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How Children Understand Artificial Intelligence —The Analysis of Statements Made by Children at a Younger School Age

Adam Naruszewicz¹

ABSTRACT

This study examines various aspects of artificial intelligence as a technology increasingly relevant to the development of children at a younger school age. It investigates children's understanding of AI, focusing on three objectives: 1) exploring children's subjective understanding of the concept of artificial intelligence, 2) assessing their knowledge of potential AI applications, and 3) describing their experiences in using AI. The theoretical framework is based on the concept of AI literacy, which is outlined alongside an overview of AI technology in the educational context. The study employed focus group interviews with 57 students (27 girls and 30 boys). Findings indicate that children perceive artificial intelligence as a set of tools with diverse applications. Although they are not active users of AI, they demonstrate awareness of its existence and functions. These results have implications for early childhood education, particularly regarding the development of digital literacy and critical thinking in an era of rapid technological change.

Instead of alternating between terms such as text, article, or research, it is more consistent to use the term *study*.

KEYWORDS: artificial intelligence, early childhood education, digital competency, AI competency.

Introduction

Artificial intelligence (AI) is playing an increasingly important role in education as it becomes an essential aspect of both teaching processes and the daily lives of children

1 Faculty of Education, University of Białystok, Poland
E-MAIL: a.naruszewicz@uwb.edu.pl ORCID: 0000-0003-4159-2324

attending grades I–III (Unesco, 2019; Walter et al., 2023, p. 4). This has been examined by researchers in Poland as well as internationally mainly in the context of opportunities and threats that this technology brings for children and adolescents (Jaskuła, 2023, p. 18; see also Więckiewicz-Modrzewska, 2024; Kostecka, 2024; Nowicka, 2024; Panjabi, AL-Sa’di, Ahmad, 2024). It is important to emphasize that research on the use of AI technology in education often focuses on analysing its potential applications as proposed by individual scholars. However, studies that include the perspectives of the primary stakeholders in the teaching process namely, students and teachers are less common. Considering this gap, the present study reports the findings of qualitative research designed to explore and understand the views and experiences of students in grades I–III regarding artificial intelligence.

Artificial intelligence—essence, functions and applications

The term *artificial intelligence* (or AI) was born at the *Dartmouth College* conference (McCarthy, 2007; McCarthy & Minsky et al., 1955, 2006). At that point, the concept referred to the science and engineering of making intelligent machines² (McCarthy, 2007; Minsky, 1968, p. 5; Rapaport, 2020, p. 52). Currently, there is no common consensus and no coherent understanding of this phenomenon (Kirsh, 1991; Allen, 1998; Hearst & Hirsh, 2000; Nilsson, 2009; Bhatnagar et al., 2018; Monett & Lewis, 2018) nevertheless, researchers have made attempts to define it (Rózanowski, 2007, p. 110; Wang, 2019). The definitions we may encounter have been developed mainly for research and legislative purposes. Some examples of such definitions are presented in *International Definitions of Artificial Intelligence* (IAPP, 2023), among others. The document elaborates on contemporary understandings of artificial intelligence proposed by various countries and institutions. These understandings have a lot in common. Given these common features, artificial intelligence may be understood as a multifaceted phenomenon and an operational mechanism underlying computer programs and mobile applications with diverse uses. More specifically, technology refers to the capacity of computers to exhibit skills resembling those of humans, enabling AI-driven systems to perceive their surroundings and address problems (European Parliament, 2023; IAPP, 2023).

Examples of different AI applications have been presented, among others, in *A Guide to Artificial Intelligence* developed by IAB Poland’s AI working group (2024). The functions outlined in the Guide operate through machines, which are equipped with such abilities as reasoning, learning, planning and creativity (Minsky, 1968). The

2 Translation and interpretation based on the original definition reading as follows: “the science and engineering of making intelligent machines.” (Wu, 2024, p. 127).

aforementioned machines, along with the emergence of natural language processing possibilities using neural networks and machine learning (Mondal, 2020; Rózanowski, p. 116), have been utilised in various areas of human life. Intelligent software, which in technical terms can be considered an expert system, is becoming increasingly available. Such programmes make it possible to carry out various types of tasks³ (Mulawska, 1997; Rózanowski, p. 116), for instance, generating and analysing data, speech and images. Generative artificial intelligence is a popular technology in this regard. In addition, AI systems are practical in activities such as broadly defined forecasting, providing diagnosis and controlling devices, e.g. in robotics (p. 116). These are just some of AI functions that can be utilised in various areas of daily life and development of humans, including education and the work of teachers.

Artificial intelligence in education

Various functions of artificial intelligence are highlighted by researchers focusing on problems associated with the presence of artificial intelligence in education (Bissoon-dath, 2024; Wu, 2024, p. 127; Su, Tsz Kit Ng, & Kai Wah Chu, 2023, p. 1). AI is viewed, among others, in terms of opportunities, threats, and social and economic challenges (Fazlagić, 2022; Su, Tsz Kit Ng, & Kai Wah Chu, 2023, p. 7; Rózanowski). Consistent with this perspective, artificial intelligence is often regarded as a trend influencing the field of education. This is particularly relevant in early childhood education, where younger students (Zafar, Khalid, Sajid, Muhammad, Yar, & Khan, 2024) are exposed to technological innovations such as chatbots, AI-generated content, and recommendation tools (Su, Tsz Kit Ng, & Kai Wah Chu, 2023, p. 1). Such technologies can impact their daily lives, development, needs, including learning processes. Significantly, children may not be aware of such an impact. Therefore, it is crucial to adequately prepare students to use AI (Kong et al., 2021, p. 1; 2022) and new devices based on the Internet of Things (Mondal, 2020). This approach is reflected in various types of documents which are being developed by educational institutions or government agencies.

According to a 2019 resolution of the European Parliament, artificial intelligence technology is central to the digital transformation of society. Within this framework, particular focus is placed on high-risk AI systems, which have the potential to substantially influence critical aspects of human life, including education (Flisak, 2024). This issue has also been brought up in the document outlining *The Policy for the Development of Artificial Intelligence in Poland from 2020* (p. 45–49), which points to the need

3 The source literature (Mulawska, 1997; Rózanowski, p. 116) provides a classification presenting examples of tasks performed by expert systems by category.

to adopt regulations in this respect and monitor the impact of AI on various sectors, including education. Although AI-related topics have not been directly included in the curricula, they have been discussed in *Directions for the Implementation of Educational Policy for 2023/2024* (p. 10), which indicates that this topic is increasingly popular in the context of the education system.

The concept of AI Literacy—the theoretical basis of the study

The development of artificial intelligence forces children to develop new competencies, including AI-related ones (*artificial intelligence literacy, AI literacy*). The source literature (Stolpe & Hallström, 2024, p. 5) distinguishes between three main areas of these competencies: understanding AI technology, using and evaluating it. A detailed description of this division can be found in the report titled *AI Literacy: A Framework to Understand, Evaluate and Use Emerging Technology* (Mills, Ruiz, Lee, Coenraad, Fusco, Roschelle, & Weisgrau, 2024), which organises the knowledge of the development of AI-related skills. As part of each area of AI Literacy Framework, there are components that demonstrate both the practical applications of artificial intelligence as well as the key values and skills necessary to use the technology effectively. The report also includes a graphical representation of interrelationships between AI competency components (p. 6), as well as detailed descriptions of each framework component along with the examples of their use (see p. 6–8). An analysis of the presented figures and the content of the report allow us to conclude that there are important correlations between AI competencies and computational thinking as well as other skills, particularly those that are key in working with data. These include Media Literacy and Digital Citizenship, including information and digital competencies that support the effective use of AI tools in various educational and professional settings (p. 9).

Based on the analyses presented, it can be concluded that the academic literature on AI literacy focuses primarily on the education of young people and adults; nonetheless, there is growing recognition of the importance of fostering the foundations of AI literacy beginning in early childhood education. Developing AI-related skills at an early stage can help children better understand technology, develop critical thinking, and make informed use of digital tools. The objective of the present study was to investigate and gain a comprehensive understanding of the opinions and experiences of students in grades I–III concerning artificial intelligence. The research, in line with the AI literacy concept, focused on three key aspects:

1. Understanding AI technology—The extent to which students are aware of artificial intelligence and its basic functions.

2. Using AI—How children use AI technologies in daily life, for instance: voice assistants, search engines and educational apps.
3. Evaluation of AI and reflection on AI—How students evaluate the performance of artificial intelligence, its limitations and impact on their lives.

Methodology

The objective of the research presented in this text was to: 1) find out the subjective way of understanding the concept of artificial intelligence by children, 2) determine the level of children's knowledge on possible applications of artificial intelligence, 3) describe children's experiences in using artificial intelligence.

The method applied in the research was focus group interviews (Morgan, Scanell, 1998). The research employed a problem-based situation as its primary methodological tool. This approach was intended to elicit insights from children that might be difficult to articulate in traditional individual interviews. To achieve this, data were collected through creative focus group sessions (p. 20), which resembled workshops where participants collaborated to develop shared concepts. In each session, respondents were asked to assume the role of advisors to individuals who were familiar with modern reality but unfamiliar with artificial intelligence. Their central task—the problem to be addressed—was to explain to these hypothetical individuals what artificial intelligence is and how it could be applied.

The rationale for using such data collection method was to offer children optimal conditions for discussion and expression of their opinions (p. 16). Ensuring the respondents' comfort was also a key consideration. Significant effort was made to cultivate an environment distinct from traditional individual surveys, one that would encourage participants to communicate openly and articulate their thoughts in their own words (Lachowicz-Tabaczek, 2004).

All 9-year-old students from three different elementary schools in the Podlaskie Voivodeship, whose parents or legal guardians gave their consents for their children's participation, were invited to take part in the research. The invitation was declined by two children, while three parents did not agree to the participation of their children in the research. Participation in the study was declined by both parents and children owing to the overlap of schedules with a mathematics competition. A total of 57 students participated in the study, comprising 27 females and 30 males. To collect data, 11 brief focus-group sessions were conducted (Lisek-Michalskaya, p. 17), each lasting approximately 45 minutes. Considering the study's subject, the participants' age, technical requirements, and the need for an interview-like format, students were organized into small groups of five, or occasionally six, individuals. It was essential for

participants within each group to be familiar with one another to ensure a sense of safety. In many instances, students requested to be grouped with specific classmates they preferred, which helped create a comfortable environment and promoted honest responses, as the children felt they were in a familiar setting (p. 19).

The statements made by the children were recorded using a microphone built into the laptop, and saved as audio files. In addition, the laptop and tablet proved useful in situations where the children needed to use the Internet. Participants were informed that the interviews would be recorded and that they could use a laptop or tablet during the sessions. All audio recordings were transcribed and stored as password-protected digital text documents containing the dialogues. During transcription, statements were coded to maintain participant anonymity while still allowing individual contributions to be tracked. Each code included information on the participant's gender, their number within the group, and the focus group number. These codes were applied throughout all stages of data processing and are also used in this text. For instance, the code [DZ1, G3] identifies statements made by the first female participant [DZ1] in the third focus group [G3]. Additionally, the transcriptions included comments noting significant emotions and behaviours observed by the researcher, such as [the girl is excited]. Statements made by the researcher were labelled with [B].

The data analysis combined both inductive and deductive coding approaches. Initially, transcripts were examined to identify statements reflecting children's subjective understanding of artificial intelligence, with particular attention to dialogues in which they attempted to explain the concept to others. Subsequently, a list of AI applications, as perceived by the children, was compiled. Deductive analysis was also conducted using the AI literacy framework, whereby children's statements were compared against the domains outlined in the AI Literacy Framework (p. 6). The final stage involved collecting responses that demonstrated children's actual use of AI technologies and highlighted relevant characteristics of these activities. Ethical considerations were paramount; informed consent was obtained from participants, their parents or legal guardians, and the institution where the research took place.

Results

Each interview began with the following question: *What is AI* [B]? In all groups there was at least one child who, upon hearing the question, clearly signalled they wanted to answer it. On the other hand, there were children whose facial expression, uncertain smile or behaviour indicated that they were clearly reluctant to speak.

Initially, only those children who were willing to speak were asked. They were the first to speak, thus their answers were mostly short, one-sentence statements: *AI*

means artificial intelligence [CH1, G1]; these are kind of apps you download from the Internet to your phone [DZ2, G11]; these are kind of different things that do things on their own [DZ3, G11]. Similar responses were consistently observed across different groups. Only a small number of participants provided more detailed answers; two such statements are presented below as examples. The first statement was a girl's attempt to explain the abbreviation AI [DZ2, G3]. *This is in English, at the English lesson, after lessons with Ms [the child gave the first name of the teacher] I remembered that it meant intelligence, but the first letter was more difficult and I can't remember, yet I can tell what it means in Polish (...) it is an intelligence in the computer that writes on its own.*

An equally elaborate statement was made by a boy [CH1, G2]. *This is this very complicated technology, which thinks for us by itself (...) it is as complicated as the human brain; there are chips that replace it only they are—I do not remember the word—oh! I know—they are not implanted inside the brain, but there are such processors in the computer.*

Such statements became, in many cases, a point of reference for other participants of the session: *You can buy such processors in the store, which, if they are fast, then artificial intelligence works faster and can do everything [CH2, G2]. Regardless of individual focus groups, children said many times that artificial intelligence: does something on its own [CH1, G11] or does something for us [DZ2, G3].*

During most sessions, at least one child would say that AI is: *a thing that is intelligent [DZ1, G2].* In such a case, the researcher would ask children to be more specific: *It's very interesting what you say, and what is this thing exactly [B]?* Then, they would usually elaborate after thinking for a few seconds. They would develop their statements by defining AI as: *a thing in the mobile phone (...) apps for different things [DZ1, G2].* The statement was spontaneously expanded by other members of the group: *for collecting Pokémon [DZ2, G2], for generating characters and faces [CH1, G2].*

In other groups, the answer was mostly motivated by the additional question asked. *What do you think we could compare it to [B]?* The children's answers were as follows: *to a computer or the Internet, because AI is on the Internet [CH1, G2]; to a car that drives on its own and recognises everything it sees. I saw such a car, I really did! [the girl emphasized], I saw it when I was coming back from Tartu in Estonia [DZ2, G11]. It is very interesting what you said. I would also like to see such a car. Would you describe it for us [B]? I don't remember much. There was a camera and long feelers attached to its roof. I really saw it [DZ2, G11].* Other children mainly referred to specific devices and applications. *There is an app in your mobile for taking pictures. If you take a picture of a pencil case, it would show you where you can buy this pencil case online [DZ1, G8].* When describing AI, many participants relied mainly on the following statements: *a computer, a robot, a kind of a machine.* Less common, though regularly repeated, were the following answers: *it is an invention [DZ1, G3], a computer programme [CH1, G2].*

Less active children, when they heard the statements presented above, would change their mind and manifest their willingness to participate in the discussion, e.g.: *I already know. AI means artificial intelligence* [DZ1, G2]; *Now I know, I can tell* [DZ1, G7]; *I didn't know that it was the same thing* [DZ2, G5]; *Oh, that's what it was. These are those apps that do things* [CH1, G11]; *Now I also know what it is* [CH3, G11]. Such reactions often served as a starting point for children to engage in a discussion. For example, one group started a discussion around the uses of various apps which can: *draw on their own* [DZ1, G9]; *generate game items* [CH1, G9]; *clean your phone of files that no one needs anymore* [DZ2, G9]. Thus, the children contributed to changing the planned course of the interview, as they had answered the question about possible applications of AI before it was asked.

In discussions devoted to the following problem: *How would you explain what AI is to someone who is not yet familiar with such technology* [B], the statements made by children were much more elaborate. Initially, the elaborate statements were made only by some respondents, but over time they became, in many cases, a source of reference for the other members of the group. *Artificial intelligence thinks for humans and is smarter than humans because it knows about all the books in the world, for instance, what is written in textbooks at school, it also knows all the books in our reading room* [DZ1, G1]. The group disagreed with this statement. *So this means that it supposedly photographs all the books and the lady in the reading room transcribes them* [CH1, G1]? *Well, so you mean that there is a guy, and he transcribes all the set books so that they can be included in artificial intelligence* [CH2, G1]. *No, it's not like that, because these books are already on the Internet and then they are generated from the Internet, and our teacher writes prompts, and she said that what the intelligence writes comes from the Internet* [DZ1, G1]. *And what is the prompt* [B]? *I don't know exactly. It is a text message to which no real person will respond* [DZ1, G1]. *I understand. But if I send such a text message, will I get any response* [B]? *Yes, but it will be, I don't know* [the girl is thinking], *it will be an answer from the Internet, from the computer* [DZ1, G1]. *I see. What can I talk to such a computer about* [B]? *You can ask your car about the weather, because it works in cars* [DZ1, G1].

According to the respondents, the Internet is the basis of the technology. In many statements, the children pointed out that AI technology is the product generated by the computer software: *artificial intelligence is computer programmes which do various things for us through the computer or phone* [CH1, G4]; *these are various applications programmed by computer scientists* [CH2, G4]; *How are such applications made* [B]? *I don't know, but you have to know a lot about maths and programming* [CH2, G4].

When asked about possible applications of AI, the children's replies varied. The respondents believed that the technology in question can be used for, among others: *guessing diagnosis and finding out how to cure a disease* [DZ1, G1]; *writing rhymes and*

making jokes [CH1, G4]; painting pictures, enhancing your face [DZ1, G4]; controlling the spacecraft and fixing it [DZ3, G9].

After hearing such suggestions, the children would often focus their attention only on one suggestion. As a result, the subject matter of the discussion was different in each group. For instance, the participants in group four focused on the applications available on the phone: *you can use such an application to create a drawing. You say what you want to be drawn and the application draws it [CH 1, G4]. Only you have to wait for a very long time [CH 2, G4]. We didn't have to wait long (...) we were taking photos with [the girl mentions the first name of her friend] and the app did make-up for us (...) because this AI is smart and can recognise faces and draw different facial expressions on it, hats, but unicorn ears and horns are the cutest [DZ2, G4].*

One of the longest discussions developed, among other things, after one of the girls gave an example of the possible use of AI: (...) *controlling the spacecraft [DZ3, G9]. She mentioned a science fiction movie in which AI played a significant role: (...) the captain of that spacecraft got sick and the artificial intelligence on the table displayed what was broken, red dots appeared on the glass (...) people were able to do everything according to the instructions given by the artificial intelligence [DZ3, G9]. And what was broken in that spacecraft [B]? Well, probably everything, when a lady wanted to eat breakfast, the machine that sold food didn't put any cereal in the bowl, it just fell on the floor, there was also an artificial bartender which also broke down, and robots were falling down, too. After that movie I was afraid to fall asleep [DZ3, G9]. It was probably a movie for older children or adults [B]? An ordinary movie on [the girl named the tv station]. We watched it on Christmas Eve, but I can't remember the title.*

Children associate AI primarily with specific information and communication technology devices: *artificial intelligence is a programme on the computer or on the phone [CH1, G2].* The respondents see AI as a tool for a variety of activities. In their opinion, this technology consists of applications available on the phone or on the computer and offering various functions. In addition, the students participating in the research indicated that AI is the basis for the operation of devices and machines other than computers. Children often mentioned robots: *thanks to artificial intelligence, people can order food [CH2, G4]. I also saw on TV, such a smart box-like robot on wheels from [name of a retail chain]; it distributes food, and people sometimes help it cross the kerb [CH1, G4].*

The example above suggests that children are aware of the presence of AI in their environment, often describing it as a technology that positively affects people. Although the respondents were not asked about the disadvantages of this technology, there were some spontaneous statements indicating that they noticed this aspect: *artificial intelligence can swap someone in a photo for someone else, and then there can be misunderstandings [DZ1, G1]; AI can be very dangerous if it turns into robots (...) then such*

robots can break down cars instead of building them in the factory, when someone installs a virus or switches levers [CH2, G1].

Generally, it can be assumed that the respondents correctly interpreted the meaning of AI, e.g. *artificial intelligence is something that does things for us through a computer or phone* [CH1, G4]. Nevertheless, some descriptions deviated from the commonly accepted understandings of AI and principle of the technology in question: *artificial intelligence is created by people who write back to your text messages* [CH1, G3]; *there are a lot of these people and they use fast and special computers* [CH2, G3].

Some discussions revealed that the children described AI as virtually everything related to digital technology and programming. It was noticed that the abbreviation 'AI' is less recognisable by the respondents than the full name of this technology. Among the respondents, there were five people who were quite well versed in the basic terminology associated with artificial intelligence. These students used such terms as *prompt* and *chatGPT*. What is more, the children were able to accurately describe the meaning of the terms.

Conclusions

The results of the study indicate that students understand artificial intelligence as a set of tools with a variety of different applications. Most of the children were aware that this kind of technology is the product generated by computer software. What is more, the students were acquainted with various applications of AI-based software, such as generating text, images and controlling various devices. Nonetheless, quite a lot of students admitted that they did not use these apps on their own, which can be explained by the age restrictions for these types of systems.

Studying how students in grades I–III understand artificial intelligence has significant implications for early childhood education, particularly in the context of fostering digital literacy and critical thinking in an era of rapid technological change. First, the findings underscore the importance of introducing AI-related topics into the curriculum at an early stage. Teachers should integrate elements of media and information education in an age-appropriate manner, enabling students to comprehend AI mechanisms and recognize its presence in daily life in an accessible and engaging way.

Second, a crucial aspect of AI education involves cultivating critical and ethical attitudes toward technology. Early instruction can support students in differentiating among AI-based tools and in using them consciously and responsibly, thereby fostering a more critical approach to the digital environment in the long term.

Third, educators should employ active teaching methods that allow students to explore AI through play, experimentation, and simple simulation-based exercises.

Approaches such as visual programming, educational games, and interactive applications can enhance children's intuitive understanding of algorithms and AI data-processing principles.

Fourth, the study highlights the collaborative role of both teachers and parents in AI education. While teachers require adequate preparation to integrate AI concepts into their lessons, parents should also be supported in fostering their children's digital literacy through relevant educational resources and guided discussions about technology.

In conclusion, further research on effective educational strategies is essential to ensure that AI-related content aligns with the cognitive abilities of early childhood students.

The study was exploratory and should be viewed as a starting point for further quantitative and comparative analyses. The study has several limitations: 1) it involved a small group of students from three schools in the Podlaskie region; 2) focus group interviews may have allowed dominant participants to influence others' responses; 3) the children's answers were shaped by their limited experience with AI technologies; 4) the study considered only the children's point of view, without including teachers' or parents' perspectives. Incorporating AI into the curriculum could play a pivotal role in equipping young learners to navigate an increasingly digital and technologically complex world consciously and responsibly.

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