

Art Education and Generative AI: An Exploratory Study in Constructivist Learning and Visualization Automation for the Classroom

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Abstract

Artificial intelligence (AI) presents significant implications for art and art education. This paper focuses on the domain of generative AI, or GAI. GAI is a form of AI that can create content, including visual and other forms of art, or art-like material. The research question we consider is: what are the implications of GAI for art education? Drawing upon constructivist learning theory, this paper asserts that GAI can provide educators an opportunity to engage students actively in the critical analysis of art or art-like material generated via AI through an experience-based approach. An exploratory method is employed to qualitatively examine this thesis. Implications and limitations of the approach are presented regarding the potential utilization of GAI to engage students in participatory art education learning experiences. GAI is conceptualized as a form or proxy for automation of visual art generation.

Keywords

Generative Artificial Intelligence, Art, Art Education, Curricular Framework

1. Literature Review

Artificial intelligence (AI) is poised to transform a variety of arenas, including art and art education. Technology long has been utilized as a means of innovation in education, including art education. Since at least the 1960s, artists have sought to employ artificial intelligence, or machines (i.e., computers) that can think or emulate human thought in the creation of art. More recently, art edu-

cators have explored ways to integrate AI into art instruction. Debuted to the public in 2022, generative AI, or GAI, is a form of AI of particular relevance to art and art education. GAI can create content, including visual and other forms of art, or art-like content. As such, GAI raises important implications for art and art education including the potential to not only create artistic expression but also to enable students to use it to that end and to critically consider it. Educators face a dilemma regarding whether to embrace GAI as an opportunity for innovation in art education, or to reject its utilization as a threat to human artistic creativity or intellectual property rights. This paper examines one particular possible application of GAI in art education based on a novel approach to experience-based learning.

Dewey (1938) posited that experienced-based education enriches learning. In contrast to more traditional forms of learning in which the student passively receives information or knowledge (e.g., listening to a lecture), experience-based learning engages students more actively in the pedagogical process (Fosnot, 1996). Experienced-based learning heightens student attention and critical thinking (Bognar, 1986). By participating more actively in the learning process students can acquire knowledge more efficiently, retain it longer, and recall it more readily (Isenberg & Jalongo, 1997). Perhaps most importantly, learning is maximized when educational experience leads to student discovery or construction of knowledge through activation of the imagination (Zagorac, 2006). This pedagogical approach is at the core of constructivist learning theory (CLT).

1.1. Constructivist Learning Theory and Art Education

CLT suggests students learn effectively by performing tasks that comprise a pedagogical experience (Tomljenović & Vorkapić, 2020). For instance, a student who participates in an experienced-based project is apt to learn more than by simply listening to a lecture on the same topic that conveys the same set of facts or principles (Marlowe & Page, 2005). Such learning-by-doing can reinforce abstract concepts in more tangible ways and thereby stimulate great mental engagement. More recently, O'Donoghue (2015) has explored the development of experience in contemporary art and the potential it raises for new approaches to art education. Research suggests CLT applies to the domain of art education (Narayan, Rodriguez, Araujo, Shaqlaih, & Moss, 2013). Dewey early on considered the nature of art as experience (Dewey, 1934). Students can learn through active engagement in participatory discovery or construction of new knowledge of art.

Innovation in art education long has employed new technology. Greh, for example, has explored how computers can be applied in the art room as well as in secondary art education (Greh, 1986, 1990). Hubbard (1985) has examined the role of digital literacy in art education. Justice (2016) has explored new materialities and maker paradigms in art education. Knochel, Liao, & Patton (2020) have pushed these ideas even further, advancing the notion of critical digital making in art education.

1.2. Artificial Intelligence Development

Artificial intelligence (AI) has been in development since at least the mid-20th century, when Dartmouth mathematics professor John McCarthy coined the phrase. In proposing the Dartmouth Summer Research Project on Artificial Intelligence, McCarthy (1956) wrote that the gathering should, “proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it”.

AI has been used in the creation of art since at least the late 1960s, when British painter Harold Cohen began experimenting with computer-generated artwork. Cohen dedicated much of his life to the development of “Aaron”, what has been called the world’s first AI art software (Tremayne-Pengelly, 2023). Moving to Stanford University’s Artificial Intelligence Lab in the 1970s, Cohen named his software Aaron after the biblical figure and anticipating that there would be subsequently a “B” version (Grimes, 2016). This art-AI history is on display in a special exhibition at the Whitney Museum of American Art in New York.

1.3. Generative AI

In the intervening decades since the development of Aaron, AI has advanced dramatically. Notably, in 2022 OpenAI introduced publicly DALL-E, a generative AI (GAI) platform that can create visual imagery based on textual input known as prompt engineering (OpenAI, 2023). Not without controversy, GAI platforms such as DALL-E have through machine learning developed a capacity to create visual expressions that simulate art, as per McCarthy’s early articulation of the nature of AI. Some have expounded upon the capacity of such platforms to create a wide range of content, from textual narratives to photo-realistic visualizations, video games and immersive media (Cetinic & She, 2022). Others have issued warnings about the legal implications of AI with regard to intellectual property rights and art, especially in the context of the body of work AI systems utilize in machine learning or training (Samuelson, 1985; Hazucha, 2022). Hutson and Lang (2023), Sheikhsari (2023) and others have examined the question of whether AI-generated visualizations can be considered legitimate art. Lin (2005) has proposed moving beyond contemporary computer technology to offer a dream of digital art. Smanov, Stycheva, Smanova, Zholdasbekova, & Isatayeva (2023) have examined the impact digital technology on art education during the time of Covid-19.

1.4. AI and Art Education

A growing number of scholars have explored the implications of AI for art education, raising a range of considerations (Kong, 2020). Leonard (2021) poses a spectrum of questions including “how an increase in AI algorithms in both daily life and formal education settings” may impact art pedagogy. Wen, Shankar, & Antonidoss (2021) have posited that AI can lead to a potentially significant

transformation of art education. [Pente, Adams, & Yuen \(2023\)](#) have expressed essential ethical concerns about the role of AI in art education in a world possibly without human artists. [Broussard \(2018\)](#) challenges the notion that AI can enhance education in any form. [Dixon-Román, Nichols, & Nyame-Mensah \(2020\)](#) raise even more grave concerns, cautioning that AI may foster the racialization of educational technologies. [Leonard \(2020\)](#) has outlined the potential for designing art education curricula integrating AI. [Hutson & Cotroneo \(2023\)](#) have directly investigated the role of prompt engineering and iterative processes for enhanced creativity in art education utilizing generative AI. [Mazzone & Elgammal \(2019\)](#) have explored the intersection of AI, art, and creativity. [Elgammal \(2019\)](#), in fact, has created an AI-based platform, AICAN, for the autonomous generation of art; the name of the platform suggests the possibility that under the right conditions AI can create true art. This is a matter explored further in the current investigation. [Bernaschina \(2023\)](#) and [Hurst, Spyrou, Tekinerdogan, & Krampe \(2023\)](#) have articulated important implications for the advance of art education and AI in the emerging virtual realm of the Metaverse.

1.5. Research Question

In this paper we ask: Can we design and assess a curricular framework in which generative AI (GAI) is employed to provide art students an experience-based learning opportunity? In particular, we outline and evaluate a three-part pedagogical framework for creating GAI-enabled art education experiences. These parts are: 1) engineer prompts for DALL-E to create (or simulate) visual artistic expression emulating different styles of art; 2) critically examine GAI-created visual art expression in terms of the presence or absence of the characteristics of differing styles of visual art; and 3) assess the capacity of GAI to create visual art or simulations of it. In this framework, GAI is conceptualized as a form or proxy for automation of visual art generation. Automation long has been an important part of art education curricula, including in collage generation ([Krzeczkowska, El-Hage, Colton, & Clark, 2010](#)).

2. Methodology

To address the above research question, we have designed and conducted a qualitative exploratory analysis of one generative AI visual content platform, DALL-E, created by OpenAI. We utilize this platform because it was the first major GAI made available to the public and it captured the greatest attention in the public spotlight. Moreover, as it was made available for free usage, DALL-E offered a viable platform for widespread utilization in art education.

2.1. A Curricular Framework

Via the exploratory analysis, which we offer as an art education curricular framework based on a constructivist approach, we seek to identify and assess the potential use of generative AI in introductory art education. A curricular frame-

work is an organized instructional plan that outlines what the student will learn and be able to do upon its completion (California Department of Education, 2023).

2.2. Utilizing DALL-E 2

DALL-E uses ChatGPT, a text-based large language model also developed by OpenAI. Users craft and submit a text-based prompt (called prompt engineering) into the DALL-E platform, which then creates images. The initial GAI platform was DALL-E; the second generation was DALL-E 2, and in the timeframe of this investigation we utilized this second generation.

2.3. The Art Styles

For the curricular framework developed here, we submitted the default textual prompt to the DALL-E 2 platform: An impressionist oil painting of a vase of purple flowers. This prompt utilizes the well-known art style known as impressionism, a painting style developed in 19th century France. The style features visible small brushstrokes that suggest or offer an impression of color, form and natural light. In default mode, DALL-E 2 generated four versions of this artistic visualization. These impressionist-style images are presented in **Figures 1-4**. We used the default mode of the GAI platform to provide the most generalizable results.

2.4. The Revised Prompts

To provide a comparative illustration, we also submitted a slightly revised prompt, a surrealist oil painting of a vase of purple flowers. This prompt features an alternative, well-known style of art, surrealism. Surrealism developed in the early 20th century. It combines a view of the world grounded in reality with the implicit influence of dreams and the unconscious. Surrealism highlights beauty of the uncanny, unexpected, and unconventional.

Notably, Salvador Dalí is a famous and pioneering artist in surrealist style, well-known for paintings of objects such as sundials and timepieces flowing as if liquid over a landscape (e.g., Dalí, 1931). The DALL-E platform is named in part after him. The name DALL-E is a portmanteau, combining Dalí and WALL-E, the AI-enabled robot character in a popular 2008 Disney animated feature film.

The surrealist-style visualizations generated by DALL-E 2 are presented in **Figures 5-8**. These prompts and associated visualizations illustrate how the DALL-E 2 platform could be used by students to conduct a comparative analysis of artistic imagery using different styles of art as generated by DALL-E 2. Students could critically assess and discuss how well DALL-E 2 conforms to authentic styles of different styles of painting in the art it generates. In the curricular framework, students would be instructed to craft or engineer prompts instructing DALL-E 2 (or another such GAI platform such as that of Midjourney, etc.) to create a visual artistic expression using a specific style of visual art. Students would be further instructed to critically analyze the resulting imagery based on the authenticity or

faithfulness of each image in terms of its utilization or representation of that style of art and the features that characterize it. Students would participate in class discussion with regard to the quality of each image as an example of a particular style of visual art. Such discussion of GAI as a platform for creating art or art-like content also should highlight the ethical dimensions (i.e., the normative qualities) as well as the legal underpinnings (e.g., intellectual property rights of artists).

3. Results

Figures 1-4 suggest, DALL-E 2 generated four relatively compelling versions of impressionist oil paintings of a vase of purple flowers. Elements of the impressionist style are apparent in these images. **Figures 1-4**, for example, feature visible small brushstrokes. Yet, we know these are not brushstrokes, as what is generated by DALL-E 2 and displayed on the screen is not a painting or a photograph of a painting. The apparent brushstrokes are a digital illusion.

Belgian surrealist **René Magritte** in 1929 famously painted an image of a pipe with the caption: “This is not a pipe.” When GAI creates a visual image, it is essential that students understand that they are not viewing a painting, and not art; what is displayed on screen is merely a digital visualization that may approximate the techniques associated with a particular style of art (**Nugent, 2018**).

These GAI-created art visualizations suggest “Rêve”, (in English, a dream or illusion) the French word Magritte employed in one of his most influential works, “L’Art de la Conversation” (in English, *The Art of Conversation*), his 1950 oil painting on display in the New Orleans Museum of Art (which the



Figure 1. DALL-E 2 Generated Art Impressionist Image 1.



Figure 2. DALL-E 2 Generated Art Impressionist Image 2.



Figure 3. DALL-E 2 Generated Art Impressionist Image 3.

authors visited 13 March 2024). *The Art of Conversation* depicts a towering stone sculpture of the word *Rêve*, a word that evokes dreams through something concrete and tangible. *Rêve* suggests the notion that a painting gains meaning as dialogue between the artist, the artwork, and the viewer (or listener, etc. depending on the artistic modality).

The form and color of the objects depicted from the DALL-E 2 prompt suggest to the viewer an impression of a vase of purple flowers bathed in natural light. Each contains a visual digital watermark (color bars in lower right) indi-

cating they were generated via AI. More specifically, the image presented in **Figure 1** suggests Lilacs, which were a favorite subject of impressionists, including Claude Monet (*Lilacs in the Sun*, Monet, 1872). Yet, there is no way to know if these are the actual type of flowers meant to be represented; our prompt did not specify and DALL-E 2 merely offers its own impression of what one possible vase of generic purple flowers might look like. The image in **Figure 2** is perhaps a vase of Peonies or Azaleas, as suggested by the form or shape of the flowers. The image in **Figure 3**, like that of **Figure 1**, suggests Lilacs, but with a vase of a different style, one more defined, lighter in color and with a handle, in contrast to a dark, simple vase. The image in **Figure 4** perhaps also suggests Lilacs, though they are somewhat lighter in color, more a muted lavender.

3.1. GAI Surrealist Imagery

In contrast to **Figures 1-4**, **Figures 5-8** indicate that the surrealist style visualizations generated by DALL-E 2 are substantially less authentic of the style. **Figures 5-8** suggest a somewhat nightmarish depiction of a vase of flowers. But they fail to combine this dreamlike view with a sense of the real world. These images are somewhat uncanny but fall short of the evocation of the unconscious. More specifically, the image in **Figure 5** suggests a purplish thistle, a flowering plant that features petals and leaves with prickles on the margins. The imagery suggests something unreal and somewhat bizarre or vaguely unsettling, but fails to connect to an unspoken dream or subconscious meaning. The image in **Figure 6** more realistically portrays purple flowers that resemble Irises. Meanwhile, the image in **Figure 7** is more evocative of wilting Lilacs. The image in **Figure 8** again suggests Irises, but in a state of decomposition. Still, none of these images suggest any real meaning, conscious or subconscious. Dali's famous melting



Figure 4. DALL-E 2 Generated Art Impressionist Image 4.



Figure 5. DALL-E 2 Generated Art Impressionist Image 5.



Figure 6. DALL-E 2 Generated Art Impressionist Image 6.

clock imagery suggests the illusion of time, and that how it passes is based on human perception. In contrast, the DALL-E 2 images, failing to authentically represent the surrealist style, lack any apparent meaning. They are simply somewhat disturbing or strange to look at.

Nevertheless, any meaning viewers garner from these images could be merely their subconscious attaching value to what is depicted, given the authors' use of a generic DALLE-2 prompt. In contrast, surrealist painters of the 20th century operated from a place in their subconscious and subsequently the style emerged from that connection. In an educational setting, students of the arts could be



Figure 7. DALL-E 2 Generated Art Impressionist Image 7.



Figure 8. DALL-E 2 Generated Art Impressionist Image 8.

encouraged to form that connection before generating a prompt through DALL-E-2. In this way students may be able to generate more authentic surrealist images.

3.2. Classroom Utilization

In a classroom setting, a teacher might ask the students to draw upon their own lived experience as the basis for formulating a prompt, and thereby imbue their art visualization with personal meaning. For example, young students may be living independently from their family and may craft a prompt expressing feel-

ings of loneliness or longing. This might suggest engineering a prompt such as, “A dream in which I cannot reach my loved ones, imagined as a vase of purple flowers painted in a surrealist style.” For a student of painting, using DALL-E-2 prompts could allow them to work out ideas before beginning a draft of a painting. When working with oil paints, the process is slow and it may take days or weeks to complete a painting. For young artists experimenting with DALL-E-2, prompts may give them an opportunity to explore other styles or subjects while they are still developing their individual creative voice as an artist. For example, if the second surrealist prompt “A dream in which I cannot reach my loved ones, imagined as a vase of purple flowers” did not generate results the student was looking for, one part of the prompt could be changed to further elaborate on the student’s concept of longing. For instance, “a pond of purple Lilies” may better convey distress, if the prompt were changed to “A dream in which I cannot reach my loved ones, imagined as a pond of purple Lilies painted in a surrealist style.” In a classroom setting, DALL-E-2 could function as a vehicle for students to explore various combinations of styles and subjects which otherwise may never intersect. A surrealist might not paint a vase of purple flowers, although DALL-E-2 allows the art student to imagine such a unique combination of style and subject which challenge perception. In the case of artists such as Dalí and Magritte, we see in their work how illusion and perception are perhaps the strongest tools to create impactful imagery.

Findings of this study suggest that DALL-E 2 can enable students with little or no technical artistic or painting skill to participate in the creation of visual art or art-like materials. However, to participate in this GAI-based art experience, some background in art and art history is essential. In particular, students with a grasp of the vocabulary pertaining to different styles of visual art (e.g., impressionist, surrealist) could engineer the appropriate prompts to generate visualizations reflecting those different styles of art. To engage in the critical analysis of GAI-created art-like visualizations, students also need relevant knowledge of art and art history that enables the meaningful analysis of the art or art simulations via GAI.

4. Analysis

Constructivist learning theory (CLT) posits that learning can be enhanced by giving students an opportunity to actively engage in phenomena, principles and practices through pertinent experience-based learning exercises or projects. The arts may be among the most important and viable subject matter domains for the pedagogical application of CLT in that it combines both the theoretical (e.g., concepts or principles) and the applied (e.g., techniques that enable the production of artistic expression and associated styles). In this manner, art educators often engage students in experience-based learning that blends both the abstract and the concrete, ranging from creating a collage to sketching an image. This combination of the theoretical and applied through hands-on experience can fa-

facilitate learning outcomes, such as understanding of the arts and art styles.

The current investigation suggests a means by which educators can craft assignments utilizing GAI to actively engage students in art creation experiences, even students who do not yet have skills in painting or other techniques endemic to various styles of visual art. Moreover, such GAI-based art-creation experiences offer potentially powerful and ground-breaking opportunities to increase accessibility for students with disabilities to participate actively in the creation of art. For instance, a student with a severe disability such as paraplegia who in the past might be limited or even unable to paint, can utilize prompt engineering to create an artistic expression, and then engage in its critical analysis. If needed, students could craft and submit their prompts via voice, or even via thought through a technology such as Neuralink's chip implant in human trials as of this writing (Neuralink, 2024). However, basic familiarity with the qualities and characteristics of art styles and the associated vocabulary are essential for both the engineering of prompts to create art simulations or expressions via GAI and to engage in meaningful critical analysis and discourse about those visualizations and the pros and cons of AI in the realm of the arts.

5. Conclusion

This study asked: what are the implications of GAI for art education? Using a qualitative exploratory methodological approach, the results suggest that GAI can be utilized effectively and ethically in art education through the application of constructivist learning theory. GAI is conceptualized as a form or proxy for automation of visual art generation. As such, it enables students to participate in the generation of visualizations emulating a particular painting style. As Margritte interposed words and images, the use of GAI platform DALL-E 2 is particularly germane. It is through the crafting of words, or engineering prompts, that DALL-E 2 enables the student of art to foster the generation of art or art-like visualizations via GAI.

DALL-E 2 can enable students with little or no technical artistic skill to participate in the creation of visual art. However, some background in art and art history, including relevant vocabulary, is necessary to the creation and meaningful analysis of visual art. For example, students need at least a basic grasp of styles of painting such as impressionist or surrealist to engineer prompts and then assess the authenticity and differences in style of imagery as manifested by DALL-E. Critical perspective is essential for students to fully understand the limited role generative AI can and should play (i.e., ethics) in the visual arts. Caution is required to ensure that GAI is engaged in a manner that underscores its capacity and limitations and that students understand that GAI can create visualizations that simulate different styles of art, but whether GAI can actually create (original) art is a matter for debate. Student discussion might include practical considerations such as:

- What are the best ways to appropriately and clearly label visual art when

generated by AI?

- Does machine learning that draws upon existing human-created art exploit the rights of artists whose work is represented in the corpus used to train GAI, and if so, should those artists (or their heirs) be compensated or their permission obtained?
- Can GAI expand opportunities for persons with disabilities to participate more fully in the creation of art? And,
- Will generative AI aid or replace human art or artists?

On a more theoretical level, students might consider:

- What is art and what are the qualities that define or characterize it?
- Is AI actually capable of creating art, or does GAI merely mimic human-generated art?
- Does GAI-produced art-like material erode concepts or perceptions of what constitutes art and the meaning it conveys or inspires? And,
- What are the likely consequences for society in a world populated increasingly by AI-generated art or art-like material?

Moreover, although the curricular framework developed for this investigation is limited to the realm of visual art, and in particular two styles of painting (impressionism and surrealism), it is likely that other styles of art may be amenable to GAI production and student critical analysis. Further, it is possible that other art modalities, such as audio, video, immersion and even haptic (e.g., tactile) could be explored in an experience-based approach. Constructivist learning theory offers a valuable avenue for further research and curricular development in the intersection of AI and art education. The current study is only a preliminary step in understanding the role and function of generative AI in art education and further research is needed to develop and assess the proposed curricular framework more generally across the wider domain of art education. The use of a single GAI platform, DALL-E 2, limits the generalizability of the findings, relative to other generative AI platforms. It is also important to note that research utilizing more quantitative approaches to the study of GAI in art education may provide opportunity to further test the results reported in this qualitative exploratory investigation.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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