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The Comparison of Pre-Service Science Teachers' Drawings of the “Universe” Concept and the Universe Visuals They Created from Artificial Intelligence

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As the use of artificial intelligence increases in areas where people are active in our daily lives such as education and health, the comparison of human and artificial intelligence has started to be discussed. Many artificial intelligence programmes are commanded by humans and artificial intelligence creates products in line with expectations. In this study, it is aimed to compare the drawings of pre-service science teachers about the concept of universe with the universe visuals created by artificial intelligence. Case study was selected as the research model. The study group consisted of 24 pre-service science teachers studying in the 2nd and 4th grades of science teaching. The worksheet prepared by the researchers and the received expert opinion was used as a data collection tool. During the application process, pre-service teachers made drawings related to the concept of universe and described these drawings during two lesson hours. Then, they made drawings related to the concept of universe of artificial intelligence with the descriptions they entered into Microsoft Bing Search application. As a result, it was determined that pre-service teachers had different views in their drawings about the concept of universe. It is seen that the drawings of the pre-service teachers about the concept of universe and the visuals created by artificial intelligence are mostly like each other. In half of the drawings, the universe drawings of the pre-service teachers were more comprehensive, while in half of the drawings, artificial intelligence made more comprehensive drawings. Based on this result, it can be said that human perception and artificial intelligence products are in parallel with each

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other. Various suggestions were presented in line with the results of the study.

Introduction

Artificial intelligence (AI) can be defined as a field of computer technology that enables machines to emulate cognitive processes such as learning, decision-making and problem-solving (Winston, 1992). Nilsson (1998) stated that the long-term goal of AI is to "develop machines that can perform tasks that humans can do at least as well, or even better". Öztürk and Şahin (2018) emphasized that the most salient feature of artificial intelligence is its capacity for rapid learning and permanent acquisition of knowledge.

A plethora of studies conducted over the past five decades has identified three distinct stages of development for artificial intelligence. The initial stage is designated as Artificial Narrow Intelligence. This initial phase is also referred to as "Weak AI", and its objective is to devise systems that are designed to address straightforward problems (Jajal, 2018). The subsequent stage, termed Artificial General Intelligence, aims to achieve machine intelligence capable of learning and comprehending complex intellectual tasks. This stage should enable machines to perform tasks such as problem-solving, reasoning, analysis, language learning, strategic planning and decision-making (Hunet & Bowen, 2024; Salmi, 2023). The fundamental distinction between these two stages is that the second stage possesses the capacity to learn independently, without the necessity of a commander or trainer. This stage, termed Artificial Superintelligence, signifies the culminating phase of artificial intelligence. Philosopher Nick Bostrom of Oxford University defines artificial superintelligence as "any intelligence that greatly exceeds human cognitive performance in almost all areas of interest" (Jajal, 2018). A substantial corpus of research and studies conducted by scientists has been published on this subject, and it can be argued that super artificial intelligence, which is the final stage of artificial intelligence, will possess consciousness that is not found in the first two stages. Thanks to this consciousness, it can become more intelligent than humans (Çeken & Akgöz, 2024).

In 1950, Alan Turing initiated his study *Computing Machinery and Intelligence* with the question "Can machines think?". He asserted that the resolution to this question could not be ascertained through the delineation of the terms "machine" and "thinking". Instead, he proposed the Imitation Game as a test to determine whether machines could think (Turing, 1950). This test is also known as the Turing test. In this test, a human and a computer are hidden from the interrogator conducting the experiment. The experimenter communicates with both parties without knowing which person is the intended recipient. The objective of the Turing test is to ascertain whether a machine is capable of logical thinking (Çeken & Akgöz, 2024).

It is widely acknowledged that Alan Turing is regarded as the progenitor of artificial intelligence. However, the term "artificial intelligence" was first coined by John McCarthy during a workshop that took place at Dartmouth College in 1956. John McCarthy (1927-2011) defined artificial intelligence as the science and engineering of developing intelligent machines and intelligent computer programs (Coşkun & Gülleroğlu, 2021).

AARON is one of the earliest systems that springs to mind when considering artificial intelligence and the creation of visual art and design products that display an element of creativity. The system was developed by British painter Harold Cohen in 1973. AARON's initial modus operandi was abstract. However, it underwent a developmental process that led to the creation of colored drawings in 1986. After this development, the system was taught to

design a wide variety of objects, including three-dimensional forms, animals, plants and people (Sawyer, 2012).

OpenAI has developed DALL-E (openAI, 2021), a 12 billion parameter version of GPT-3 that can generate images from text descriptions using a text and image dataset (Ramesh et al., 2021). Text-to-image systems such as DALL-E provide users with a series of images that depict the scene described in the text within a few seconds (Taluğ & Eken, 2023). McNeill (1972) described text-to-visual generation in artificial intelligence as 'describing something that is unformed and is like trying to describe a color that does not exist' (McNeill, 1972). It can be posited that these systems are object-oriented in nature (Taluğ & Eken, 2023).

The software utilizes artificial intelligence algorithms that generate images from text, incorporating coding designed to produce images within a digital environment that aligns with the user's request. In such software, the process commences upon the entry of data into the text box. Each data entry, or prompt, within the software can influence the subsequent image in a variety of ways (Aydın, 2024). To ensure the generation of the intended image, it is imperative that the text input is both correctly composed and comprehensible to the algorithm. The form and content of the generated image is subject to variation based on the particulars of the text input (Aydın, 2024). While these systems can generate novel images, their functionality is constrained to statistical combinations of pre-existing images. Consequently, they impede the emergence of novel styles or concepts (Taluğ & Eken, 2023).

In the contemporary era, there was an integration of OpenAI's GPT language model into the Microsoft Bing Chatbot, which is driven by artificial intelligence. This sophisticated technology enables the crawling of websites, the indexing of content, and the generation of results that are pertinent to the user's search query. The term "chatbot" is open to interpretation. Barış (2020) defines chatbots as "artificial intelligence-supported chatbots designed to interact with people through text messaging, voice interaction or visuals, answering their questions and helping them." Chatbots are further defined as artificial intelligence programs that mimic the human communication process by using text, visual or listening methods, answering questions like humans and using the most frequently matched keywords in this communication (Kane, 2016; Say, 2018). Uzun et al. (2021) used the term 'dialog-based training systems for chatbots' (İncemen & Öztürk, 2024).

Bing search engine employs sophisticated algorithms to categorize its results into various types of content, including text, images, video, and news. The developer has realized these algorithms by integrating the Chat GPT developed by OpenAI into the Microsoft Chatbot. The Bing search engine was initially developed using the C Sharp programming language by Microsoft in 2009. The query results presented by the Bing search engine include images, websites, content, video, maps, translation, news, travel, health and online games (Keleş, 2023). When queries are typed into the search bar, an AI-powered chatbot responds to the questions (Turğal & Küçükerdoğan, 2023). Bing AI employs natural language processing to facilitate interaction with users through chat. This interaction facilitates the provision of responses to user queries and the generation of suggestions (Sivri, 2024).

A review of the extant literature reveals that, despite the considerable amount of time that has elapsed since the advent of artificial intelligence applications, the impact of these applications in the field of education has been limited. Nevertheless, the education system worldwide is undergoing perpetual transformation in accordance with the integration of artificial intelligence applications. The integration of artificial intelligence into education is a subject that has been

extensively discussed. A plethora of predictions and conjectures have been proffered. A significant proportion of these predictions and thoughts are focused on which tasks of teachers can be replaced by these applications in the classroom (İşler & Kılıç, 2021). Presently, there are several applications that utilize artificial intelligence technologies. A notable example is SHOLAR, which was developed as an artificial intelligence application within smart education systems. Intelligent tutoring systems are among commonly used applications of artificial intelligence in education (Uzun et al., 2021). These applications offer customized learning environments, enabling each student to progress at their own pace.

In the report of the sixth artificial intelligence workshop organized by the Institute of Education Industry and Technology (ESTEN), it was mentioned that "Smart Classroom Behavior Management" could be realized thanks to image processing technologies. The system under discussion is said to rely on the deployment of cameras within the classroom setting, with the capacity to capture images at 30-second intervals. Consequently, educators would be equipped with the capability to ascertain which segments of the lesson students are demonstrating engagement in, and which segments do not align with their interests. Furthermore, it was posited in the workshop that these technologies could be installed at the entrances and exits of schools with a view to controlling attendance (İşler & Kılıç, 2021).

In the field of artificial intelligence and education, research has demonstrated substantial contributions of artificial intelligence to the educational sector. The potential benefits of AI in education have been well-documented, and it has been posited that an AI-based education can yield optimal benefits. It can thus be concluded that the earlier students are introduced to AI, the higher the quality of education will be.

Astronomy is widely regarded as one of the most ancient sciences, playing a pivotal role in human life throughout history and consistently capturing the public's attention and interest. From this standpoint, astronomy can be defined as a discipline encompassing the entire universe. A study was conducted by Özkan and Kayhan (2021) to ascertain the views of pre-service science teachers on the universe and its properties. The analysis revealed a predominant focus among participants on the energy-matter cycle and the Big Bang as explanatory frameworks for the universe's structure. It was also noted that none of the participants mentioned the concepts of dark matter or dark energy. In a separate study, Emrahoğlu and Öztürk (2009) examined the level of understanding and misconceptions of pre-service science teachers regarding these concepts. The study revealed that pre-service teachers perceived the universe as the sky and expressed a worldly conception of the universe. Bolat and Değirmenci (2020) sought to ascertain the cognitive structure of eighth-grade students in middle school in relation to fundamental concepts in the "World and Universe" learning domain. The study employed a word association test as a research method, and the findings indicated that the students exhibited a deficiency in scientific knowledge concerning the universe.

In this study, it was aimed to compare pre-service science teachers' drawings of the universe concept with the universe visuals created by artificial intelligence. Thus, there will be an opportunity to compare the creativity of pre-service science teachers about the concept of universe, which is a macro level concept, with the creativity of artificial intelligence. By comparing the images of pre-service science teachers about the concept of universe with artificial intelligence, their superiorities and weaknesses will be discussed. It is planned to reveal whether the drawings of pre-service science teachers or artificial intelligence are more explanatory about the concept of universe. The reason for selecting pre-service science teachers for the study is that they will be teaching this concept in secondary school science courses.

Therefore, their views on this concept are expected to be accurate and complete (McNamara, 1991; Murhpy, 2012). This study analyses how pre-service teachers' cognitive processes and their interactions with artificial intelligence are shaped and examines how artificial intelligence can contribute to education. Within the scope of the study, comparing the cognitive levels of pre-service teachers with artificial intelligence is important in terms of answering the question of artificial intelligence or human, which is a much-debated issue today. In this context, it is aimed to answer this question by determining which one makes better drawings. It is thought to be a guiding study for researchers working in this direction.

The research questions guiding this study are as follows:

- (1) How do pre-service science teachers experience the process of creating artificial intelligence-supported visuals?
- (2) How do pre-service science teachers' drawings provide clues about their scientific thinking processes when compared with the artificial intelligence-supported visuals?
- (3) What are the similarities and differences between pre-service science teachers' drawings of the universe concept and the visuals generated by artificial intelligence?

Method

In this study, the qualitative research method was employed to facilitate a comparative analysis of pre-service science teachers' drawings of the universe concept and the universe visuals generated by artificial intelligence. Qualitative research is an appropriate approach to examine participants' experiences, thoughts and perceptions in depth (Creswell & Poth, 2016). Since this study aims to examine the drawings of the participants and the artificial intelligence in detail and compare them with each other, it is compatible with the nature of qualitative study.

Research Design

The present study was designed in the case study design. The utilization of case studies is advantageous in that they facilitate a detailed examination of a specific phenomenon, thereby yielding in-depth answers to research questions (Yin, 2018). In this study, the pre-service teachers' drawings and the visuals they created with artificial intelligence were qualitatively evaluated, and their mental representations of the concept of the universe were analyzed. The utilization of case studies is well-suited to the meticulous analysis of individuals' perceptions within a defined context (Creswell & Poth, 2018). Consequently, it can be posited that the case study approach is more appropriate for research design.

Participants

The participants of the study comprised twenty-four pre-service science teachers enrolled in the second and fourth years of their science education programme at a state university. The participants were determined by purposive sampling method. Purposive sampling is a method of data collection that allows for greater depth by selecting individuals who meet specific criteria (Patton, 2015). The inclusion criteria of the participants in the study were that they had taken a course on technology applications in education and that they were interested in artificial intelligence applications.

The class and gender distributions of the pre-service teachers are shown in Table 1 below.



Table 1. Class and gender distribution of pre-service teachers

Gender	Grade 2	Grade 4
Female	7	13
Male	1	3
Total	8	16

Data Collection Tools

The study utilized worksheet as data collection instruments. The tool was developed by researchers and the developed worksheet was examined by three science education experts to ensure content validity. With worksheets, pre-service teachers were asked to make drawings related to the concept of universe and to describe these drawings. The worksheet gives pre-service teachers the opportunity to compare both their own drawings and artificial intelligence visuals. Then, pre-service teachers were asked whether the universe visual of artificial intelligence was similar to their own drawings. This process involved the collection and analysis of both visual data and descriptive statements.

Data Analysis

The data obtained were analysed by descriptive analysis method. Descriptive analysis allows the data to be classified and interpreted under certain themes (Miles & Huberman, 1994). The similarities and differences between the drawings and the visuals generated by artificial intelligence were analysed and the drawings of the pre-service teachers were evaluated in this study.

Validity and Reliability

A triple control mechanism was employed to ensure the validity and reliability of the study:

- (1) Triangulation: Both drawings and written descriptions were analyzed to verify data from multiple sources (Denzin, 2017). In order to ensure this, the universe visuals and universe descriptions drawn by the pre-service teachers on the worksheets were compared.
- (2) Participant Verification: The accuracy of the data obtained from the participants was confirmed (Lincoln & Guba, 1985). The pre-service teachers were asked to describe their drawings, and these descriptions were compared with their drawings. In this way, their drawings and descriptions were compared.
- (3) Inter-Coder Reliability: Two independent researchers took part in the data analysis and coding reliability was ensured by calculating Cohen's Kappa coefficient (Landis & Koch, 1977). Firstly, the categories in which the universe drawings of pre-service teachers and artificial intelligence would be included were analysed independently by the two researchers in this study. Cohen's Kappa coefficient between the two coders was calculated as .91. The two authors came together and continued to code the different codes until they reached a consensus on the drawings.
- (4) When comparing pre-service teachers' drawings and the visuals they created from artificial intelligence, pre-service teachers were given codes as T1, T2, T3....

Implementation Process of the Study

The activity was planned for implementation with pre-service science teachers enrolled in the faculty of education at a state university. The objective of the activity was to facilitate the pre-service teachers' ability to conceptualize the universe and to compare it with the visual they created from artificial intelligence. The study utilized a worksheet developed by researchers as a data source.

Implementation Steps of the Study

Prior to the initiation of the activity, pre-service teachers were requested to install the "Microsoft Bing Search" application on their mobile devices.

Introduction to the Event

The pre-service teachers were provided with a general overview of artificial intelligence, delivered via a presentation prepared by the researchers. Subsequently, the Bing application that the pre-service teachers would utilize in the subsequent activity was introduced. Consequently, the pre-service teachers were made aware of the application they would employ. This artificial intelligence tool was chosen in the study because Bing application is fast in creating drawings, it can make four different drawings at the same time and unlimited drawing can be done unlike other applications.

Implementation of the activity

The pre-service teachers were furnished with a worksheet and tasked with illustrating the concept of the universe in their minds.

An example of a worksheet is as follows:

Draw your imaginary universe in the box below.





Image 1. Pre-service teachers' drawings



Image 2. Pre-service teachers' drawings

Following this, the participants were invited to provide a detailed description of their drawings by referring to the relevant section of the worksheet.

The question on the worksheet is as follows: 'Write your imaginary universe by describing it in the space below.'

Upon completion of the written descriptions, the pre-service teachers were instructed to utilize the "Microsoft Bing Search" application and transcribe the written descriptions into the Microsoft Bing Copilot. They were then required to create a visual representation by entering the "draw me this" command. If any of the pre-service teachers encountered difficulties in creating visuals, they were provided with assistance. The visuals were then collected electronically from the pre-service teachers who had created them.

Below are T22's universe drawings and artificial intelligence drawing example.



Image 3. T22's drawing

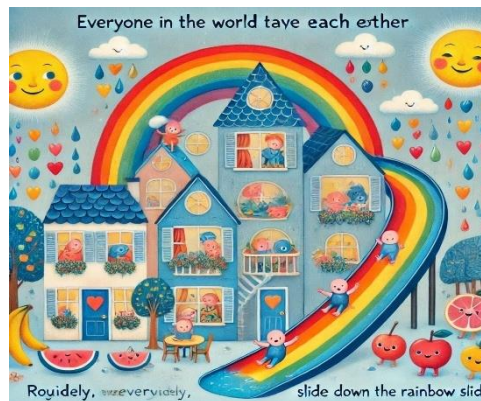


Image 4. Drawing of artificial intelligence

Evaluation of the Activity

The pre-service teachers were expected to answer the questions on the reverse side of the worksheet. Following the completion of the questions by the pre-service teachers, the worksheets were collected, and the activity was thus concluded.

The questions asked in the worksheet to evaluate the drawings of artificial intelligence are as follows:

Is the universe you draw similar to the universe image created by artificial intelligence? If so, write the similarities.

Write the differences between the universe you draw, and the universe image created by artificial intelligence.

Findings

The objective of the present study was to undertake a comparative analysis of the drawings created by pre-service science teachers regarding the concept of the universe, and to contrast these with visual representations of the universe generated by artificial intelligence. The findings obtained are presented below.

Findings related to the first research question

Table 2 below shows the command writing status of pre-service teachers.

Table 2. The subsequent analysis focused on the grouping of pre-service teachers according to the writing commands that they employed in relation to the pictures they drew.

Category	n (%)
Those who write commands according to their pictures	22 (%92) (T1, T2, T3, T4, T5, T6, T8, T9, T10, T11, T12, T13, T14, T15, T16, T18, T19, T20, T21, T22, T23, T24)
Those who do not write appropriate commands for their pictures	2 (%8) (T7, T17)

Table 2 presents a delineation of pre-service teachers into two groups, based on their written descriptions of their drawings on the concept of the universe. The first group comprises those who wrote commands related to their drawings, while the second group consists of those who did not write such commands. While a significant proportion of the pre-service teachers (92%) demonstrated proficiency in articulating commands that were commensurate with their visual representations, a notable minority (8%) exhibited an absence of such alignment, failing to provide descriptions that mirrored the complexity and content of their visual depictions. T7 wrote only "Dystopian happy universe" in the part of the worksheet where they described the universe they drew. Consequently, this was classified as a drawing that did not describe the commands.

T17's drawing is outlined as follows: *"In a universe where individuals reside within stadiums and their sole occupation is to partake in football, every person is affiliated with specific teams. In this universe, the fulfilment of vital needs is contingent on the success of these teams, with the failure of a team resulting in starvation. The fulfilment of their shelter needs is derived from sofa beds located within the stands, which serve both as seating and sleeping arrangements."* However, the artist's visual output was limited to a single stadium with a single crowd.

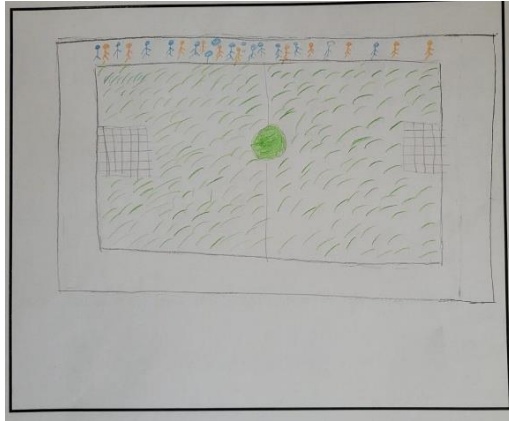


Image 5. T17's drawing

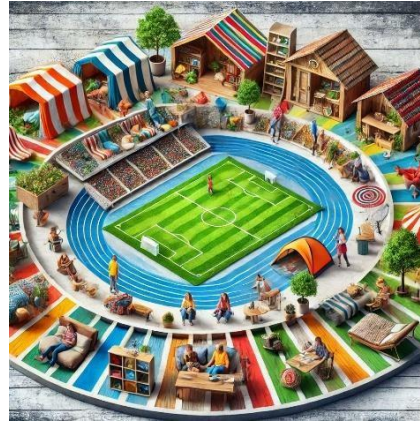


Image 6. Drawing of artificial intelligence

As shown in Image 6, the artificial intelligence system produced a representation of a football field, as delineated by the pre-service teacher, in addition to beds situated within the stands, thereby addressing the participants' shelter requirements.

Findings related to the second research question

After the pre-service teachers articulating explanations concerning their drawings pertaining to the concept of the universe, they transcribed these explanations as commands to artificial intelligence. The findings concerning the compatibility of the drawings created by artificial intelligence with the commands given by the pre-service teachers are presented in Table 3 below.

Table 3. Artificial intelligence drawing of pre-service teachers' descriptions

Category	n (%)
Illustrations Depicting the complete commands	14 (%58) (T1, T3, T4, T6, T7, T9, T11, T15, T16, T17, T18, T21, T22, T23)
Illustrations depicting some of the commands	6 (%25) (T2, T8, T12, T13, T14, T19)
Drawings that do not depict commands	4 (%17) (T5, T10, T20, T24)

As shown in Table 3, the categorization of the drawings of the pre-service teachers' descriptions was conducted using artificial intelligence. The analysis revealed that 58% of the AI's drawings depicted all the pre-service teachers' commands, 25% depicted some of the commands, and 17% were drawings that did not depict the commands.

The creation of these visuals by the pre-service teachers involved the formulation of an expression to describe the desired image and the subsequent issuance of the command "draw me this" to the artificial intelligence.

Findings related to the third research question

The findings obtained from the comparison of the drawings made by pre-service teachers and artificial intelligence regarding the concept of the universe are given in Table 4.

Table 4. Comparison of pre-service teachers' and artificial intelligence universe drawings

Category	n (%)
Pre-service teacher's drawing is more comprehensive	12 (%50) (T3, T4, T8, T10, T12, T13, T16, T18, T19, T21, T22, T24)
Artificial intelligence drawing more comprehensive	12 (%50) (T1, T2, T5, T6, T7, T9, T11, T14, T15, T17, T20, T23)

Table 4 shows the comparison of the universe drawings of pre-service teachers and artificial intelligence. When the commands written by pre-service teachers and the visuals created by artificial intelligence were examined, it was realized that artificial intelligence created more comprehensive visuals in accordance with the 50% written description. For example, T2 said "There is a universe with aliens. Some aliens have different physical shapes, for example, the alien's hair is very long, and the stars are in his hair. In my imagination, each alien has a task." However, artificial intelligence did not draw the stars in the hair of an alien mentioned by the pre-service teacher. However, it was observed that artificial intelligence drew aliens with different physical characteristics, contrary to the pre-service teacher's drawing.



Image 7. T2's drawing



Image 8. Drawing of artificial intelligence

As can be seen in Image 7 and Image 8, both T2 and AI drew a planet with a ring and a planet like the Earth. It is seen that AI also drew stars like T2 and drew aliens with long hair as stated by the pre-service teacher. In addition, the pre-service teacher stated that the aliens had different physical characteristics, and the artificial intelligence drew them with different physical characteristics. The artificial intelligence described all alien depictions in the same way. However, it is seen that artificial intelligence did not draw stars in the hair of an alien, as in the drawing of the pre-service teacher, but drew different shapes.

T4, on the other hand, initially encountered an error after typing his description into Microsoft Bing Copilot. Artificial intelligence did not create a visual for the command. Then, the pre-service teacher was asked to change her description and try again. In the pre-service

teacher's next attempt, the AI generated a visual. The description of the pre-service teacher was as follows: *"Earth, Mars, sun, journey to Mars, black hole, dirty snowball, different aliens, gateway to other universes, nebulae, explosions in the sun, a house where the creator watches the whole universe. Meteorites to Earth. The black hole is a gateway to other dimensions. Elon Musk, Cybertruck"*.

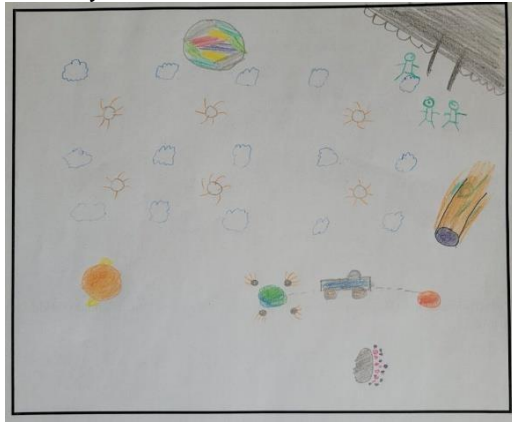


Image 9. T4's drawing



Image 10. Drawing of artificial intelligence

When Image 9 and Image 10 are analyzed by considering the description of the pre-service teacher, it is seen that the Earth, black hole, humans, meteorites, some vehicles and planets are similar. However, artificial intelligence did not draw different aliens as mentioned by the pre-service teacher. It can be said that artificial intelligence created a visual that is generally suitable for the pre-service teacher's description. In this drawing, it is seen that some of the commands written by the pre-service teacher about the description of the universe were not drawn by artificial intelligence.

T8 described it as *"Children play soccer with meteors. A child fell asleep on a dust cloud. One child is connected to the music player via Bluetooth and listening to music. Another child is eating fruit. Another child remembers his memories on earth and feels sad. Everything that can be done on Earth can also be done in this universe."*



Image 11. T8's drawing



Image 12. Drawing of artificial intelligence

When Image 11 and Image 12 are analyzed, differences are also seen besides similarities. The pre-service teacher stated that the children played soccer with meteorites, but the artificial intelligence drew them as normal soccer balls. Artificial intelligence drew a world, but it did not draw a child who misses his/her memories on Earth as the pre-service teacher wrote. The

artificial intelligence did not draw a child eating fruit, but instead drew fruit. In addition, although the pre-service teacher did not mention rockets and cars, artificial intelligence drew them. These drawings show that there are differences between the universe description of the pre-service teacher and the drawing of the artificial intelligence.

T10 described it as *"The sun has an incredible color. It scatters red-orange and yellow light around it. When viewed from space on Earth, all colors are mixed. Stars do not have a specific shape. They are squashed. It is filled with spacecraft. That's why human beings go there often. For this reason, a profession called space scavenger emerged because they would pollute the environment. The black hole swallows the stars, the original owners of space have homes, and impassable gas puddles have formed. There is a different life on the moon."*

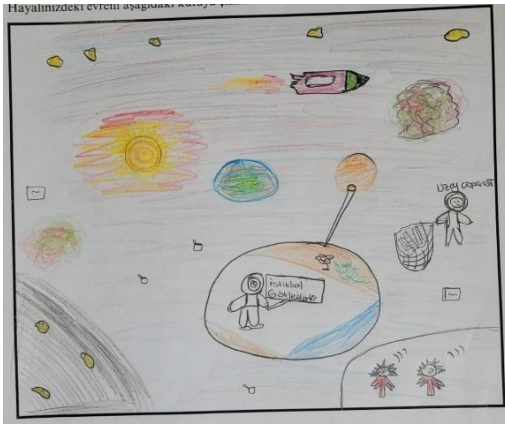


Image13. T10's drawing



Image 14. Drawing of artificial intelligence

When Image13 and Image 14 are examined, it is seen that there are many differences. Only as described by the pre-service teacher, he drew the sun emitting red-orange and yellow light around the sun, the houses of the owners of space and spacecraft. However, the AI did not draw the 'space scavenger' profession mentioned and drawn by the pre-service teacher. The AI's drawings are incomplete according to the pre-service teacher's description.

T13 said, *"The universe in my imagination should remain the same with many features. In addition, I would like there to be happy people in this universe and I would like there to be vehicles that we can travel in time and space."* However, the expression "the universe in my imagination should remain the same with many features" is not a clear way of description.

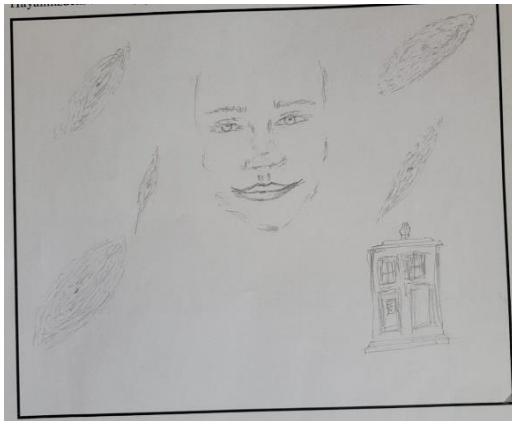


Image 15. T13's drawing



Image 16. Drawing of artificial intelligence

The drawings of T13 and the artificial intelligence are not like each other. The pre-service teacher drew a happy face and drew a vehicle that can travel in time and space. The AI, on the other hand, drew a vehicle that can travel in time and space, which was written by the pre-service teacher in the sky. It can be said that this is the only similarity between the two drawings.

Apart from this, the universe drawing of the pre-service teacher and the drawing of the artificial intelligence are not similar. T18 wrote his description as follows: *"A universe where we get maximum efficiency from the sun thanks to the satellites around the sun, where we achieve a high level of civilization and get maximum efficiency from our whole galaxy and all planets. A universe where we have mass transportation with UFOs and spaceships."*

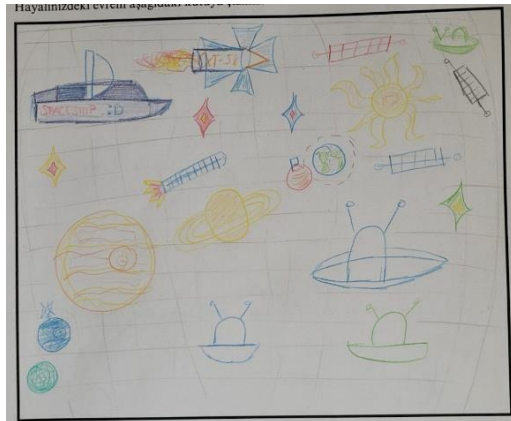


Image 17. T18's drawing



Image 18. Drawing of artificial intelligence

When Image 17 and Image 18 were analyzed, it was seen that the pre-service teacher drew other planets and a planet with a ring. The AI, on the other hand, drew the Sun, Earth and planets without rings. The AI drew satellites and spaceships as the pre-service teacher wrote. However, it is seen that artificial intelligence did not draw UFOs as the pre-service teacher wrote and drew. In this respect, the universe drawing of artificial intelligence was incomplete compared to the description of the pre-service teacher.

T23 described his imaginary universe as follows: *"There are many galaxies in my universe, and when you look at them, they are in the shape of infinity. Some of them are a combination of these galaxies and have a flower-like appearance. There are pairs of each planet in my galaxy, but there is only one planet where we live. Just like planets have moons in real life, galaxies have moons here. Also, meteorites and some planets can fall on these moons (like meteor showers). Inside the galaxies there are spiral and circular smaller galaxies. My stars are in different colors."*



Image 19. T23's drawing

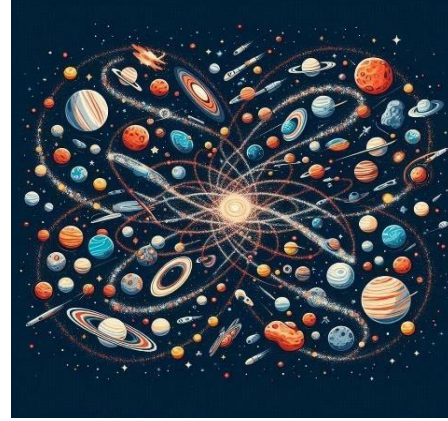


Image 20. Drawing of artificial intelligence

When Image 19 and Image 20 are analyzed, the visual created by artificial intelligence is like the pre-service teacher's drawing. The pre-service teacher drew the Earth in the center. Artificial intelligence placed a bright object in the center. Both the pre-service teacher and the artificial intelligence drew planets with rings. It is seen that the infinity shape is similar in both. The colors used by the pre-service teacher and the AI are different. Artificial intelligence created a visual on a dark blue background, but since the pre-service teacher did not give a description about the colors, the artificial intelligence decided on this color itself.

T24 described the universe in his imagination as follows: *"The universe in my imagination is only the movement of the planets and stars in our galaxy and I imagined that the whole universe moves to infinity only with our galaxy. The house where our galaxy does not visit is doomed to remain in darkness. The only owner of the universe is the galaxy with human beings."*

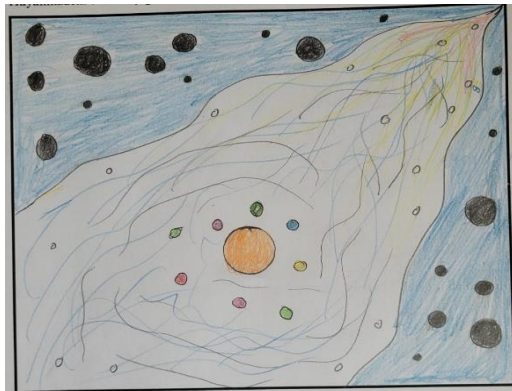


Image 21. T24's drawing



Image 22. Drawing of artificial intelligence

When Image 21 and Image 22 are analyzed, there is no similarity between the drawing of the pre-service teacher and the drawing of artificial intelligence. Artificial intelligence drew bird-like beings, trees, rainbows and galaxies that look like cells as the pre-service teacher put it. However, the pre-service teacher did not mention these. Artificial intelligence drew structures like galaxies, but as the pre-service teacher mentioned, it did not depict the planets outside our galaxy in a dark way.

Discussion

To create an image with artificial intelligence, it is very important to define it in detail. Aydın (2024) used the artificial intelligence on the Microsoft Bing website to create and observe visual changes from general to detailed by creating four different images. He stated that when the command 'butterfly' is typed into artificial intelligence, a random butterfly image is obtained by giving freedom to artificial intelligence. He stated that as the details written as command increase, the unintentional additions of artificial intelligence decrease. As a result of his experiments with another software, he stated that the effect of the words at the end decreases as the command gets longer. In addition, because of the experiments he conducted, he stated that the most important point was the description. This result supports the conclusion reached in the study. In the study, it was observed that the drawings of pre-service teachers who could not describe their drawings and the visuals created by artificial intelligence were different and did not match their descriptions. However, it was observed that the drawings of pre-service teachers who described their drawings in detail and the drawings created by artificial intelligence were like each other. Aydın (2024) stated that it is also important how the software used reacts to the command rather than how detailed the description is written.

Sivri (2024) created images with Microsoft Bing Image Creator. While creating the images, she specified the desired art technique (digital painting, oil painting, watercolor, and others) in some images, but not in others. When no art technique was specified, an image was created according to a random technique, and he stated that he gave the specified art techniques correctly to a great extent.

The part that can be mentioned as human labor in the visuals created in artificial intelligence applications is the stage of thinking about the text commands entered and creativity. In addition, text commands are entered for editing purposes until the desired image emerges. The work created by an artist is unique in both traditional and digital media. We can also say this for any image created with artificial intelligence. Because, when the same command is entered again, it is seen that artificial intelligence does not give the same outputs (Kansteiner, 2022; Lauwaert, 2021; Taluğ & Eken, 2023).

Artificial intelligence-generated images and photographs are getting stronger day by day. Artificial intelligence models also feed on the images created by each other and provide new outputs of better quality. In other words, they also use the images they create to produce new images (Aktay, 2022; Anantrasirichai & Bull, 2022; Sivri, 2024). At this point, many cognitive features of human intelligence have been successfully created on artificial intelligence systems. However, these systems have not yet achieved the desired success in many other features of human intelligence such as producing original products, creative thinking, synthesizing new information, evaluation, imagination and critical thinking (Sariel, 2017; Spector & Ma, 2019). What should not be forgotten in the use of artificial intelligence is that the human brain is ahead of artificial intelligence. Artificial intelligence can offer options. Here, the individual should not be under the control of artificial intelligence. At the same time, the individual should be able to question and criticize more so that artificial intelligence does not limit the individual (Collins, 2021; Genç et al., 2023).

Conclusion and Recommendation

The aim of the activity was to enable pre-service teachers to draw the concept of the universe in their minds and compare it with the visual they created from artificial intelligence. At the same time, it was aimed to encourage pre-service teachers to use artificial intelligence in

science lessons with such applications. 24 pre-service science teachers participated in the application planned by the researchers. Through the feedback received from the pre-service teachers and the researcher's observations, it was determined that the pre-service teachers had not participated in such an activity before.

According to the observation results obtained during the implementation process, it was observed that some pre-service teachers had problems logging in to the application because they had not used the Microsoft Bing Search application before. It was also observed that some pre-service teachers had difficulty in using Microsoft Bing Copilot, and since they sent their descriptions directly to artificial intelligence after writing them, it was seen that artificial intelligence explained what they wrote instead of a visual output.

It was observed that a great majority of the pre-service teachers did not write a command suitable for their drawings and a small number of pre-service teachers did not write a command suitable for their drawings. Although one pre-service teacher described the picture he drew only as "a dystopian happy universe", it was seen that artificial intelligence created a more comprehensive visual by creating a visual suitable for the pre-service teacher's command. It was observed that pre-service teacher did not draw his description completely. However, artificial intelligence created a more comprehensive visual than the pre-service teacher by following the pre-service teacher's description.

While it was observed that the drawings made by the artificial intelligence mostly depicted all the commands, there were a few cases where the teacher candidates could not make drawings for their descriptions. One of pre-service teachers stated that the hair of an alien was long, and the stars were in his hair, but it was seen that although the artificial intelligence drew the alien's hair long, it did not draw the stars in his hair. When the drawings of one of pre-service teacher and artificial intelligence were compared, it was seen that the artificial intelligence did not make a drawing in accordance with the pre-service teacher's command. When these two drawings were compared, it was seen that they were not like each other. Artificial intelligence did not draw the concept of 'space scavenger' mentioned by the pre-service teacher. It was seen that the AI created a completely different visual from T24's description. In addition, it was seen that concepts such as flying bird, mushroom, tree, rainbow, which the pre-service teacher did not write at all, were included in the visual created by artificial intelligence.

In half of the drawings related to the concept of universe, it was observed that the drawings of pre-service teachers were more comprehensive than the drawings of artificial intelligence, while in half of the drawings of artificial intelligence were more comprehensive than the drawings of pre-service teachers. Another pre-service teacher wrote in his description that children played soccer with meteors, but the artificial intelligence drew a normal soccer ball instead of meteors. Artificial intelligence created the description of the pre-service teacher either incomplete or incorrect. It did not draw the child eating fruit mentioned by the pre-service teacher, instead it drew only fruit and a child missing his/her memories on Earth. At the same time, looking at the visual created by artificial intelligence, it was seen that it drew a rocket and a car, which the pre-service teacher did not mention. When the drawings of one of pre-service teacher and the artificial intelligence are compared, it is seen that the artificial intelligence created a more comprehensive visual. As the pre-service teacher described and drew, the artificial intelligence also drew the shape of infinity. It was observed that there were planets with rings in the drawings of the pre-service teacher and the artificial intelligence. The pre-service teacher did not provide any information about the colors and the artificial intelligence decided on its own and created the image on a dark blue background.

After the application, it was determined that the pre-service teachers had different opinions in their drawings about the concept of universe. Some pre-service teachers stated that they resembled the visuals created by artificial intelligence. Some students, on the other hand, stated that their drawings were not similar and that the artificial intelligence either did not draw what was written in the descriptions or did not draw what was written in the descriptions.

Different results may be obtained when the application in this study is performed on different profiles, age groups and subjects. Aydın (2024) stated that it is important how the software used reacts to the command. Therefore, different results can be obtained when the study is conducted with an artificial intelligence program other than Microsoft Bing Copilot. In addition, it is recommended that artificial intelligence-based applications should be included in education programs so that pre-service teachers can use artificial intelligence tools more effectively. In addition, because artificial intelligence cannot fully understand the descriptions and ignores some details, it would be useful to organize trainings that will enable pre-service teachers to make more explicit and detailed descriptions. In future studies, similar studies should be conducted with participants from different disciplines to evaluate the effects of artificial intelligence-supported educational tools in different fields and more comprehensive research should be conducted on the integration of such tools into science education.

Declarations

Funding: None

Ethics Statements: The study adhered to all ethical standards and protocols.

Conflict of Interest: The authors declare no conflict of interest.

Informed Consent: Informed consent was obtained from all participants prior to their inclusion in the study.

Data availability: The data of this study are not publicly available. The data are, however, available from the authors upon reasonable request.

References

- Aktay, S. (2022). The usability of images generated by artificial intelligence (AI) in education. *International Technology and Education Journal*, 6(2), 51-62.
- Anantrasirichai, N., & Bull, D. (2022). Artificial intelligence in the creative industries: A review. *Artificial Intelligence Review*, 55(1), 589-656. <https://doi.org/10.1007/s10462-021-10039-7>
- Aydın, K. (2024). The relationship between form and content in artificial intelligence-based visual productions in the context of art and design. *Ondokuz Mayıs University ERKIN International Journal of Art and Design Research*, 2(1), 97-117.
- Barış, A. (2020). A new business marketing tool: Chatbot. *GSI Journals Serie B. Advancements in Business and Economics*, 3(1), 31-46. <https://doi.org/10.5281/zenodo.4030216>.
- Bolat, A., & Değirmenci, S. (2020). Determining the mind maps of middle school students: "Earth and universe" learning field. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, 14(1), 84-105.

- Coşkun, F., & Gülleroğlu, H. D. (2021). Development of artificial intelligence in history and its usage in education. *Ankara University Journal of Faculty of Educational Sciences (JFES)*, 54(3), 947-966.
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- Çeken, B., & Akgöz, B. (2024). The impact of artificial intelligence on design: The example of Dall-E. *Art & Design Journal*, 14(1), 374-397. DOI: [10.20488/sanattasarim.1506116](https://doi.org/10.20488/sanattasarim.1506116)
- Collins, H. (2021). The science of artificial intelligence and its critics. *Interdisciplinary Science Reviews*, 46(1-2), 53-70. <https://doi.org/10.1080/03080188.2020.1840821>
- Denzin, N. K. (2017). *The research act: A theoretical introduction to sociological methods*. Routledge.
- Emrahoğlu, N., & Öztürk, A. (2009). A longitudinal research on the analysis of the prospective science teachers' level of understanding the astronomical concepts and their misconceptions. *Çukurova University Journal of the Institute of Social Sciences*, 18(1), 165-180.
- Genç, M.A., Daniş, S. & Özalp Hamarta, H.K. (2023). A critical look at the use of artificial intelligence in the education of specially gifted individuals in the field of visual arts. *Necmettin Erbakan University Ereğli Faculty of Education Journal*, 5(Special Issue), 497-519.
- Hunter, C., & Bowen, B. E. (2024). We'll never have a model of an AI major-general: Artificial Intelligence, command decisions, and kitsch visions of war. *Journal of Strategic Studies*, 47(1), 116-146. <https://doi.org/10.1080/01402390.2023.2241648>
- İncemen, S., & Öztürk, G. (2024). Artificial intelligence in various educational areas: Application examples. *International Journal of Computers in Education*, 7(1), 27-49.
- İşler, B., & Kılıç, M. (2021). The use and development of artificial intelligence in education. *e-Journal of New Media*, 5(1), 1-11.
- Jajal, T. D. (2018). "Distinguishing Between Narrow AI, General AI and Super AI", <https://medium.com/@tjajal/distinguishing-between-narrow-ai-general-ai-and-super-ai-a4bc44172e22>, Erişim tarihi: 15.04.2020.
- Kane, D. A. (2016). The role of chatbots in teaching and learning. E-Learning and the Academic Library: Essays on Innovative Initiatives inside (s. 131-156). UC Irvine: Libraries. <https://escholarship.org/content/qt1hs0k71b/qt1hs0k71b.pdf>
- Kansteiner, W. (2022). Digital doping for historians: Can history, memory, and historical theory be rendered artificially intelligent?. *History and Theory*, 61(4), 119-133. <https://doi.org/10.1111/hith.12282>
- Keleş, P. (2023). What is a search engine? What are the most used search engines?. <https://www.ticimax.com/blog/en-cok-kullanilan-arama-motorlari#genel-arama-motorlari-nedir>. Erişim T. 20 Haziran 2023
- Kutlusoy, Z. (2019). *Artificial intelligence in terms of philosophy*. G. Telli (Ed.), Artificial intelligence and the future inside (ss. 25-43). Istanbul: East Bookstore.
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *biometrics*, 159-174.
- Lauwaert, L. (2021). Artificial intelligence and responsibility. *AI & SOCIETY*, 36(3), 1001-1009. <https://doi.org/10.1007/s00146-020-01119-3>
- Lincoln, Y.S., & Guba, E.G. (1985) *Naturalistic inquiry*. SAGE, Thousand Oaks, 289-331. [http://dx.doi.org/10.1016/0147-1767\(85\)90062-8](http://dx.doi.org/10.1016/0147-1767(85)90062-8)

- McNamara, D. (1991). Subject knowledge and its application: Problems and possibilities for teacher educators. *Journal of Education for Teaching*, 17(2), 113-128. <https://doi.org/10.1080/0260747910170201>
- McNeill, N. B. (1972). Colour and colour terminology. *Journal of Linguistics*, 8(1), 21-33. [CrossRef]
- Murphy, C. (2012). The role of subject knowledge in primary prospective teachers' approaches to teaching the topic of area. *Journal of Mathematics Teacher Education*, 15(3), 187-206. DOI [10.1007/s10857-011-9194-8](https://doi.org/10.1007/s10857-011-9194-8)
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications, Inc.
- Nilsson, N. J. (1998). *Artificial intelligence a new synthesis*. China: Morgan Kaufmann Publishers, China Machine Press.
- Özkan, M., & Kayhan, C. (2021). Machine learning applications in astronomy. *Turkish Journal of Astronomy and Astrophysics*, 2(1), 13-20.
- Öztürk, K., & Şahin, M. E. (2018). A General view of artificial neural networks and artificial intelligence. *Takvim-i Vekayi*, 6(2), 25-36.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Sage Publications.
- Ramesh, A., Pavlov, M., Goh, G., Gray, S., Voss, C., Radford, A., ... & Sutskever, I. (2021). *Zero-shot text-to-image generation*. In International Conference on Machine Learning (pp. 8821-8831). PMLR
- Salmi, J. (2023). A democratic way of controlling artificial general intelligence. *AI & SOCIETY*, 38(4), 1785-1791. <https://doi.org/10.1007/s00146-022-01426-x>
- Sariel, S. (2017). *Artificial intelligence today*. M. Karaca (Ed.) Humanizing machines and artificial intelligence (ss. 21-25). Istanbul: Journal of Istanbul Technical University Foundation.
- Say, C. (2018). *Artificial Intelligence in 50 Questions*. Science And Future Library.
- Sawyer, R. K. (2012). *Explaining creativity: The science of human innovation*, Second Edition, New York: Oxford University Press.
- Spector, J. M., & Ma, S. (2019). Inquiry and critical thinking skills for the next generation: From artificial intelligence back to human intelligence. *Smart Learning Environments*, 6(8), 1-11. <https://doi.org/10.1186/s40561-019-0088-z>
- Sivri, O. (2024). The future of visual arts in the framework of artificial intelligence. *Insanat: Journal of Art Design and Architecture*, 4(1), 322-344.
- Taluğ, D. Y., & Eken, B. (2023). Intersection of human creativity and artificial intelligence in visual design. *Journal of Art and Iconography*, 4(1), 18-29
- Turğal, L., & Küçükerdoğan, B. B. (2023). Artificial intelligence as a disinformation tool: Analyzing news photos on climate change in the example of bing search engine. *Communication and Diplomacy*, 11, 57-82.
- Turing, M. A. (1950). Computing Machinery and Intelligence. *Mind*, 59(236), 433-460.
- Uluay, G. (2020). Pre-service science teachers' views towards universe. *Anatolian Teacher Journal*, 4(2), 209-225.
- Uzun, Y., Tümtürk, A. Y., & Öztürk, H. (2021). Today And Used in The Future Artificial Intelligence. 1st International Conference on Applied Engineering and Natural Sciences.
- Winston, P. H. (1992). *Artificial intelligence*. Addison-Wesley Longman Publishing Co., Inc..
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.