Generative AI Pedagogy Implementation in Design Class for Creativity Cultivation in Chinese Higher Education

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Abstract
Gen AI can provide collective knowledge beyond individual knowledge to allow people to connect with content beyond personal creativity. The emergence of Gen AI is a good way to help students think outside the box for creativity cultivation in design education. However, there is still a lack of teaching methods for creative training in Chinese design education with Gen AI integration. According to theory, in traditional creativity training, the association thinking, and critical thinking approach could facilitate creativity. However, the impact of these two methods on creativity training integrated with Gen AI is still unknown. Therefore, we proposed critical thinking and association thinking as pedagogy to apply in real design classes. The purpose of this research is to understand the students' experience and interpretations of Gen AI integrated creative training with pedagogies. Therefore, we employed qualitative-based methods like focus groups and interviews which included around 68 student participants and 3 teacher participants. The teaching intervention lasted for two weeks. Our findings show that (1) Teaching methods make it easy for people to integrate their ideas in the cultivation of creativity. (2) Without teaching methods, it's not easy for students to synthesise ideas with Gen AI. (3) Teaching pedagogy tools guide reflection and cultivate critical thinking.

Keywords: Generative AI Design Education, Gen AI Creativity, AI Creativity Cultivation

Introduction

The emergence of Artificial Intelligence Generated Content (AIGC) has had a profound impact on the industry and education of the design field (Huang et al., 2024; Lin & Liu, 2024; Wei et al., 2024; Wu et al., 2024). The purpose of Gen AI implementation in the design industry and design talent training should be different. The impact of AIGC on design work could be efficiency improvement, while the impact on design education should be considered in cultivating people's creativity (Wong & Siu, 2012). The emergence of Gen AI can greatly increase the efficiency of designers at work and quickly produce visual effects including graphic and video works (Wu et al., 2024). The benefits of using Gen AI in the design industry are to reduce repetitive work, production time, and labour costs to improve production efficiency. However, the purpose of Gen AI in design education should not be entirely to improve efficiency. The purpose of Gen AI teaching for design learning should be to help students improve their creative ability and help students generate more creative ideas.

The emergence of Generative Artificial Intelligence (Gen AI) has a significant impact on students studying in higher education. The utilization of Gen AI in learning is an unavoidable trend. It is better to encourage students to use it in a manner, rather than preventing students from using it. Especially in design disciplines, the emergence of Gen AI has caused a great shock. It has powerful visual output capabilities have caused academia and industry to discuss a series of challenges, including whether Gen AI will replace designers and, if not, how it can empower designers and establish good cooperative relationships and appropriate work models. When considering the relationship between Gen AI and designers, we began to think about how to establish a good cooperative relationship with Gen AI from the designer's training stage so that designers can better leverage the assistance of Gen AI and enhance design outcomes. Some scholars have researched the application of Gen AI integrated design education. They discussed the impact of self-efficacy on the learning process of design students (Huang et al., 2024). However, there is still a lack of comprehensive understanding of Gen AI integrated design education, teaching methods, and learning processes. In particular, there is seldom a study to reveal the changes that Gen AI brings to creative cultivation.

Research Gap and Research Question

Gen AI technology can offer effective educational opportunities and it also be employed as a creative learning from memory assistance aspect(Maney, 2023). Additionally, AI technology can also bring improvement in teaching quality by providing teacher assistance with instructions (Alam, 2023). AI-driven chatbots can help teachers create effective, individualized lesson plans that will improve student's academic performance (Niewint-Gori, 2023). It can also give teachers information for evaluation and development quickly (Bahroun et al., 2023). AI integration with pedagogy has been found the positive impacts on education both from teachers' and students' perspectives (Bahroun et al., 2023). However, according to existing literature, the teaching methods with AI intervention have not been fully discussed. Therefore, we proposed critical thinking and association thinking as pedagogy to apply in real design classes to understand the student's experience and interpretations of these two methods of creativity training. The research question is what are the impacts of these two methods on creativity training integrated with Gen AI? The purpose of this research is to understand the students' experience and interpretations of Gen AI integrated creative training with pedagogies.

Literature Review

Design Education and Creativity Relationship

The development of social technology means that many new things have emerged, and new things are always facing challenges and opportunities. It may be more crucial to mix and manipulate knowledge and information when faced with challenges, or to choose which information to combine and manipulate while addressing problems (Ma, 2017). This skill, commonly referred to as creativity, is the capacity to produce original ideas by drawing inspiration from existing ones (Boden, 2004). Therefore, the design discipline is to solve these problems creatively. The design discipline has always been required to improve the existing situation to achieve a better situation, which requires creative ideas (Boden, 2004). Creativity in design is reflected in the design process. In non-routine design processes, creativity is related to the process of developing useful and original solutions.

Gen AI is made up of a large amount of data. The amount of data and knowledge in Gen AI exceeds the amount of personal information. When individuals find themselves confined within their cognitive boundaries, the content generated by Gen AI can facilitate a departure from these limitations, connecting disparate ideas and helping individuals overcome personal stereotypes. As the theory of 'Synthetic'[1] techniques in creativity says, creativity often requires some abnormal content, which happens to be what artificial intelligence can provide. Therefore, we assume that artificial intelligence can stimulate creativity (Gordon, 1961).

When ideas are generated during brainstorming, indirectly relevant information could increase the originality of the ideas, as well as elaborations on ideas enhance the usefulness of the ideas (Montag-Smit & Maertz Jr, 2017). There is this kind of novel and irrelevant information in the answers given by generative AI. If it can be elaborated by students in the brainstorming, it could increase the creativity of their design ideas. Therefore, we suggested that while learning with AI, we should teach students to elaborate ideas based on AI-generated suggestions(outcomes) to increase the usefulness of final design ideas.

In the design thinking stage, when the idea is formed, a lot of divergent thinking is needed, and divergent thinking is related to creativity. Creation requires some cognitive activities, including association and critical thinking. These have been proven to affect creativity. With the intervention of AI in design, we still don't know what impact these methods will have on creativity after integrating AI. Therefore, we combined these two theories to design two teaching methods, which are called association and critical thinking.

Association Thinking

Thinking style refers to individuals using their abilities in the way they like. Thinking legislatively—that is, choosing to think in novel ways—is especially crucial for creativity when it comes to thinking styles (Sternberg, 1988). It was proposed that associative thinking methods may foster innovative ideas by enabling the fluent retrieval and combining of remote associations. Empirical research has shown that associative processes and divergent thinking are closely related. The validity of associative capacities concerning divergent thinking was discovered that associative skills account for around half of the variation in divergent

[1]Synectics is "a technique developed by Gordon (1961) for improving creative problem solving. The synectics means joining together different and apparently unconnected or irrelevant elements."

thinking capacity (Benedek et al., 2012). Association thinking was developed as a teaching tool.

Critical Thinking

Creative thinking is considered the ability to produce original ideas or answers (Duff et al., 2013) and to perceive new and unsuspected relationships or unrelated factors (Piawa, 2010). Nosich (1994) theorized that critical thinking requires more than higher-order thinking skills (Nosich, 1994). Critical thinking encompass various traits associated with higher-order thinking skills, particularly those related to logical decision-making, information acquisition and evaluation, and problem-solving (O'Hare & McGuinness, 2005; Schafersman, 1991). Critical thinking involves the evaluation of ideas and the assessment of fact validity prior to decision-making. It is characterized by a logical inquiry into the relevant facts of an issue, establishing rules and criteria within the thinking process. This skill includes the ability to ask questions and define problems, aiming to identify the most suitable solutions. Essential attributes of critical thinking include analytical assessment, decision-making, and logical problem-solving (Ülger, 2016). Furthermore, critical thinking was developed as a pedagogical tool.

Procedure

Before the Gem AI workshop started, the researcher assigned a design task with a specific theme to students and left students half a day to use Gen AI tools to generate creative ideas by themselves. Before our teaching method intervention began, the researcher distributed paper and pen to students and asked them to write down their creative ideas. Then the researcher introduced the association thinking and critical thinking teaching tools. Students were required to use two teaching methods for the generation of creative ideas separately. Students designed a project according to two teaching methods. The teaching intervention lasted for 4 hours. Then the researcher conducted a focus group with students to collect qualitative data and used maxqda to code and analyze the data to draw the following conclusions.

Conclusion

Teaching Methods Make It Easy for People to Integrate Their Ideas Into the Cultivation of Creativity

Teaching methods help students get rid of dependence and establish independent thinking. The tools of the intervention pedagogy are listed and easy to understand, so the students feel they can make connections quickly.

Student 21 said, "(Pedagogy tool) It can help me sort out some things, and people like me who have a confused mind will be very suitable for this."[2] Student 13, "(Pedagogy) tools can help us think more deeply and meticulously. My biggest feeling after using this tool is that I have been using AI to expand my thinking, but it may be scattered, and I can only extract some scattered information. I don't have any integration. But this (pedagogy) tool can give

[2] "（教学方法）可以以帮我理清楚一些东西，然后像我这种头脑比较混乱的人就会很适合这种。"

me an integration. Especially when AI plus my thinking, and then come up with a new solution, it is equivalent to integrating my ideas and rethinking it."[3]

Gen AI teaching shouldn't let students rely on Gen AI to give answers and use the answer directly. Otherwise, students' personal abilities and thinking abilities cannot be improved. In the process of AI participation, the student's thinking process needs to be considered. Teacher P11 asked, "How do we control the creativity performance of the students? I think this process is still a problem that needs pay to attention. In this case, the students may be able to come up with a lot of things, but in this process, did the students pass the requirements step by step through constantly divergent thinking to reach the final result or directly hand in an assignment to the teacher through other methods? Therefore, in this process, teachers are required to control."[4] Therefore, the design of our teaching method is also to hope that students can use their insights to interact with AI results. Student 19 feels that "it (pedagogy tools) can help to organize things, so if you think on your own, you have completely blue-sky thinking, but if you think according to its framework (pedagogy tool), you can have structure, and then continue to ask in-depth questions based on the points of inspiration it gives you."[5]

Without Teaching Methods, It's Not Easy for Students to Synthesise Ideas With Gen AI

When communicating with AI, students feel it is not easy to add an individual's thoughts or let students think. When students use ChatGPT by themselves, they will just ask Gen AI questions, take a look at the answers, ask a few more questions when they see something interesting, and then end the conversation. But when they don't have teaching tools, students find it difficult to integrate their own ideas and prefer to rely directly on the answers given by Gen AI.

Student 19 said "I just ask it (Gen AI), it answers me. If I only use AI, it will easily replace my thoughts."[6] Student 10 gave an example" I usually browse GPT by myself, I ask, then I look, and then I may find something interesting, so I ask him to say a few more words. Relying on AI to give answers."[7] Student 1 said, "The first thing I want to do is to rely on this AI. I just started using AI to generate pictures without thinking for myself."[8] Student 13 said, "If I only use AI, it will easily replace my thoughts." Lack of methods, the student said that if a beginner uses it, he feels that AI is not that easy to use because he does not know how to get inspiration from AI in depth."[9]

Teaching Pedagogy Tools Guide Reflection and Cultivate Creative Thinking

There is a difference between using and not using teaching intervention reflect by one teacher. From the perspective of the teaching, the experience process of our proposed pedagogy

[3] "工具能够帮我们更深入细化思考。使用了这个工具以后给我最大的感受是，因为我之前也一直有在用 AI 去就是 GPT 去扩散我的思维，但是可能是比较零散，只能去提取一些零散的信息，我自己没有 一个整合。但是这个(教学)工具就可以说给我一个整合。然后特别是 AI 加上我自己的思 考，然后得出一个新的方案的时候，就等于我自己又融入了我自己的想法去重新思 考了一下。"

[4] "我们怎么样来把控，这个是学生的一种创意(表现)，这个过程我觉得还是要注意的一个问题.这个过程当中他到底是不是他一一步一步通过我的课题的要求，然后不断的去思考发散，然后形成了你最终的结果，还是直接通过别的方法就给老师就交了个作业，所以在这个过程里面就要求老师可能在这一块要有一个把握。"

[5] "感觉他（教学法工具）能起到一种梳理的作用，你自己想的话就完全天马行空，但是你按照他（教学工具）的框架来想，是稍稍有一个统筹，然后再根据他给你灵感的那些点再继续深入问。"

[6] "我就是问,他怎么回答我就好了。如果只用 AI 会容易代替我的思想。"

[7] "我平常一般我自己刷 GPT 的时候，我问，然后看，然后可能觉得他哪个有意思，我就让他再说几句这样。依赖 AI 给答案。"

[8] "第一下就会想要依赖这个 AI 说我直接就开始用 AI 生成图的想法就是没有自己的思考。"

[9] "可能新手的话用起来，他觉得 AI 这个东西好像也没那么好用，因为他不知道如何深入从 AI 获得启发。"

guidance is effective in influencing students' creative ideas, which is logical, easy to guide thinking and saves effort. Students feel that the teaching pedagogy intervention can well organize the logic inside, which reduce students' effort. On the one hand, and on the other hand, it can provide some information, which allows students to think further.

Student 10 mentioned, "I think this tool is very useful. When I browse GPT by myself, I usually ask, then look, and then I may find something interesting, so I ask him to say a few more words. Then I use the tool to guide me to continue reflecting. I write more deeply than just looking at it (teaching tools). Then I will tell him my ideas, and then tell him his ideas, and then combine his ideas, let him combine the two ideas with what I am doing now, and then he will give me a plan. I prefer to find a direction. Keep asking him to go deeper to see if he can think of more ways that I can't think of, and see what I can't see."[10] Teacher P14 said that "there is a difference between using and not using teaching intervention. From the perspective of our teaching, the experience process of our proposed pedagogy guidance is effective in influencing students' creative ideas, which is logical, easy to guide thinking and saves effort." Students feel that the teaching pedagogy intervention can well organize the logic inside, which reduces students' effort.

With the help of teaching tools, students can think about the information obtained from the communication with AI and advance their ideas step by step.

[10] "我是觉得这个工具很有用，我平常一般我自己刷 GPT 的时候，我问，然后看，然后可能觉得他哪个有意思，我就让他再说几句这样。然后我用工具就是他可能会引导我再继续反思，我在往（教学工具）上写比我只是看，然后乍一想会想的更深 刻，然后我就会把我的想法再告诉他，然后再告诉他他那个想法，然后再结合他那个想法，让他结合两个想法和我现在要做的东西，他再给我一个方案，我就比较喜欢找一个方向。一直让他。深下去看一下他能不能想出更多我想不出来的一些方式，对看自己看不到的。"

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