Metaphorical Analysis of Primary School Students' Perceptions of Artificial Intelligence

Kevser HAVA [1], Aslıhan ASLAN [2], Ziya ASLAN [3]

[1] kevserhava@gmail.com, orcid.org/0000-0003-3822-6796, Yozgat Bozok University, Turkey

[2] ziyaslihan@hotmail.com, orcid.org/0009-0000-6042-3206, Yozgat Bozok University, Turkey

[3] ziyaslihan@hotmail.com, orcid.org/0009-0000-6588-3375, Yozgat Bozok University, Turkey

ABSTRACT

This study investigates the metaphors used by primary school students (aged 7–8) to describe Artificial Intelligence (AI), aiming to clarify their conceptual understanding of the subject. The metaphor analysis method was employed to explore how students conceptualize AI and to uncover the underlying cognitive structures influencing their perceptions. A phenomenological approach was adopted to understand students' experiences and perceptions of AI. A total of 240 primary school students from Yozgat, Turkey, participated in the study during the 2024–2025 academic year. Students were asked to create a metaphor for AI and to visually represent it. The data were analyzed using content analysis. The findings revealed six key conceptual categories: education and knowledge, social and communicative roles, technological and mechanical structure, entertainment and ease of life, unusual/creative, and emotional/future-oriented metaphors. The most frequently occurring metaphors fell under the categories of education and knowledge and social and communicative roles, followed by technological and mechanical structure. The remaining categories were less commonly represented.These results suggest that primary school students primarily view AI as a tool for learning and social interaction, placing less emphasis on its technological or emotional dimensions.

Keywords: *Artifical intelligence, metaphor, primary school students, phenomenology, metaphorical analysis.*

INTRODUCTION

As Artificial Intelligence (AI) becomes increasingly integrated into daily life, it is imperative to examine how young learners perceive and interpret this complex and rapidly evolving technology (Kolasinska et al., 2019; Su & Yang, 2022). The urgency of developing AI literacy among students is rising, particularly in light of projections indicating that a substantial proportion of future occupational tasks will be automated (Kong et al., 2024; Williams et al., 2022). In this context, education systems are challenged not only to equip students with technical competencies but also to cultivate critical and creative thinking regarding the broader societal implications of AI (Karalekas et al., 2025). Understanding AI in contemporary society necessitates far more than proficiency in coding or algorithmic knowledge; it also demands ethical reasoning, social awareness, and the capacity to critically assess the impact of intelligent systems on human life (Lyublinskaya & Du, 2025; World Economic Forum, 2025). Many K–12 curricula globally are increasingly reflecting this paradigm shift, positioning AI literacy as both an educational challenge and a developmental opportunity (Casal-Otero et al., 2023). However, the implementation of effective AI education for children necessitates that such instruction be age-appropriate, cognitively accessible, and emotionally engaging (Pahi et al., 2024). This approach

requires that educators teach students not only the functionalities of AI but also its operational context within human systems and its potential implications for their lives (Rizvi, Waite, & Sentance, 2023). Concepts such as algorithmic bias, supervision and automation must be introduced in a manner that is comprehensible and conducive to critical reflection among children (Yang et al., 2025). One valuable method for exploring children's cognition regarding these abstract topics is through metaphor. Metaphorical analysis enables researchers to uncover how children conceptualize AI by employing familiar, concrete comparisons (Yang, 2022). These metaphors provide insights into both the cognitive frameworks and emotional responses that shape students' understanding of intelligent technologies. When a child characterizes AI as "a robot that never sleeps" or "a teacher that knows everything," they are revealing not only their knowledge but also their emotional perceptions. Understanding these expressions can inform educators and curriculum designers in the development of effective and developmentally appropriate AI literacy programs (Chiu et al., 2024).

Literature Review

AI is commonly defined as the capacity of a system to execute tasks that traditionally necessitate human intelligence, including but not limited to learning, pattern recognition, problem-solving, and natural language processing (Su et al., 2023). As AI technologies increasingly permeate children's daily experiences manifesting through digital assistants, games, educational platforms, and even toys, it becomes paramount to address prevailing misconceptions and cultivate a foundational understanding from an early age (Mertala & Fagerlund, 2023; Casal-Otero et al., 2023). Nevertheless, a significant challenge arises from the absence of a universally accepted definition of AI literacy. There exists considerable variance among researchers and educators regarding their conceptualizations of this term and the components they believe should be included in AI education. To mitigate this ambiguity, scholars advocate for a definition of AI literacy that encompasses not only technical competencies but also ethical considerations, problem-solving skills, and sociocultural reflection (Chiu et al., 2024; Wang & Lester, 2023). This comprehensive perspective necessitates that students comprehend the operational mechanisms of AI and critically evaluate the contexts, rationales, and methodologies for its application. The incorporation of project-based learning activities wherein students utilize AI tools to address real-world challenges has been demonstrated to enhance both creativity and analytical thinking.

As AI becomes more embedded in educational technologies, it is also important to consider its ethical implications and potential drawbacks. Scholars have raised concerns such as data privacy, the erosion of human interaction, and the possibility of over-reliance on AI for learning (Gouseti et al., 2024; Hur, 2024). Several scholars caution that inadequately implemented AI tools may impede the development of critical thinking skills and potentially undermine educators (Lozano & Blanco Fontao, 2023). In response, there is a growing consensus around the need for comprehensive AI ethics frameworks to inform the design of future educational curricula and applications (Adams et al., 2023). Furthermore, effective AI education for children should be rooted in concrete, experiential learning approaches (Gouseti et al., 2024). Research highlights the significance of designing developmentally appropriate tools and activities that render fundamental AI concepts both tangible and engaging (Williams et al., 2022). Lastly, interdisciplinary studies are essential to determine best practices for integrating AI literacy across subject areas and for establishing pedagogical strategies aligned with children's cognitive and emotional development (Wang & Lester, 2023).

Related Research

Numerous studies illustrate that students frequently attribute human-like characteristics to AI. Research indicates that primary school students often perceive AI as a "living" entity capable of cognition and decision-making (Saçan et al., 2022; Tartuk, 2023). Similarly, Walan (2024) and Mertala et al. (2022) report that students conceptualize AI as machines that have human traits, despite generally having a limited understanding of AI's technical foundations. These findings reflect a common childhood tendency to attribute human qualities to AI. Students often express their perceptions of AI through metaphorical language. Demir and Güraksın (2022) identify various metaphorical categories including "intelligence," "robotics," "nature," and "security" that students use to describe AI. Kalemkuş and Kalemkuş (2025) classify

student-generated metaphors into 17 distinct themes, indicating that students perceive AI as both beneficial and potentially dangerous. This metaphorical diversity reflects the complexity of students' conceptualizations. Studies indicate that students are both excited and worried about AI. While they recognize AI as a tool that enhances everyday life (Demir & Güraksın, 2022; Oruç et al., 2024), they also express concerns about ethical implications and security risks. Metaphors such as "monster," "weapon," or "threat" exemplify how these concerns are internalized on a conceptual level (Kalemkuş & Kalemkuş, 2025). According to Akbay and Yıldırır (2024), age significantly influences students' perceptions of AI. Middle school students tend to use more concrete metaphors (robot, machine), whereas high school students are more likely to employ abstract and cognitive descriptors (intelligence, thinking entity). This difference highlights the need to match AI education with students' developmental levels. Taken together, the literature demonstrates that students exhibit both curiosity and misconceptions regarding AI. There is a clear need for educational strategies that integrate technical knowledge with ethical awareness and critical thinking. Curriculum and policy efforts should prioritize correcting media-influenced misconceptions and promoting a deeper understanding of AI (Mertala et al., 2022; Shin et al., 2018).

The purpose of this study is to explore how primary school students perceive and conceptualize AI through metaphors. Understanding their views can help educators design effective teaching strategies that address both the technological and social aspects of AI. This study is important for understanding how primary school students perceive AI, a rapidly growing technology affecting many areas of life. As AI increasingly influences education, society, and technology, it is vital to know how young students interpret it, since their views may shape future interactions with AI. The findings can help educators create teaching methods that highlight both AI's technological aspects and its wider social impact.

RESEARCH METHOD

Research Model

This study adopts a qualitative research design grounded in phenomenology to explore primary school students' metaphorical perceptions of AI. Phenomenology is particularly well-suited for examining individuals' lived experiences and their subjective interpretations of abstract concepts such as AI (Moustakas, 1994).

Participants

The study group consists of primary school students enrolled in public schools in Yozgat, Turkey, during the 2024–2025 academic year. Participants were selected using a convenience sampling method, which allows easy access to individuals who meet the research criteria. While convenience sampling facilitated efficient data collection, it is important to acknowledge that the findings may not be fully representative of all primary school students in Turkey.

Table 1. *Students' Demographic Characteristics and Attitudes Toward Technology*

Variable	Category	f	%
Grade Level	3rd Grade	96	40.1
	4th Grade	144	59.9
Gender	Female	114	47.6
	Male	126	52.4
Do you enjoy using technology?	Yes	222	92.5
	No	18	7.5
Do you own a tablet or PC?	Yes	159	66.1
	No	81	33.9
Do you have internet access at home?	Yes	210	87.7
	No	30	12.3
Have you received coding education?	Yes	94	39.2
	No	146	60.8
	Total	240	100

Table 1 summarizes the demographic characteristics and technology-related attitudes of third- and

fourth-grade primary school students. Of the 240 participants, the majority (59.9%) are fourth graders. Most students (92.5%) report enjoying the use of computer technologies; however, access to devices varies, with 66.1% owning a tablet and 87.7% having internet access at home. In terms of technical skills, 60.8% have not received formal coding education, whereas 39.2% have. Awareness of AI is relatively high, with 81.9% familiar with the term. Media and family serve as the primary sources of AI exposure. While platforms such as ChatGPT and Gemini are frequently mentioned, some students lack direct experience with AI applications.

Data Collection Tool

During data collection, researchers used a semi-structured paper questionnaire. Students were asked to complete the sentence, "AI is like _____ because _____," and to draw an image of their metaphor. Each student was given a unique ID (e.g., S1, S2, S3) to keep track of their answers. A total of 240 students took part in this task. After reviewing their answers, 227 were found to have meaningful metaphors and explanations. The responses from 13 students who could not create a metaphor were not included in the analysis. The questionnaire was carefully checked, and 227 responses were selected for detailed study.

Data Analysis

The data analysis was done step-by-step to make sure it was clear and thorough. First, open coding was used to find common themes in the students' answers. Then, related codes were grouped into larger themes using axial coding. Finally, selective coding helped identify the main categories that best described the data. Two researchers independently analyzed the valid responses to ensure accuracy and reduce bias. After their first review, they compared results and agreed on the final categories. An expert in educational technologies also reviewed these categories and suggested improvements. This process helped find important themes and patterns in how students think about AI.

FINDINGS

In the findings section, the metaphors created by students about AI, the main conceptual categories derived from these metaphors, and examples within each category are presented in detail. The validity of these findings is supported by direct quotes from the participants. The analysis identified six primary conceptual categories for the metaphors students used to describe AI: education and knowledge; technological and mechanical structure; social and communicative roles; entertainment and convenience; emotional and future-oriented; and extraordinary and creative metaphors.

Table 2. *Distribution of Metaphors for the Concept of AI According to Conceptual Categories*

Category Name	f	%
Education and Knowledge	102	44.9
Social and Communicative Roles	88	38.8
Technological and Mechanical Structure	20	8.8
Entertainment and Life Convenience	11	4.8
Extraordinary / Creative	4	1.8
Emotional and Future-Oriented	2	0.9
Total	227	100

Table 2 presents the main metaphor categories students used to describe AI. Most students associated AI with education and knowledge, highlighting its role in learning and information access. The next common

view was AI's social and communicative roles, reflecting its connection to interaction and communication. Other categories included technological and mechanical aspects, entertainment and convenience, creativity, and emotional or future-oriented perspectives, but these were mentioned less often. In summary, students mainly perceive AI as a tool for education and social interaction, with less emphasis on its emotional or creative dimensions.

AI as a Source of Education and Knowledge

The metaphors produced by the students in the category of AI as a source of education and knowledge are presented in Table 3.

Table 3. *Distribution of Metaphors Regarding the Concept of AI as a Source of Education and Knowledge*

Metaphor	f	%
Robot	39	17.2
Teacher	21	9.3
Brain Memory	17	7.5
Assistant Guide	13	5.7
Information	6	2.6
School	6	2.6

Students commonly use metaphors such as "robot," "teacher," and "brain memory" to describe AI as a source of education and knowledge. Interest in computer games and technology, especially among boys, may explain the frequent use of the "robot" metaphor. Additionally, household robots used for tasks like cleaning make this metaphor more familiar. The "teacher" metaphor reflects students' views of teachers as knowledgeable role models. AI's ability to provide real-time information and support learning likely influences students to see it as an educational tool.

Some views regarding the metaphors produced by students for AI as a source of education and knowledge are as follows:

- Robot: "AI knows everything" (S11), "AI answers every question without thinking" (S12), "AI finds the answer to every question without thinking" (S106). These statements indicate that students often regard AI as an omniscient and effortless source of information, attributing to it cognitive authority and perpetual availability.
- Teacher: "It explains things we don't know, just like my teacher" (S79), "It always gives correct information, just like my teacher" (S159, 160). The metaphor of 'teacher' underscores how students perceive AI as a reliable instructional figure, closely aligned with the authoritative and educational roles traditionally held by human educators.
- Brain Memory: "AI is like brain memory because it can do everything" (S102), "It is as intelligent as brain memory" (S117). In this context, students associate AI with advanced human cognition, reflecting their perception of AI as an extension or imitation of the memory capabilities of the human brain.
- Assistant Guide: "It is like an assistant guide because it researches and tells" (S103), "I learn by asking it" (S147). These expressions suggest that students view AI as a facilitator of learning, supporting independent inquiry and the retrieval of information.
- Information: "It gives information without getting tired" (S1), "It teaches us what we don't know" (S100). Students perceive AI as a tireless source of knowledge that operates with consistent availability and reliability.

- School: "It teaches everything like school" (S220, 222), "We learn once we get into it, like school" (S228). These analogies illustrate that students conceptualize AI as a comprehensive and structured learning environment, akin to traditional educational institutions.

The drawings made by students regarding AI as a source of education and knowledge also provide additional insight into these metaphors.
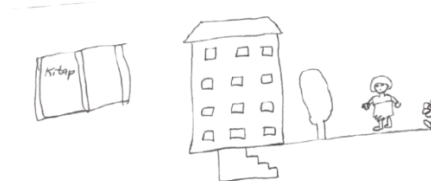
Brain (S117)   School (S220)   Teacher (S13)

Robot (S116)   Information (S71)   Assistant Guide (S5)

Figure 1. *The Drawings Regarding AI as a Source of Education and Knowledge*

Social and Communicative Role-Providing Tools for AI

The metaphors related to the social and communicative roles attributed to AI by students are presented in Table 4.

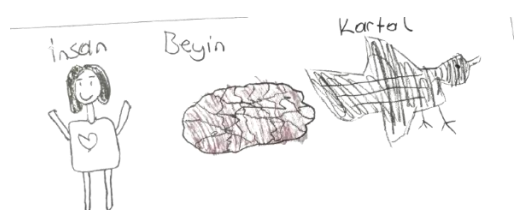**Table 4**. *Social and Communicative Roles Attributed to AI by Students*

Metaphor	f	%
Human	47	55.3
Communication Tool	22	25.9
Friend	15	17.6
Family	4	4.7

Table 4 shows that in the "Social and Communicative Role" category, students most often described AI as a human, friend, communication tool, or family. The frequent use of the "human" metaphor suggests that primary school students tend to give AI human-like qualities to better understand it. Students also associate AI with friends and family because it can reduce loneliness, offer support, and help with communication. Examples of student statements are as follows:

- Human: Students emphasized AI's ability to answer questions and converse ("Like a human, it answers every question I ask and can talk" - S33, 44), perform multiple tasks ("Like a human, it does a lot of things" - S56), and possess a realistic quality ("Like a human, it is realistic" - S149).

- Communication Tool: Students perceive AI as a helpful tool for obtaining information ("I research things I don't know from it" - S43) and facilitating communication ("It helps me communicate" - S22).
- Friend: AI was described as fun ("Like my friends, it's very fun" - S22), bringing peace and happiness ("Like a friend, it brings me peace and happiness" - S52), and being a supportive presence always there for them ("Like a friend, it is always with me" - S99).
- Family: Students expressed that AI provides continuous help ("Like my family, it always helps me" - S50) and support in areas where they lack knowledge ("Like my family, it helps me with things I don't know" - S69).

Below are some visual representations related to the metaphors students produced regarding the social and communicative roles attributed to AI.
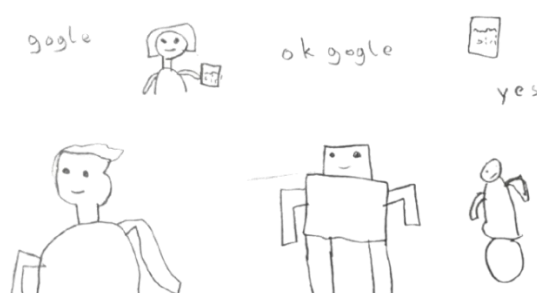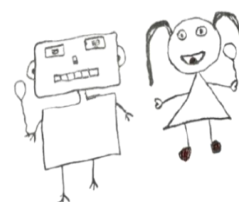

Human (S153)   Communication (S133)

Family (S50)   Friend (S12)

Figure 2. *The Drawings Regarding AI as Social and Communicative Roles*

Technological and Mechanical Structure of AI

The table presents the frequencies and percentage values of the metaphors produced by students related to the "Technological and Mechanical Structure" category of AI.

Table 5. *Technological and Mechanical Structure Metaphors Attributed to AI by Students*

Metaphor	f	%
Machine	9	4.0
Technological Device	7	3.0
Car	3	1.3
Jet	1	0.4

Table 5 shows that students often describe AI in the "Technological and Mechanical Structure" category using metaphors like machine, technological device, car, and jet. The most common metaphor, "machine," reflects ideas of continuous operation and making life easier. Some student statements are as follows:

- Machine: "Because it works continuously like a machine" (S225), "It helps people with many tasks like a machine" (S25).
- Technological Device: "It's smart, like technological devices" (S120, 124), "It makes our lives easier" (S190).
- Car: "It carries people's burdens" (S41), "It takes you wherever you want to go and does what you want" (S65).
- Jet: "It's fast, it immediately does what you want" (S15).

The drawings made by students about AI as a technological and mechanical structure also support these metaphors.
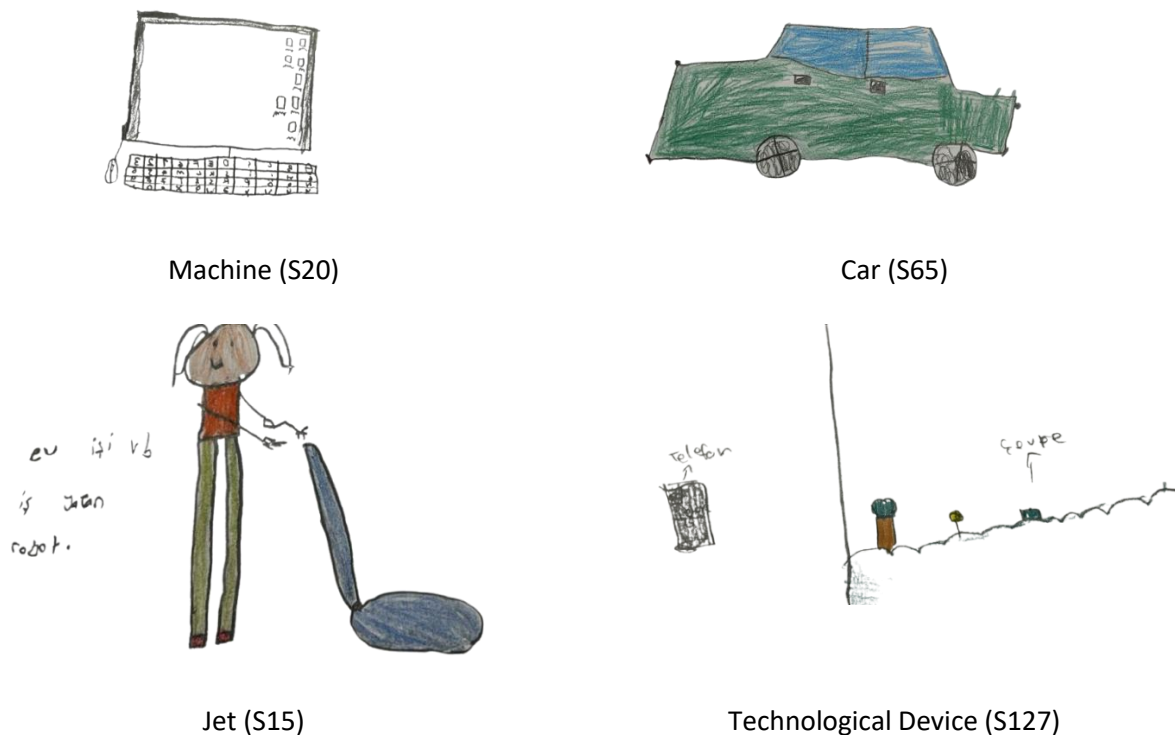

Machine (S20)

Car (S65)

Jet (S15)

Technological Device (S127)

Figure 3. *The Drawings Regarding AI as Technological and Mechanical Structure*

AI Providing Entertainment and Ease of Life

The metaphors produced by students under the category of AI providing entertainment and ease of life are shown in Table 6.

Table 6. Metaphors in the Category of AI Providing Entertainment and Ease of Life

Metaphor	f	%
Game	10	4.4
Comfort	1	0.4

Table 6 shows that students most often associated AI with metaphors like game and comfort. This likely reflects that students mainly use AI and computers for gaming, and recognize AI's role in making life easier. Some student statements are as follows:

- Game: "The game is fun" (S206), "It allows us to play with many people" (S214), "It is entertaining, and it also develops our brains" (S184), "Since it is always in children's hands, it's like a toy" (S112).
- Comfort: "It doesn't let us think too much while doing some tasks" (S98).

The metaphors students created for AI providing entertainment and convenience are also reflected in their drawings. Below are examples related to the game metaphor from the drawings of S112 and S198:

Game (S112)   Comfort (S198)

Figure 4. *The Drawings Regarding AI as Entertainment and Ease of Life*

Extraordinary and Creative Metaphors for AI

The metaphors produced by students under the "Extraordinary and Creative" category of AI are shown in Table 7.

Table 7. *Metaphors of AI under the "Unusual and Creative" Category*

Metaphor	f	%
Donkey	1	0.4
Bread	1	0.4
Cotton	1	0.4
Jam	1	0.4

Table 7 lists the metaphors students used to describe AI as "extraordinary and creative." Common examples include donkey, jam, cotton, and bread. These metaphors reflect students' focus on AI's functionality, usefulness, and appeal. Some student statements are as follows:

- Donkey: "It instantly finds what people can't find and lightens their load" (S81).
- Bread: "You eat bread, your stomach gets full, and you're happy. You ask AI a question you don't know, it answers, and you are happy" (S49).
- Cotton: "It gives an answer to every question immediately, it's very sweet and gentle" (S9).
- Jam: "It knows everything, and you never want to stop using it" (S101).

The metaphors that students created in the "extraordinary and creative" category for AI can also be seen in their drawings.

Donkey (S81)   Cotton (S9)

Bread (S49)   Jam (S101)

Figure 5. *The Drawings Regarding AI as "Unusual and Creative" Category*

Emotional and Future-Oriented AI

The metaphors produced by students under the "Emotional and Future-Oriented" AI category are shown in Table 8.

Table 8: *Metaphors in the Emotional and Future-Oriented AI Category*

Metaphor	f	%
Addiction	1	0.4
Future	1	0.4

Table 8 shows that students most often described AI using the metaphors "addiction" and "future." They linked addiction to spending too much time with AI, and associated AI with the future because of its ability to provide information. Some student statements are as follows:

- Addiction: "People become addicted to the internet and lose connection with the world" (S186).
- Future: "It knows our future, we can ask and learn" (S193).

The metaphors drawn by students in the Emotional and Future-Oriented AI category are as follows:

Addiction (S186)   Future (S193)

Figure 6. *The Drawings Regarding AI as Emotional and Future-Oriented Category*

DISCUSSION AND CONCLUSION

This study examined how primary school students perceive and conceptualize AI, revealing that their primary associations with AI relate to educational and social functions, while less attention is given to its technological, emotional, or creative aspects. This may be because children's initial and most consistent exposure to AI often occurs in educational contexts such as digital learning platforms, voice assistants used for homework help, or classroom technologies, leading them to form predominantly academic associations.

The metaphors most commonly used by students were strongly connected to education and

knowledge. For example, they compared AI to "robots," "teachers," "brain memory," "assistant guides," "information," and "school." These metaphors suggest that students view AI as a tool designed to aid learning, gather information, and support knowledge acquisition. The comparison to a "teacher," in particular, highlights students' perception of AI as a reliable source of education, similar to a traditional instructor. This metaphor likely emerges from classroom experiences where AI is framed as a knowledge provider, mirroring how students already understand teachers, thus reinforcing the idea of AI as a non-threatening and helpful educational figure. This aligns with the growing trend of incorporating AI into educational settings, where it increasingly serves as an instructional aid.

This observation is consistent with previous studies (Shin et al., 2018; Kalemkuş & Kalemkuş, 2025), which emphasize that students tend to conceptualize AI as a functional and supportive technology. Our findings also resonate with Tartuk (2023), who noted that students often perceive AI as an entity with human-like capabilities, such as the ability to think and remember. Students in our study frequently described AI as a "helper," "tool," or "technological innovation," indicating a generally positive perception. The prevalence of these functional metaphors could be attributed to the way AI is introduced through tools that simplify tasks, like voice assistants, educational apps, or YouTube recommendations, thereby reinforcing its utility-oriented image in young minds. This contrasts somewhat with Mertala et al. (2022), who observed that students often define AI as "intelligent" and "human-like," focusing more on its cognitive and anthropomorphic qualities.

Beyond educational associations, another significant theme emerged around AI's social and communicative roles. Students commonly used metaphors like "human," "friend," "communication tool," and "family" to describe AI. This suggests that students do not see AI merely as a machine but as something capable of interaction and communication. The "human" metaphor implies that students relate to AI in human-like terms, while comparisons to "friend" and "family" indicate AI is viewed as a supportive and comforting presence that helps reduce loneliness and foster communication. Such social metaphors may stem from students' interactions with AI-powered technologies like virtual assistants (e.g., Siri or Alexa) or chatbots in games, tools designed to respond conversationally and exhibit socially intelligent behavior. These findings align with Saçan et al. (2022) and Demir & Güraksın (2022), who observed that students often associate AI with human-like traits, conceptualizing it more as an abstract entity than just a practical tool. Our study extends this by suggesting that students hold a broader understanding of AI, encompassing not only its cognitive functions but also its societal implications. This could reflect a shift in children's media consumption patterns, where AI characters are portrayed not only as machines but as social agents capable of empathy and relationships. This broader perspective implies that, alongside discussing AI's technological features, educators should also address its ethical and social impacts.

Students also showed an understanding of AI's technological and mechanical aspects. Metaphors such as "machine," "technological device," "car," and "jet" were commonly used. These reflect recognition of AI as a tool that simplifies tasks and improves efficiency. The "machine" metaphor particularly highlights perceptions of AI as a highly efficient, continuously operating entity. This suggests that while students may not fully grasp the technical mechanisms of AI, they are keenly aware of its instrumental value, perhaps shaped by observing adults or media narratives that associate AI with automation and speed.

Interestingly, students also linked AI to entertainment and convenience, using metaphors such as "game" and "comfort." These suggest common associations with gaming and the role of AI in making life easier. The "comfort" metaphor reflects the view of AI as something that effortlessly handles daily tasks. Such interpretations may arise from children's frequent engagement with AI-enabled games or recommendation systems, where convenience and enjoyment are central experiences.

Conversely, metaphors related to AI's extraordinary and creative qualities were less common. Terms

like "donkey," "bread," "cotton," and "jam" reflect practical, utilitarian aspects rather than imaginative or exceptional qualities. These metaphors suggest students mainly perceive AI as a functional tool rather than a creative or extraordinary phenomenon. This could be due to limited exposure to AI's use in creative domains such as art or music, which are often less visible in primary education settings.

The least frequent metaphors were those connected to AI's emotional and future-oriented aspects, such as "addiction" and "future." While students acknowledged AI's potential to influence the future and predict upcoming events, these aspects were less prominent in their overall understanding. This might stem from developmental factors; younger students may find it more difficult to conceptualize long-term, abstract consequences, focusing instead on immediate and observable functions.

A notable difference from earlier studies is the greater variety and abstract nature of metaphors used by students in our study. For example, while Alkan & Yıldız (2024) and Kim et al. (2023) focused mostly on metaphors like "robot" and "human," our findings show students employed a much wider range. This diversity suggests students view AI as a multidimensional phenomenon rather than simply a technological tool. Metaphors such as "brain," "technology," and "human" indicate a more creative and abstract perspective, reflecting growing awareness of AI's broader societal, ethical, and security implications.

This increased conceptual variety may be due to the wider availability of AI-related content in children's digital environments, ranging from YouTube videos to AI-generated content, broadening their conceptual frameworks. This contrasts with studies like Mertala et al. (2022), which showed a narrower focus on AI as a cognitive, anthropomorphic technology.

In conclusion, our findings suggest primary school students predominantly view AI as a tool for education and social interaction, using metaphors related to learning, communication, and assistance. However, they are less likely to emphasize its technological, emotional, or creative potential. These results highlight the importance of not only focusing on AI's educational and social roles but also broadening students' exposure to its wider capabilities. By doing so, educators can support more critical, imaginative, and future-oriented thinking about AI; skills that are essential in preparing students for life in an increasingly AI-integrated society.

Recommendations

Based on the study's findings, several recommendations are proposed. When introducing A) to primary school students, it is important to use metaphors and visual aids that support concrete thinking. Educators should encourage students to create and discuss their own metaphors to explore different aspects of AI. Considering students' perceptions of AI's social role, it is crucial to emphasize that AI cannot replace human relationships and to promote healthy social interactions. Providing clear explanations of AI principles, along with engaging and interactive activities, can enhance technological literacy. Additionally, raising age-appropriate awareness of risks, such as excessive use, is essential for fostering balanced technology habits.

Regarding the study's limitations, it should be noted that the research focused only on third- and fourth-grade students in Yozgat and employed convenience sampling, which limits the generalizability of the findings. This sampling approach involves selecting participants who are easily accessible, rather than using random or stratified sampling techniques. As a result, convenience sampling may introduce selection bias, as the sample may not accurately represent the broader population of primary school students in different regions or contexts. Therefore, this method limits the generalizability of the findings, and caution should be exercised when applying these results to other student population. The semi-structured written format may have restricted students' ability to fully express themselves, suggesting that future studies consider interviews or group discussions to gather richer data. Furthermore, metaphor interpretation may be subject to researcher bias, despite efforts to use direct quotations and systematic coding. Comparing different age

groups and examining students' varying access to technology could provide deeper insights. Longitudinal studies and research with more diverse samples are recommended to better understand how perceptions of AI change over time.

REFERENCES

Adams, C., Pente, P., Lemermeyer, G., & Rockwell, G. (2023). Ethical principles for artificial intelligence in K-12 education. *Computers and Education Artificial Intelligence, 4*, 100131.

Al-Zahrani, A. M. (2024). Unveiling the shadows: Beyond the hype of AI in education. *Heliyon, 10*(9), 1-15.

Akbay, B., & Yıldırır, H. E. (2024). A comparative investigation of middle and high school students' metaphors towards AI. *International Journal of Computers in Education, 7*(2), 118–132.

Alkan, A., & Yildiz, E. P. (2024). AI and education: A metaphorical analysis on the perceptions of students with special abilities. *International Journal of Research in Education and Science, 10*(4), 761–775.

Casal-Otero, L., Catala, A., Fernández-Morante, C., Taboada, M., Cebreiro, B., & Barro, S. (2023). AI literacy in K-12: a systematic literature review. *International Journal of STEM Education, 10*(29), 1-17.

Chiu, T. K., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open, 6,* 100171.

Demir, K., & Güraksın, G. E. (2022). Determining middle school students' perceptions of the concept of AI: A metaphor analysis. *Participatory Educational Research, 9*(2), 297–312.

Gouseti, A., James, F., Fallin, L., & Burden, K. (2025). The ethics of using AI in K-12 education: A systematic literature review. *Technology, Pedagogy and Education, 34*(2), 161-182.

Hur, J. W. (2025). Fostering AI literacy: Overcoming concerns and nurturing confidence among preservice teachers. *Information and Learning Sciences, 126*(1/2), 56-74.

Kalemkuş, J., & Kalemkuş, F. (2025). Primary school students' perceptions of AI: Metaphor and drawing analysis. *European Journal of Education, 60*(1), e70007.

Karalekas, G., Vologiannidis, S., & Kalomiros, J. (2025). Teaching Artificial Intelligence and Machine Learning in Secondary Education: A Robotics-Based Approach. *Applied Sciences, 15*(8), 4570.

Kim, S., Lee, J., & Park, Y. (2023). Exploring children's perceptions of AI: A metaphor analysis. *Computers & Education, 186*, 104538.

Kong, S. C., Cheung, M. Y. W., & Tsang, O. (2024). Developing an artificial intelligence literacy framework: Evaluation of a literacy course for senior secondary students using a project-based learning approach. *Computers and Education: Artificial Intelligence, 6,* 100214.

Kolasinska, A., Lauriola, I., & Quadrio, G. (2019, September). Do people believe in artificial intelligence? A cross-topic multicultural study. In *Proceedings of the 5th EAI International Conference on Smart Objects and Technologies for Social Good* (pp. 31-36).

Lozano, A., & Blanco Fontao, C. (2023). Is the education system prepared for the irruption of artificial intelligence? A study on the perceptions of students of primary education degree from a dual perspective: Current pupils and future teachers. *Education Sciences, 13*(7), 1-12.

Lyublinskaya, I., & Du, X. (2025). *Teaching AI Literacy Across the Curriculum: A K-12 Handbook*. Corwin Press.

Mertala, P., Fagerlund, J., & Calderon, O. (2022). Finnish 5th and 6th grade students' pre-instructional conceptions of AI (AI) and their implications for AI literacy education. *Computers and Education: AI, 3*, 100095.

Mertala, P., & Fagerlund, J. (2024). Finnish 5th and 6th graders' misconceptions about artificial intelligence. *International Journal of Child-Computer Interaction, 39,* 100630.

Moustakas, C. (1994). *Phenomenological research methods.* Sage Publications.

Octavianto, A. W., Priyonggo, A., & Setianto, Y. P. (2023). *Framing the future: Exploring AI narratives in Indonesian online media using topic modelling.* Jurnal Komunikasi Indonesia, 13(2), 172-194.

Oruc, T., Korkmaz, Ö., & Kurt, M. (2024). Primary school students' views on Artificial Intelligence. *International Journal of Technology in Education and Science, 8*(4), 583–601.

Ottenbreit-Leftwich, A., Glazewski, K., Jeon, M., Hmelo-Silver, C., Mott, B., Lee, S., & Lester, J. (2021, March). How do elementary students conceptualize artificial intelligence?. In *Proceedings of the 52nd ACM technical symposium on computer science education* (pp. 1261-1261).

Pahi, K., Hawlader, S., Hicks, E., Zaman, A., & Phan, V. (2024). Enhancing active learning through collaboration between human teachers and generative AI. *Computers and Education Open, 6,* 100183.

Rizvi, S., Waite, J., & Sentance, S. (2023). Artificial Intelligence teaching and learning in K-12 from 2019 to 2022: A systematic literature review. *Computers and Education: Artificial Intelligence, 4,* 100145.

Saçan, S., Yaralı, K. T., & Kavruk, S. Z. (2022). Çocukların "yapay zeka" kavramına ilişkin metaforik algılarının incelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, (64)*, 274–296.

Su, J., Ng, D. T. K., & Chu, S. K. W. (2023). Artificial intelligence (AI) literacy in early childhood education: The challenges and opportunities. *Computers and Education: Artificial Intelligence, 4,* 100124.

Su, J., Guo, K., Chen, X., & Chu, S. K. W. (2024). Teaching artificial intelligence in K–12 classrooms: a scoping review. *Interactive Learning Environments, 32*(9), 5207-5226.

Su, J., & Yang, W. (2022). Artificial intelligence in early childhood education: A scoping review. *Computers and Education: Artificial Intelligence, 3*, 100049.

Shin, S., Ha, M., & Lee, J. K. (2018). Exploring primaryschool students' image of AI. *Journal of Korean Primary Science Education, 37*(2), 126–146.

Tartuk, M. (2023). Metaphorical perceptions of middle school students regarding the concept of AI. *International Journal of Education and Literacy Studies, 11*(2), 108–116.

Wang, N., & Lester, J. (2023). K-12 Education in the Age of AI: A Call to Action for K-12 AI Literacy. *International Journal of Artificial Intelligence in Education, 33*(2), 228-232.

Walan, S. (2024). Primary school students' perceptions of AI–for good or bad. *International Journal of Technology and Design Education*, 1–16.

World Economic Forum. (2025, January 15). *Industries in the intelligent age: AI tech theme at Davos 2025*. World Economic Forum. https://www.weforum.org/stories/2025/01/industries-in-the-intelligent-age-ai-tech-theme-davos-2025/

Williams, R., Ali, S., Devasia, N., DiPaola, D., Hong, J., Kaputsos, S. P., ... & Breazeal, C. (2023). AI+ ethics curricula for middle school youth: Lessons learned from three project-based curricula. *International Journal of Artificial Intelligence in Education, 33*(2), 325-383.

Yang, W. (2022). Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation. *Computers and Education: Artificial Intelligence, 3*, 100061.

Yang, Y., Zhang, Y., Sun, D., He, W., & Wei, Y. (2025). Navigating the landscape of AI literacy education: insights from a decade of research (2014–2024). *Humanities and Social Sciences Communications, 12*(1), 1-12.