Humanities & Social Sciences Communications

ARTICLE

https://doi.org/10.1057/s41599-022-01284-4 OPEN

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The future of education utilizing artificial intelligence in Turkey

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This study examined the potential effects of artificial intelligence on Turkish education. A qualitative research approach was employed by posing an open-ended question to academics in order to attain this objective thanks to built-in capabilities for conducting complicated computer operations, cloud-based services, and conciliatory accession for agile network connections. This study emphasizes that Turkey is highly fragmented and consists of various business organizations at both the municipal and regional levels. The two main policy documents produced by the Turkish government suggest that colleges play a strong role in national and regional Artificial Intelligence (AI) strategies for workforce growth, with substantial consequences for AI adoption strategies. These documents include information on three well-known educational entities: The new oriental workgroups, recurrent neural networks, and classroom clustering. Significant aspects of Turkey's educational AI growth include a strong private education industry and a growing international interest. The investigation results revealed a decline in the level of understanding regarding the methods of using artificial intelligence, indicating the necessity for additional awareness-raising in Turkey.

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Introduction

Artificial intelligence (AI) is a machine-based technology that uses algorithms to deliver predictions, diagnoses, suggestions, and evaluations. Recently, the educational community has recognized AI's potential to facilitate learning in various contexts (Hwang et al., 2020). Scientific and technical advances affect not only the evolution of teaching materials and methods but also education, educational models, and the kinds of educational systems and organizations (Onder, 2002). Little is known at this time regarding the implementation of modern educational technology, the management of instructional technology issues, the utilization of existing educational technology results, the maximization of educational resource applications, and the improvement of educational efficacy through a comprehensive educational reconstruction (Arslan, 2020). Therefore, educational technology research is vital.

Artificial Intelligence in Education (AIEd) is primarily concerned with the development of computers that perform cognitive tasks, typically associated with human minds, especially learning and problem-solving education for all ages should prepare society for the future and help humans achieve self-fulfillment (Sucu, 2019). In the age of artificial intelligence, education is both difficult and an opportunity (Ocaña-Fernández et al., 2019). New learning channels, including learning management systems based on digital textbooks, tailored learning via big data learning analysis, interactive technologies based on voice recognition and speech synthesis, and chatbots driven by natural language processing (NLP), are being created (Ekin, 2022). The majority of AI technologies have educational and instructional uses. Education is necessary for a person's complete growth (Sulak, 2021). Theoretically, technology, particularly AI, in contemporary education enhances educational material, transforms educational perspectives, and disrupts old educational paradigms.

Given that education is required for advancement in many fields, the real influence of AI on education would be substantial. AIEd applications include responding to student inquiries, presenting questions and offering remarks, and evaluating narrative responses (Dogan and Kubat, 2008). According to Kanejiya (2019), AI will alter schooling in the next 4–5 years. Indian firms are using AI to enhance school quality with notable results. A method of feedback and individualized suggestions offered by an AI platform may be utilized to assist students in correcting past errors based on student data (Dalal et al., 2020).

Consequently, children's performance improves with time. It also addresses the teachers' failure to offer pupils individualized attention and the discrepancies in student learning rates. Utilizing Machine Learning (ML) approaches to offer instructors feedback. For instance, the platform might assist instructors in optimizing their information delivery and correcting knowledge gaps by identifying areas where pupils lack understanding. By emulating their teaching technique, robotic teaching assistants linked to the cloud may make skilled knowledge practitioners in outlying areas more accessible on their own or in real-time cooperation with human instructors (Faggella-Luby et al., 2017).

Government support for research and development (R&D), and innovation efforts is vital. Most wealthy nations, as well as a few emerging nations, are spending extensively on R&D and innovation connected to AI. This article demonstrates how education contributes to Turkey's growing interest in AI and why universities must play a crucial role in this regard. In addition to traditional pedagogy and learning issues, this study focuses on geopolitics as a factor in technological growth (Ma and Siau, 2018). This paper's concept is founded on three essential principles: interdependence, interconnection, and contention. The crucial connection within the identified networks is the impact of global governance on global education levels.

Recent research, particularly in the United States, has addressed the commercialization and purifying of conventional classrooms, schools, and university lecture halls (Kim and Park, 2017). According to this perspective, educational AI might be seen as a component of a wider learning marketplace based on political principles and prioritizing product creation and consumption as a commercial strategy. Consequently, the purpose of this article is to demonstrate how the rise of AI in Turkey is facilitated by many factors, such as the convergence of educational policies and geopolitics and the incorporation of learning activities into the corporate practices of the IT sector (Khare et al., 2018). Government and private sector partnerships might be a rivalry (Waltzman et al., 2020). Their work distinguishes between the broad conceptions of 'politics' and 'polarity'—in this instance, the effort to explain human equality in terms of logical and natural social equality.

Study questions. Numerous theories have attempted to explain AI as a controversial topic, and it is frequently portrayed negatively; others may describe it as a convincing boon for businesses; and still, others believe it is a technology that threatens the very existence of the human race because it may be able to control and manipulate man; however, AI has directly or indirectly affected our lifestyle and is shaping the future. This has inspired many scholars to consider the intriguing subject of how far technology may disrupt the education business. As a result, this study investigates the future of higher education if AI is accepted, as well as the preparedness of Turkish education to implement AI applications. The following are some of the most pressing inquiries:

- What is the recent situation in education in the light of AI?
- What is the most probable future scenario for Academic Instruction in Education in the light of AI?
- What are the correct actions and measures that must be undertaken in education to make the most possible benefits of AI?

Justification and objectives. This study focuses on examining the significance and potential applications of AI in education in Turkey. As far as we know, no scientific mapping of the word in issue has been performed in a study using the knowledge at hand. Therefore, it was decided to do this exploratory work to deliver new results in this area of knowledge, eliminate the gap in the literature related to this discipline, and present the results provided here as a starting point for AI-focused researchers. Consequently, this study focuses on the following objectives:

- To determine the performance of scientific production indexed in Web of Science (WoS) on "AI and Education";
- To concretize the scientific evolution of "AI and Education" in WoS;
- To determine the most significant issues and authors on "AI and Education" in WoS.

Literature review

When AI studies in education are examined today, knowledge-based and data and logic-based AI and its applications can be seen in almost every field. These include personalized education or dialog education systems, exploratory education, data mining in education, article analysis of students, smart agents, chatbots, education for children with special needs, child-assist bot interaction, AI-based evaluation systems, and automatic test creation systems (Velik, 2012). Note that these fields are mostly related to

the support of learning. However, AIEd also supports schools and universities in administrative aspects. For example, curricula, staff programs, exam management, cybersecurity, facility management, and security are areas where AI contributes directly to school management and indirectly to teaching (Holmes et al., 2019). With the investments made and technological developments, AI applications are increasing daily in terms of performance and awareness, while costs decrease day by day. Although these applications sometimes remain in the background of our daily lives, they have been integrated, widespread, and inevitable in terms of their effects (Groff, 2013). And this technology is being used effectively in a wide range of fields, from Siri to digital journalism, from stock movement prediction to crime prediction, and from face recognition to medical diagnostics (Holmes et al., 2019). However, the purpose of this study is to reveal how AI, which has already entered the classroom in different ways, contributes to education and within which applications it is used (Luckin et al., 2016). While many people perceive AIEd as the involvement of "robot teachers," the reality is a little different than what was predicted. AI can be grouped under three headings in terms of its areas of interest. These are data-based, logic-based, and knowledge-based AI approaches. From the 1980s to the 2000s, educational applications of AI were mostly based on a knowledge-based approach (Long et al., 2020). The research areas are mostly under intelligent education systems in the specified period, consisting of three modules: domain, learner, and pedagogical (Woolf, 1990). In a typical learning management system for that day, the domain module has defined the area to be learned, the learner module has defined the knowledge and learning situation of the learner, and finally, the pedagogical module has defined how the learning materials to present the learner with a pedagogical approach which has an adaptable and interactive interface (Fryer et al., 2019).

Intelligent Educational Systems (IES), which can be considered the second generation of computer-aided teaching, are among the most used in AIEd. In general, IESs provide personalized learning environments appropriately and are carried out step by step for each student through well-structured subjects such as medicine, mathematics, or physics (Alkhatlan and Kalita, 2018). Virtual teaching is computer-based teaching systems that have separate databases or knowledge structures for determining teaching content, namely what to teach, and teaching strategies, that is, how to teach, and make inferences based on the student's mastery of the subject in teaching dynamically (Woolf, 1990). The system determines a step-by-step path for the student, using the relevant learning materials and activities according to the student's success or mistakes. This path is constantly updated regarding difficulty level, tips, or explanations in line with the feedback and adjusted according to the student's needs. The aim is to enable the student to learn effectively on the specified subject.

The Turkish context of artificial intelligence

Artificial intelligence in education. Due to its vast power to modify our thinking, behavior, and interactions, AI-enhanced digital technology has become a crucial component of our everyday life. Since its origin, AI has thrived and expanded, especially with the advent of Artificial Neural Networks (ANN) and Deep Learning (DL) (Chan and Zary, 2019). Intelligent machines and AI date back to the 14th century (Hrastinski et al., 2019). However, the notion of AIEd has existed for around 25 years, with AI being incorporated into the education sector through several routes and ways (Bayne, 2015; Heffernan and Heffernan, 2014; Humble and Mozelius, 2019; Koedinger and Corbett, 2006). Instructors and students in K-12 and higher education use AI-powered apps and resources, such as intelligent robots and adaptive learning systems. AI technologies enable the implementation of individualized learning to meet the unique needs of each learner (Della Ventura, 2018). Since each person is unique and has various learning styles, talents, and demands, it may be difficult to meet the needs of each student using standard educational practices.

However, with AI, instructors may respond to the unique demands of each student (Della Ventura, 2018). Consequently, students may be more engaged, independent, and motivated throughout the learning process (Della Ventura, 2018; Wang et al., 2017). Moreover, AI technologies provide chances to boost student engagement in learning challenges.

With the increased usage of AI technologies for teaching and learning, instructors may eliminate time-consuming and repetitive duties and deliver rapid replies to students, promoting adaptive and personalized learning (Chan and Zary, 2019). Specifically, hardware developments, such as high-speed graphics processing units and the availability of software libraries have enhanced AI technologies, particularly with the expansion of deep learning research and data analysis methods. In addition, the future development of education will be intimately linked to the future expansion of AI. Future education will become more innovative and thrive as new technologies, and the computing capacities of intelligent computers continue to grow. AIEd research covers several sub-disciplines. Coledam et al. (2014), for example, provided a formative assessment system for learners that was able to produce and evaluate examinations and track their learning progress. Comparing the results of the suggested system to those manually graded revealed that the strategy was successful for grading exams. Eguchi (2016) presented RoboCupJunior and evaluated its efficacy in fostering youngsters' STEM content and skill development. Lan et al. (2014) developed a unique method for ML-driven learning analytics based on assessing the subject-matter knowledge of learners. Due to the increasing amount of AIEd research publications, it is essential to define and logically debate important points. As noted before, we encounter news or information about AI almost daily. For instance, news articles such as "AI defeated the world champion in a difficult strategic game" are highly intriguing to fans of digital games. Similarly, for sci-fi fans brought into our life by Hollywood productions, at least one film every term, "The Matrix: Reloaded," is forthcoming. Followed the news with keen curiosity. Alternatively, the news of "Elon Musk's new smart vehicle" may be seen on every news channel, even local ones, for the new generation of technology enthusiasts who believe that entirely autonomous—electric automobiles will join our lives and pique the curiosity of almost everyone. Lastly, "education by expert systems tailored to our learning pace and style" is highly exciting news for students and instructors who want to study from home, whenever and whatever they like, without attending school.

Analysis of artificial intelligence in the context of education in Turkey. The unique thing about AI, which is found in the international political and business sense rather than the design and creation of the technologies, is the younger population and much of AI usage in the lessons. Indeed, the fast creation and high adoption of Turkish educational features, such as facial recognition, have drawn international attention rather than simply their novelty. This is why the paper examines how governmental policy affects commercial growth by focusing on various educational technologies in Turkey. A review of the subjects mentioned above offers additional value in breaking new ground, particularly because it highlights some of the common assumptions that go along with discussions about new technology. International AI creation is greatly aided by the Turkish specialist who is best known, not as an isolated initiative, or national

undertaking, but rather as an interconnected part of many international actors. Similarly, Anderson et al. (2018) believe that Turkey is at the forefront of AI because highly creative and technologically sophisticated countries lead in foreign affairs. A better grasp of contemporary geopolitics appears to be growing regarding national capabilities for AI growth, which helps reinforce Turkey's status as the world's leading economic force. Others recommend that the United States and Turkey return to their status before Turkish AI creation to combat this perceived threat. At present, an Istanbul-based research team has unveiled an AI that can predict global trends, international events and offers automated forecasts for foreign policy choices. Not only is Turkey's invention of AI seen as a threat to strategic stability, but it is also seen. In recent years, a narrative of a worrying Turkey has seen to develop in the media regarding Turkish technological growth. The stronger inclination to conceive Turkish technology as being very different from Western notions increases the perception of the risk to the perceived problem.

Numerous nations engage in advancing AI in light of the advantages supplied by applications of AI. In this approach, the implementation of artificial AIEd is anticipated to grow significantly in the future, with worldwide expenditures reaching $6 billion by 2025 (URL-10). China and the United States spend more than half of the world's education on AI. SquirrelAI, a China-based AI-supported adaptive education provider, develops and continues to work so that each student may be counted as an AI super instructor.

Similarly, US-based McGraw-Hil developed ALEKS, an adaptive AI training software. The AI software dubbed Watson, developed by IBM in the United States was implemented in 2010 and began to be utilized not only in schools but also in many commercial domains. In addition to providing students with tailored learning opportunities, this software enhances efficiency by disclosing each student's learning potential. Similarly, the UK-based AI initiative "third space learning" allows students to teach online alongside an instructor. This saves time and decreases the instructor's burden. In addition, owing to the program's feedback, the learning rates of each student can be assessed, and classes may be tailored to each student's learning level.

Similarly, the UTIFEN software, which was developed with learning in mind, was created using adaptive learning concepts. Adaptive learning systems use AI to customize learning to an individual's specific features, abilities, or requirements. Additionally, since the software is built for mobile education, it gives instruction whenever and wherever it is needed. Examining the research, it is shown that educational outcomes are higher in situations where instructors are less engaged, i.e., in environments where students study online at their own pace and level using an expanded curriculum (URL-1). Sana Labs, a firm established in Sweden, continues to work on individualized education in school. Unlike other organizations, Sana labs continue to work on various subjects, including mathematics, language teaching, and vocational education, instead of focusing on a single topic. Programs that provide individualized learning use the principle of dividing the material to be learned into discrete chunks. Information to be learned in a mathematics course, for instance, is split into a given number of information points (e.g., 2000–5000–1000, etc.). The software identifies weaknesses in key information points and, based on these shortcomings, offers individualized education programs to enhance pupils' understanding. When a student regularly offers accurate responses, the next missing information point is relocated to the next missing information point, and the student's knowledge map is updated to ensure that the teaching is completely realized (URL-13).

Considering the work of these nations and organizations, it is possible to predict the future efficacy of AIEd. In this respect, discussing AI research undertaken in Turkey's education sector would be beneficial. In Turkey, education-related AI applications and training are the subjects of several seminars and conferences. Six times, the Education Industry and Technology Institute hosted a workshop on AIEd. In the sixth workshop's final report, it was said that "Smart Classroom Behavior Management" might be implemented using image processing technology. Due to this system, pupils' facial expressions and emotional conditions throughout the session may be identified using classroom-mounted cameras that can collect photos at 30-s intervals. These emotional states of the kids might be studied and communicated to the instructor. Consequently, the instructors indicated that due to this feedback, they could determine which portion of the class the pupils were engaged in and which portion of the lecture failed to capture their attention. This system may benefit instructors in finding the optimal instructional teaching.

In the same session, it was suggested that attendance control might be implemented by installing image processing technology at school entrances and exits (URL-7). In addition to workshops, the Ministry of National Education seeks to create AI-based educational tools. In this regard, they cooperated with Istanbul Technical University to promote students' individual growth by creating individualized instructional material. ITU has also provided instructors with advice services by arranging pieces of training on AI (URL-12). In addition, the Ministry of National Education's General Directorate of Innovation and Educational Technologies has said that different topics would be produced for schools and instructors to use AI applications in education from the beginning of elementary school. The "Artificial Intelligence Education for Children" project has been established in this context. Under the supervision of Manisa Celal Bayar University, research has been planned to give pupils AI training. In addition, it was said that within this project's scope, several applications would be developed via various games and visualizations, and manuals on AI would be compiled. The Cambridge Professional Education Academy from England, CCS and Pobalscoil Neasain school from Ireland, and IBM Watson will assist the initiative, which has been revealed (URL-5).

Artificial intelligence and Learner Evaluation. In sports research, mathematics, and computer science, there is a growing consensus that self-learning algorithms for performance analysis offer exciting applications. Typical applications of these algorithms include research examining the actions of athletes in golf, baseball, soccer, and basketball. Furthermore, it has been shown that self-learning algorithm maps are successful. These examples demonstrate the clear use of AI in developing monitoring systems, including categorization algorithms for real-time analysis and feedback output in each sport. For measuring a student's physical activity performance, an AI-based learner evaluation might prioritize pattern recognition methods (Chen et al., 2020). Sensors attached to the learner's body and exercise equipment can collect data from which significant characteristics for each physical activity can be deduced, enabling evaluation of measured physical activity and additional characteristics based on a general pattern recognition methodology incorporating automatic classification algorithms.

Unique systems using cutting-edge information and communication technology and sophisticated control techniques enable the quick gathering, transmission, storage, and analysis of sensor data acquired from physical activity. The data collected by these sensors is utilized to develop intelligent procedures based on current machine learning techniques, enabling the independent evaluation of pupils' motor skills and providing useful feedback (Munir et al., 2022). With the evolution of measuring technologies, the integration of sensors into equipment and

instruments is growing. This data might be utilized to automate the analysis of physical activity using machine learning and sophisticated algorithms.

Closely monitoring children's physical activity is enabled by a self-learning system that employs pattern analysis for various school sports activities. Feedback based on objective data enables students to increase their physical activity while avoiding damage (Chiu and Tseng, 2021). In addition, by objectively measuring the physical potential of young athletes, these AI-based evaluations and measures may aid in identifying and selecting talent.

Artificial Intelligence Policy of Turkey. Turkey has launched a national AI plan in recent years, garnering international interest. The study document is regularly recognized in the media, particularly geopolitically and commercially, as the primary catalyst for Turkey's AI advancement. This year, Turkey hopes to become a global innovation powerhouse by being the center of AI. The business strategy's fundamental objective is to reduce interdependencies and reliance on external technologies to attain AI autonomy (Orman and Sebetci, 2022).

Education status within Turkish policy and educational institutions and activities has been accorded a far lower priority, and fewer resources have been allocated to it. Despite many references to the need for foundational training in The Scientific and Technological Research Council of Turkey (TUBITAK) for AI Growth, Turkey's use of AI is fundamentally dependent on an education system geared toward developing particularly AI. A 2019 action plan supports the focus on AI in Turkey's strategy for AI Colleges and Universities, which aims to accelerate the use of artistic and creative intelligence in teaching, encourage the training of talent models, strengthen educational governance, and create an artificial networked and lifelong structure. The political platform includes three primary objectives that must be prioritized. The scope of university infrastructures and curricula by 2020, elevating AI research and development to a national priority by 2025 and making Turkey a world-renowned AI destination by 2030, seems particularly important to AI's overall growth, given the private sector's specific preference for entrepreneurship and disruption. AI has the potential to be incorporated into both schools and universities. Such organizations are tasked with expanding their support for the study, creating new knowledge, and staff training. All educational institutions are increasingly related to an AI-infused economy, not just in terms of research and growth but also in training certifications, new and innovative initiatives, and the competencies of the future generation. The initiative to enhance the nation's AI training systems for entrepreneurship, plus construction, education, and cultural interchange' is more concentrated. We believe that this integrated creativity and education will inspire the future generation of artificial bits of intelligence. The goal of promoting AI as a core subject for all universities and colleges and the designation of the best AI program in Turkey as "first-level" are particularly important. This can be viewed as an endeavor by Turkey's educators to include AI in more advanced disciplines such as computer science and statistics. Turkish institutions are rising to the challenge by announcing over 50 new AI-related programs. The degree program includes the purpose of defining subjects, often known as "TUBAI" (Cifci, 2021): merging disciplines to focus on an applied field while incorporating "mathematics, computer science, physics, biology, sociology, and psychology." In addition, the policy advocates a "universal education" that combines training and development possibilities with existing education techniques. The Turkish Research and Technology Foundation (2020) stated at a recent policy conference that developing its own "natural AI capabilities" and getting a ranking of Turkey's current purpose is "to develop the world's best natural talent".

In addition, many Turkish nationals who conduct AI research abroad tend to work on development teams. While the Turkish government has recognized national and numerous local "talent programs" schemes to attract AI researchers to the country, it has also supported numerous programs to cultivate Turkish researchers at the local level (Tamer and Övgün, 2020). Incentives, such as "The 10,000 Talents Initiative," provide academics with substantial incentives to return to Turkey.

Innovations in Artificial intelligence and education

Intelligent schooling methods. Before discussing smart instructional systems, it is important to discuss computer-assisted education, which may be considered an earlier step in the evolution of AI. In terms of applications, we might argue that the 1960s and 1970s were the golden periods of BDI. PLATO, developed by the University of Illinois, is among the most well-known instances of CDI during this period. While accessing the university's conventional course materials, thousands of students were provided with interactive course materials. This system, created in the 1970s, included relatively new educational technology capabilities, such as user forms, e-mails, instant messaging, remote desktop connections, and multiplayer games, which are still developed efficiently today. Nonetheless, the instructional material and the operation were identical for each student. In other words, he assumed that all students were at the same academic level.

In addition, this prompted John Self and William Clancey to work on new strategies for adapting CBL methods to match the unique requirements of each student and for using AI techniques. In his dissertation, Ph.D. student Jaime Carbonell proposed the scholar system, perhaps the first use of intelligent instructional systems. This marked the beginning of the next phase of the project. Intelligent Instructional Systems, regarded as the second generation of computer-assisted instruction, is one of the most popular uses of artificial intelligence in education. Through well-structured disciplines such as medicine, mathematics, and physics, EOSs create tailored learning environments that are suitable and sequential for each student. According to Murray, LESs are computer-based instructional systems with distinct databases or knowledge structures for instructional material (stating what is to be taught) and teaching methodologies, drawing inferences based on the student's topic competence to give dynamic education. Here, the system generates a step-by-step route for the student, employing the appropriate learning materials and activities based on the student's successes and failures. This route is continuously updated regarding difficulty level, clues, and explanations based on student input and customized to meet their specific requirements. The objective is to facilitate the student's mastery of the topic at hand.

Variations were expanding a radically new perspective and dimension. The emphasis of the study is precisely on thinking outside the box to add additional previously undiscovered dimensions (Cifci, 2021). It emphasized problem-solving abilities. The cognitive components involve understanding rules, methods, and concepts in terms of problem-solving. Social work students graduating this year participated in a "critical reflection" assignment that utilized a "deep learning" method. Regardless of how they accomplished this, their talent has mostly gone unappreciated in an environment where high curriculum achievement expectations. Teachers are hesitant to assist other teachers in the learning process due to content and evaluation concerns. Bouanna and colleagues (2020) evaluated student data and categorized strategies for keeping them in school. Bayesian Network Classifiers: The J48, Random Forest, and WEKA

algorithms were utilized. Sheikh (2020) states that the student dataset has the greatest impact on a continuous assessment in the final semester. The classifiers displayed a substantial advantage over random forests in terms of accuracy and error rates. It was questioned if it is possible to predict the final grade based on forum participation and examined whether the suggested classification technique achieves the same level of accuracy as other traditional classifiers (Ryu and Han, 2017).

In contrast to the idea that the Turkish government is attempting to centralize AI development for political reasons, the article describes Turkish policy as hands-off, enabling the private sector to flourish. On the one hand, Turkish AI enterprises have performed rather well on the global stage in terms of product development. On the other side, they have garnered attention for their quick expansion in commercial sectors, such as government use. According to several assessments, it is the most valuable AI startup globally (Ali et al., 2019).

Methodology

Dataset description. The dataset was collected from two different sources: Istinye University and Yildiz Technical University. There were 7950 records with 10 attributes.

We acquired data by using two methods: the first is interviews and focus groups, including speaking with subjects face-to-face on a particular problem or topic. Interviews are normally conducted one-on-one, but focus groups often consist of many people. Both methods may be used to gather qualitative and quantitative data. The data collecting processes are shown in Fig. 1.

By recording student and instructor perspectives on the AI learning process throughout the course of a protracted educational program, AI systems may give students and instructors useful feedback. In addition, the data are used in an ML environment to improve the user experience, which is measured by the length of time people spend interacting with the system. Student interactions with systems throughout the contact process are now included in creating and updating recommendations. As learning tools provided by AI automate procedures and instructors give direct assistance to students in person, teaching will become simpler. AI is seen as a "neutral" tool for the trial-and-error learning technique.

We gathered input from students in the target group through interviews and focus groups. Observing their real-time data with our product and documenting their reactions and replies to questions may give important information on which product features to pursue.

The second method is surveying which are physical or digital surveys that gather qualitative and quantitative data from students. After that, we chose to run a survey to get feedback from attendees. This gave insight into what attendees liked, what they wished was different, and areas where we improved our research.

Data mining in education. The conventional approach to data analysis is hypothesis-driven, which means it starts with a query and then analyzes the data to find answers (see Fig. 2). First, it can start by knowing the subject's interests. On the other hand, the question-driven process is valuable in detecting the information when variables are justifiable, but complicated details participate.

Instead of using standard data analysis, data mining methods analyze previously unknown trends to discover destination relevance and profitability. Data mining is a means of acquiring data, as well as an analytical method for finding models. As of this time, the principles and techniques of data mining are the cutting edges in the database, and as new database technologies emerge, the technology is experiencing a golden age. These are considered valuable uses of data mining techniques as defined in Fig. 3.

Computer-based education. Computer-based education (CBE) uses computers to teach students the use of computers in education. CBE systems were the first independent applications that ran on a local computer without using AI to address student modeling, flexibility, and personalization. With the broad use of the Internet, new web-based educational systems, including e-learning systems, have evolved. In addition, the expanding usage of AI technologies has spurred the development of innovative adaptive and intelligent educational systems. Numerous prominent CBE systems, such as ITS, a learning management system (Romero et al., 2008), an adaptive hypermedia and multimedia system, and a test and quiz system, are also AIEd systems; hence, there are parallels between CBE and AIEd.

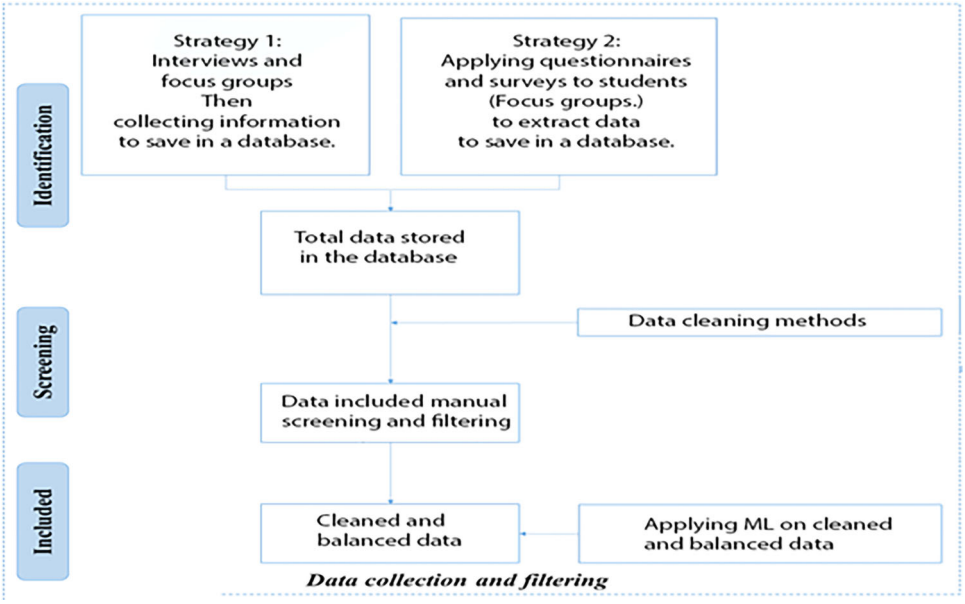

Fig. 1 Methods of data collecting in qualitative research.

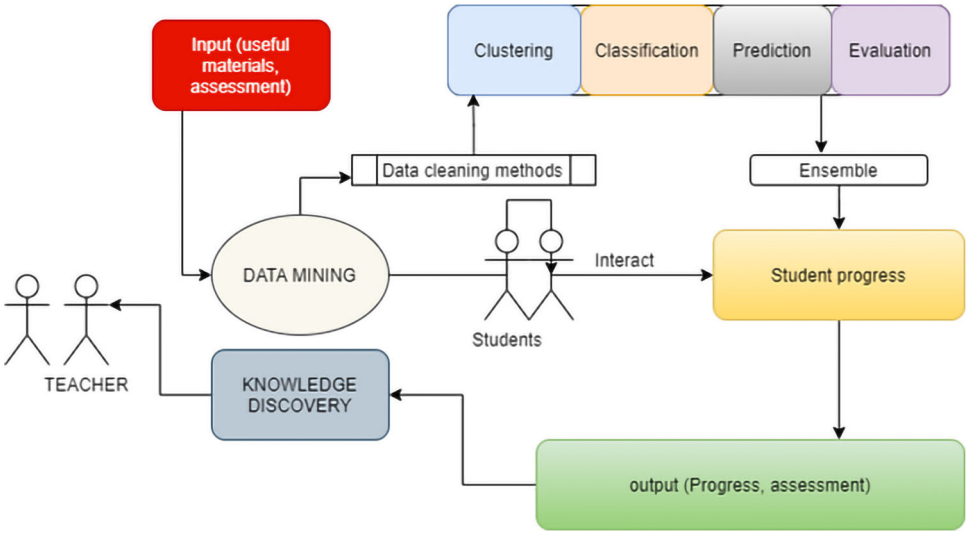

Fig. 2 Main architecture of the proposed system.

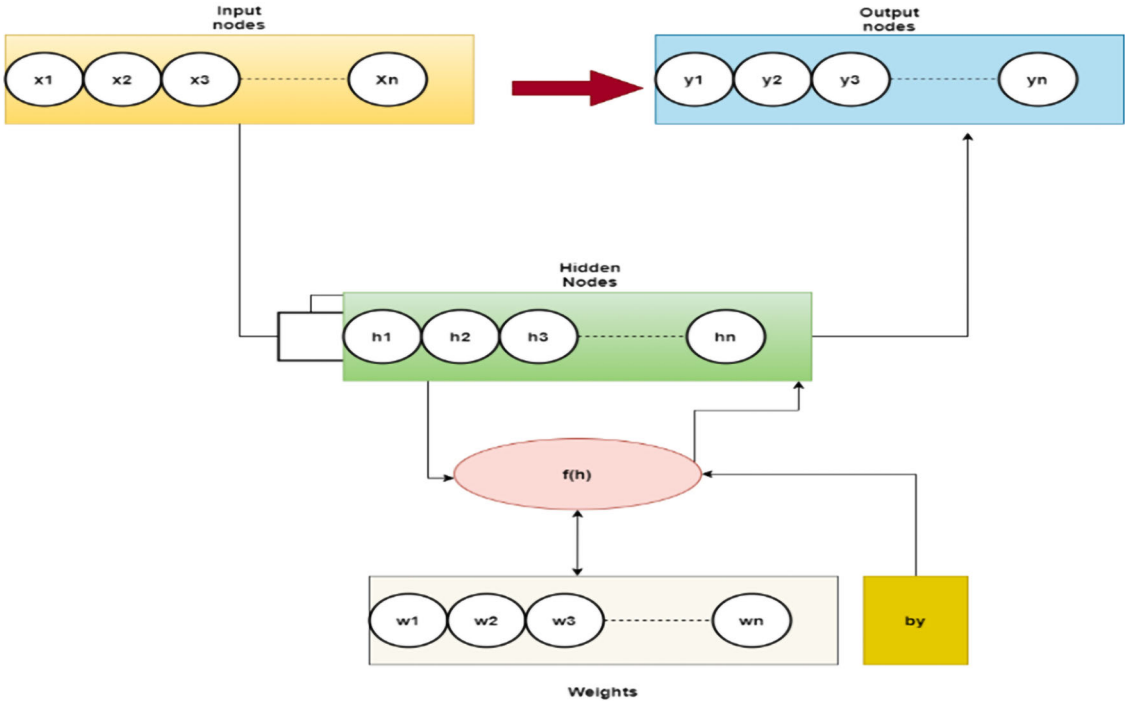

Fig. 3 The architecture process – systematic creation of a system.

Deep learning and recurrent neural network. Several learning algorithms have been applied to the spectrum of neural networks in light of the increasing development. Neural networks imitate the operation. A categorization system that employs parallel processing, for instance, utilizes deductions based on deduction rather than experience, similar to the human brain. There are several approaches to discovering neural networks, all too complex for the human mind to comprehend. Cooperation between nodes varies, such as between direct and reverse cooperation. As humans do, these nodes were linked like neurons are, enabling them to communicate information through dendrites and axons. Recurrent neural networks control the information flow in neural networks.

Figure 3 shows how the proposed architecture works.

Deep learning (DL), which has recently made state-of-the-art progress in advanced science engineering and medical diagnoses, has shown significant potential in text mining and education. DL has become popular in several fields, mainly in processing information, including natural language processing, computer vision, speech recognition, machine translation, and control system, and is also widely in classification and segmentation. As a result, DL will not function if there is explicit text included. The DL has shown great results so far. Education researchers have been attempting to extract relevant information from large datasets for many years for a successful mapping of knowledge to predictions that increases the value of the deep learning system (Kim et al., 2020; Tezci, 2009).

Due to the recent proliferation of neural networks, several learning algorithms have been applied to the spectrum of neural networks. Neural networks mimic the workings. For example, a classification that uses parallel processing uses deductions based on deduction rather than experience, like the human brain.

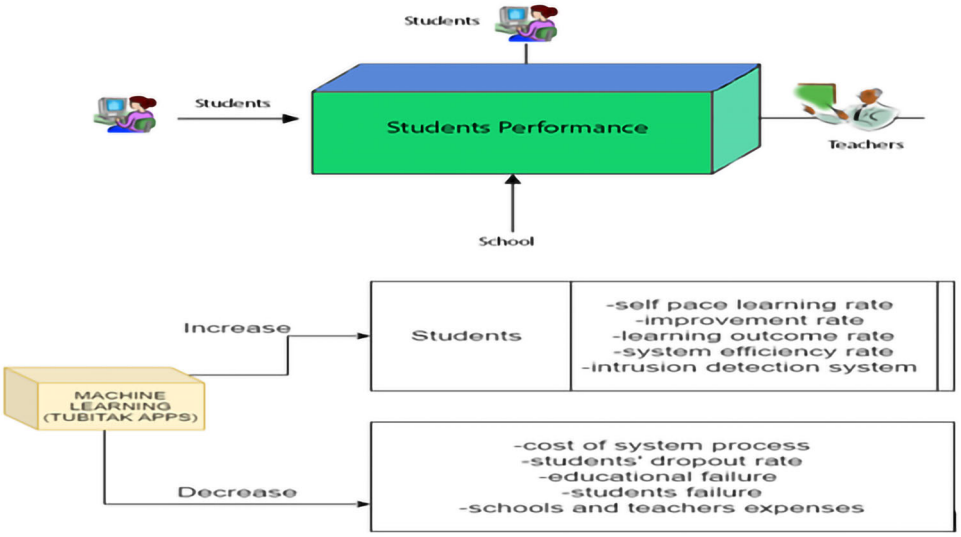

Fig. 4 The system how Machine Learning is enhancing the Future of Education.

Neural networks can be found in many ways, all too difficult for the human mind to understand. The cooperation of nodes varies, such as between straightforward and backward cooperation (sequential or convolution) (Lee, 2019). These nodes were interconnected as the neurons would, thereby allowing them to share information as we do through dendrites and axons (Chavlis and Poirazi, 2021). Recurrent neural networks manage the flow of information in the neural networks. Recurrent Neural Networks are related to the tasks such as long-term learning and multi-input transformations that must be held up for a long time while the network is learning and mathematically repeated for computational purposes. This diagram illustrates the Recurrent Neural Networks, which compute a sequence of hidden vectors by feeding a sequence of inputs to a sequence of outputs (Fig. 4).

Learner, instructor, and educational work are used to describe AI-based education. AI helps students gather data, evaluate the fundamentals, and visualize, allowing them to devote more time to high-level physical activities, practical and virtual experiences, and educator–student interactions. AI facilitates instructors' decision-making by providing real-time updates on class status and proposing various solutions to learners' challenges. It also supports instructors with assessment and efficiently learning management. AI assists instructors by lowering the time they spend on administrative tasks, allowing them to devote more time to enhancing the quality of work and learning.

Educational data mining (EDM) analyzes several forms of educational data using statistical, machine learning, and data mining approach. It focuses on developing tools for evaluating unique educational data to understand how students learn and discover the circumstances in which they obtain superior learning outcomes and a deeper understanding of educational phenomena. There are two forms of EDM research: statistics and visualization and web mining using clustering, classification, association rule mining, and text mining technologies. Concerning the study of models, a method prevalent in cognitive modeling and bioinformatics research but unusual in education research, new kinds of EDM studies would emerge. Thus, EDM approaches may impact education and its significant transdisciplinary sectors, such as AIEd. Numerous universities and other educational institutions have already adopted a variety of AIEd-driven applications, many of which integrate AIEd and EDM techniques to "track" students' behaviors, such as identifying students at risk of dropping out in order to provide timely support by analyzing data regarding class attendance and assignment submission.

Table 1 Comparison of diff methods.

Methods	Prec	Recall	*F*-score	Acc	Kapa statistics
Machine learning	0.952	0.982	0.972	95.332	0.252
AI recognition system	0.912	0.922	0.912	93.172	0.202
Swarm intelligence	0.932	0.932	0.922	95.462	0.272
Ensemble methods	0.932	0.951	0.942	0.954	0.241

Experiments evaluation

The classification was conducted using deep learning. The neural model and the Adam algorithm were implemented sequentially. With this formulation, the loss function was binary cross-entropy. The first two rectification layers began with the use of the activation function. The activation feature was chosen to be sigmoid in the output layer (Zheng et al., 2022). It took 24 neural cells and nine input (variables) to build the first level. The secret units had eight neurons, and the resulting class predicted value had one element. The TensorFlow machine learning library was used to deploy the implementation. The sample set was set at 70–30%; additionally, classifications were carried out in various ways. The table provides a detailed comparison of all of the various approaches. Ten generations of the artificial immune classifiers were performed using the Adaboost Algorithm, cross-generation classifier was used. For this application, it was required that the number of epochs was 300, and the batch size was 28. Parameters may be set to 256, while classifiers like deep learning, achieved a high level of accuracy.

As seen in Table 1, the Ensemble model in education was achieved overall with an average of 0.93 precision, 0.95 accuracy, 0.94 *F*1-score, and 0.24 Kapa statistics.

The ultimate conclusion we reached on the current status of Academic Instruction in Education in light of AI developments tends to confirm that there is total satisfaction with what technology has achieved and trust in its possibilities. Moreover, most faculty members have a positive view of technological progress. The final expert judgment on the second study question indicates that the most likely future scenario for Academic Instruction in Education in light of AI breakthroughs is the optimistic scenario. The experts noted that AI tools could actively contribute to a variety of academic aspects, such as improving academic education and students' learning, promoting academic guidance, enhancing the student assessment and scoring process, activating university and student

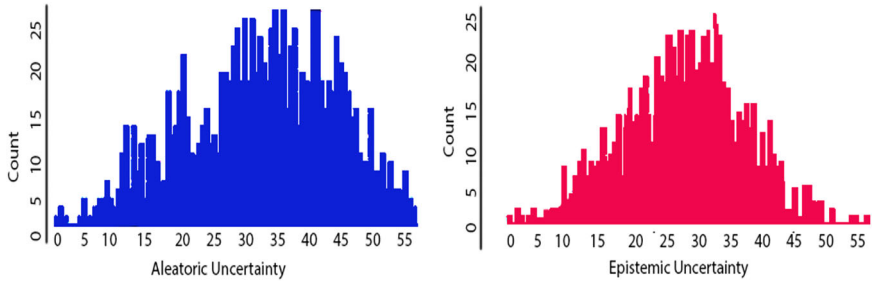

Fig. 5 Distributions of internal assessment percentage of the students concerning results.

Table 2 Metrics used for evaluation.

Accuracy = (TP + TN)/(TN + FP + TP + FN)	(1)
Precision = TP/(TP + FP)	(2)
Sensitivity = TP/(TP + FN)	(3)
Specificity = TN/(FP + TN)	(4)
*F*1-score = (2*P*R)/(P + R)	(5)

activities, enhancing programs and quality assurance, providing virtual reality learning, providing additional student support, and making error-based learning less frustrating. Experts recommend equipping faculty members to implement AI products effectively via training courses, conferences, seminars, and internships so that education may get the possible benefits from AI developments. In Fig. 5, distributions of internal assessment percentage of the students concerning results are shown as seen two types of pf uncertainty are studied and illustrated.

Classifier evaluation techniques metrics. The device's performance is calculated based on AUC precision, precision, recall, and *F*1 accuracy. The evaluation metrics are shown mathematically below. Instances of breast cancer that have been successfully detected are referred to as True Positive (TP), True Negative (TN), mistakenly identified as Breast cancer, False Positive (FP), incorrectly identified as pneumonia or frequent cases, and incorrectly identified as False Negative (FN). Evaluation metrics used in health check systems.

Different performance metrics are often used to investigate different models' performance, such as specificity, accuracy, and sensitivity (Table 2).

Conclusion

Finally, Turkey's AI strategy is distinguished by the contrast between a statist and a market-based approach; tensions of this sort define and legitimize the educational space. As policy discussions have shown, institutions are crucial in both pieces of research and in producing new generations of technology specialists to maintain an economy focused on AI. Governments around the country or especially in the United States, fund AI initiatives, institutions, and the private sector, all of which follow set pathways. AI policies should be seen in the context of Turkey's recent history with the government, science, and technology since they are a new concept. However, throughout this period, there is a major interaction between private and governmental groups seeking expansion.

Furthermore, in the lack of enabling government regulation, privately owned schools have devised creative approaches to incorporating AI into their non-new education sectors. Claims for ostensibly advanced AI applications focus on a pedagogical commercial growth strategy rather than any specific educational goal. AI development influences the Turkish educational system on two fronts: national and regional governments, who want to make educational institutions more strategic and concerned with the private sector's bottom line. Higher education research contributes to the advancement of educational research. This method improves the company's ability to track students' development. This method also benefits the educational system. Using the experiment, we were able to estimate the candidate's internal properties precisely. As a result, candidates who score badly on internal assessments will be able to dedicate more time to complete their final exams. Students with a bad academic record are likely to fail. While the predictive model may be used to identify candidates, who are likely to fail, it may also help them, and their parents estimate how well they will perform on exams.

AI technology has been proved to assist students by making some learning tasks easier. Language translation in real-time, for example, makes information more accessible to students all across the world. It also aids understanding in students learning a second language. AI can increase efficiency, personalization, and streamline administrative tasks, giving instructors more time and freedom to give understanding and adaptability—human characteristics that robots lack. We have implemented AI techniques on the data gathered from schools and study with the data showing that AI has a promising future in the Turkish educational system.

Data availability

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Received: 15 February 2022; Accepted: 26 July 2022;
Published online: 11 August 2022

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Competing interests
The author declares no competing interests.

Ethical approval
This article does not contain any studies with human participants performed by any of the authors.

Informed consent
Ethical approval is not applicable, because this article does not contain any studies with human or animal subjects containing personal information.

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