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ARTIFICIAL INTELLIGENCE AS A METHODOLOGICAL INNOVATION IN THE TRAINING OF FUTURE DESIGNERS: MIDJOURNEY TOOLS

Abstract. Applications of artificial intelligence are used in almost all spheres of human activity. Their use in the educational process at all levels of education is no exception. The article discusses the possibility of using a new generation of artificial intelligence Midjourney tools in the process of training future designers. A review of 2022 releases for creating complex, abstract or photorealistic images Stable Diffusion, DALL-E 2 and Midjourney. The analysis showed that Midjourney is most suitable for using artificial intelligence tools as a methodological innovation in training. The presence of an extended instruction on the formation of a prompt for the generation of an image stimulates non-standard new ways of thinking and allows you to expand the imagination of future design specialists. Midjourney developers recommend structuring the prompt by Subject, Medium, Environment, Lighting, Color, Mood, Composition. You can also use images from the Internet or add your own images. Any subscriber gets access to the gallery of Midjourney members. A survey of art students was conducted regarding the formation of a description of the proposed images. The result of image generation according to the students' description using the Midjourney tool is given. The analysis of the answers confirms our assumptions about the need to form fundamental knowledge of the principle of operation of the image generation application; insufficient knowledge in visual arts as such; low ability to integrate knowledge of, one might say, opposite fields - art and exact sciences (mathematics, artificial intelligence, etc.); the lack of skills in formulating a description of images through the expression of the main categories of visual art through the linguistic means of language, whether in English or in the mother tongue. Such a situation prompts the selection of methods and means for developing the ability to carry out a qualitative verbal description of images and the surrounding reality in order to popularize the possibility of using artificial intelligence technologies in the process of training future designers.

Keywords: artificial intelligence; generative artificial intelligence, artificial intelligence applications; image description; image generation; artificial intelligence in education; training future designers.

1. INTRODUCTION

> *«This isn't going to stop,» Mr. Allen said. «Art is dead, dude. It's over. A.I. won. Humans lost»* [1].

The annual Colorado State Art Competition in 2022 featured the work of Jason M. Allen of Pueblo West, Colo. «Théâtre D'opéra Spatial» was presented at the annual art competition. The author printed the image on canvas at a local print shop and submitted it to the division for «digital art/digitally manipulated photography», «the category's rules allow any artistic

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practice that uses digital technology as part of the creative or presentation process». «Mr. Allen's work, «Théâtre D'opéra Spatial», took home the blue ribbon in the fair's contest for emerging digital artists – making it one of the first A.I. – generated pieces to win such a prize...» [1].

The work of art was created by a new generation of artificial intelligence tools – Midjourney. The principle of operation of such applications is based on generating images based on hints and «built by scraping millions of images from the open web, then teaching algorithms to recognize patterns and relationships in those images and generate new ones in the same style. That means that artists who upload their works to the internet may be unwittingly helping to train their algorithmic competitors» [1].

Allen declined to provide the exact written order he gave Midjourney to create "Théâtre D'opéra Spatial".

Analysis of recent research and publications. Technology observer Kevin Roose considers the following chatbots to be the new generation of AI-powered chatbots.

- «ChatGPT. ChatGPT, the artificial intelligence language model from a research lab, OpenAI, has been making headlines since November 2022 for its ability to respond to complex questions, write poetry, generate code, plan vacations and translate languages. GPT-4, the latest version introduced in mid-March, can even respond to images (and ace the Uniform Bar Exam).
- Bing. Two months after ChatGPT's debut, Microsoft, OpenAI's primary investor and partner, added a similar chatbot, capable of having open-ended text conversations on virtually any topic, to its Bing internet search engine. But it was the bot's occasionally inaccurate, misleading and weird responses that drew much of the attention after its release.
- Bard. Google's chatbot, called Bard, was released in March to a limited number of users in the United States and Britain. Originally conceived as a creative tool designed to draft emails and poems, it can generate ideas, write blog posts and answer questions with facts or opinions.
- Ernie. The search giant Baidu unveiled China's first major rival to ChatGPT in March 2022. The debut of Ernie, short for Enhanced Representation through Knowledge Integration, turned out to be a flop after a promised "live" demonstration of the bot was revealed to have been recorded» [1].

As for tools for creating complex, abstract, or photorealistic images, the new products of 2022 include Stable Diffusion, DALL-E 2, and Midjourney. The emergence of such applications allows amateurs to create art and suggests that such software implementations are inherently a high-tech form of plagiarism.

A quantitative comparison of three popular systems in terms of their ability to generate photorealistic faces in the wild was conducted by Ali Borji [2]. The author presented a dataset of generated faces in the wild called GFW (Generated Faces in the Wild), including a total of 15,076 faces, and concluded that Stable Diffusion generates better faces than other systems, according to the FID (Fréchet Inception Distance) score [3].

In his work, the author makes a comparison of the three novelties of 2022 mentioned above:

1. Stable Diffusion [4], [5] Released by StabilityAI in 2022, this model is primarily used to generate detailed images conditioned on text descriptions. It can also be applied to other tasks such as inpainting, outpainting, and image translation. This model is trained on 512 × 512 images from a subset of the LAION-5B database. It uses a frozen CLIP ViT-L/14 text encoder to condition the model on text prompts. With its 860M UNet and 123M text encoder, the model is relatively lightweight and runs on a GPU with at least 10GB VRAM. We use the Colab notebook provided by Hugging Face2 [6] to run Stable Diffusion.

2. Midjourney [7]. This model was created by an independent research lab with the same name. It can synthesize images from textual descriptions and is currently in open beta. Midjourney tends to generate surrealistic images and is popular among artists. We used a collection of images generated by this model available via this Kaggle link.

3. DALL-E 2 [8], [9] is created by OpenAI and is a successor of DALL-E. It can create more realistic images than DALL-E at higher resolutions and can combine concepts, attributes, and styles. DALL-E 2 is trained on approximately 650 million image-text pairs scraped from the Internet. Since DALL-E 2 code is not available, we were not able to generate images on a large scale. We accessed the system via their portal by manually entering the prompts and saving the results.

Australian developer and digital specialist Hasan Tour has compiled a selection of seven services that can be used to generate images for free. The developer assures that these tools work no worse than the popular Midjourney neural network and are completely free. Here is what Hasan Tur advises: *Leonardo AI* is an image generator based on artificial intelligence that creates images in seconds; *Bing Image Creator* creates AI images based on a text request. The number of requests in the service is not limited; *Leap AI* – In addition to image generation, there is also the option to use Leap AI to create your own professional headshot; *Playground AI* – with the help of Playground it is possible to create any images. From animals to humans and more; *Pixlr* is another amazing tool that can help you create stunning realistic images for free; *Craiyon* is a free program that turns words into digital art; *DreamStudio* – creating a high-quality image in just a few seconds [10].

Ukrainian photographer Valery Veduta printed a children's book about an astronaut frog using artificial intelligence programs. The book is called «How a toad-frog became an astronaut». The basis for it was a story invented by the photographer, which he often told his son before going to sleep. The text for the publication was generated by the ChatGPT chatbot in response to a short query, and the illustrations were created by the Midjourney image generator [11].

The educational process at all levels of education is not left out of the picture with regard to the application of artificial intelligence innovations. The use of artificial intelligence in education brings new opportunities on the one hand and new challenges on the other. Educators and scientists are actively conducting various workshops and master classes to discuss the possibilities of using new tools. One of these events identified 11 AI services that will allow you to reach a new level in teaching right now. *Deepai* – AI for creativity in the classroom. DeepAI offers a set of tools that generates images based on text queries and has 11 styles in its free version (no registration required). *Paintbytext* is a picture-to-text chat. Edit your photos and create presentation materials based on written instructions with the help of AI (no registration required). *Bedtimestory* – AI for creating stories to read to children at bedtime. Create a story about your students or your child, specify the genre and artistic style. *Talk to Books* is a neural network that answers questions with quotes from books. It can handle abstract questions, such as «What is the meaning of life?» or «What does it mean to be human?». It does not yet recognize questions in Ukrainian, but it can be used in English classes. *MakeMyTale* is an innovative platform that allows you to create unique stories with the help of AI. Choose a topic, genre, characters, and the neural network will create a fairy tale with illustrations. There are free (5 stories) and paid plans. *Mubert* is a neural network that creates music based on a text query or a chosen genre or mood. *Kaiber* will create an animated video based on the specified image (30 credits for free, 1 video = 8 credits). *Pictury* extracts content from your Zoom, Teams, and webinars. Ideal for creating video content for social media. *ChatGPT* creates any text content, just write down the prompt correctly. It will also create exercises for classes and help you find the necessary information. *Microsoft Designer* is suitable for creating visuals and designs, both for lessons and for promoting

educational products. Tome creates entire stories from scratch or adds content at your request [12].

In order to determine the directions and typical scenarios that fall into the field of artificial intelligence in education, the authors [13] analyzed 47 works of the AIED magazine over three years (1994, 2004 and 2014). Two parallel, one might say global, directions of research are proposed: evolutionary and revolutionary. The evolutionary direction is focused on current practices in classes, collaboration with teachers, and the diversification of AI technologies and the field of education. The revolutionary direction follows the active introduction of artificial intelligence technologies into everyday student life, supporting their culture, practice, goals and communities.

Using the most common technologies of artificial intelligence (fuzzy logic, neural networks and genetic algorithms), developers offer a number of automated expert systems. One of these is a system for identifying the expert's competence for evaluating pedagogical phenomena and processes [14]. This system is developed on the basis of fuzzy logic, as one of the technologies of artificial intelligence and the use of both unclear and stochastic data.

Another interesting area of application of artificial intelligence technologies in education is the use of dialogue systems with artificial intelligence for teaching English as a foreign language (EFL), which effectively improve the reading, writing, and listening skills of university students [15].

Speaking of generative systems for converting text into images, they learn informative representations of image-text data. The key idea is using a diffusion model's ability to denoise a noised image given a text description of a label as a proxy for that label's likelihood [16]. The authors use their method to Imagen, using it to probe fine-grained aspects of Imagen's knowledge and comparing it with text encoder CLIP's (Contrastive Language-Image Pre-Training) zero-shot abilities.

As Ashraf Alam states: "Education is helped by AI in at least two ways: (1) the educational process – assistance and modifications to pedagogy and educator's routine function; and (2) the educational ambit and content – what kind of education is needed" [17].

Artificial intelligence in education (AIEd) which are characterized into three paradigms in this position paper [18]: AI-directed, learner-as-recipient, AI-supported, learner-as-collaborator, and AI-empowered, learner-as-leader. In three paradigms, AI techniques are used to address educational and learning issues in varied ways. AI is used to represent knowledge models and direct cognitive learning while learners are recipients of AI service in Paradigm One; AI is used to support learning while learners work as collaborators with AI in Paradigm Two; AI is used to empower learning while learners take agency to learn in Paradigm Three.

On the positive side, the awareness of the dynamism of the modern world, the need to master new technologies and their constant adaptation to educational needs, taking into account technological changes and innovations, make it possible to consider artificial intelligence tools not as a threat but as an auxiliary tool for professional activities, including education.

The **purpose of the article** is to evaluate the promising ways of using artificial intelligence, in particular the Midjourney chatbot tools, a methodological innovation, in the process of training future design professionals.

2. RESEARCH RESULTS

The practice of using artificial intelligence in art has been around for a long time. However, the biggest breakthrough in this direction was made by tools released in 2022: Stable Diffusion, DALL-E 2, and Midjourney. The use of this type of artificial intelligence allows art enthusiasts to create complex, abstract, or photorealistic works based on their

verbal description. This way of creating images makes it possible to conduct a comparative analysis of the resulting models with other existing categories such as paintings by famous artists, people themselves, animals, household items, etc.

Some researchers argue that artificial intelligence is playing an increasingly important role in the creative industries, opening a new era of art and technology, and AI tools help to create a completely new design vision in design concepts.

To study possible ways of using AI in the training of future designers, we conducted a survey of students of a higher education institution of the relevant specialty, the Polytechnic University of Valencia, Spain. In total, we received feedback from 39 respondents studying in the following specialties: Bellas artés, Fine Arts, illustration, Dibujo and pintura.

The questionnaire (Google form) offered three images taken from the Internet. The first image offered («Autumn Sunset») depicts nature, a river, and a boat at sunset (see Figure 1). «With a picture of a sunset, you will have sunshine in your house even on the gloomiest day». The second image, a work of art likely drawn by the famous British street artist Banksy, shows a gymnast in a neck brace performing with a ribbon over a hole in the wall of a building in Irpin. Irpin is another city near Kyiv, Ukraine, that has become synonymous with the worst crimes committed by the Russian army. Photos from the city have gone viral, showing civilians trying to flee the city under Russian shelling (see Figure 2). The third image is «Portrait of a Stranger with a Swan». The painting depicts a beautiful and graceful girl with curly hair that shimmers and plays in the sun. Bright lips shimmer in the light. Her face expresses tenderness and emphasizes her femininity. The swan on her arm is also a symbol of grace and beauty. The shapes of both figures gently blend together to create a harmonious image (see Figure 3). All images are entered in the survey form (https://docs.google.com/forms/d/e/1FAIpQLSfxl6E94Mw0TNJ0hwaBbdoy9_zLi2dyFHPMANPTHEv9VLeJ_Q/viewform?usp=sf_link).

Fig. 1. Autumn sunset

Fig. 2. Gymnast in a neck brace

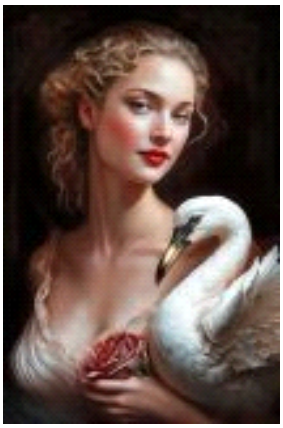


Fig. 3. Woman with a swan

When describing images, they were advised to avoid direct titles and authors' names, even if they recognized them, to use specific verbs and pay attention to small details in the image, to use concepts not only from the suggested ones but also additional ones that they thought would better express the image. They were also asked to describe the image according to the model proposed by the developers of Midjourney: «Think about:

Subject: person, animal, character, location, object, etc.

Medium: photo, painting, illustration, sculpture, doodle, tapestry, etc.

Environment: indoors, outdoors, on the moon, in Narnia, underwater, the Emerald City, etc.

Lighting: soft, ambient, overcast, neon, studio lights, etc.

Color: vibrant, muted, bright, monochromatic, colorful, black and white, pastel, etc.

Mood: Sedate, calm, raucous, energetic, etc.

Composition: Portrait, headshot, closeup, birds-eye view, etc.» [19].

However, the fact that these were recommendations from the authors of Midjourney was not communicated to the respondents, nor was it explained to them how and why they were describing the image. That is, the task was to convey the meaning of the image according to the scheme: Subject, Medium, Environment, Lighting, Color, Mood, Composition, Additionally.

As a next step, in order to possibly find patterns in the use of artificial intelligence products in the process of training future designers, we selected the respondents with the most non-standard answers. Those who described the image not only using the proposed concepts

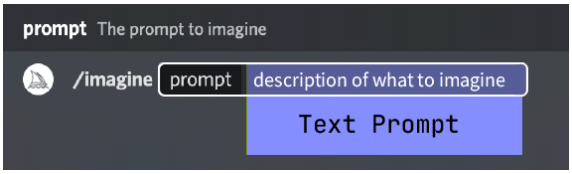
in certain categories of description. Based on such relevant descriptions, we generated several images in Midjourney.

We would like to remind you that according to the terms of Midjourney authors, there are three subscription levels. Each subscription plan includes access to the Midjourney contributor gallery, the official Discord, the general terms of commercial use, and more. If you are a subscriber at any time, you are free to use your images in any way you wish.

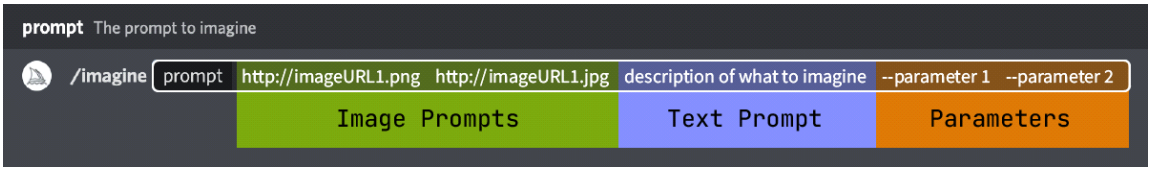
The Midjourney development team is an independent, self-funded research lab focused on exploring new ways of thinking and empowering the human imagination, human infrastructure, and AI [19].

To generate an image, you need to specify its description. Midjourney Bot uses so-called prompts. «A Prompt is a short text phrase that the Midjourney Bot interprets to produce an image. The Midjourney Bot breaks down the words and phrases in a prompt into smaller pieces, called tokens, that can be compared to its training data and then used to generate an image. A well-crafted prompt can help make unique and exciting images»[19].

The description can be simple, i.e., given by a single word, phrase, or emoji. A more complex description can contain several text phrases. You can also add an image to the description by typing or pasting the web address where the image is stored on the Internet. This address should end with an extension such as .jpg, .png, or .gif. To complete the description of the future image, you need to add additional text and parameters. If you use a link to the image in the description, it should be placed at the beginning (see Figure 4). For the description to work properly, it must either contain a link to two images or a link to one image and additional text. It is also possible to use multiple images in the description of a future image using the */blend* command. You can learn more about this feature by following the link [19].



a)



b)

Fig.4. Structures Prompts: a) simple basic prompt; b) advanced prompts.

In addition to using images from the Internet, Midjourney Bot allows you to use a personal image as part of the description of a future image. To do this, you need to upload a file and send a message, i.e. add the URL of the image to the prompt. To get the best results when using images, it is necessary to set their aspect ratio to the same as that of the future generated image.

In general, the developers' website provides general guidelines for writing a tooltip and how it can affect the final generated image. The length of the tooltip is taken into account. For the look of a unique generated image, a tooltip with a more detailed description is preferable, but not always. Very short tooltips allow Midjourney to use the default style. The developers recommend that authors focus on the main concept of the future image. In terms of grammar,

Midjourney does not understand grammar, sentence structure, or words the way humans do. However, the choice of words matters, and certain synonyms give a better desired result. If there are fewer words in the prompt, then each word will have a greater impact. You can use commas, brackets, and hyphens to organize your thoughts (the hint). According to the developers: «Midjourney Model Version 4 is slightly better than other models at interpreting traditional sentence structure» [19].

The result of the formulated clue can be a pleasant surprise. Whether the prompt is specific or vague does not matter, the missed concepts will also be randomized. A vague clue will provide variety, but at the same time, the image will lack specific details.

The combination of such concepts as artistic medium, historical periods, location, etc. in the prompt will allow Midjourney to create more interesting personalized results. However, all of these features of image generation prompts in Midjourney were not disclosed to the respondents.

To demonstrate the results of students' ability to formulate an image description, we selected several descriptions and generated images. The descriptions were selected based on the principle of the most complete and detailed description in our opinion. Here we present the most similar images generated by Midjourney for comparison with the proposed originals presented in the questionnaire (see Figure 5-7). «The generated link is unique for each account and should never be shared with others!».

Fig. 5. The result of generating the image «Autumn sunset»

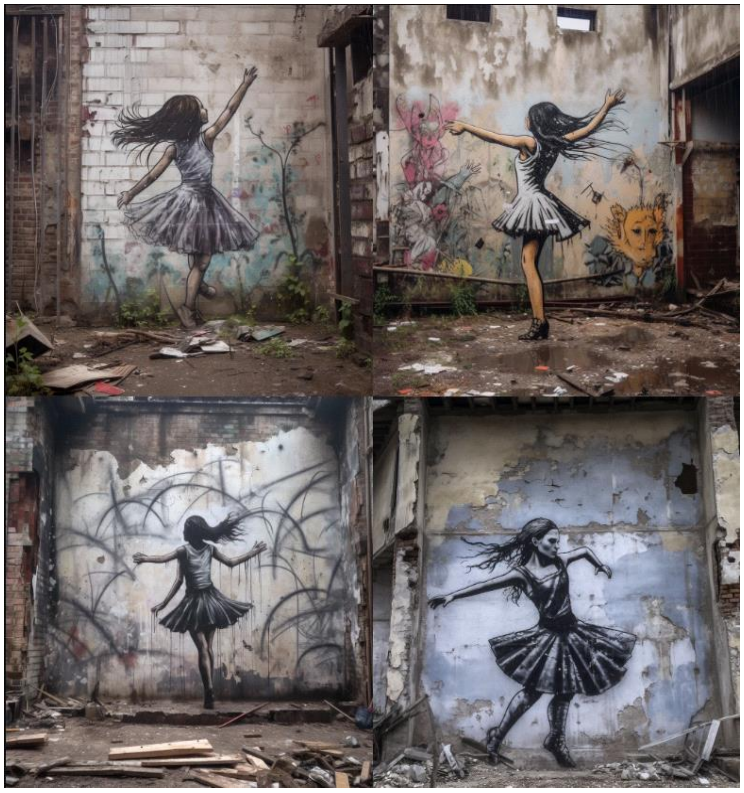


Fig. 6. The result of generating the image «Gymnast in a neck brace»

Fig. 7. The result of generating the image «Woman with a swan»

3. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

In the process of generating images based on students' descriptions, we tried to find common patterns that impede the effective use of artificial intelligence in the training of future design professionals. Based on the results, it can be concluded that in the vast majority of answers, students used the concepts that, in their opinion, characterize the image from those proposed in the question.

We can say that in general, the descriptions lack detailed image analysis. Quite often, the details of the image that are crucial are missing. For example, in the description of the third image, the most frequent answer is 'man and animal'. Although we see a young woman with a swan in her arms. Accordingly, in the absence of a clear indication of the main objects in the image, Midjourney defaults to showing a dog as the most popular animal among people.

Speaking about the smaller details of the images, in the description of the second image «Gymnast in a neck brace», only one respondent mentioned that the gymnast is wearing a neck brace. The presence of which prompts reflections on the reasons why she is wearing a neck brace. It also causes emotional tension, what mood the dancing gymnast in a neck brace wants to convey to the audience, what prompted her to dance in this state.

Analyzing the descriptions of the first painting «Autumn Sunset», almost all respondents successfully conveyed the color scheme of nature during sunset. However, the descriptions do not include the same list of the main objects in the painting, their location in relation to the natural landscape, and a detailed description, such as the ratio of the size of the water and the shoreline, the number of trees and their relative position, etc.

In our opinion, the reasons for the not so widespread use of any AI application may be as follows:

Lack of fundamental knowledge of how an image generation application works, i.e. lack of knowledge about neural networks as one of the artificial intelligence technologies Midjourney is based on;

Insufficient knowledge of the visual arts as such;

Low ability to integrate knowledge of, one might say, opposite fields – art and the exact sciences (mathematics, artificial intelligence, etc.);

Lack of skills in formulating a description of images through the expression of the main categories of visual art by linguistic means of language, whether in English or in the native language.

In our opinion, the reasons we have outlined are nothing more than a methodological innovation in the use of artificial intelligence in the process of training future designers, and constant work on improving it will yield positive results in general.

Accordingly, we see the prospect of further research on the possibility of using artificial intelligence technologies in the process of training future designers in the selection of ways and means to develop the ability to make a high-quality verbal description of images and the surrounding reality.

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ШТУЧНИЙ ІНТЕЛЕКТ ЯК МЕТОДОЛОГІЧНА ІННОВАЦІЯ У ПІДГОТОВЦІ МАЙБУТНІХ ДИЗАЙНЕРІВ: ІНСТРУМЕНТИ MIDJOURNEY

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Анотація. Застосунки штучного інтелекту використовуються практично в усіх сферах людської діяльності. Не є винятком і використання їх в освітньому процесі на всіх рівнях освіти. У статті розкрито питання можливості застосування нового покоління інструментів штучного інтелекту – Midjourney під час підготовки майбутніх дизайнерів. Проведено огляд новинок 2022 року для створення складних, абстрактних або фотореалістичних зображень Stable Diffusion, DALL-E 2 та Midjourney. Аналіз показав, що для використання інструментів штучного інтелекту як методологічної інновації в підготовці найбільше підходить Midjourney. Наявність розширеної інструкції щодо формування підказки для генерації зображення стимулює до нестандартних нових способів мислення та дозволяє розширювати можливості майбутніх фахівців дизайну. Розробниками Midjourney рекомендовано структурувати підказку за Subject, Medium, Environment, Lighting, Color, Mood, Composition. Також можна використовувати зображення з мережі Інтернет чи додавати власні зображення. Будь-який підписник отримує доступ до галереї учасників Midjourney. Проведено анкетування студентів мистецького напрямку щодо формування опису запропонованих зображень. Наведено результат генерації зображень за описом студентів інструментом Midjourney. Аналіз відповідей підтверджує наші припущення про: необхідність формування фундаментальних знань принципу функціонування додатка з генерації зображень; недостатні знання в зображувальному мистецтві як такому; низьку здатність до інтеграції знань, можна сказати, протилежних галузей – мистецтва та точних наук (математики, штучного інтелекту і ін.); відсутність навичок формулювання опису зображень через вираження основних категорій зображувального мистецтва лінгвістичними засобами мови чи то англійською, чи рідною мовою. Така ситуація наштовхує на добір способів та засобів для розвитку здатності здійснювати якісний словесний опис зображень та оточення задля популяризації можливості використання технологій штучного інтелекту у підготовці майбутніх дизайнерів.

Ключові слова: штучний інтелект; генеративний штучний інтелект; додатки штучного інтелекту; опис зображень; генерація зображень; штучний інтелект в освіті; підготовка майбутніх дизайнерів.

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