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Effects of Artificial Intelligence Integration on Design Mindset, Creativity, and Reflection

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ABSTRACT

Artificial intelligence (AI) improves the efficiency of the design process, helps with fast and accurate data analysis, and aids creativity with innovative ideas. Using a quantitative approach with a cross-sectional design, this study looked at how the incorporation of AI impacts students' creativity, design mindset, and reflection. 96 people responded using an online questionnaire. The results showed that artificial intelligence had a moderate positive effect on design mindset, especially in terms of concept building, problem finding, and design iteration. AI also helped students become more creative, develop imagination, and become more productive. Critical analysis, learning from mistakes, and a deeper understanding of the creative process are enabled by AI. The study found that AI integration can enhance human-machine collaboration to produce more innovative and reflective design outcomes. However, to implement it successfully, a balance between AI automation and human control is required. This study provides insights for educational institutions on how best to utilize AI in learning design and creativity.

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INTRODUCTION

Artificial intelligence (AI) has changed the way humans create, learn and work in many fields. AI speeds up the process of idea iteration, enables fast and accurate data analysis, and enables human-machine collaboration in the fields of design and creativity. However, while the use of AI in design has led to innovation and efficiency, there are still problems. The most important one is finding ways to balance AI automation with human control [1]. These technologies not only help solve difficult problems, but also change the way people think about design and how they create creative works.

Previous studies have shown that artificial intelligence contributes to various aspects of technology-based learning[1] discovering how AI can help with data-driven decision-making. On the other hand[2] and [3] a look at how AI aids creativity. [4] discusses how human-AI collaboration can speed up prototyping and lead to more creative solutions in the context of design education. However, not much research has thoroughly studied the relationship between design mindset, creativity, and critical reflection.

Previous studies have shown that artificial intelligence contributes to various aspects of technology-based learning[1] discovering how AI can help with data-driven decision-making. On the other hand, [2] and [3] looks at how AI aids creativity. Simeone (2022) discusses how human-AI collaboration can speed up prototyping and lead to more creative solutions in the context of

design education. However, not much research has thoroughly studied the relationship between design mindset, creativity, and critical reflection.

This research provides key findings covering three aspects: (1) how AI improves the design mindset through the process of iteration and problem identification, (2) how AI expands students' creative abilities in the face of creative obstacles, and (3) how AI supports critical reflection on learning. This research contribution broadens the scope of the literature by integrating all three aspects simultaneously, providing a new perspective on the impact of AI in design education.

However, some very important questions remain unanswered. How can AI continue to drive innovation without compromising the role of humans in the creative process? How can schools maximize the use of AI to enhance technology-based learning? These questions form the basis of future research.

Therefore, the purpose of this study is to see how the incorporation of AI impacts students' creativity, design mindset, and critical reflection. This research also makes theoretical contributions to the field of technology-based education and offers practical ideas on how educational institutions can optimally utilize AI.

METHOD

A quantitative method with a cross-sectional design was used in this study to evaluate the relationship between variables at a specific point in time. This design was chosen because it can provide a comprehensive picture of the influence of AI on respondents' creativity, design mindset, and reflection.[5] [6]

The study involved university students who have used artificial intelligence in the design and learning process. A purposive sampling method was used to select 96 respondents relevant to the study[7] [8]. During October to November 2024, data was collected through an online questionnaire distributed via Google Form.

Three main variables were used in this study: design mindset, creativity, and reflection. The design mindset variable includes elements such as the ability to spot problems, create innovative ideas, and use an iterative process to create prototypes. The creativity variable looks at how artificial intelligence affects creative self-efficacy, innovation, and the ability to think outside the box. The reflection variable looks at how AI affects the ability to think outside the box Respondents' experience with the use of AI in learning and design is described in each questionnaire statement[4][9].

For data analysis, descriptive statistical methods were used. This method calculates the mean, and sum values for each variable. The purpose of this method is to provide an easier and deeper understanding of the respondents' data patterns, so that the research results can be better interpreted. Descriptive statistics are used to present data in a way that is easy to understand without requiring complex analysis[10] [11].

Table 1. Research Instrument

No	Aspect/Sub Factor	Statement	Statement Number	Reference

1	Influence on Design Mindset	The integration of artificial intelligence into the learning process has improved my design mindset skills.	1	[12]
		Working with artificial intelligence-based tools has improved my ability to identify and define problems.	2	
		The collaborative use of artificial intelligence has helped me come up with more innovative design ideas.	3	
		Artificial intelligence has supported me in the iterative process of prototyping and testing design solutions.	4	
		The integration of artificial intelligence has contributed to my overall understanding of the design mindset process.	5	
2	Influence on Creativity	The use of AI-assisted tools has had a positive impact on my creative self-efficacy.	1	
		Collaborating with artificial intelligence has expanded the range of creative possibilities in my work.	2	
		Artificial intelligence has helped me overcome creative blockades and come up with more original ideas.	3	
		The integration of artificial intelligence has improved my ability to combine existing ideas in new ways.	4	
		Working with artificial intelligence has stimulated my imagination and encouraged me to think outside the box.	5	
3	Effect on Reflection	The integration of artificial intelligence has supported my critical reflection on the learning process.	1	
		Collaborating with artificial intelligence has encouraged me to engage in deeper self-reflection.	2	
		The use of artificial intelligence-based tools has helped me understand my own learning and creative process better.	3	
		Artificial intelligence has facilitated my ability to analyze and learn from my mistakes and failures.	4	
		The integration of artificial intelligence has contributed to the overall development of my reflective thinking skills.	5	

Table 2. Likert scale

Scale	Description
1	Strongly Agree
2	Agree
3	Neutral

4	Disagree
5	Strongly Disagree

In this research, a Likert scale is used to measure the responses, with the scale ranging from 1 (Strongly Agree) to 5 (Strongly Disagree). To ensure consistency in how the data is interpreted, the NJI (Interval Scale) is calculated using the formula:

$$NJI\ \frac{Maximum\ Value - Minimum\ Value}{Number\ of\ Statement\ criteria} = \frac{5-1}{5-1} = 1$$

Where:

- Maximum Value (5) represents the highest point on the scale, which corresponds to "Strongly Disagree."
- Minimum Value (1) represents the lowest point on the scale, corresponding to "Strongly Agree."
- Number of Statement Criteria (5) refers to the total number of scale points.

Thus, the interval between each scale point is 1, ensuring consistency in the responses.

Table 3. Interval Likert Scale

Scale	Description
1,00 – 1,75	Strongly Agree
1,76 – 2,50	Disagree
2,51 – 3,25	Neutral
3,26 – 4,00	Agree
4,01 – 5,00	Strongly Agree

In Table 3, the interval scale is used to categorize the Likert scale responses into specific ranges. The interval is based on the NJI value (1), which determines the spread of each range. These intervals help in categorizing the students' responses into meaningful groups based on their attitudes toward the statement.

RESULTS AND DISCUSSION

In higher education, artificial intelligence (AI) is increasingly being used, especially to aid students' creativity, design thinking, and reflection. Before discussing the results of the study in detail, it is important to examine the demographics of the respondents to provide context to the data. The study involved 96 students, mostly female (67.7%) with an average age of 20 years; male respondents, 32.3%, had an average age of 19.5 years. This distribution shows how age and gender can influence perceptions towards the use of AI in education[13] found that AI can enhance creative learning and learning experiences across multiple disciplines. In addition, [14] found that students see the relationship between AI and creativity as an important component that can help their creative process, especially when generative tools are used in design education.

As shown by de [15] for writing and verbal tasks, similar studies have also shown that AI does not replace human creativity but serves as a tool to enrich and accelerate the creative process.

In addition, research [13] shows that the use of AI in education helps in personalizing the learning experience and accelerating the adaptation of technology in the classroom. These findings are in line with the findings from the article "The Effectiveness of Artificial Intelligence Integration in Design-Based Learning", which shows that artificial intelligence enhances student creativity in design-based learning, reduces creative blocks, and increases the potential for new ideas in design.

Table 4. Respondent demographics

Gender	N	Percentage (%)	Mean age (years)
Male	31	32.3 %	19.5
Female	65	67.7 %	20.0
Total	96	100.0 %	

Table 5. Age Descriptives

Average age of male	
Male Age	
Mean	19.5

Table 6. Age Descriptives

Average age of female	
Female Age	
Mean	20.0

This table shows the results of the descriptive analysis of the five statements used to evaluate the influence of artificial intelligence (AI) on students' design mindset. The results show that respondents' responses to the influence of AI in supporting students' design mindset tend to be neutral to positive, with a mean score of 2.53-2.68. These values indicate that most respondents believe that AI makes a positive contribution to For example, a better response was given by AI's ability to identify problems and generate creative ideas than the ability to generate concrete design solutions.

According to research conducted by[16] in "Creativity and Artificial Intelligence: A Student Perspective", students who have a deeper understanding of AI have a more positive perception of using AI in their learning. They see AI as a tool to accelerate the creative process and help them develop ideas and design iterations. The results of this study are in line with the data findings that show that AI can help the learning process.

The article "Artificial Intelligence, Creativity, and Education: Critical Questions for Researchers and Educators" also emphasizes the importance of accurately understanding how to use AI to enhance creativity in education. With proper use, AI can enhance learning by enabling deeper personalization of learning and helping students develop creative skills. The findings of this data support the idea that AI helps students' creativity and design mindset

Overall, the findings of this study suggest that AI has great potential to improve students' design abilities in a more creative and efficient way, something that has been recognized in current educational literature. However, there are still challenges to implementing more in-depth AI in the classroom.

Table 7. Descriptives of Influence on Design Mindset (V1)

	V1	V2	V3	V4	V5
Mean	2.53	2.68	2.58	2.56	2.58

	V1	V2	V3	V4	V5
Sum	243	257	248	246	248

Results show that the majority of respondents perceived moderate benefits from the integration of artificial intelligence, especially in terms of improving the ability to find problems, develop new ideas, and perform iterative design. As stated in the article, "AI technologies can enable performance improvements in terms of speed, flexibility, customization, scale, innovation, and decision-making[17]. The following table illustrates further analysis and discusses the distribution of response scores for each statement.

Table 8. Descriptives of Total Computation of Influence on Design Mindset

	v1
Mean	2.59

The results of the descriptive compute analysis show that the Influence on Design Mindset element has a total mean value of 2.59, indicating that respondents generally gave moderate to positive responses regarding the contribution of AI to their design mindset. "AI-based inspiration has a significant influence on design ideation, increasing the uniqueness, variety, and number of ideas generated[18]

Table 9: Descriptives of Influence on Creativity

	V6	V7	V8	V9	V10
Mean	2.63	2.69	2.60	2.57	2.48
Sum	252	258	250	247	238

These results show that most respondents gave neutral to near-positive responses regarding the influence of artificial intelligence in supporting their creativity. The highest mean score of 2.69 was seen for the contribution of AI in expanding the range of creative possibilities, while the lowest mean score of 2.48 was for its contribution in stimulating imagination. As stated in the study, "AI techniques can be used to create new ideas in three ways: by producing novel combinations of familiar ideas; by exploring the potential of conceptual spaces; and by making transformations that enable the generation of previously impossible ideas[19].

Table 10. Descriptives of Total Computation of Influence on Creativity

	V2
Mean	2.59

The results of the analysis show that the total average for the Influence on Creativity aspect is 2.59, reflecting neutral to positive responses from the respondents. This value indicates that artificial intelligence makes a moderate contribution to enhancing students' creativity, including the

ability to overcome creative blockades, generate innovative ideas, and expand the range of creative possibilities. As stated in the study, “AI facilitates the customization of education” and “AI can help students develop skills.[21]

Tabel 11. Descriptive Influence on Reflection

	V11	V12	V13	V14	V15
Mean	2.68	2.69	2.73	2.66	2.66
Sum	257	258	262	255	255

Results showed that participants gave relatively positive responses to how AI contributed to their reflection process. The highest mean score of 2.73 was given to artificial intelligence's support in aiding creative understanding and learning processes, while a mean score of 2.66 was given to its contribution to supporting critical reflection and analyzing errors and failures. As stated in the research, "AI tools can offer valuable assistance" and "students emphasize the importance of maintaining their original ideas"[20].

Table 12. Total Computation of Influence on Reflection

	V3
Mean	2.68

The results of the analysis show that the Influence on Reflection component has a total average of 2.68, which reflects the positive responses from respondents regarding the role of AI in supporting critical reflection. This result indicates that most respondents perceived significant benefits from the use of artificial intelligence in improving reflective thinking skills, analyzing errors, and enhancing their understanding of the learning process. As stated in the study, "critical thinking skills enable better decisions" and "education can help recognize misinformation".[21]

CONCLUSIONS

The study found that the use of artificial intelligence had a great impact on students' creativity, design mindset and reflection. In terms of design mindset, artificial intelligence helps students develop analytical and iterative thinking skills that help them find solutions to problems and develop a wider range of creative ideas. In terms of creativity, artificial intelligence helps students overcome mental blockades and broaden their spectrum of creative ideas. This research shows the great potential of artificial intelligence as a cooperative partner in learning, which can enhance understanding and personal development in addition to improving technical capabilities.

Based on the results of this study, higher education institutions should use artificial intelligence more to help students, especially in the field of design and innovation. To improve students' critical and creative thinking skills, the use of artificial intelligence can be expanded to include more complex simulations and analysis. To enable the use of artificial intelligence in the curriculum to be better integrated, teachers and students should be given more comprehensive training. In addition, further research is recommended to investigate the long-term impact of artificial intelligence on the development of thinking skills and reflective learning. Research should also look

into the challenges that may arise in the application of artificial intelligence in educational settings.

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