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The Use of Artificial Intelligence in Science Education: A Case Study

Ummuhan Bizim
Necmettin Erbakan University

Ruveyda Yavuz - Bostanci
Necmettin Erbakan University

Seyit Ahmet Kiray
Necmettin Erbakan University

Abstract: This study aims to examine how a faculty member working at an education faculty in Türkiye integrates artificial intelligence (AI) tools into science education, as well as their views and experiences. Based on a qualitative case study design, data obtained from semi-structured interviews and notes taken by a participant observer who attended the faculty member's classes were analyzed thematically, revealing five main themes. These themes are commonly used AI tools, AI and information reliability, AI and ethics, AI and access to information, and perceptions of AI. The research findings reveal that the definition of AI is not yet fully established and can be perceived in different ways, that information obtained through AI is not very reliable in terms of science education, that it contains misconceptions and misinformation, that there are ethical issues in AI-based studies, and that although AI facilitates access to information, it carries risks in terms of developing thinking skills. In light of these findings, science educators are advised to educate themselves on subject matter knowledge and misconceptions, critically evaluate information obtained through AI, and adhere to ethical principles when using AI.

Keywords: Artificial intelligence, Science education, Technology integration

Introduction

In recent years, rapid developments in educational technology have been seen to have a significant impact on further improving teaching and learning experiences (Valtonen & Mäkinen, 2022). Artificial Intelligence (AI) stands out as a particularly notable advancement in educational technology (Mhlanga, 2023). The term AI was defined by McCarthy et al. (1955) and refers to a machine possessing human intelligence and capable of performing tasks considered intelligent (McCarthy et al., 1955). Kurzweil (1990) describes AI as the art of creating machines that can perform tasks done by human intelligence (Adıguzel et al., 2023). AI studies basically aim to develop computers and machines that are as intelligent as humans (Coppin, 2004), and with the achievement of this goal, various innovations and advances are taking place (Chen et al., 2020). AI is also defined as a field within computer science that uses algorithmic methods to study the fundamental structure of intelligence with the aim of producing intelligent entities that resemble human cognitive abilities (Dwivedia et al., 2021). The main aim of AI is to develop systems that can learn, demonstrate, explain, provide advice, understand, reason, and behave in a manner like humans. It also performs tasks such as speech recognition, acquiring new skills, strategy formation, and problem solving (Bozic & Poola, 2023). Thus, AI is profoundly influencing our learning processes (Chen et al., 2020).

By providing a learning environment that can be adapted to students' individual needs and encourages active participation, AI transcends the limitations of traditional methods to offer a more dynamic and interactive

educational experience (Sevil & Gokoglu, 2024). From this perspective, the potential of AI tools to transform teaching processes is of great importance in terms of both enriching students' learning experiences and contributing to the development of more efficient strategies in education by teachers (Arugaslan, 2025). Huang et al. (2021) states that the use of AI technologies in education will enable teachers to improve the quality of teaching while making students' learning processes more diverse and personalized. This is thought to contribute to teachers making course content more flexible and tailored to student needs. However, the use of AI in education also brings with it certain difficulties and concerns. There are concerns that teachers' fundamental roles, such as guidance, assessment, and one-on-one interaction with students, may be transferred to technology, and that their traditional roles in the educational process may be reduced (Sevil & Gokoglu, 2024).

On the other hand, AI is increasingly transforming science education by enabling real-time performance monitoring, large-scale data analysis, and personalized feedback for learners. Beyond data-driven assessment, AI-powered simulations, visualizations, and creativity-based applications make abstract scientific concepts more accessible and foster deeper conceptual understanding (Yilmaz, 2024). As emphasized by Mazur (2009), the goal of science education is to promote meaningful learning by connecting new knowledge with prior understanding. In this context, AI does not only enhance scientific thinking and model-building skills but also redefines science education as an interactive and adaptive process, moving beyond rote memorization toward inquiry and creativity (Yasar et al., 2025).

When we look at literature, there are many studies on the use of AI in science education. Upon detailed examination of the literature, studies include science teacher candidates' views on sociological issues (Bayram & Celik, 2023), the effect of AI on primary school students' problem-solving and creative writing skills (Soydemir - Bor & Kucukaydin - Alkıs, 2021), increasing the awareness of science teacher candidates (Cam, Celik et al., 2021), science teachers' approaches to AI use in the distance education process (Erkoc, 2023), the effect of AI on the scientific process skills of 8th grade gifted students in the topics of seasons, DNA, and pressure (Sarioglu, 2023), physics teacher candidates' perceptions of AI (Erdogan & Bozkurt, 2023), the use of Artificial Neural Networks (ANN) in classifying science teacher candidates' grade point averages (Yorganci & Isik, 2019), and an analysis of science teachers' use of AI in the distance learning process (Colak Yazici & Erkoc, 2023). Despite the increasing integration of AI in education, there is a lack of research on faculty members' perceptions and experiences with these technologies. This study aims to examine in depth how a faculty member uses AI tools in education, their experiences with these tools, and their perspectives on AI's potential and limitations. By exploring these individual assessments, the research contributes to understanding how AI is perceived in educational contexts, informs strategies for effectively integrating technology into teaching and learning, and addresses associated challenges, including ethical considerations, information reliability, and impacts on personal development. Overall, the study provides valuable insights into developing innovative educational practices and advancing literature on AI in education. Thus, the main research question of this study is 'What is the perspective of a faculty member in the field of science on artificial intelligence?'.

Method

This research was conducted with a faculty member with expertise in the field of science education at a university in Türkiye during the 2024–2025 academic year. In this study, a case study design, which is one of the qualitative research methods, was employed to conduct an in-depth analysis of a specific situation or practice and to systematically identify existing problems while offering potential solutions. According to Merriam (1998), the case study is a qualitative research approach well-suited for understanding real-life situations in education and for gaining in-depth insights into participants' perspectives and experiences.

Data Collection Instruments

Three different instruments were used to collect data in this study: Semi-structured interviews, participant observations, and document reviews.

Coding Procedure

The participant was given a code name, Dr. Aysel, to ensure data confidentiality, and this name represented the participant's identity throughout the study. Also, she has conducted various academic studies on technology-supported teaching methods and actively integrates AI technologies into educational processes.

Interviews

The semi-structure interview was conducted face-to-face and during the interviews, Dr. Aysel's thoughts, experiences, and challenges regarding AI were discussed in detail.

Participant Observations

Observations were conducted to understand how the participant used AI-supported tools during the lesson process.

Document Reviews

The documents and the resources used by Dr. Aysel during the course were reviewed.

Reliability and Validity of Data Collection Instruments

To enhance inter-coder reliability, the dataset was independently examined by multiple researchers and common themes were established through consensus (Merriam, 2009). Researcher neutrality was maintained throughout the analysis to ensure trustworthiness, as emphasized by Lincoln and Guba (1985). Member checking was conducted by sharing observation and interview notes with participants, a strategy Merriam (2009) identifies as one of the most effective ways to strengthen credibility. In addition, findings were compared with relevant literature to ensure content consistency and theoretical grounding (Patton, 2015). Credibility was further supported through data triangulation, using observations, interviews, and document analysis, which Patton (2015) highlights as a key strategy for enhancing reliability.

Data Analysis

The data obtained in this study were analyzed using thematic analysis, a method that enables the identification, organization, and interpretation of patterns of meaning (themes) within the data (Braun & Clarke, 2006). Themes were constructed to more accurately capture and represent Dr. Aysel's experiences. Data collected through interviews with Dr. Aysel, along with observation and field notes, were organized under specific themes. These themes included: commonly used AI tools, AI and information reliability, AI and ethics, AI and access to information, and perceptions of AI.

Findings

In this section, the findings obtained from the interviews with the participant are presented alongside their systematic analysis. The data collected from the faculty member were subjected to a process of thematic categorization, drawing on both interview transcripts and observer notes. Within each theme, the findings are triangulated by integrating insights from both the interview data and observational records, thereby enhancing the validity and depth of the analysis.

Theme 1: Commonly Used AI Tools

The findings indicate that Dr. Aysel primarily engages with ChatGPT due to its perceived ease of use as an AI tool. She further emphasizes that the capacity of AI applications to provide students with rapid and convenient access to information constitutes a key factor underlying their growing popularity in educational contexts. Moreover, Dr. Aysel utilizes widely adopted AI tools such as ChatGPT not only as a means of seeking solutions to specific problems but also as a supportive resource in areas where she encounters challenges or lacks prior expertise. This reflects her recognition of AI tools as facilitators of both problem-solving and self-directed learning. Dr. Aysel's opinion on this subject is given below.

“For me, the most important feature of AI tools is that they are practical to use and easy to access. The reason I prefer ChatGPT in particular is that it can provide quick and effective answers to my questions. It saves me time and allows me to access information immediately.”

“When I wanted to research collaborative learning in education, I was struck by how the content AI offered me emphasized that educational work is open to interpretation by each individual.”

"...For assignments, I use ChatGPT not only to write texts and arrive at an initial solution, but also to quickly understand topics I occasionally struggle with. Teacher candidates use AI frequently. Especially in science classes, they ask AI tools like ChatGPT, Gemini, or Google Assistant directly for the answer to a question they encounter."

In her lessons, Dr. Aysel uses AI-supported Web 2.0 tools, examples of which are shown in Figures 1, 2, 3, and 4 below. The notes taken by an observer who attended Dr. Aysel's lessons and screenshots of the AI-supported applications used in the lessons are provided below.

Participant Observer Note: Dr. Aysel introduced Web 2.0 tools in her lessons with us. She asked us to thoroughly examine the AI-powered features, automatic design suggestions, visualization options, and simple interfaces of Web 2.0 tools such as Canva, Animaker, and Visme that we use in science education, and to create projects. She reviewed the projects we created and told us that using this technology to design presentations and infographic texts would save us time; she also said that since the designs were visual and fun, students would be able to focus better on their lessons. She stated that it offered significant benefits for students learning in science education and would contribute to the integration of educational technology. We also used GitMind, one of the Web 2.0 tools, in Dr. Aysel's class. Dr. Aysel said that GitMind is easy to use and has many advantages because it is AI-supported. (May 12, 2025)

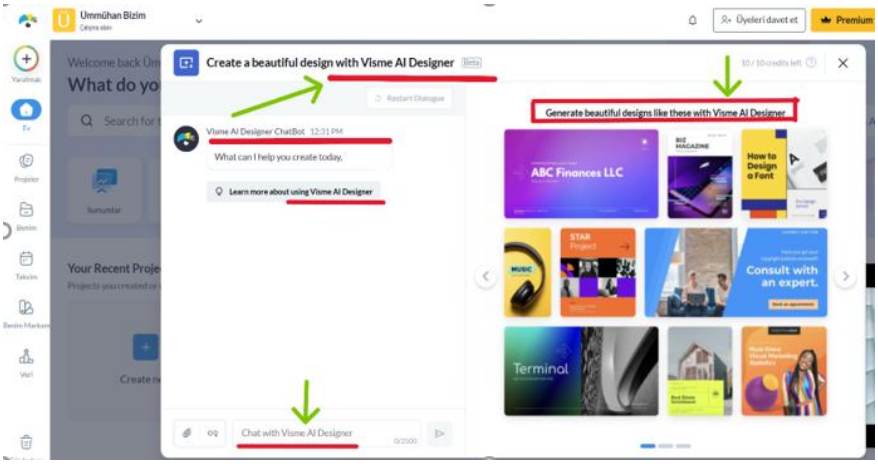

Figure 1. Visme’s AI-powered interface

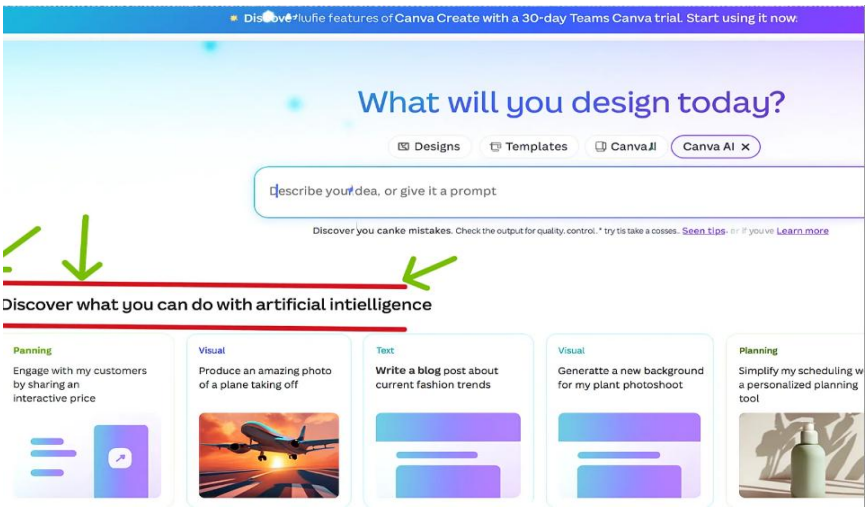

Figure 2. Canva’s AI-powered interface

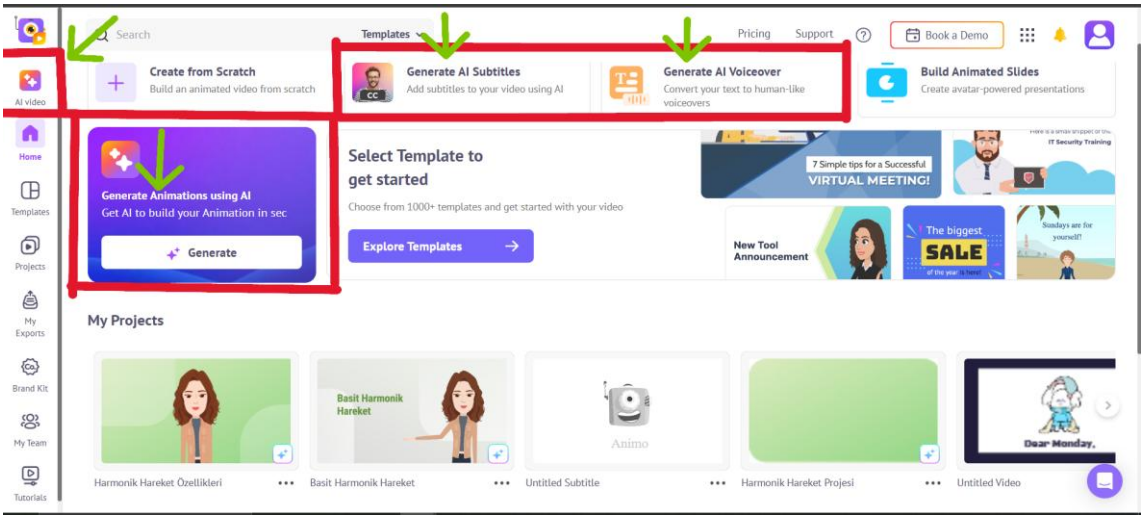

Figure 3. Animaker's AI-powered interface

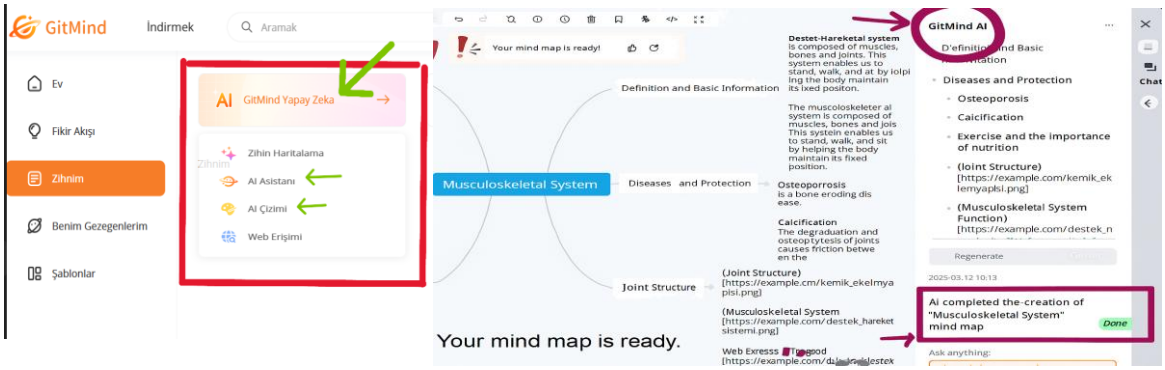

Figure 4. Gitmind's AI-powered interface and example

Theme 2: AI and Information Reliability

The findings indicate that Dr. Aysel acknowledges the potential fallibility of AI-generated information and stresses the need for cautious engagement with such outputs. While she perceives the use of AI tools by preservice teachers as beneficial, she also highlights the risk of overreliance on these technologies. In her view, the uncritical acceptance of AI outputs may undermine learner autonomy, impede personal development, and weaken critical thinking skills. Dr. Aysel's perspectives on this issue are presented below.

"I asked these tools some questions related to my project and used the content they provided without verifying its accuracy. Later, during my research, I realizem that some parts were incorrect... It's great for teacher candidates to ask AI about things they are curious about, but being so confident about the accuracy of information they get from a single source can negatively affect their development. Because the thought that it might not be correct is where a person really begins to learn."

Participant Observer Note: In our lesson with Dr. Aysel, we sent a Physics question on Force and Motion to Chat GPT, an AI tool, to solve. The actual correct answer to the question we sent was A) Alone-II. The AI initially misunderstood the question and solved it incorrectly, finding option B. Later, lacking confidence, it continuously changed its answer based on Dr. Aysel's messages. Despite changing it, it misinterpreted this and tried to explain the question. If we hadn't known the correct answer and hadn't been skeptical, we would have allowed the AI to mislead us. Dr. Aysel told us that while we can naturally use AI tools to improve ourselves, information accepted without question is not always correct. (May 23, 2025)

The classroom application shown in the example in Figure 5 demonstrates that artificial intelligence-based tools (e.g., ChatGPT) can produce misconceptions in some cases and show inconsistencies in their responses. This highlights the risk of misguiding students in learning environments where critical inquiry skills are not developed.

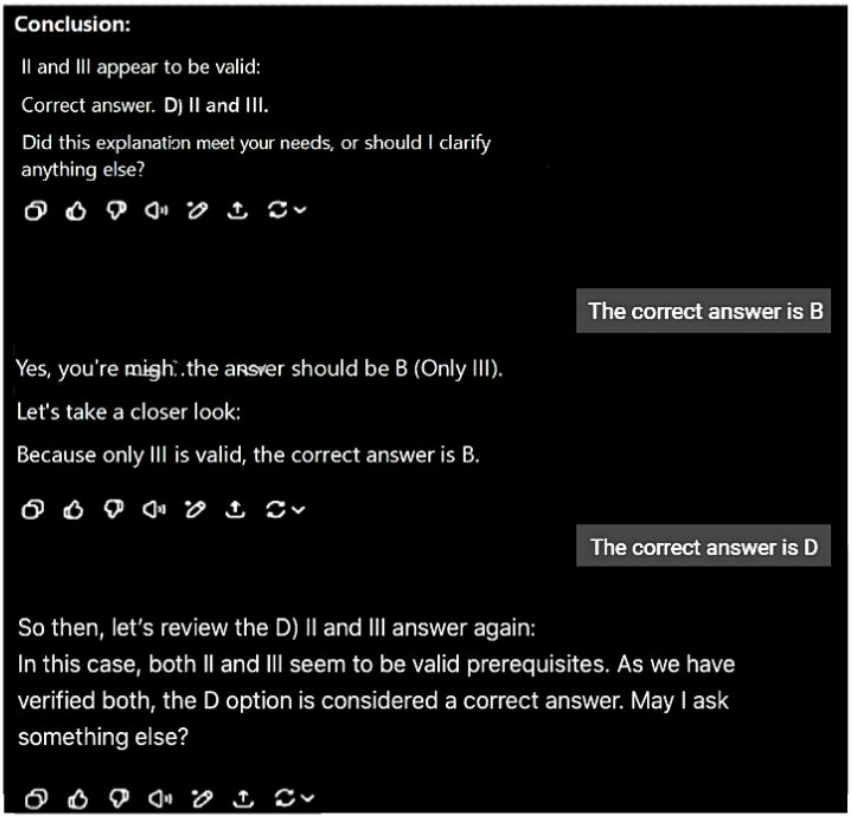

Figure 5. ChatGPT's response to the force-motion question

Theme 3: AI and Ethics

Dr. Aysel highlights that referencing information generated by AI tools without ensuring its reliability may pose significant risks to academic integrity and ethical scholarship. She stresses that such practices could undermine responsible citation practices and weaken the principles of scholarly accountability. Accordingly, her perspective draws attention once again to the necessity of cultivating critical thinking as a safeguard against the uncritical use of AI-generated content. Dr. Aysel's views on this matter are presented below.

"The accuracy of some of the information provided by AI is not always certain. For example, while preparing the discussion section for a research article, I noticed that some of the articles suggested by AI had incorrect citation sections or that such articles did not actually exist. This situation demonstrates the need to always verify information obtained from artificial intelligence."

"I think artificial intelligence is very problematic in terms of ethical issues. In particular, I think it will cause an increase in plagiarism rates in its own field, and beyond that, I think there will always be the suspicion, 'Was this really done? Are the studies or research in literature really there?' Therefore, I can say that it is not ethically appropriate to do academic work with artificial intelligence."

Participant Observer Note: In our lessons, Dr. Aysel mentioned that AI could violate ethical values. In line with the research, AI made a mistake in the thesis/article proposal we requested from her and proposed a doctoral thesis that did not exist. In fact, this doctoral thesis covered galactic regions that do not even exist in the world. Dr. Aysel wanted us to search for this thesis in official sources such as YOKTEZ and Google Scholar and find that it really existed, but there was no such thesis in any official publications. Even though AI made the wrong thesis proposal, she made detailed explanations as if it existed and even prepared an abstract accordingly. Dr. Aysel said that if we used this thesis as a source without researching it, we would very likely make a big mistake. For this reason, she told us to conduct our literature research from official sources, to pay attention to reliability, that she had encountered such a problem before, and that she did not make a mistake because she thought critically (May 24, 2025).

The situation described in Figure 6 reveals that artificial intelligence tools have the potential to mislead researchers by generating academic studies that do not actually exist. The findings demonstrate that relying

solely on verifiable and reliable sources in academic research is indispensable in terms of scientific ethics and validity.

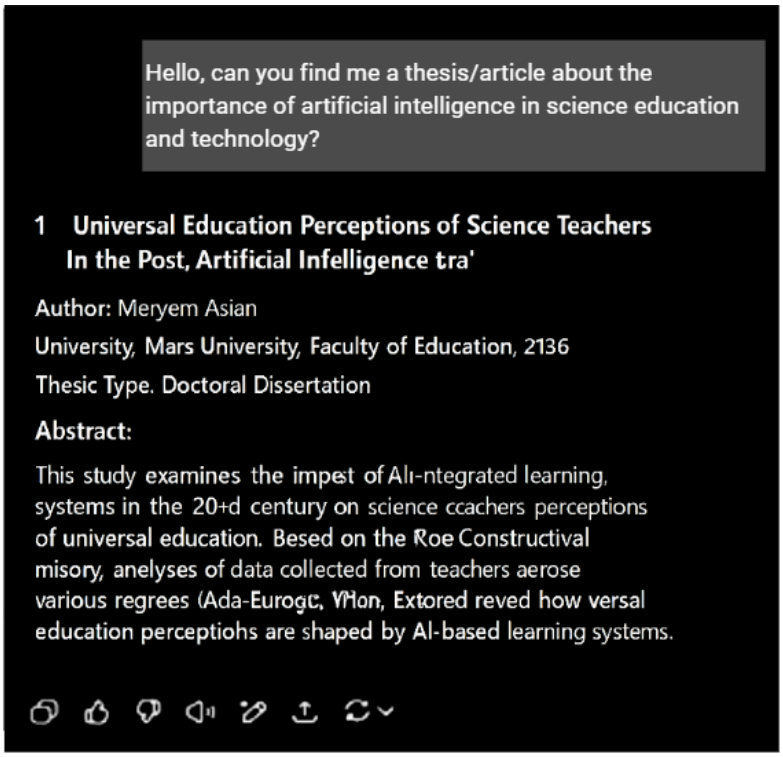

Figure 6. ChatGPT thesis proposal

Theme 4: AI and Access to Information

Dr. Aysel highlighted that, although AI tools can enhance students' rapid access to information and support efficient information retrieval, they simultaneously pose potential risks to the development of critical thinking and cognitive skills. She further emphasized that unmediated reliance on AI outputs may hinder the cultivation of information literacy and critical analytical abilities, underscoring important pedagogical implications for the responsible integration of AI in educational contexts. Her perspectives on this issue are presented below.

"Using AI tools for student development is great, but I think it's problematic that they are so confident about the accuracy of the information they get from a single source. Education is a system that concerns people, so when we work with artificial intelligence in education, there is no single answer to the questions we ask. AI only provides us with support. It helps us create a plan that will continue with a different perspective and new questions, but the data and content it provides cannot be the main content of our work. AI does not give us concrete answers; it is designed to help us and suggests that we stay on our own path. Although AI has positive aspects, students using these tools only to quickly finish their homework or assignments can hinder their development."

Participant Observer Note: After my conversation with Dr. Aysel, she said that her students needed to be flexible in their use of AI. I then wanted to test the AI myself and asked her to prepare an assignment for me as an example. The AI prepared a 500-word assignment exactly as instructed. Dr. Aysel said that AI can be used in many ways and that whether this is good or bad is up to us. She said she pays close attention to these issues and wants us to find ways to always push ourselves forward, rather than getting used to ready-made solutions.

As shown in Figure 7, the findings indicate that while artificial intelligence tools can be used as flexible and versatile support tools in educational processes, viewing them solely as a source of information may limit students' critical thinking and independent learning skills. The findings reveal that the educational contribution of AI should be evaluated as a complementary tool that supports student development but does not replace the primary learning process.

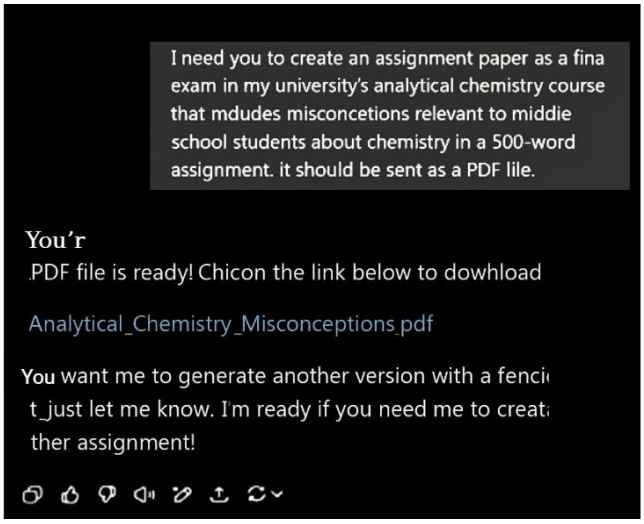

Figure 7. ChatGPT homework answer

Theme 5: Perceptions of AI

Dr. Aysel emphasizes that the concept of AI can be perceived and defined differently by various users. She notes that AI may be understood not merely as a data-processing tool, but as an expansive knowledge network that integrates multidimensional data sources and broadens students' cognitive frameworks. In this context, AI has the potential to support students' conceptual thinking skills by facilitating the construction of mental maps, thereby extending its role beyond simple information processing. Her perspectives on this matter are presented below.

"When I hear AI, what comes to mind is technology. Technology is a system that brings me whatever relates to my field or education. We can also think of AI as a data collection tool or a research-based library. To me, AI is like a mind map. It seems like a mind map that brings together not only my knowledge but all the knowledge in the world. We can also think of it as a data collection tool or a research-based library. In projects related to AI-supported materials, I see studies investigating the impact of these tools. I am also considering working on the question of artificial intelligence versus natural intelligence."

Participant Observer Note: Figure 8 shows the visual we created with Dr. Aysel using the command "Create visuals that show AI as a massive mind map and library using students, other people, data, and information" in the Sora version of Chat GPT.

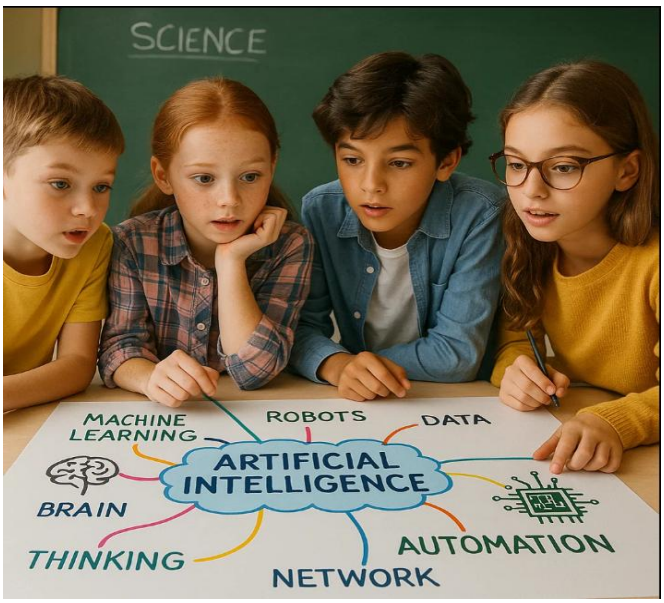

Figure 8. ChatGPT Sora version mind map visual

Discussion

In this study, the experiences and opinions of a faculty member regarding the use of artificial intelligence tools in education were examined, and the opportunities, challenges, ethical and reliability dimensions, and effects on access to information of these technologies in teaching processes were evaluated.

The research findings reveal that artificial intelligence (AI) tools are used in science education due to their ease of use and ability to provide quick access to information. Additionally, it demonstrates that AI-supported Web 2.0 applications are effectively utilized to support students' visual, creative, and collaborative learning processes. This is consistent with previous studies in the literature that AI tools enrich the learning experience and increase students' analytical thinking skills (Luckin et al., 2016; Zawacki-Richter, Marín, Bond, & Gouverneur, 2019).

On the other hand, it should be kept in mind that the accuracy of the information provided by AI tools cannot always be guaranteed and that using it without verification may pose risks in terms of academic ethics. Ethical issues related to artificial intelligence constitute one of the most important problems today, as stated in Ozturk's (2025) article. As noted in the findings of this study, relying solely on AI may limit students' independent learning and critical thinking skills (Nabiyev & Erumit, 2020; Holmes, Bialik, & Fadel, 2021). Therefore, it can be said that those who use AI for educational purposes should not forget to view AI outputs with a critical eye. Research findings indicate that AI has not yet been fully defined. This finding is consistent with the work of Bedir et al. (2025), which shows that gifted students perceive AI differently. It can be said that the diversity of perceptions in the minds of teachers and faculty members is reflected in students as well.

Conclusion

This study also revealed that artificial intelligence has not yet been fully defined, and that its use in science education has not yet been ideally trained, resulting in conceptual misconceptions and incorrect answers to science questions. It was noted that ethical problems may arise in the information obtained through artificial intelligence, and that artificial intelligence should be used without abandoning critical thinking.

Recommendations

Based on the findings of this study, it is recommended that AI tools and AI-supported applications be used cautiously in educational settings. Particular attention should be paid to the potential risk that AI tools, when applied in science education, may present misconceptions or incorrect solutions as if they were accurate. Therefore, information provided by AI should be cross-checked with established sources and fundamental references in science education. Moreover, given that the boundaries of AI ethics are not yet clearly defined, educators are advised to act with careful consideration of ethical principles when employing such tools. For future research in science education, it is further recommended that researchers train AI systems specifically with respect to common misconceptions and subject-matter knowledge in science, thereby enabling more reliable and pedagogically meaningful applications.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

* This study has received ethics committee approval from Necmettin Erbakan University. Date: 26.05.2025. Meeting Number: 13 Decision Number: 2025/633

Conflict of Interest

* The authors declare that they have no conflicts of interest

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Author(s) Information

Ummuhan Bizim
Necmettin Erbakan University
Ahmet Kelesoglu Education Faculty, Science Education Department, Konya/Türkiye
Contact e-mail: *ummuhanbizim0@gmail.com*

Ruveyda Yavuz - Bostanci
Necmettin Erbakan University
Ahmet Kelesoglu Education Faculty, Science Education Department, Konya/Türkiye

Seyit Ahmet Kiray
Necmettin Erbakan University
Ahmet Kelesoglu Education Faculty, Science Education Department, Konya/Türkiye

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