Chapter 1 - Transforming Education with Artificial Intelligence: Shaping the Path Forward

Hamza Polat

Chapter Highlights

- Artificial intelligence has a considerable positive impact on education, opening up possibilities like individualized learning experiences and improved teacher interaction, but it also brings ethical problems to the fore.
- Artificial intelligence tools are frequently used in educational settings and can be divided into three categories: learner-facing tools that enable personalized learning, teacher-facing tools that help teachers manage their workloads and gain new perspectives, and system-facing tools that assist administrative choices.
- Artificial intelligence applications tailored to student needs and intended to improve teaching and learning processes include profiling, intelligent tutoring systems, assessment, and adaptivity.
- Generative modeling in AI involves producing artificial creations by studying patterns and distributions of training data, enabling the generation of authentic content beyond initial programming, which has significant implications for education and various creative domains.
- The development of generative AI in education poses a paradoxical problem that needs to be balanced by its advantages and potential disadvantages.
- Chatbots, including conventional and AI-enabled types, play diverse roles in education, facilitating personalized learning and instructional support through various interaction modes, categorized as teaching, peer, teachable, and motivational agents, thereby enhancing the teaching and learning process in online environments.
- A balanced strategy by educators and policymakers is required to maximize the potential of AI in education by addressing ethical considerations.

Introduction

Artificial intelligence (AI), introduced in the 1950s, refers to systems capable of performing human-like tasks and continuously enhancing themselves by processing information. Initially, AI systems followed specific patterns to solve certain problems, but they now generate more creative and original solutions that emulate human intelligence. Advanced techniques like machine learning, artificial neural networks, deep learning, and advanced algorithms enable these systems to extract patterns and features from large datasets and learn from them.

Among several domains, education is one in which AI integration has significantly transformed. Incorporating AI into education has led to a paradigm change in its landscape, influencing key educational aspects like predictive analytics, intelligent tutoring systems, evaluation methods, and personalized learning experiences. These transformative changes have brought ethical considerations to the forefront, spurring conversations about pertinent issues.

This book chapter aims to comprehensively discuss the applications of AI in education, the integration of generative AI into educational contexts, and the ethical challenges surrounding these topics based on the existing literature. This chapter focuses on AI and education, the use of generative AI in education, the application of chatbot technology, and the ethical issues arising from using AI in education.

Artificial Intelligence and Education

The origins of AI can be traced back to the 1950s when initial depictions of the field emerged. The phrase “Artificial Intelligence (AI)” was coined by John McCarthy during an academic conference organized at Dartmouth College in the USA (Russell & Norvig, 2010). AI is a comprehensive term that encompasses a broad spectrum of technologies and methodologies, such as machine learning, natural language processing, data mining, neural networks, and algorithms (Zawacki-Richter et al., 2019). AI has been defined in various ways, with some definitions emphasizing its collection of skills or capabilities present in digital computers. According to Baker and Smith (2019), AI refers to the capacity of computers to perform cognitive tasks akin to human minds, especially in learning and problem-solving.

AI plays a pivotal role in providing solutions across diverse fields, including but not limited to health, education, and engineering. Regarding education, AI applications increasingly attracted interest and considerable attention in recent years (Taş, 2021; Zawacki-Richter et al., 2019). Although it presents numerous opportunities to enhance teaching and learning, the advancement of AI in higher education also introduces fresh ethical considerations and potential risks (Zawacki-Richter et al., 2019). Incorporating AI into education (AIEd) represents a two-sided phenomenon capable of yielding unintended outcomes and prompting a reevaluation of our perspectives on learning, knowledge, skills, performance, creativity, and innovation (Gibson et al., 2023). Indeed, integrating artificial intelligence opportunities in conjunction with pedagogical components can potentially drive a transformative paradigm shift in education. In this regard, the crucial emphasis lies not in attempting to exclude artificial intelligence from the teaching process by instructional designers and practitioners but rather in

reimagining learning activities by incorporating the advancements in artificial intelligence.

The Horizon report published in 2023 discusses AI advancements in detail, highlighting the potential for new predictive and personalized learning applications. AI-enabled applications promise to transition from "one size fits all" technology to scalable personalized learning experiences, allowing students to leverage these tools even when faculty and staff are unavailable (EDUCAUSE, 2023). The same report also stresses that AI applications offload time-consuming teaching tasks, giving faculty more time to engage directly with students on challenging pedagogical endeavors like synthesizing information and fostering new knowledge.

Categories of Artificial Intelligence Tools in Education

AIEd tools are extensively employed in schools and colleges, broadly categorized into three groups: learner-facing, teacher-facing, and system-facing, acknowledging that certain products may combine features from multiple categories (Baker & Smith, 2019). Table 1 presents examples of these tools. Additionally, Baker and Smith (2019) provide explanations for these concepts. Firstly, learner-facing tools, also called 'intelligent tutoring systems,' 'adaptive,' 'personalized,' or 'differentiated' learning platforms, are software applications that students use to receive and comprehend new information tailored to their needs.

Table 1. Categories of AIEd (Adapted from Baker and Smith (2019))

AIEd Type	**Examples**
Learner-facing	Customizing and organizing learning materials to match individual student needs. Identifying a student's strengths, weaknesses, or knowledge gaps. Offering automated feedback. Fostering collaboration among learners.
Teacher-facing	Automating tasks like assessment, plagiarism detection, administration, and feedback. Supplying valuable insights into the progress of individual students or entire classes. Assisting teachers in fostering innovation and experimentation in their teaching approaches.
System-facing	Organizing timetables efficiently. Predicting inspections and optimizing institutional planning.

Secondly, AIEd tools designed for teachers offer advantages like reducing their workload, gaining valuable student insights, and promoting classroom innovation. Lastly, system-facing AIEd plays a crucial role in supporting and influencing decisions made by school administrators and education system managers. In summary, the diverse range of AIEd tools shows AI's capacity to revolutionize and optimize the paradigm shift in education, covering student-directed applications for learners' benefits, teacher-oriented tools to enhance instructors' capabilities, and system-oriented solutions to aid administrators.

AI Applications in Education

Several systematic review studies provide insights into the various AI applications in education. These studies also present specific examples of these applications. According to Zawacki-Richter et al. (2019), for example, AIEd tools find applications in (i) profiling and prediction, (ii) intelligent tutoring systems (ITSs), (iii) assessment and evaluation, as well as (iv) adaptivity and personalization. Learner profiling and prediction involve the development of learner models or profiles, enabling the anticipation of individual learners' behaviors and needs. The tutoring system offers real-time feedback and hints at each step, with some systems providing immediate feedback as the student progresses, while others wait until the solution is submitted to mark individual steps or conduct a debriefing, commonly known as intelligent tutoring systems (VanLehn, 2011). Assessment and evaluation direct our attention toward the level of teaching and learning. Finally, adaptive and personalized systems are automated and utilize real-time data from an automated system to tailor learning content and activities to individual learners' characteristics and needs (Peng et al., 2019).

As seen in Table 2, Zawacki-Richter et al. (2019) suggest various sub-categories of AIEd applications based on the literature. Within the "profiling and prediction" category, there are three primary research areas. The first area examines the possibility of accurately predicting admission decisions, which could alleviate administrative staff workload and enable them to concentrate on more complex cases. The second area centers on developing early warning systems to identify at-risk students during their first year of study and forecast undergraduate student attrition. Lastly, certain studies within this category aim to profile students and model their learning behaviors, aiming to predict their academic achievements at the course level.

The research on Intelligent Tutoring Systems (ITSs) is classified into five groups by Zawacki-Richter et al. (2019). Firstly, ITSs provide teaching content to students while offering adaptive feedback and hints to help them solve related questions, and they also detect students' difficulties or errors when engaging with the content or exercises by monitoring their actions. Secondly, ITSs mainly involve one-way communication from computer to student, addressing gaps in students' knowledge and providing feedback. Thirdly, ITSs offer personalized assistance by observing students' behavior and generating individual profiles, tailoring recommendations and course material to meet each learner's needs. Fourthly, ITSs foster collaboration among learners through online discussions and collaborative writing activities. Lastly, ITSs support teachers in collaborative learning and alleviate their workload using AI applications.

AI applications in assessment and evaluation in education encompass four categories. Firstly, automated grading systems across disciplines offer potential benefits in streamlining large-scale assessments, reducing costs and time. Secondly, AI-supported feedback employs student-facing tools, including intelligent agents for guidance, software for pilot alerts, and machine learning for automatic feedback, enhancing student writing and reducing cognitive overload. Thirdly, AI assesses student understanding, evaluates engagement, and checks academic integrity, possibly minimizing the need for invigilators and addressing privacy concerns. Lastly, data mining algorithms evaluate lecturer performance through course evaluations, identifying irrelevant questions and providing insights into the impact of teaching methods on various tasks.

Table 2. AIEd Applications in Higher Education (Adapted from Zawacki-Richter et al. (2019))

Research domain	**AIEd Applications**
Profiling and prediction	Admission decisions and course scheduling
	Drop-out and retention
	Student models and academic achievement
Intelligent tutoring systems (ITSs)	Teaching course content
	Diagnosing strengths or gaps in student knowledge, and providing automated feedback
	Curating learning materials based on student needs
	Facilitating collaboration between learners
	The teachers' perspective
Assessment and evaluation	Automated grading
	Feedback
	Evaluation of student understanding, engagement, and academic integrity
	Evaluation of teaching
Adaptivity and personalization	Teaching course content
	Recommending/providing personalized content
	Supporting teachers in learning and teaching design
	Using academic data to monitor and guide students.
	Supporting representation of knowledge in concept maps

The final category of AI in Education is adaptivity and personalization, encompassing five research areas. The literature lacks a consensus on a standard term for adaptive systems, likely due to their diverse functions, reinforcing the classification of studies (Zawacki-Richter et al., 2019). However, these systems can be utilized to personalize teaching course content across various disciplines. They also assist teachers in defining teaching strategies, addressing detected problems, and freeing up more time for teachers to focus on creative work. Adaptive systems analyze students' academic information to perform diagnostic tasks and offer proactive personal guidance to tutors. Moreover, they support tasks such as accommodating peer ideas in concept or mental maps.

Consequently, the growing digitalization of society is being significantly influenced by the pivotal role of AI. As AI continues to automate tasks, process massive volumes of data, and offer predictive insights, its impact on various aspects of our daily lives is bound to revolutionize further and expand (Yang, 2022). As highlighted earlier, AI presents numerous opportunities and advantages from an educational standpoint. However, as noted by Celik (2023), the full potential of AI in the educational context still needs to be explored and fully comprehended. There is much more to discover and understand about how AI can truly revolutionize and enhance the field of education. In this regard, the generative transformation of AI solutions stands as a notable advancement in AIEd that is poised to shape the direction of educational research and practical applications. The forthcoming section will focus on "Generative AI," delving into its principles, capabilities, and potential implications in various domains, particularly in education.

Generative AI (GAI) in Education

Generative modeling is an AI method that produces artificial creations by studying training instances, understanding their patterns and distribution, and subsequently crafting authentic replicas (Jovanovic & Campbell, 2022). This technology utilizes deep learning models to create human-like content, such as images or text, responding to diverse and intricate prompts, such as languages, instructions, or questions (Lim et al., 2023). While traditional AI applications follow a pre-determined flow designed by programmers, generative AI (GAI) surpasses these limitations by going beyond its initial programming, enabling it to produce more authentic and creative outcomes. In contrast to conventional AI machine learning approaches that identify patterns in training data to make predictions, classifications, personalized recommendations, or aid in decision-making, GAI stands out as it has the capability to generate fresh content rapidly and spontaneously in response to user prompts (Murugesan & Cherukuri, 2023). Thus, GAI has been identified by many higher education experts as one of the most disruptive technologies of our time, with the potential to create educational text, images, and sounds in ways that sometimes convincingly mimic human creation, impacting instructional materials, assessments, and more (EDUCAUSE, 2023).

GAIs can be differentiated based on their employed architecture, training techniques, and the types of data they are designed to generate. Generative adversarial networks (GANs), for example, are composed of two neural networks: the generator and the discriminator. The generator's role is to produce synthetic data, while the discriminator's task is to differentiate between the generated synthetic data and actual data (Goodfellow et al., 2020). This interplay between the two networks leads to the generation of high-quality content, particularly in the case of images. Another example of GAI, Generative Pre-trained Transformer (GPT), is a large transformer-based language model that underwent pre-training on extensive datasets, enabling it to generate human-like words, sentences, and paragraphs with a natural and coherent structure (OpenAI, 2023). The key distinguishing feature of GPT from other language models is its ability to perform effectively in multiple tasks without the need for retraining (Radford et al., 2019).

A paradoxical viewpoint

The advancements in GAI technologies have opened up new opportunities for developing diverse AI solutions in education and have also introduced numerous challenges that must be carefully addressed. Lim et al. (2023) outlined a paradoxical approach addressing this dilemma concerning the potential adverse influence of GAI on education or its role in facilitating the teaching process. To begin with, the dual nature of GAI is highlighted, characterized as both a 'friend' and a 'foe.' Initial considerations of GAI lean towards its role as a 'friend,' as it demonstrates the potential to provide a personalized learning experience (Kuhail et al., 2023), support collaborative learning, and possess the ability to provide valuable feedback (Hsu & Ching, 2023). However, concerning knowledge production, educators express apprehension that GAI might transform into a 'foe' that hampers students' creativity and impedes the learning process. For instance, there are concerns about GAI being used to present AI-generated knowledge as if it were a student's original work. Consequently, maintaining a balance between these two aspects is crucial for realizing a promising future for GAI.

GAI demonstrates remarkable proficiency in retrieving, organizing, and presenting information. For example, GAI systems have advanced to the point where they can effortlessly generate many scenarios on a wide range of topics, and the cost for users is virtually negligible (Spaniol & Rowland, 2023). However, the outputs of GAI are contingent upon the inputs it receives. The resulting response may also be inadequate when insufficient instructions are provided in the input. This circumstance has given rise to the paradox of GAI being 'capable' yet 'dependent,' illustrating its capability while highlighting its dependence on the clarity and comprehensiveness of the input instructions (Lim et al., 2023). Thus, learners and educators must develop an essential skill: the capacity to produce and deliver proficient prompts that direct GAI systems to generate valuable and relevant answers (Lo, 2023).

The developers of GAI have underscored that this technology is primarily intended for the improvement and benefit of humanity (OpenAI, 2023). GAI systems, including ChatGPT and Bard, have gained widespread popularity in society. Furthermore, there has been a rapid influx of new GAI systems designed for various purposes, swiftly finding their place in the market. Unfortunately, the complete utilization of some GAI systems with all their features is not always accessible for free. As a matter of fact, certain new initiatives have emerged, offering access to these systems through intermediary applications and monetizing the information generated by these tools. This commercialization and restriction on access can hinder some individuals or organizations from fully benefiting from these GAI technologies initially designed for society's greater good. Lim et al. (2023) call this situation the paradox of GAI being 'accessible' but 'restrictive,' indicating that GAI systems lie in their potential to democratize access to knowledge, making valuable information more widely available; however, the ability to access and utilize these tools may be constrained by resource availability, leading to potential equity and accessibility challenges.

The latest editions of the Horizon Report (EDUCAUSE, 2019, 2023), which highlight emerging technologies and practical applications, forecast widespread adoption of GAI across various industries in the future. However, some researchers caution that these systems may negatively impact specific sectors. From an educational perspective, educators express serious concerns about students accessing information effortlessly through GAI and using it without proper effort, passing it off as their work. To act against this problem, several countries have raised discussions about potentially banning GAI systems. However, such prohibitive actions, often seen as buffer solutions, might not effectively curb the proliferation of GAI. Paradoxically, attempts to restrict the use of a system or product can lead to an opposite reaction, accelerating its popularity. This phenomenon was pointed out by Lim et al. (2023), suggesting that GAI could become even more 'popular' when 'banned.' Educators, researchers, and policymakers face a significant challenge to avoid this paradox. Addressing this issue requires comprehensively reconsidering educational practices at different levels, from micro to meso and macro scales (Gibson et al., 2023). The traditional focus on integrating technology, including artificial intelligence, into education processes must be reviewed. Finding a balance between leveraging GAI's potential benefits and addressing its potential drawbacks will be crucial for the future of education.

It is beneficial to approach the matter paradoxically to gain a deeper understanding of GAI in education. Such an approach helps us comprehend GAI's potential risks and hazards in education. Engaging in new discussions on this topic will aid in defining the limits and boundaries of the field.

Chatbots

Chatbot Technology in Education

A chatbot, also referred to as a conversational agent, is a computer program that utilizes a combination of language models and algorithms to engage in conversations with users in either written or spoken form (Ashfaque et al., 2020). There are two types of chatbots: conventional and AI-enabled chatbots. Conventional or rule-based chatbots are limited to specific functions as they can solely generate predefined responses for particular tasks (Luo et al., 2022). These chatbots have a couple of drawbacks, such as the absence of personalized guidance and an incapability to understand user intentions (Hwang et al., 2022).

On the other hand, AI chatbots, or conversational agents, are computer programs designed to engage in human-like conversations using various artificial intelligence techniques, such as natural language process, information retrieval, machine, and deep learning techniques (Fidan & Gencel, 2022; Mageira et al., 2022; Zhang et al., 2020). In educational settings, these chatbots can provide valuable instructional assistance (Huang et al., 2022), personalized learning experience (Mageira et al., 2022; Smutny & Schreiberova, 2020), feedback to students (Fidan & Gencel, 2022; Lee et al., 2020), scaffolding for learners' understanding (Winkler et al., 2020), and a chance to improve learners' outcomes (Wu & Yu, 2023).

The interaction between learners and chatbots can be in different ways, including text-based, voice-based, and embodied (Kuhail et al., 2023). The nature of this interaction depends on both the input system employed and the attributes of the media being engaged with. During text-based interaction, the user employs the keyboard as the input method. Voice-based interaction involves engaging through sound using the microphone as the input medium, such as Alexa, Siri, and Google Assistant (Følstad et al., 2019). Finally, embodied chatbots possess a human or pedagogical avatar-like appearance. These chatbots can utilize facial and eye movements, gestures, and verbal expressions. They can be used to provide cognitive, affective, and social learning support in context (Schouten et al., 2018). Chatbots can potentially promote emotional, transparent, and consistent interactions between students, thereby boosting their sense of social presence (Zhang et al., 2023). As these chatbots create the sensation of interacting with a real person (Wu et al., 2020), they have a positive impact on the social presence experienced by users. Progress in AI technologies will play a significant role in increasing both the quantity and the quality of such chatbots. As a case in point, these advancements enable educational videos, which typically offer a relatively linear interaction with learners, to be rendered more interactive by incorporating embodied chatbots. Having been trained on the subject matter outlined in the video in advance, these tools can equip learners with suitable feedback, guidance, and instruction.

The dialogue with the chatbots can take place in either a user-driven or chatbot-driven manner (Følstad et al., 2019). According to Følstad et al. (2019), in user-driven dialogue, the chatbot must be capable of discerning the

user's intention, both within individual messages and throughout the entire interaction or its segments, and also possess the ability to respond appropriately to this intent. Technically, providing such a dialogue might be more challenging. Nonetheless, the GAI systems' capacity to generate more genuine and innovative responses could potentially lead to increased adaptability concerning the diverse inputs users might provide. Conversely, specific chatbots generate responses following a predefined flowchart, making it exceedingly challenging for them to deviate from this pre-determined path. The distinction between these two dialogue forms can also be accounted for by the presence or absence of a generative capability in AI. From an educational perspective, both types of dialogue can be used to enhance the interactivity of the teaching process, particularly in online learning environments, where providing individual support from educators to students is challenging. For instance, the chatbot-driven dialogue can be employed to offer instructions or feedback based on input from students, providing an opportunity to assess their current progress. On the other hand, the user-driven dialogue can guide the student through the learning process using the chatbot system, facilitating a more personalized and authentic learning experience that aligns with the principles of student-centered learning approaches.

Various roles can be attributed to chatbots in education, and Kuhail et al. (2023) have classified these roles into four groups: teaching agents, peer agents, teachable agents, and motivational agents. First, teaching agents engage in conversations with students to propose a range of tutorials and instructional materials (Kuhail et al., 2023). For instance, Winkler et al. (2020) examined the impact of incorporating scaffolding and a voice-based chatbot onto online video lectures to enhance information retention and transfer capabilities. The research showed that using a voice- and text-based chatbot, which supports learners' understanding during video instruction, enhances both information retention and transfer abilities. Second, peer agents refer to chatbot systems that assist students on demand (Kuhail et al., 2023)—as an example of peer agent, Verleger and Pembridge (2018) developed an AI chatbot called EduBot, as a plugin to the Canvas Learning Management System. This tool allows students to ask questions anytime they need assistance. If the question is already in the database, the student receives support accordingly. Otherwise, the relevant faculty member is informed about the request. The findings indicated that chatbots like EduBot hold the potential to stimulate student questions, particularly from those who might feel hesitant or apprehensive about participating actively in a regular class session. The third agent, teachable agents, prompts students with questions to teach specific topics (Kuhail et al., 2023). Law et al. (2020) introduced a learning-by-teaching platform called Curiosity Notebook to respond to the need for teachable agents. This platform enables students to collaborate either individually or in groups to teach a conversational agent how to perform a classification task across different subject areas. The study offers valuable insights into the design factors for creating conversational, group-based learning-by-teaching scenarios. The last role of the chatbots is that of motivational agent. These agents act as coaches, seeking to inspire and motivate learners to take action (Schouten et al., 2018).

In summary, chatbots can be designed to facilitate personalized learning, experiential learning, social dialoguing, collaborative learning, affective learning, learning by teaching, and scaffolding in educational contexts (Kuhail et al., 2023). Indeed, the interaction and dialogue with these systems can vary based on their design and intended educational roles. However, research into using chatbots for facilitating learning is still in its initial phases, underscoring the need for further contributions to advance this field (Hwang & Chang, 2021; Zhang et al., 2023).

AI-Enabled Chatbots

AI chatbots are sophisticated systems or applications that possess intelligence, enabling them to engage in natural language interactions with humans across diverse aspects of daily life (Mageira et al., 2022). In order to enhance the quality of user interactions, these chatbots acquire knowledge from past user inputs through learning mechanisms (Nguyen et al., 2022). These chatbots possessing interactive, adaptable, and personalized traits can efficiently handle user inquiries and promptly respond in real-time through text, voice, or a combination of both mediums (Wu et al., 2020).

AI chatbots can be divided into three types for general classification: machine learning-based chatbots, natural language processing-based chatbots, and hybrid chatbots (Wu & Yu, 2023). This classification is based on the text understanding module, which facilitates direct interaction with the user and extracts meaning from the user's input before generating a specific response (Safi et al., 2020). By implementing machine learning algorithms, conventional machine learning-based chatbots can understand user intent, filter irrelevant information, and offer valuable guidance (Wu & Yu, 2023). There has been a noticeable and recent trend toward adopting machine learning-based approaches in developing chatbot systems (Safi et al., 2020). Natural language processing-based chatbots with advanced machine learning algorithms can learn from users' past inputs and recognize, infer, and effectively utilize human languages (Wu & Yu, 2023). Natural language processing help to teach computers to talk to humans naturally, like humans, by understanding user texts, voices, audio, or video notes and converting them into a structured data format for effective interaction (Christopherjames et al., 2021). Finally, hybrid chatbots are composed of a blend of AI algorithms and rule-based logic (Wu & Yu, 2023).

Due to advancements in GAI and large language models, numerous institutions are now creating diverse AI-enabled chatbots. Examples of publicly available chatbots include ChatGPT, Bard, Language Model for Dialogue Applications (LaMDA), Sparrow, and YouChat 2.0, along with their various extensions and application programming interfaces (APIs).

ChatGPT

ChatGPT (GPT-3.5), developed by OpenAI, a research organization supported by Microsoft, has gained considerable attention and popularity since its introduction in November 2022 (Mondal et al., 2023). In March 2023, the corporation launched GPT 4.0, with enhancements encompassing creativity, visual aids, dependability, precision, and contextual understanding. ChatGPT can collect information from the internet and deliver responses comparable to those found on the Google search engine. The distinction lies in their approach: Google presents multiple options from various sources, while ChatGPT rapidly provides a single answer through educated guesses. Trained on extensive textual data, such as books, news, articles, websites, and Wikipedia, ChatGPT constructs sentences step-by-step and selects the most probable phrase to follow each word. Due to its reliance on internet-sourced information, ChatGPT may occasionally provide incorrect responses (Murugesan & Cherukuri, 2023).

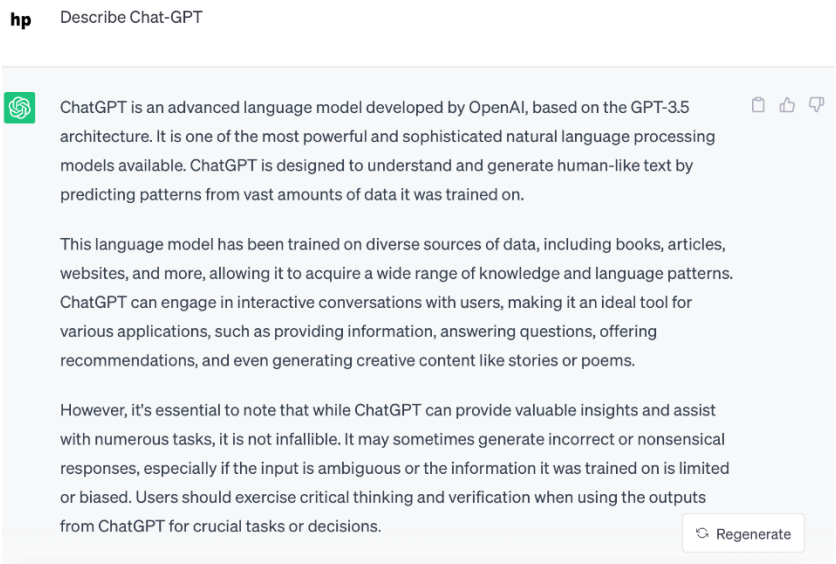

Figure 1. How ChatGPT is Described by ChatGPT

Figure 1 presents the outcome where ChatGPT defines itself in response to the question “Describe ChatGPT.” The response centers on three key aspects. Firstly, it highlights ChatGPT as a robust natural language processing model capable of generating text that resembles human language. Secondly, it provides insights into the training process and the types of results it can produce. Lastly, the response acknowledges that the generated information may occasionally be flawed, emphasizing the importance of cautiously approaching the results.

Microsoft has introduced a new iteration of ChatGPT, powered by Bing, which aims to deliver users with search outcomes that are both more precise and punctual (Mondal et al., 2023). Likewise, utilizing APIs enables the creation of various applications using ChatGPT. For educational settings, ChatGPT-supported applications can potentially find extensive use in online learning procedures and language learning, particularly in learning activities related to providing feedback, offering guidance, and assessing progress.

Google Bard

Launched in May 2022, Google Bard is a conversational AI service driven by a language model called LaMDA, which has been trained on an extensive dataset of over 1.56 trillion words from conversational exchanges and online content (Murugesan & Cherukuri, 2023). This training used the transformer architecture, making it a powerful tool for dialogue applications. Bard resembles ChatGPT’s functionality but distinguishes itself by sourcing information directly from the internet. Much like ChatGPT, Bard is capable of coding, solving mathematical queries, and aiding in writing tasks.

Both ChatGPT and Bard provide a user-friendly interface with a designated space for entering prompts and receiving responses. The AI engine produces answers that specifically address or prompt consumers’ queries. As a result, the engagement is more effective because the user’s needs are addressed with pertinent and coherent information. Users of ChatGPT have the helpful option to regenerate the same job or inquiry, allowing them to customize the answer they get. Users can comment on the generated responses through this iterative process,

which helps the system comprehend and advance over time. The effectiveness and precision of subsequent AI interactions are improved because of this interactive feedback loop. Like ChatGPT, Bard shares an iterative feedback mechanism that enables users to improve their responses and offer insightful feedback to the AI system.

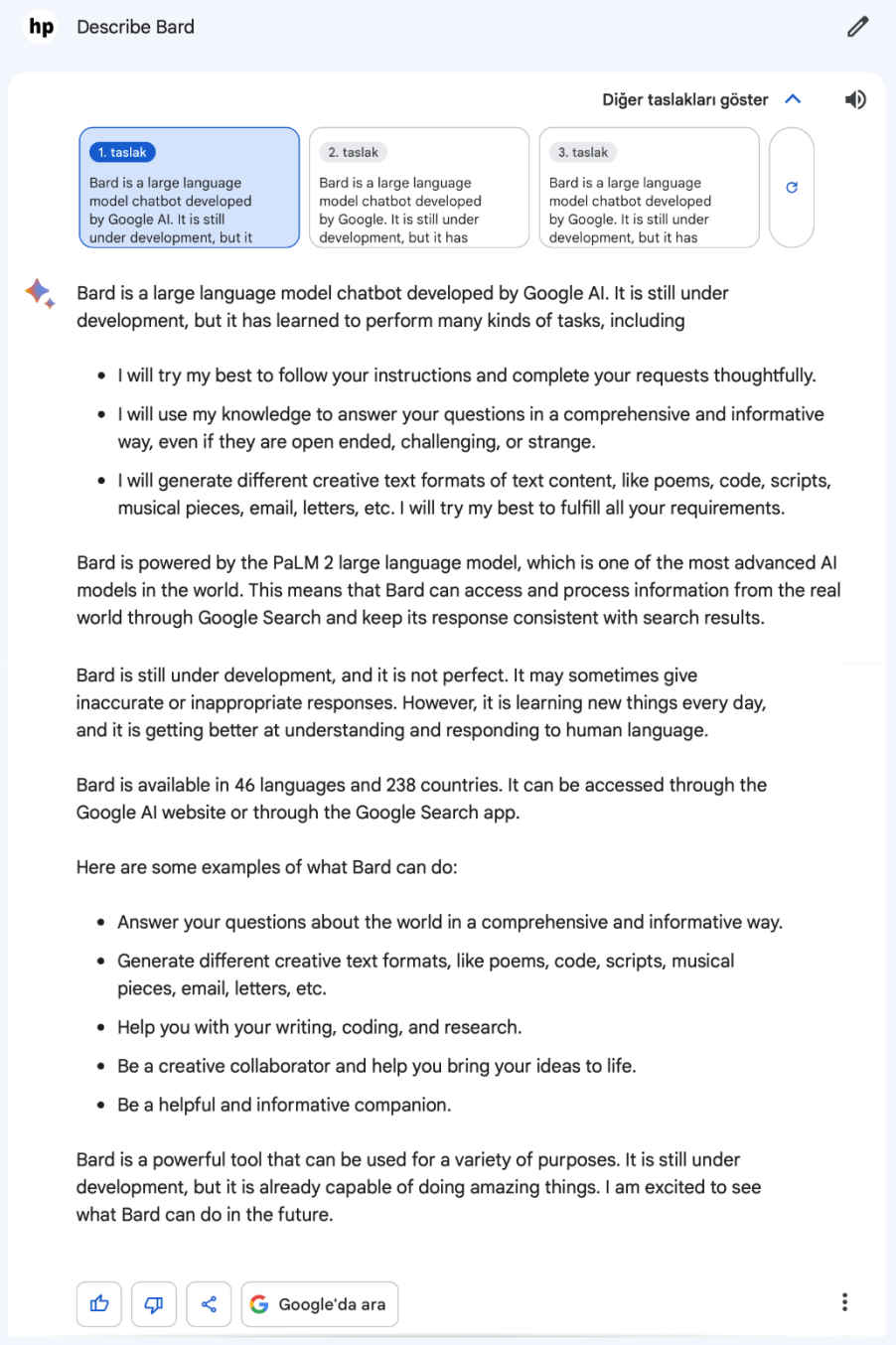

Figure 2. How Bard is Described by Bard

On the other hand, Bard allows customers to see alternate solutions within the same window, which is a noticeable difference. This feature increases transparency and provides a more thorough user experience by giving users a more comprehensive picture of the AI's capabilities and variances in its comprehension of the question. Additionally, Bard offers a unique function that lets users select to vocalize the generated responses. The voice-

based interaction gives the user experience a new dimension, making it more engaging and appropriate for situations where spoken communication is preferred or required.

As depicted in Figure 2, Bard introduces itself by highlighting its capabilities, methods to generate information, the range of tasks it can perform, its inherent strengths, and its potential applications. Consequently, it adheres to user directives and endeavors to provide precise responses. Bard can create diverse outputs, encompassing poems, code, and letters. It is important to note that Bard's evolution is an ongoing process; over time, it continues to enhance its capabilities by incorporating various features.

Both ChatGPT, Bard, and other newly released AI-enabled chatbots are in a continuous state of evolution driven by competitive forces. This progress is anticipated to yield a more profound comprehension of user prompts, leading to more accurate responses. As technical capabilities advance, these conversational agents will begin generating solutions with profound implications across various industries. From an educational perspective, it is essential to note that these tools are intended to supplement instructors. Instead, they will accelerate the development of diverse online solutions, alleviating some of the instructor's workload and fostering students' cognitive abilities. This acceleration is particularly significant in personalized learning, where we can expect a surge in applications designed to support students in their individual learning journeys, providing constructive feedback as needed.

However, these advancements in both General Artificial Intelligence (GAI) and chatbots raise significant ethical concerns, particularly in their use within education. The following section will delve into an ethical evaluation of the utilization of AI in educational settings.

Ethical Issues for AIEd

Artificial intelligence applications in education vary across different disciplines. These applications can be categorized into several groups: creating student profiles and making educational predictions, developing and implementing intelligent tutoring systems, monitoring and executing measurement and evaluation processes, and producing adaptable-personalized solutions (Zawacki-Richter et al., 2019). However, using AIEd tools also raises several ethical concerns (Selwyn, 2022). For instance, there are questions about the possibility of obtaining academic degrees or grants using AIEd tools. Additionally, the extent to which it is acceptable and appropriate for certain students to rely heavily on these systems in distance education processes is a matter of debate. Using AIEd tools for homework raises concerns about achieving fairness and justice in the classroom. Another ethical dilemma involves presenting other people's ideas as one's own when using AI-generated content. Furthermore, there is a need to identify who is responsible for educational outcomes derived from artificial intelligence tools. These ethical considerations have led to discussions in the literature about the appropriate use of AIEd and have raised question marks regarding its implications (Selwyn, 2022).

Dieterle et al. (2022) discuss ethical concerns about five distinct and interconnected divides in the AIEd contexts: algorithms, access, representation, interpretations, and citizenship. Initially, AI-driven algorithms have been

instrumental in developing digital tools and learning platforms to enhance students' learning experiences. However, researchers are concerned about the appropriate reliance on these systems, as they may not always provide precise information about students' current learning status. Algorithmic bias is linked to the accuracy of digital data, and both access and representation divides are considered upstream divides that significantly influence the data used in algorithm development, validation, and improvement (Dieterle et al., 2022).

Some students using educational digital tools or platforms may benefit from cognitive and affective gains. Nevertheless, the unequal access to these tools among students and educators raises ethical issues. The third ethical concern pertains to data representativeness, as not all stakeholders in the education process have access to digital learning tools or platforms. Consequently, the data derived from these environments might only partially reflect some population segments. This situation gives rise to the problem that the inferences drawn from the available data may not be applicable to real-world situations.

Dieterle et al. (2022) also suggest downstream divides (i.e., interpretation and citizenship divides) that emerge from algorithms using data disproportionately drawn from learners with access and representation. The data produced when students and educators interact with digital tools and learning platforms serves as a source of information for decision-making by researchers, educators, and policymakers. In this regard, Dieterle et al. (2022) ask whether educators can appropriately utilize this data and the algorithmic outputs to make decisions without proper training on interpreting and applying them. Finally, the digital divide affects learners and educators beyond technology access, impacting their success and opportunities. Algorithmic bias is prevalent in various domains, necessitating fairness and transparency. We must ensure that data-driven decisions lead to an equitable future.

Given the ethical considerations and the pedagogical affordances of AIEd, it can be concluded that AI in education is undoubtedly a two-sided tool that can bring about unintended outcomes and is likely to prompt a reconsideration of various assumptions concerning learning, knowledge, skills, performance, creativity, and innovation (Gibson et al., 2023). Undoubtedly, there are bound to be new opportunities and advancements in the utilization of AI in education soon. However, with these developments, there will also arise new ethical and practical challenges. While some (e.g., Gibson et al., 2023) will embrace AI as an intelligent partner in the educational journey, others (e.g., Selwyn, 2022) will approach it cautiously, viewing it as a tool that requires careful consideration. The matter at hand is likely to remain a topic of extended discussion, exerting a remarkable role in shaping future education policies. Educators, researchers, instructional designers, and policymakers should actively consider integrating these technologies into instructional processes rather than overlooking AIEd. This involves thoroughly considering theoretical frameworks, learning activities, and educational assessment and evaluation procedures. In essence, the primary goal is to support well-qualified human resources who can effectively cater to the needs of the contemporary educational landscape by leveraging AI.

Conclusion

Consequently, advancements in AI are prompting us to reconsider traditional educational practices and routines. This perspective anticipates the proliferation of online systems capable of making accurate forecasts regarding

student progress and instructional methods. Furthermore, incorporating artificial intelligence to support in-class activities and learning materials, along with adapting evaluation processes to align with the capabilities of AI applications, is recommended. Enhancing the functionality of AI-powered chatbot systems also holds the potential to deliver personalized learning experiences. Educators are enthusiastic about the potential to foster a more immersive learning environment and attach AI to education to lessen undesirable learning outcomes. However, numerous researchers have raised concerns that the benefits derived from generative AI-supported applications could restrain students' creativity and hinder their original output.

Hence, the involvement of AI in education carries a dual nature, akin to a double-edged sword. Rather than shying away from this technology, educational practices should be reevaluated through the lens of instructional design, carefully considering its advantages and limitations. Lastly, even though generative AI and AI-enabled Chatbot applications have introduced numerous innovations in education, the research in this field still needs to be expanded. Thus, it is advisable to transcend conceptual discussions about the topic and focus on empirical studies that delve into the practical integration of AI. In the present circumstances, AI emerges as a pioneering technology, with researchers predominantly concentrating on its affirmative aspects. However, the long-term impact of this technology on various cognitive, affective, and social learning outcomes remains uncertain and needs further investigation.

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Author Information

Hamza Polat

https://orcid.org/0000-0002-9646-7507

Atatürk University

Faculty of Applied Sciences, 25400, Erzurum

Turkey

Contact e-mail: *hamzapolat@atauni.edu.tr*

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