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ORIGINAL RESEARCH ARTICLE

# Generative AI tools in art education: Exploring prompt engineering and iterative processes for enhanced creativity

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## ABSTRACT

The rapid development and adoption of generative artificial intelligence (AI) tools in the art and design education landscape have introduced both opportunities and challenges. This timely study addresses the need to effectively integrate these tools into the classroom while considering ethical implications and the importance of prompt engineering. By examining the iterative process of refining original ideas through multiple iterations, verbal expansion, and the use of OpenAI's DALL-E2 for generating diverse visual outcomes, researchers gain insights into the potential benefits and pitfalls of these tools in an educational context. Students in the digital at case study were taught prompt engineering techniques and were tasked with crafting multiple prompts, focusing on refining their ideas over time. Participants demonstrated an increased understanding of the potential and limitations of generative AI tools and how to manipulate subject matter for more effective results. The iterative process encouraged students to explore and experiment with their creative ideas, leading to a deeper understanding of the possibilities offered by AI tools. Despite acknowledging the ethical concerns regarding copyright and the potential replacement of artists, students appreciated the value of generative AI tools for enhancing their sketchbooks and ideation process. Through prompt engineering and iterative processes, students developed a more detail-oriented approach to their work. The challenge of using AI-generated images as final products was conceptually intriguing, requiring further investigation and consideration of the prompts. This study highlights the potential benefits and challenges of integrating generative AI tools into art and design classrooms, emphasizing the importance of prompt engineering, iterative processes, and ethical considerations as these technologies continue to evolve.

***Keywords:*** generative AI tools; prompt design; art and design curriculum; ethical usage of AI; AI integration in artmaking

## 1. Introduction

In recent years, the rapid development and proliferation of artificial intelligence (AI) art generators have garnered significant attention within the art world. With the advent of open-source options such as Stable Diffusion and Lensa.ai, AI's mainstream adoption has become increasingly visible across various social media platforms[1]. This swift

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adoption by the general public has been met with staunch resistance from traditionally trained artists and designers, who express concerns over copyright infringement and the emergence of AI art as a new genre championed by dilettantes worldwide[2–4]. This controversy, fueled by the growing accessibility of AI technologies, has prompted higher education professionals to call for an outright ban, citing fears of rampant plagiarism[5,6]. Consequently, the academic community has largely overlooked practical applications and best practices for adopting these novel tools, instead of choosing to focus on the theoretical and aesthetic implications stemming from this technological disruption. Ajani[7] highlights this trend, noting two competing definitions of "art" in the context of human authorship in AI-generated content: "Art as an expression of technique, art as a display of sentiment"[7, p. 253]. Thus, the discourse has centered on the ways in which "art" may be perceived and valued, either as a reflection of the human experience or as a demonstration of technical skill[8,9].

The valuation of AI-generated art and non-fungible tokens (NFTs) remains a topic of ongoing debate within the art world[10,11]. While such discussions hold merit, they often overlook the reality that AI art, regardless of its official acceptance or rejection, has already impacted the creative processes of practicing artists[12]. Artists have acknowledged the benefits of AI art generators, enabling them to explore novel and innovative approaches in their work[13]. From proposing fresh color palettes, compositions, arrangements, and spatial understanding to fostering new inspirational and iterative formative processes, AI represents a turning point for the fine arts. However, these use cases have yet to be integrated into higher education and the instruction of studio art within the classroom setting. Consequently, this study seeks to present a case study exploring the utilization of AI-generative art tools within the context of a traditional studio art classroom.

The study design involved students in an AI-based art course working with image generators to create and modify prompts, exploring form, format, and style alongside subject matter. They also participated in discussions on ethical concerns and recreated AI-generated images using Adobe Photoshop. Advanced students in Digital Art 3 were tasked with inventing unique alien plant designs and generating more realistic versions with AI. The results indicated that students were inclined to modify subject matter and make aesthetic choices. They expressed concerns about the ethical implications of AI on the job market and copyrighted works, but also acknowledged AI as a valuable tool for idea generation. The recreation of AI-generated images showcased a range of approaches, and advanced students successfully analyzed and interpreted each other's creative work using AI-generated imagery.

These results demonstrate the potential of generative AI tools to enhance creativity and innovation in the art and design classroom. The diverse approaches taken by students in modifying prompts and recreating AI-generated images highlight the versatility of AI tools in fostering different perspectives and styles. The successful collaboration and interpretation of creative work among advanced students also emphasizes the importance of communication and critical analysis skills in the creative process. By integrating generative AI tools into the art and design curriculum, educators can encourage students to experiment with new techniques, explore various aesthetic choices, and expand their creative horizons. Furthermore, these tools can be used to facilitate discussions on ethical considerations, allowing students to develop a deeper understanding of the implications and responsibilities associated with using AI in their field.

## 2. Literature review

The practical application of artificial intelligence (AI) in the studio art classroom has received limited attention in literature, with previous studies primarily concentrating on philosophical or theoretical discussions. Coeckelbergh[14] provides a conceptual framework for a philosophical debate about whether machines can create art, posing three

critical questions: What is meant by "creation"? What is meant by "art"? And what is meant by machines "creating art"? The author argues for an unstable and objective understanding of creativity, suggesting that the binary between human and non-human forms of art is arbitrary and should be replaced by a collaborative definition where technology assists in the creative process. Coeckelbergh further contends that discussions on creativity and the artistic status of machines are irrelevant since the widely accepted definition of creativity inherently assumes a human agent. Instead, the author calls for a new "poetic" understanding of the creative process in which human-machine hybrid processes can surprise both audiences and artists themselves in innovative ways.

This perspective aligns with the views of Mazzone and Elgammal[15], who developed AI processes for identifying style and detecting large-scale style patterns in art history. They advocate for rethinking the relationship between machine and human creativity "as parallel to but not in conflict with human artists and their emotional and social intentions of art making"[15, p. 1]. Tao[16] describes this partnership as the "actor network" of art, wherein humans and machines collaborate as co-agents. Such joint efforts could potentially leverage the strengths of both parties, maximizing their combined capabilities in the creative process.

Further discussions have emerged that similarly explore the role of machines in the creative process, emphasizing the need to recognize the process itself as creative. For instance, Ahmed[17] approaches the discussion of AI from a design-based praxis perspective, drawing from the disciplines of arts and humanities. The author contends that the permanent physical manifestations of AI in media museums should not be seen merely as design but rather as a medium for design. By examining interactive and immersive media installations, Ahmed[17] argues that the act of making "immaterial humanistic characteristics"—including emotions, experiences, senses, and memories—tangible and physical, necessitates a reevaluation of AI as more than just a product or traditional image for design[17, p. 133]. The interactions and emotions experienced by humans when engaging with art generated by AI can be considered design elements in their own right. However, these discussions of AI and art have yet to address one of the most contentious aspects of art: creativity.

Debates surrounding artistic autonomy and creativity often drive discussions about whether AI-generated art can be considered "true art". Numerous definitions of "creativity" exist, but Csikszentmihályi's model[18,19] is particularly relevant for this discussion, as it considers three interrelated elements: an agreed-upon body of knowledge; a volitional agent who innovatively changes an aspect of the field in question; and experts who determine whether the novel production should be accepted into that domain or field. Building on this definition, Jennings[20] further identifies three criteria that an "agent" must fulfill in order to qualify as a volitional system with creative autonomy: the ability to evaluate autonomously without external or undue influence; the capacity to autonomously change and direct variations on a standard without explicit direction; and the ability to avoid randomness.

When applied to AI-generated art and "creativity", Jennings[20] observes that "progressing from a capable apprentice to a creator in its own right, an AI system must be able to both independently apply and independently change the standards it uses. This ideal will be called 'creative autonomy', and represents the system's freedom to pursue a course independent of its programmer's or operator's intentions"[20, p. 491]. Ajani[7] notes that since the artist or author is not the sole agent in the creative process determining the value of the creation, creativity does not exist independently. Instead, "creativity depends on individual capacity, acquisition of information, and judgment by experts"[7, p. 258]. Given that creativity requires external validation, AI has been exempted from being judged in these terms. In each domain (art and/or design), experts must "judge" whether the product can be considered "creative", as it cannot inherently possess creativity.

Recently, there have been advances made since the wide availability of generative AI tools to begin integrating into the curriculum. For instance, Hughes et al.[21] investigated how generative networks, particularly generative adversarial networks (GANs), have increasingly been incorporated into the workflows of designers to enhance creativity, productivity, and design horizons. In the context of art teaching, Zhang et al.[10] proposed the Artificial Intelligence-assisted Effective Art Teaching Framework (AIEATF) to adapt to AI-oriented art instruction, develop intelligent teaching styles, and enhance AI-oriented art teaching knowledge and environment. The study found that AI's impact on various art courses' teaching effectiveness was significantly improved. Similarly, Xu and Jiang[22] presented an AI-based Art design and teaching (AI-ADT) method in colleges, aiming to adapt to AI-oriented art education, establish intelligent teaching methods, and improve AI-oriented art teaching knowledge and environments. This method showed considerable improvements in smart teaching, flexibility, performance, participation, and interaction. Finally, focusing on architectural painting, Li[23] and Zhang[24] explored the application of AI in art teaching using technologies such as the Internet, wireless sensor networks (WSNs), and lightweight deep learning models. The proposed system utilized the Limited Broyden–Fletcher–Goldfarb–Shanno (L-BFGS) art algorithm, which achieved high accuracy in both training and testing phases when compared to traditional algorithms like Gradient Descent, Adam, and Adadelta.

Therefore, scholarship to date has shed light on the complex relationship between art and technology, examining the philosophical and theoretical aspects of creativity, autonomy, and the role of machines in the creative process. While the debate on whether AI-generated art can be considered "art" in the traditional sense remains ongoing, recent research has demonstrated the potential benefits of AI in enhancing the teaching and learning experience in creative fields, as well as the design and execution of various art forms. However, it is evident that there is a need for further exploration in the pedagogy of AI, particularly in relation to prompt engineering and the iterative stages of the creative process. The integration of AI tools, such as generative networks, into art and design education has shown promising results, but more research is needed to understand how these tools can be effectively and ethically incorporated into the classroom, and how they might impact students' creative growth.

As such, future studies should focus on developing innovative teaching methods and frameworks that harness the potential of AI in art and design education, while addressing the ethical and philosophical implications of using AI-generated content. By investigating prompt engineering and iterative processes, researchers can gain a deeper understanding of how AI tools can be utilized to facilitate creative exploration, refine ideas, and ultimately enhance the overall educational experience for students in the art and design fields.

## 3. Methodology

This mixed-methods study utilized data from student surveys, instructor feedback, and artifacts, including AI-generated content and final project submissions. The sample was obtained from a private, four-year liberal arts institution located in the suburban area of St. Louis, Missouri. The participants comprised 15 students majoring in both Art and Design and Game Design enrolled in the College of Arts and Humanities' cross-listed Digital Art II-III course. This advanced course builds upon the software and fine art strategies introduced in Digital Art II, incorporating more advanced technical skills to enable students to develop their creative use of digital technology within a fine art context. The course was delivered online, which assumed that students had a fundamental knowledge of hardware and software required for class participation. The primary aim of this project was to evaluate pedagogical best practices for employing AI art generators by examining student perceptions, performance, and feedback in conjunction with instructor feedback and observations.

The course commenced with a brief introduction to AI art, swiftly progressing to hands-on experience with image generators. Students were assigned to craft 10 prompts using OpenAI's DALL-E2 image generator, including at least four variations of the same prompt to encourage exploration of form, format, and style in addition to subject matter. Design Synectic triggers served as a starting point for considering both form and content. Following this exercise, students engaged in discussions surrounding the ethical usage of AI in image generation and reflected on an article by Mok[25]. Despite concerns about AI's impact on the job market for artists, many students considered AI as a useful tool for generating ideas. Subsequently, students were tasked with recreating one of their AI-generated images using Adobe Photoshop, resulting in a range of creative interpretations. Advanced Digital Art 3 students utilized AI differently, inventing unique alien plant designs and using DALL-E to generate more realistic interpretations of their peers' creations.

The mixed-methods project was conducted in Spring 2023 to gather data, employing qualitative (open-ended comments) and thematic (quantitative) findings from an online survey. The survey tool centered on diverse AI art generator applications in digital art courses, aiming to inform future pedagogical decisions regarding this emerging technology. Data collected included student demographics, feedback on the AI usage experience for image collection and inspiration, preferences for AI-generative content integration in art-making processes, and suggestions for optimal future utilization of the technology. Students were also asked an open-ended question about their experience and the pedagogical potential of AI. Students were contacted through the University course management system or emailed survey links. The survey was accessible for roughly one week at the end of the eight-week term, and all data was gathered using Qualtrics to ensure privacy and anonymity. The data was sorted based on demographics (e.g., gender identity, major, age) and exported from the survey system. Descriptive statistics were calculated for group comparisons. The final student-produced artifacts were assessed alongside survey results to gain further insights into learning outcomes and more comprehensive feedback on the experiences.

# 4. Results

Out of the 15 student respondents, 40% were juniors, 33.33% seniors, 13.33% sophomores, and 13.33% graduate students. The age distribution indicated that 60% of the students were between 18–24 years old, and 40% were in the 25–34 age group. In terms of gender identity, 57.14% identified as female, 35.71% male, and 7.14% non-binary. Regarding race and ethnicity, 55.56% identified as White, 11.11% American Native or Alaskan Native, 11.11% Asian, 5.56% Black or African American, 5.56% Native Hawaiian, and 33.33% Hispanic or Latino. A small percentage (6.67%) identified as international students, while 40% were first-generation college students. The majority (66.67%) of participants were commuter students, with 33.33% being residential students. Concerning class format, 60% reported primarily taking classes online, 6.67% face-to-face, and 33.33% as hybrid. Most students enrolled in the class to fulfill a degree requirement, pursuing either a BA or BFA in Art and Design with an Emphasis in Digital Art, or a BA in Game Design as part of their major.

In a series of questions discussing general preferences for generative AI tools, 60% of students agreed that they preferred incorporating AI generator exercises into the art making process. However, 66.67% did not believe that these tools enhanced their final work. This negative response may be due to the exercises focusing solely on utilizing the tools during the iterative stages of the project, rather than the final product. Free responses shed light on students' perception of how the tools helped improve their work. One student mentioned, "I think it helps with my final art projects because it helps me have a visual of my ideas and allows me to use the AI-generated photos to make new ideas". Another student acknowledged the formative usefulness of the tools, stating, "It was easier to get a good idea of

what I wanted to do with the AI generator". Despite these positive insights, students showed mixed feelings about using the tool after the class. When asked if they would continue to use it, 46.67% were unsure, 33.33% said maybe, and 20% said they would not.

In the following set of questions, the focus shifted to help students comprehend how AI tools could be more thoroughly integrated into their creative processes through effective prompt engineering. Initially, participants were asked if they gained a better understanding of the technology's role in the art making process, and 73.33% agreed that they had. Subsequently, after completing the prompt design assignment, students were asked if they understood how their prompt input influenced the image output; 73.33% agreed that they did. However, when asked if they believed the AI tool enhanced their conceptual potential for the final project, responses were mixed. While 46.67% agreed, 40% disagreed, and 13.33% were unsure.

The subsequent set of questions aim at discover how the AI tool could help students refine their initial concepts. When asked if they had a clear concept in mind before starting the exercises with various prompts, only 26.67% indicated that they did. Meanwhile, 40% chose "sort of", and 33.33% said they did not. Participants were then asked about the number of prompt iterations they went through before achieving their desired goal. Results showed that 20% chose 1–3, 20% picked 4–6, 20% opted for 7–10, 13.33% selected 11–14, 6.67% went with 15–17, 6.67% decided on 18–20, and 13.33% needed more than 20 iterations.

In terms of the difficulty experienced by respondents in achieving their desired outcome through multiple attempts with different prompts, the majority (46.67%) were neutral, while 20% found it somewhat easy and 26.67% considered it somewhat difficult. Following that, respondents were asked how they altered their prompts throughout multiple iterations of their work (**Figure 1**). The survey revealed that students made a range of modifications to their prompt language while generating multiple versions or iterations of their work. The most frequent adjustment was extending the overall description to provide more detail, which accounted for 26.47% (9) of responses. Both changing the subject and changing an adjective were chosen by 11.76% (4) of students. Altering different terms in the same prompt to observe differences was selected by 14.71% (5) of students. The least common modification was changing to incorporate different artists' styles, which only 2.94% (1) of students picked. No students chose the "Other" category.

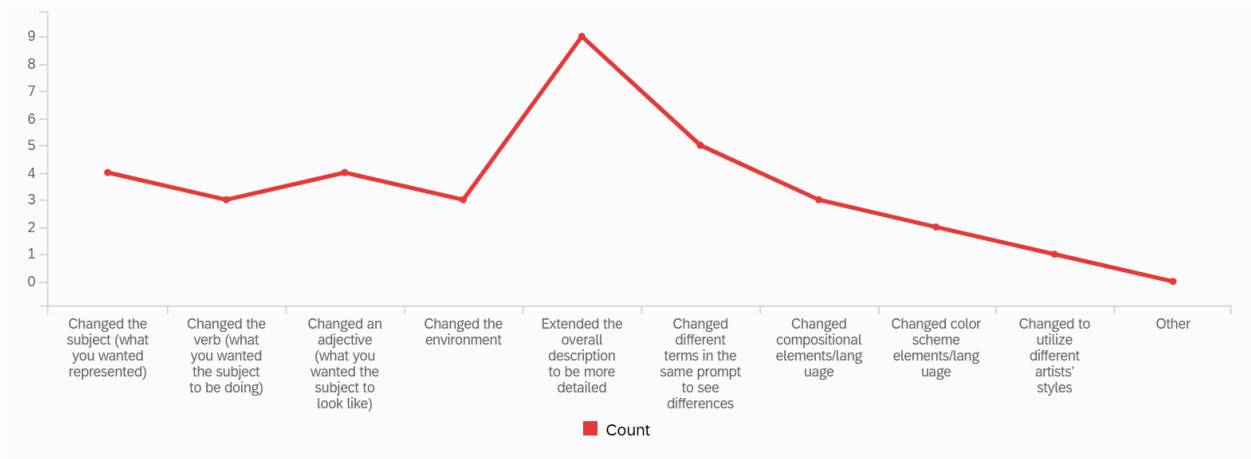



**Figure 1.** Types of student modification of prompt language.

Lastly, students were asked about the perceived usefulness of AI in the art making process. After analyzing the students' responses, it is evident that they found the use of AI in their art making process to be most beneficial in suggesting creative solutions (m: 2.29) and assisting in creating new ideas (m: 2.5).

These two applications were ranked the highest among the seven fields. On the other hand, students ranked providing a scientific approach to art making (mean: 5.57) and understanding how to leverage emerging technologies in art (mean: 5.64) as the least beneficial applications of AI in their art making process. In the middle range, students found AI helpful in organizing existing ideas (mean: 3.29), gaining a better understanding of AI in general (mean: 3.93), and maximizing their conceptual potential (mean: 4.79). **Figure 2** shows the ranking of the seven fields based on the students' experiences during the term. The categories were:

1. Suggest creative solutions
2. Provide a scientific approach to art making
3. Assist in creating new ideas
4. Help in organizing existing ideas
5. Better understand AI in general
6. Understand how to leverage emerging technologies in art
7. Maximize Conceptual Potential

The mean values for each field provide an indication of how the students ranked the potential uses of AI in their art making process, with lower mean values representing higher rankings.

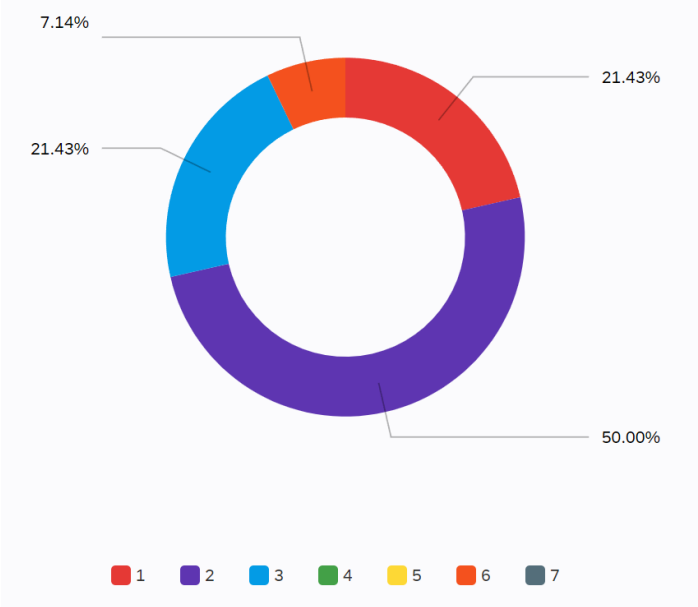



**Figure 2.** Ranking of ways students felt AI applications may improve the art making process.

The last question was a free-response and asked participants what recommendations they would want to give others using AI generative tools to create visual art regarding prompt design. Several participants highlighted the significance of being specific and detailed when designing prompts. One respondent advised others to "be very descriptive, like telling a story", emphasizing the importance of providing a clear narrative. Another participant offered the recommendation to "be detailed in prompt design, the more detail and describing you give will yield better results", suggesting that a more comprehensive description can lead to improved outcomes. Additionally, one respondent encouraged users to "be specific and not add too much fluff into the prompt", highlighting the need for clarity and conciseness in prompt design. On the other hand, some respondents did not provide any recommendations. A few participants mentioned their lack of experience with AI tools as the reason, with one stating, "I am completely new to AI tools, so I do not have any suggestions". The responses reveals that, for those who shared recommendations, being specific, detailed, and descriptive is considered valuable when designing prompts for AI generative tools in visual art. However, some respondents refrained from providing recommendations due to their limited experience or not having any suggestions.

Insights gleaned from how students perceive and utilize generative AI tools in art and design ed-

ucation are helpful in shaping curriculum. A significant portion of participants found the AI generators helpful in the ideation process and gained a better understanding of the role technology can play in the art making process through prompt engineering. However, there were mixed opinions about the improvement of their final works, with some students remaining conflicted about the continued use of AI tools after the class. Moreover, the ethical concerns surrounding AI-generated art were also raised, highlighting the need to address these issues in future curricula. As educators and researchers continue to explore the integration of AI into art and design education, it is essential to consider these insights to develop effective strategies that can maximize the potential of AI tools while addressing the challenges and ethical concerns that may arise.

## 4.1. Instructor observations

The course commenced with a brief introduction, quickly transitioning to AI art and engaging with image generators. Students were assigned a task involving OpenAI's DALL-E2 image generator, where they needed to create 10 prompts, with a minimum of 4 being variations of the same prompt. This condition was designed to encourage students to consider form, format, and style alongside subject matter. Design Synectic Triggers served as a starting point for contemplating both form and content, providing a clear objective by requiring students to incorporate at least one Synectic Trigger in half of their prompts.

The instructor observed that students were more inclined to modify subject matter and incorporate environmental details to influence image outcomes. The most common formal adjustments revolved around aesthetic choices, such as shifting between digital art, oil painting, or photorealism. These formal qualifiers yielded varying results for the students. Those who initiated with more imaginative or creative prompts often obtained more visually intriguing outcomes (though this may be a matter of the sign and the signified). Placing formatting considerations, like "photorealistic", at the end of the prompt resulted in more "photorealistic" outcomes than starting the prompt with such wording (**Table 1**).

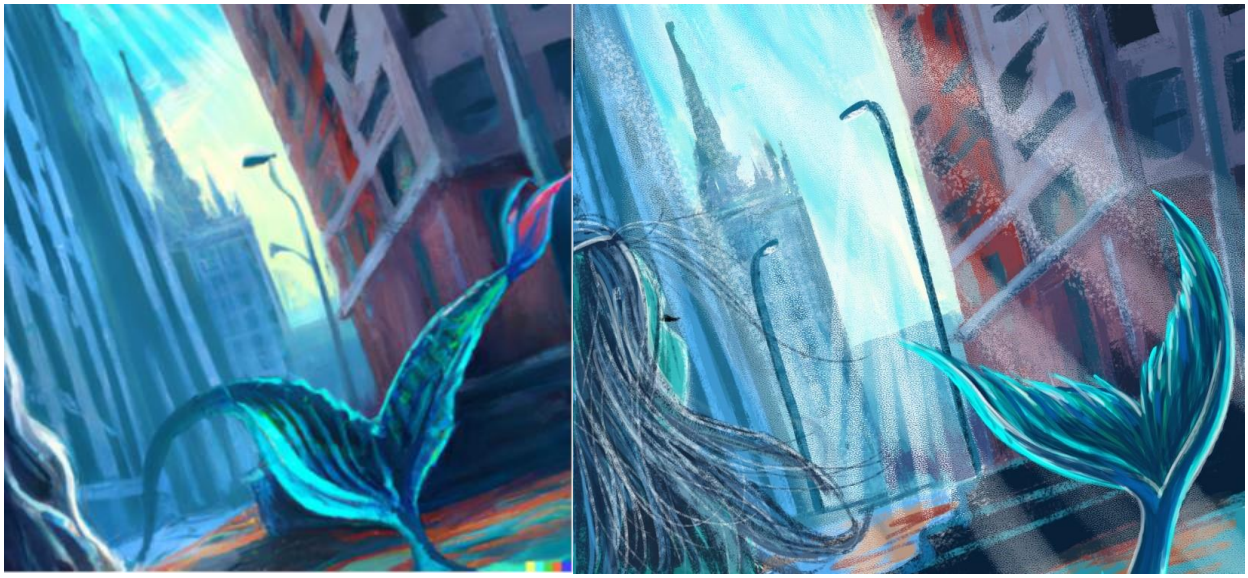
**Table 1.** Student prompt examples

| **Prompt / Student #1** |
|---|
| A cowboy riding a velociraptor |
| A cowboy riding a velociraptor digital painting front view |
| A cowboy riding a running velociraptor in the desert realistic digital painting front view |
| **Prompt / Student #2** |
| Photorealistic abandoned Disney ride with water dripping from the ceiling with a decayed Donald the Duck character costume in the corner |
| Photorealistic abandoned Disney land at night with fog with a person standing in the middle wearing a decayed Mickey Mouse costume |
| Photorealistic dark, decrepit, abandoned Chuck E Cheese with broken and old lights, with the color yellow, and a Helen Henny animatronic on the stage |
| **Prompt / Student #3** |
| A dimly lit room with sheer curtains in front of big windows with red light coming through the windows |
| A dimly lit room with sheer curtains in front of big windows, hazy light red color coming through the windows, dream like feeling |
| A hazy room with sheer curtains in front of big windows, A red light outside is spilling into the room, foggy dream like feeling |
| A hazy room with sheer curtains in front of big windows, A red light outside is spilling into the room in streaks |
| **Prompt / Student #4** |
| A man made of grapes flying above a city with a woman held in his left arm |
| An oil painting of a grape themed superhero flying in the city with a woman in his arm |
| An oil painting of a costumed grape themed superhero flying in the city with a rope, with a scared woman in his arm |

After a week of working with prompts, students participated in a discussion on the ethical use of large language models in generating images using the article of Mok[25]. Throughout the discussion, students from various backgrounds, including undergraduate and graduate students, artists, and graphic designers, expressed similar concerns about the ethics of AI and its impact on the job market. The primary ethical concern was that AI might be harming the artist community by using copyrighted work without explicit permission and without compensating the artists whose work was used to train the AI system. During the discussion, many students also expressed concerns that AI could limit job opportunities for artists and designers. Some specifically mentioned, "I believe the issue of AI taking the jobs of people in various industries is a big problem as well…" However, these thoughts were typically in response to another post that didn't mention AI actually taking jobs from people. In fact, none of the students made a definitive statement that AI is taking jobs away from artists, but they did agree with other students who made this declaration.

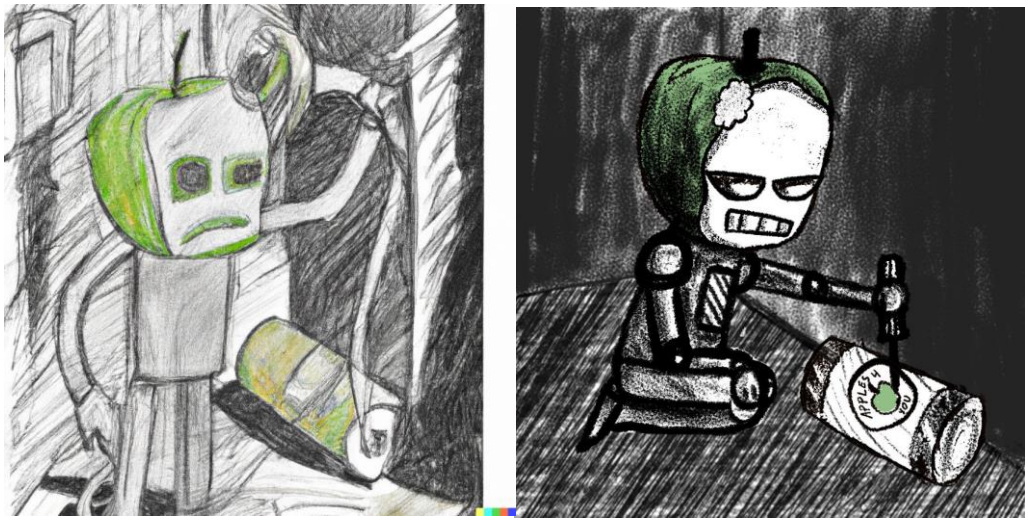
Despite being required to share an additional article on the topic of AI and its ethical usage, none of the students provided any evidence of AI systems replacing artists in the market. One article shared discussed an AI-generated image winning an art contest at a county fair. Some students did express positive views on the topic of AI and the role of artists in society, stating, "Presenting something new and making artistic decisions that often deviate from rationality are AI's weak areas". Other aspects of the argument were that AI image generators are tools, and artists will always adapt and use tools in new ways. Out of 14 initial posts, 10 mentioned AI as a useful tool for generating ideas.

After the prompting exercise and during the ongoing discussion on the ethics of AI art, students were given the task of recreating one of the images they received from their AI prompts, building it from scratch. The instruction was limited to recreating the image using Adobe Photoshop tools. Students approached this task in various ways. Some students used the AI-generated image as a reference photo and tried to emulate the lines, shapes, and colors while making some adjustments to the composition (**Figures 3(a)**, **(b)**). Others took creative licenses and used the reference image as a starting point for exploring different styles and design applications (**Figures 4(a)**, **(b)**). Lastly, some students treated the AI image as a template or underpainting, working on top of it to achieve smoother transitions of paint strokes and colors while maintaining the original composition (**Figures 6(a)**, **(b)**).



**(a).** Photorealistic, Dalle-2. **(b).** Photorealistic, Photoshop.

**Figure 3.** Corinne Loar, Underwater City with Mermaids, 2023.



**(a).** Dalle-2. **(b).** Photoshop.

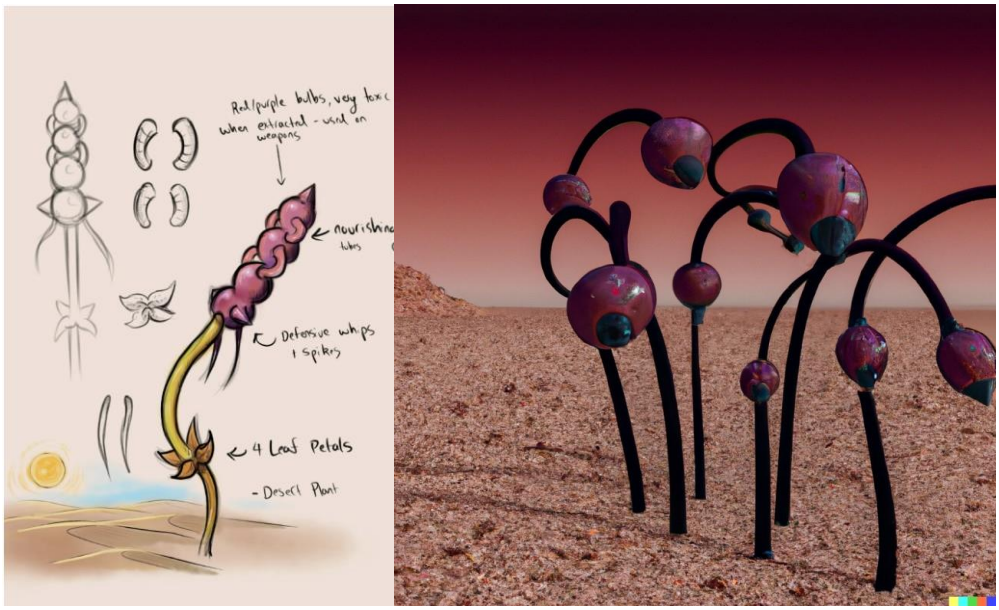
**Figure 4.** Deven Debro, A charcoal drawing of a crying green robot trying to open a can of peaches with a screwdriver in an alley, 2023.

**(a).** Dalle-2. **(b).** Photoshop.

**Figure 5.** Per Gulbranson, A geisha walking through the streets of feudal Japan in a 1 pt perspective digital art, 2023.

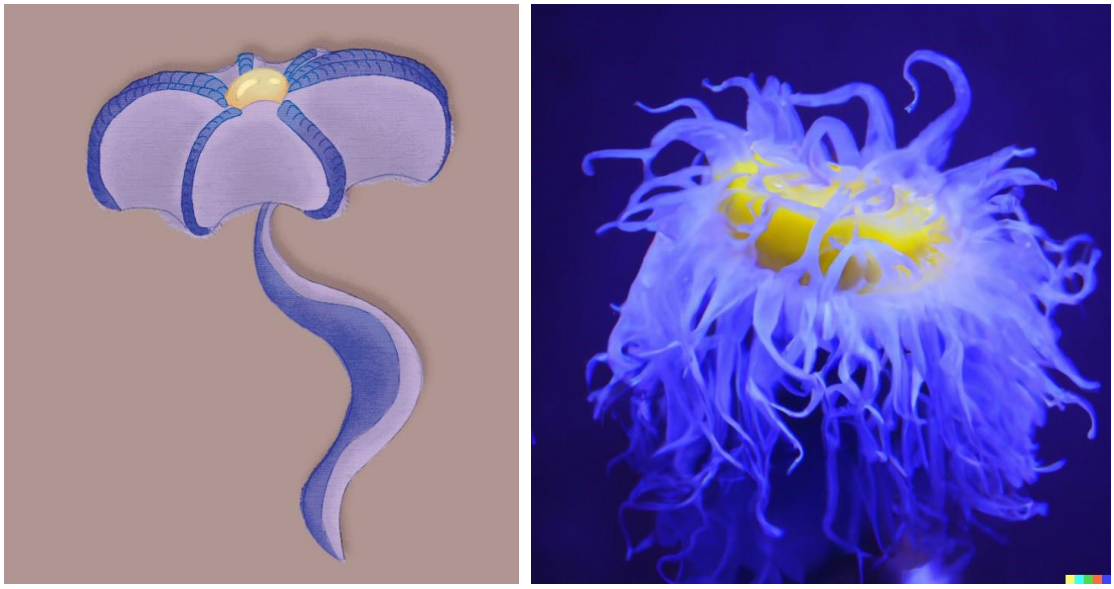
**(a).** Dalle-2. **(b).** Photoshop.

**Figure 6.** Christian Torres, Photorealistic abandoned Disney ride with water dripping from the ceiling with a decayed Donald the Duck character costume in the corner, 2023.




**(a)** **(b)**

**Figure 7. (a).** Per Gulbranson, Alien Plant Design, Original Artwork, 2023; **(b).** Cassidy Krewson, A toxic, red/purple plant made of round bulbs with rings connecting them, spikes, and a yellow stem, in a desert; photorealistic, after Gulbrandson, Dalle-2, 2023.



**(a)** **(b)**

**Figure 8. (a).** Cassidy Krewson, Alien Plant Design, Original Artwork, 2023; **(b).** Per Gulbranson, An underwater plant that looks like a blue jellyfish mixed with a mushroom that has a yellow blob at its tip, after Krewson, Dalle-2, 2023.

In the more advanced Digital Art III course, students utilized AI in a different manner. They were assigned the task of creating five unique alien plant designs from their imagination (**Figures 7(a)**, **8(a)**). These designs had to include textual descriptors labeling various parts of the plant or inventing taxonomical names for them. Students then shared their designs in an open discussion, where their peers reinterpreted the plant designs textually. These reinterpretations were fed into the DALL-E 2 image generator, with the added term "photorealistic", and the more realistic results were then shared (**Figures 7(b)**, **8(b)**). This process allowed students to analyze essential aspects of their imaginative designs, develop language for others' creativity, and be "rewarded" with images that built upon these interpretations.

In all, the instructor observations have provided a unique perspective on how students engaged with AI tools in the art and design curriculum. Students demonstrated creativity and adaptability when

working with AI-generated prompts, exploring various strategies and modifications to achieve desired outcomes. The ethical discussions around AI and art shed light on concerns students have regarding the impact on the job market and the use of copyrighted work without permission. Furthermore, the diverse approaches students took in recreating AI-generated images highlight the potential for AI to be a springboard for creativity and artistic expression. As instructors continue to incorporate AI in art and design education, it is crucial to consider these observations and insights to develop teaching methods that effectively address student concerns, encourage creative exploration, and promote responsible use of AI tools in artistic processes.

## 5. Conclusions

The advent of generative AI technology holds immense promise for transforming the landscape of art and design education, offering innovative ways to enhance creativity, ideation, and collaboration among students. As such, this study offers valuable insights into the effective integration of generative AI tools in art and design curriculums. One of the key findings was that while a majority of students appreciated the AI generator exercises as part of the art making process, they were divided on whether these tools improved their final work or if they would continue using them after the class. This suggests that further exploration of AI's potential impact on art outcomes and sustained engagement is needed.

The study also demonstrated that students gained a better understanding of the role AI technology can play in the art making process, as well as how their prompt inputs affected the image outputs after completing the prompt design assignment. This highlights the importance of incorporating thorough prompt engineering and hands-on experiences with AI tools in the curriculum. Despite initial uncertainties about their concepts, students were able to use the AI tool to help clarify their ideas through multiple iterations and modifications of their prompts. This points to the potential of AI as an effective tool for refining concepts and encouraging experimentation in art and design.

Ethical concerns emerged from the study, with students expressing worries about the use of AI in art, particularly in relation to copyright issues and potential job displacement for artists. However, many also acknowledged the potential of AI as a useful tool for idea generation. Addressing these ethical concerns and fostering informed discussions on the topic are essential for successful integration of AI in art and design education. The integration of AI in more advanced courses demonstrated the potential for students to analyze and build upon their imaginative designs through the use of AI-generated imagery. This suggests that incorporating AI tools in different contexts and assignments could further enhance students' creative processes and outcomes.

For future research and integration of generative AI tools in art and design curriculum, it is recommended to encourage students to explore the use of AI tools in various stages of their creative process, including both ideation and final product development, to better understand the full potential of AI in art and design. Developing strategies for addressing ethical concerns related to AI in art, such as copyright issues and potential job displacement, by fostering open dialogue and critical thinking about the impact of AI on the art community is also crucial. Researchers should investigate the potential for AI tools to support collaboration and peer learning by incorporating assignments that involve students interpreting and building upon each other's work using AI-generated imagery. Lastly, continuously evaluating and refining the curriculum to ensure that it remains up-to-date with the latest advancements in AI technology and its applications in art and design is essential. By considering these key takeaways and recommendations, educators and researchers can work towards the successful integration of generative AI tools in art and design curriculums, ultimately enhancing the creative process and outcomes for students.

## Conflict of interest

The authors declare no conflict of interest.

## References


1. DelSignore P. The new age of creative AI began in 2022 [Internet]. 2022 [updated 2022 Dec 24; cited 2023 Apr 6]. Available from: https://medium.com/predict/the-new-age-of-creative-ai-began-in-2022-ece07bb93350.
2. Ansari T. How AI transformed the art world in 2022 [Internet]. 2022 [update 2022 Oct 30; cited 2023 Apr 8]. Available from: https://analyticsindiamag.com/how-ai-transformed-the-art-world-in-2022/.
3. Murphy BP. Is lensa AI stealing from human art? An Expert Explains the Controversy [Internet]. 2022 [update 2022 Dec 15; cited 2023 Apr 8]. Available from: https://www-sciencealert-com.cdn.ampproject.org/c/s/www.sciencealert.com/is-lensa-ai-stealing-from-human-art-an-expert-explains-the-controversy/amp.
4. Hazucha B. Artificial intelligence and cultural production: Possible impacts on Creativity and Copyright Law [Internet]. 2022 [update 2022 Feb 6; cited 2023 Apr 6]. Available from: https://ssrn.com/abstract=4028106.
5. Francke E, Bennett A. The potential influence of artificial intelligence on plagiarism: A higher education perspective. In: Griffiths P, Kabir MN (editors). European Conference on the Impact of Artificial Intelligence and Robotics (ECIAIR 2019); 2019 Oct 31–Nov 1; Oxford. New York: Academic Conferences and Publishing International Ltd.; 2019. p. 131–140.
6. Sherry B. 3 Limits to artificial intelligence's creativity (and how to solve them): Here's what you need to know about harnessing A.I. technology to be more creative [Internet]. 2022 [update 2022 Dec 16; cited 2023 Apr 7]. Available from: https://www.inc.com/ben-sherry/3-limits-to-artificial-intelligences-creativity-and-how-to-solve-them.html.
7. Ajani G. Human authorship and art created by artificial intelligence—Where do we stand? In: Dreier T, Andina T (editors). Digital ethics. Baden-Baden: Nomos Verlagsgesellschaft mbH & Co. KG.; 2022. p. 253–270.
   doi: 10.5040/9781509964154.ch-015.
8. Rosenberg H. The de-definition of art. Chicago, USA: University of Chicago Press; 1983.
9. Mullholland N. 2. definitions of art and the art world. In: Exploring visual culture: Definitions, concepts, contexts. Edinburgh, USA: Edinburgh University Press; 2005. p. 18–33.
   doi: 10.1515/9781474471879-006.
10. Zhang C, Lu Y. Study on artificial intelligence: The state of the art and future prospects. Journal of Industrial Information Integration 2021; 23: 100224. doi: 10.1016/j.jii.2021.100224.
11. Wellner G. Digital imagination, fantasy, AI art. Foundations of Science 2022; 27: 1445–1451. doi: 10.1007/s10699-020-09747-0.
12. Slotte Dufva T. Entanglements in AI art. In: Global media arts education: Mapping global perspectives of media arts in education. Cham: Springer International Publishing; 2022. p. 181–196.
13. Compton N. Generative art: The creatives powering the AI art boom [Internet]. Wallpaper: Future Publishing Limited Quay House; 2022 [cited 2023 Apr 6]. Available from: https://www.wallpaper.com/art/generative-art.
14. Coeckelbergh M. Can machines create art? Philosophy & Technology 2017; 30(3): 285–303.
    doi: 10.1007/s13347-016-0231-5.
15. Mazzone M, Elgammal A. Art, creativity, and the potential of artificial intelligence. Arts 2019; 8(1): 26. doi: 10.3390/arts8010026.
16. Tao F. A new harmonisation of art and technology: Philosophic interpretations of artificial intelligence art. Critical Arts 2022; 36(1–2): 110–125.
    doi: 10.1080/02560046.2022.2112725.
17. Ahmed D. Senses, experiences, emotions, memories: Artificial intelligence as a design instead of for a design in contemporary Japan. Intelligent Buildings International 2022; 14(2): 133–150.
    doi: 10.1080/17508975.2020.1764327.
18. Csikszentmihalyi M. Society, culture and person: A system view of creativity. In: Sternberg RJ, Davisdon JE (editors). The nature of creativity. New York: Cambridge University Press; 1988. p. 325–329.
19. Csikszentmihalyi M. Society, culture, and person: A systems view of creativity. In: Sternberg RJ, Davisdon JE (editors). Heidelberg: Springer Netherlands; 2014. p. 47–61.
20. Jennings KE. Developing creativity: Artificial barriers in artificial intelligence. Minds and Machines 2010; 20: 489–501.
    doi: 10.1007/s11023-010-9206-y.
21. Hughes RT, Zhu L, Bednarz T. Generative adversarial networks–enabled human–artificial intelligence collaborative applications for creative and design industries: A systematic review of current approaches and trends. Frontiers in Artificial Intelligence 2021; 4: 604234.
    doi: 10.3389/frai.2021.604234.
22. Xu B, Jiang J. Exploitation for multimedia Asian information processing and artificial intelligence-based art design and teaching in colleges. ACM Transactions on Asian and Low-Resource Language Information Processing 2022; 21(6): 1–18. doi: 10.1145/3526219.
23. Li J, Zhang B. The application of artificial intelligence technology in art teaching taking architectural

painting as an example. Computational Intelligence and Neuroscience 2022; 2022; 8803957. doi: 10.1155/2022/8803957.

24. Zhang W, Shankar A, Antonidoss A. Modern art education and teaching based on artificial intelligence. Journal of Interconnection Networks 2022; 22(Supp01): 2141005. doi: 10.1142/S021926592141005X.
25. Mok K. The power and ethical dilemma of AI image generation models [Internet]. Portland, Oregon: The New Stack; 2023 [update 2023 Jan 6; cited 2023 Apr 6]. Available from: https://thenewstack.io/the-power-and-ethical-dilemma-of-ai-image-generation-models.