. They should take equal access to AIGC tools into account as well, supporting students from disadvantaged backgrounds to ensure the parity and equity of education.

Filling these gaps through empirical studies and developing theoretical frameworks will make contribution to a more complete understanding of the implications of AIGC in design pedagogy and offer guidance for the future ad-

vancement in this expanding field.

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