The usability of Images Generated by Artificial Intelligence (AI) in Education

Sayim Aktay, sayimaktay@gmail.com, Mugla Sitki Kocman University, Turkey, https://orcid.org/0000-0002-5301-0099

SUMMARY

In this study, the usability of images generated by artificial intelligence (AI) in education was attempted to be determined. For this purpose, the DALL·E AI tool developed by OpenAI was used. This research aims to determine the usability of images generated by artificial intelligence in education and the qualitative research design was used. Document analysis technique was selected as the most appropriate technique for examining images generated by artificial intelligence. In this context, images produced in categories determined based on the field text by artificial intelligence were examined according to criteria determined by the researcher. When the research findings are examined, it is seen that images generated by artificial intelligence are generally very effective and successful. Artificial intelligence can also visualize abstract concepts such as sports and entertainment, in addition to concrete concepts such as animals, landscapes and objects. The fact that almost all images generated by artificial intelligence give results in accordance with the text, and almost all of them are quite good. As a result, it is concluded that the potential for using images generated by artificial intelligence for educational purposes is high.

Keywords: Artificial intelligence, AI, Education

INTRODUCTION

In recent years, especially in terms of software, significant developments have been made with the rapid development of information and communication technologies. One of these developments is undoubtedly in the field of artificial intelligence. Today, tools created based on artificial intelligence can be used even through browsers on the internet and many useful tools are available. Therefore, these artificial intelligence tools can be used not only through desktop computers, but also through smartphones and tablets. While these tools can be used for personal purposes such as entertainment and usability, many artificial intelligence tools have the potential to be used for educational purposes.

When the field text is examined, it is seen that it is quite difficult to make a definite definition of artificial intelligence. Wang (1995) states that there is a continuous need for updating the definition due to the continuous development and change of artificial intelligence. Artificial intelligence has been defined as a science and engineering that produces intelligent machines, especially intelligent computer programs, by McCarthy (2007). Artificial intelligence is defined by Encyclopedia Britannica (Encyclopedia Britannica, 2022) as the ability of a digital computer or computer-controlled robot to perform tasks that can be done by intelligent beings. In addition, there are suggestions to prioritize the dimensions of artificial intelligence skills and abilities rather than a specific definition (Schuett, 2019). For all these reasons, artificial intelligence is an interdisciplinary phenomenon that includes fields such as anthropology, biology, computer science, linguistics, philosophy, and neuroscience (Luckin et al., 2016).

Artificial intelligence offers educators the opportunity to use it in the educational process as an assistant to the teacher, in addition to its use in creating personalized learning environments and providing feedback to students. In this context, the use of artificial intelligence tools in education has increased in recent years. However, despite the potential of artificial intelligence in education, there are also concerns about its potential negative effects on education. These negative effects, which can be caused by the use of artificial intelligence in education, include the risk of reducing the role of the teacher, the risk of reducing the creativity and critical thinking skills of students, and the risk of increasing the gap between students with high and low socio-economic status (Luckin et al., 2016).

Since Allen (1998) stated that artificial intelligence is at a turning point and will change many things in the future, it has gained momentum especially in recent years. As artificial intelligence becomes more prevalent in people's lives, its potential for use in different dimensions, such as education, healthcare, and food and drink, increases (Yang et al., 2021). Artificial intelligence can help educators by assisting with routine tasks in the teaching process and determining what type of training is necessary in the field of education (Alam, 2021). When the use of artificial intelligence in education is examined in the literature (Zhai et al., 2021), it is seen as an important requirement for presenting how artificial intelligence can be used for goals such as students' academic achievement.

Checked with a plagiarism detection software

In recent years, many tools that change users' lives and provide convenience in the field of artificial intelligence have emerged. For example, Google Translate, which offers translation in more than 100 languages, can work through a browser and automatically perform very accurate translations (Recent Advances in Google Translate – Google AI Blog, n.d.). In addition, tools such as Siri (Siri - Apple (IN), n.d.) and Google Assistant (Google Assistant, Your Own Personal Google, n.d.), which allow people to ask questions and get answers, have become an integral part of smartphones. Recently, tools such as ChatGPT (ChatGPT: Optimizing Language Models for Dialogue, n.d.) can quickly perform skills such as answering any questions, explaining, providing examples, writing poetry or stories, and summarizing text. Therefore, when the artificial intelligence-based tools that have been developed so far are examined, it can be predicted that education and the education system will change and be updated in a fundamental way.

In addition to all of these, there have been significant developments in image processing and generation in recent years. Examples of this include the This Person does not Exist tool, which can generate images of people that do not exist in reality (This Person Does Not Exist, n.d.), and the Quick, Draw tool, which tries to identify what people draw on the screen within 20 seconds (Quick, Draw!, n.d.). In addition, visual services produced based on texts expressed in natural language are also very advanced today. Examples of tools that allow text input to produce realistic images include Stable Diffusion (Stable Diffusion Online, n.d.) and Imagen: Text-to-Image Diffusion Models (n.d.).

This study aims to determine the usability of images produced with artificial intelligence in education. For this purpose, the DALL·E artificial intelligence tool developed by OpenAI was used. DALL·E (DALL·E 2, n.d.) is a new artificial intelligence system that can produce realistic images and artwork based on expressions defined in natural language. The need for this study is important because the use of AI-generated images in education has the potential to transform the way that students learn and could lead to more effective and efficient educational outcomes. Therefore, this study could be an important resource for educators, researchers, and other stakeholders interested in exploring the potential of these technologies in education.

METHOD

This study, which aims to determine the usability of images produced with artificial intelligence in education, adopted a qualitative research design. Document analysis technique was chosen as the most appropriate technique for examining the images produced by artificial intelligence, so this technique was preferred. In this context, the Images created in the categories determined based on the literature on artificial intelligence were analyzed by the researcher according to predetermined criteria. The visual categories determined by the researcher are people, animals, landscapes, objects, abstract concepts, nature, food and drinks, sports, entertainment, historical and cultural environments, and absurd images.

These images produced by artificial intelligence were examined according to the criteria of liveliness, appropriateness to text, and regularity. In this context, attention was paid to whether the resulting image was lively and impressive, how well it was suited to the created text, and whether it was properly formed without distortion.

FINDINGS

In line with the aims of the study, the images produced with artificial intelligence were examined in the context of categories.

Images created in the "People" category

In the "people" category, artificial intelligence was used to create images of a single person, groups of people, and two people interacting. The resulting images are shown below.
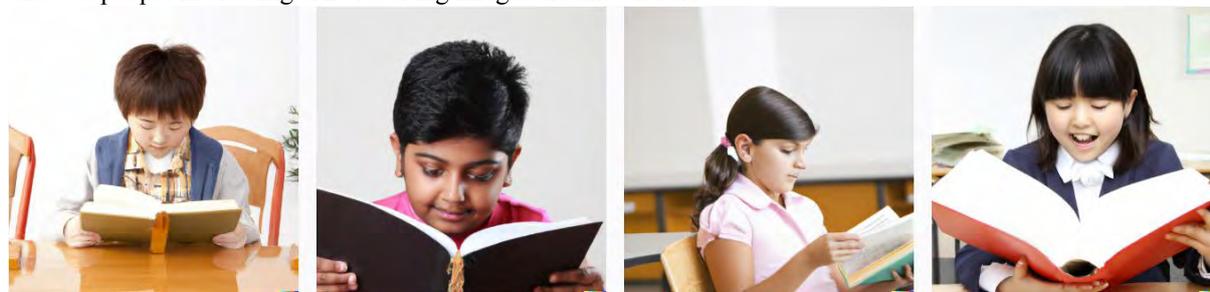

Figure 1. A child reading a book

Figure 2. A group of people standing upright

Figure 3. A man and a woman shaking hands

Upon examination of the images of people produced by artificial intelligence, it was seen that there were small distortions around the eyes in the "a child reading a book" images. This situation is somewhat more prevalent in the "a group of people standing upright" images and is quite disturbing. However, the "a man and a woman shaking hands" images are relatively more smoothly formed. All the Images created in the "People" category are very lively and clear images and are produced in a manner that is consistent with the text.

Images created in the "Animals" category

In the "animals" category, artificial intelligence was used to create images of a domestic animal, wild life, and farm animals. The resulting images are shown below.
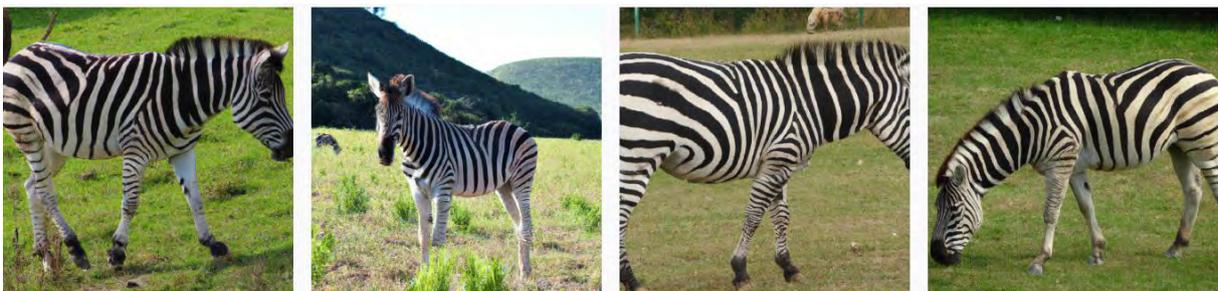

Figure 4. A domestic cat

Figure 5. A zebra in a meadow

Figure 6. Cows on a farm

Upon examination of the images of animals produced by artificial intelligence in the "Animals" category, all of the "a domestic cat", "a zebra in a meadow", and "cows on a farm" images are smoothly formed and produced without any striking distortion. At the same time, these images are lively and aesthetically pleasing and are produced in a manner consistent with the text. However, some zebra images show zebras extending out of the frame. This problem can be eliminated by selecting all the visible images instead of those in this form.

Images created in the "Landscapes" category

In the "landscapes" category, images of mountains, forests, beaches, and deserts were produced. The resulting images are shown below.
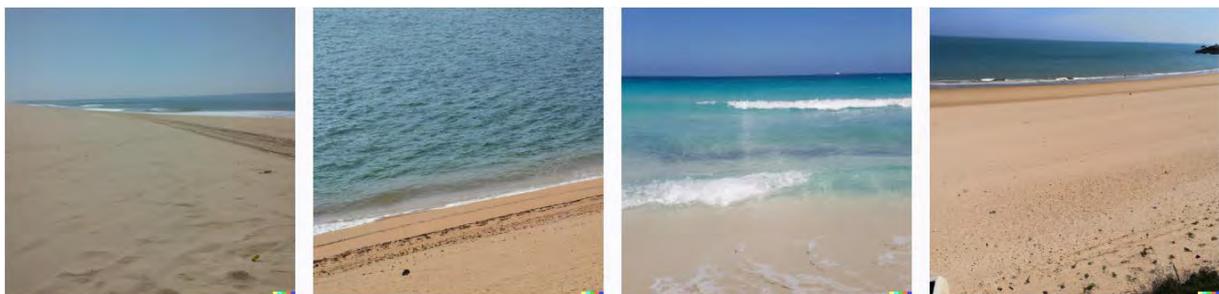

Figure 7. Mountains covered in snow

Figure 8. A beautiful sea and a beach

Figure 9. A waterfall surrounded by trees

Upon examination of the "Snow-covered mountains", "a beautiful sea and a beach", and "a waterfall surrounded by trees" images produced by artificial intelligence, it is particularly seen that the mountain and waterfall images are very lively and aesthetic. All the images in this category are produced without any distortion and, again, in a manner consistent with the text.

Images created in the "Objects" category

In the "objects" category, images of buildings, vehicles, and household items were produced. The resulting images are shown below.

Figure 10. An apartment with a view of the blue sky

Figure 11. A red train

Figure 12. A laptop computer

Upon examination of the images of objects produced by artificial intelligence in the "Objects" category, it can be seen that the "an apartment with a view of the blue sky", "a red train", and "a laptop computer" images are smoothly produced. The liveliness and aesthetic stance of the images is flawless. However, in some images related to the apartment, the apartment is slightly in the background while the laptop computer extends out of the screen in almost all images. However, all the images in this category are produced without distortion and in a manner consistent with the text.

Images created in the "Abstract" category

In the "abstract" category, patterns and shapes that do not fit into any other category were produced. The resulting images are shown below.

Figure 13. Tree pattern

Figure 14. Intertwined geometric figures

When examining the "tree pattern" and " intertwined geometric figures" images produced by artificial intelligence, it is possible to say that the liveliness and clarity of the tree patterns are somewhat low, although it can also be stated that this is also due to the type of pattern desired. On the other hand, it can be said that the images related to geometric shapes are quite lively and aesthetic. In addition, all images have produced results that are consistent with the text, and there has been no distortion.

Images created in the "nature" category

In the "nature" category, plant, flower and tree images were created. The images created by artificial intelligence in the nature category are as follows.

Figure 15. A pine tree

Figure 16. Red roses

Figure 17. A mushroom

In the Nature category, when the "a pine tree", "red roses", and "a mushroom" images created by artificial intelligence are examined, all of the images created are quite lively and colorful. However, it is noteworthy that some of the tree images have disruptions or blurriness. In addition, the fact that the tree and mushroom images were created with different angles and compositions can also offer different options for the person who will benefit from the image. All images created in the Nature category are suitable for the text.

Images created in the "Food and Drink" Category

In the "food and drink" category, various food and drink images have been created and these images are as follows.
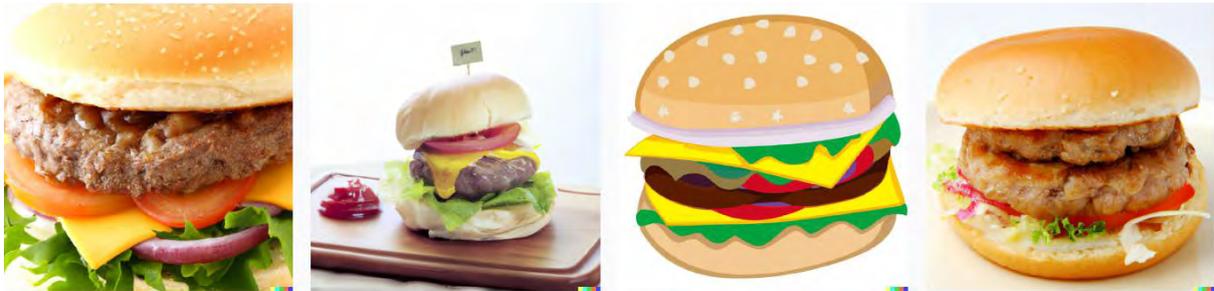

Figure 18. A hamburger

Figure 19. A jug of fruit juice

Figure 20. Food on a table

When the images of "a hamburger", "a jug of fruit juice", and "food on a table" in the food and beverage category are examined, it is seen that all of the images are real photographs except for one being in the form of a

drawing. All of the images are very colorful. In addition, it is noticeable that the images are created in a very aesthetically pleasing and text-appropriate manner.

Images created in the "sports" category

In the "sports" category, images of various sports and sporting activities have been created. These images created by artificial intelligence in the sports category are as follows.

Figure 21. Tennis game

Figure 22. Football game

Figure 23. Bicycle riding

When the "tennis game", "football game", and " bicycle riding" images created by artificial intelligence are examined, it can be said that they are all lively images in terms of color. However, in the soccer-related image, there is a poster-style content in a different language and deformities in human figures. However, both soccer and bike images show overflows outside the screen. Therefore, by providing explanatory inputs to the artificial intelligence tool on this issue in the images to be used, such a problem can be prevented.

Images created in the "Entertainment" category

In the "entertainment" category, events such as music, movies, and dancing have been created. These images created by artificial intelligence in the entertainment category are as follows.
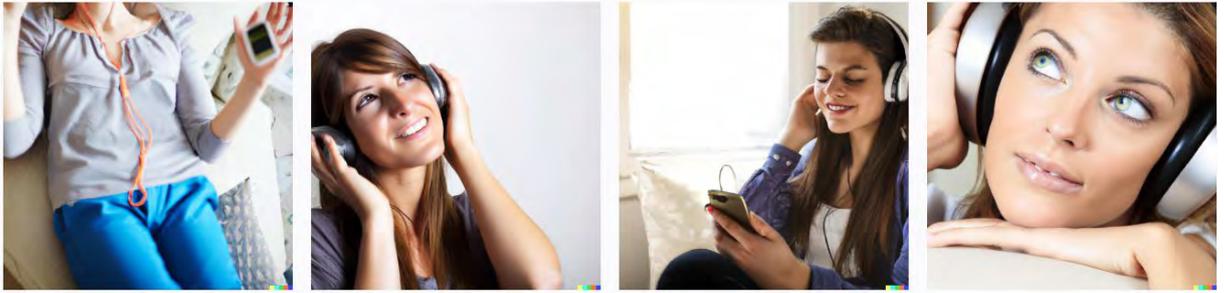
Figure 24. Listening to music

Figure 25. Watching a movie at the cinema

Figure 26. Dancing

When the "listening to music", "watching a movie in the cinema", and "dancing" images created in the entertainment category are examined, it is seen that all of the images are quite realistic and lively. Only silhouette has been used in the dancing image. Although there are small deformities on the faces of people in the music-related images, it is relatively better. However, deformities in human figures in cinema-related images are more disturbing. In addition to all of these, the images created are text-appropriate and do not produce an unwanted result.

Images created in the "Historical and cultural environments" category

In the category of "historical and cultural environments", images of monuments and castles, as well as the Eiffel Tower, which is an element of culture existing in the real world, have been created. The artificial intelligence images created in this category are as follows.

Figure 27. A tomb

Figure 28. A historical castle

Figure 29. The Eiffel Tower

When the images of "a tomb", "a historical castle", and "the Eiffel Tower" created in the category of historical and cultural environments are examined, it is seen that all of the images are surprisingly realistic, lively, and in accordance with the historical texture. In addition, the images of the Eiffel Tower, which exists in reality, are also noteworthy for being in accordance with reality. Although there are overflows outside the screen in some images, all of the images produced are text-appropriate.

Images created in the "Absurd images" category

In the category of "absurd images", images depicting situations that would normally not be possible and absurd have been created. The images created in this category are as follows.

Figure 30. A wolf and rabbit watching the sunset together

Figure 31. A robot with a hat and mustache, smiling

Figure 32. A pixelated blackboard and teacher in the style of a Mario game

When the images of "a wolf and a rabbit watching the sunset together", "a robot with a hat and mustache smiling", and "a pixelated teacher and blackboard in the style of a Mario game" created in the category of absurd images are examined, it is seen that all of the images have a text-appropriate and correct output. However, it is seen that the wolf and rabbit images are more in the style of animation graphics, and the robot image is in the form of a drawing. The pixelated teacher image in the Mario style is very successful and exactly as desired.

CONCLUSION AND DISCUSSION

When the findings of the research are examined, it can be seen that the images created by artificial intelligence are generally very effective and successful. There may be problems when using the images in the human category for training purposes due to deformities in places such as the eye area. However, this problem will disappear in images that do not have a human face or are turned towards the back.

The images in the categories of animals, landscapes, objects, abstract concepts, nature, food and beverages, sports, entertainment, historical and cultural environments, and absurd have a good potential for use for training purposes in terms of liveliness, aesthetics, and color. Therefore, while concrete concepts such as animals, landscapes, and objects can be visualized with artificial intelligence, abstract concepts such as sports and entertainment can also be visualized. The fact that almost all of the images produced by artificial intelligence are text-appropriate is also a very positive output. In conclusion, the potential for using images produced by artificial intelligence for training purposes is very high.

Based on the research findings, the possible contributions of images produced by artificial intelligence in the field of education can be expressed as follows:

- Enriching teaching activities. Images produced by artificial intelligence can help to explain topics and ideas in a more interactive and lively manner. For example, lessons in subjects such as biology can be better understood by visualizing live examples.
- Avoiding problems with copyrights. Since images produced by artificial intelligence are original and unique, they can be considered more reliable because they eliminate the copyright problems that may occur with images taken from environments such as the internet.
- Recreate events. Historical or social events can be recreated and visualized using artificial intelligence images.
- Concretize teaching content. Abstract lesson content can be visualized, enabling students to learn more easily and permanently.
- Enrich internet-based education. In addition to being able to create all the images needed by teachers when working on lessons over the internet, they can also be used for the purpose of creating interactive images.
- Eliminate concept misunderstandings. Students can test whether the images in their minds are correct by creating correct images from what they write.
- Eliminate the problem of insufficient content. Sometimes, the image that is searched for with the keyword or text on the internet may not be available. Therefore, the important problem of not being able to create any kind of image for educational purposes is eliminated by artificial intelligence-generated images, which can create any kind of image for educational purposes.

Based on the research findings, besides all these benefits, it is possible to express the disadvantages of using artificial intelligence-generated content as follows:

- Low quality: Some images may have imperfections or be pixelated, which can be problematic in terms of visuals.
- Copyright: Although the images are unique, the AI service that generates them may hold the copyright for them. Therefore, care must be taken.

- Inability to produce accurate output: Some images produced for certain texts may not match the texts. Therefore, different texts can be used to create images.

Based on the research results, the following recommendations can be made for researchers:

- Different image generation services can be used to obtain different results than those obtained using DALL·E, which was used to create the images in this research.
- Detailed studies can be conducted by conducting studies on the use of AI-generated images directly in educational and teaching environments.

REFERENCES

Alam, A. (2021). *Possibilities and Apprehensions in the Landscape of Artificial Intelligence in Education; Possibilities and Apprehensions in the Landscape of Artificial Intelligence in Education*. https://doi.org/10.1109/ICCICA52458.2021.9697272

Allen, J. F. (1998). AI growing up: The changes and opportunities. *AI Magazine*, *19*(4), 13–23.

ChatGPT: Optimizing Language Models for Dialogue. (n.d.). Retrieved December 30, 2022, from https://openai.com/blog/chatgpt/

DALL·E 2. (n.d.). Retrieved December 30, 2022, from https://openai.com/dall-e-2/

Encyclopedia Britannica | Britannica. (n.d.). Retrieved December 30, 2022, from https://www.britannica.com/

Google Assistant, your own personal Google. (n.d.). Retrieved December 30, 2022, from https://assistant.google.com/#?modal_active=none

Imagen: Text-to-Image Diffusion Models. (n.d.). Retrieved December 30, 2022, from https://imagen.research.google/

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An argument for AI in education. In *Pearson Education*. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/Intelligence-Unleashed-Publication.pdf

Mccarthy, J. (2007). W*hat is artificial intelligence?* http://www-formal.stanford.edu/jmc/

Quick, Draw! (n.d.). Retrieved December 30, 2022, from https://quickdraw.withgoogle.com/

Recent Advances in Google Translate – Google AI Blog. (n.d.). Retrieved December 30, 2022, from https://ai.googleblog.com/2020/06/recent-advances-in-google-translate.html

Schuett, J. (2019). A Legal Definition of AI. *Article in SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3453632

Siri - Apple (IN). (n.d.). Retrieved December 30, 2022, from https://www.apple.com/in/siri/

Stable Diffusion Online. (n.d.). Retrieved December 30, 2022, from https://stablediffusionweb.com/

This Person Does Not Exist. (n.d.). Retrieved December 30, 2022, from https://thispersondoesnotexist.com/

Wang, P. (1995). *On the Working De nition of Intelligence 1 To De ne Intelligence*. 1–32.

Yang, S. J. H., Ogata, H., Matsui, T., & Chen, N. S. (2021). Human-centered artificial intelligence in education: Seeing the invisible through the visible. *Computers and Education: Artificial Intelligence*, *2*, 100008. https://doi.org/10.1016/J.CAEAI.2021.100008

Zhai, X., Chu, X., Chai, C. S., Siu, M., Jong, Y., Istenic, A., Spector, M., Liu, J.-B., Yuan, J., & Li, Y. (2021). *A Review of Artificial Intelligence (AI) in Education from 2010 to 2020*. https://doi.org/10.1155/2021/8812542