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Artificial Intelligence in The Education Sector in Türkiye: Opportunities and Challenges[1]

Türkiye'de Eğitim Sektöründe Yapay Zekâ: Fırsatlar ve Zorluklar

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ABSTRACT

The concept of artificial intelligence, which emerged with online education platforms and their applications in education, brings along platforms that offer students options such as interactive course materials by using artificial intelligence-supported learning methods. In this way, it allows not only learning but also measurement and evaluation tools to be used, and it can also provide feedback by measuring students' knowledge-skill levels. With these functions, the concept of Artificial Intelligence can determine learning management in education and offer personalized learning paths by determining student-specific learning methods. In this context, this article aims to provide information about Artificial Intelligence and Educational Applications used in Türkiye and to examine its advantages and disadvantages, especially in terms of how it affects students who have difficulty in accessing technology.

Keywords: Artificial Intelligence, Education, AI-Supported Education, Instructional Materials, Digital Transformation in Education

ÖZET

Eğitimde online eğitim platformları ve bunların uygulamaları ile ortaya çıkan yapay zekâ kavramı beraberinde yapay zekâ destekli öğrenme yöntemleri kullanılmasıyla öğrencileri interaktif ders materyalleri gibi seçenekler sunan platformlar beraberinde getirmektedir. Böylelikle yalnızca öğrenme değil aynı zamanda ölçme ve değerlendirme araçlarını da kullanılmasına imkân tanıyarak öğrencilerin bilgi-beceri seviyelerini ölçerek geri bildirimde de bulunabilmektedir. Bu işlevlerle Yapay Zekâ kavramı eğitimde öğrenme yönetimini belirleyerek öğrencilere özgü öğrenme metotlarının belirlenmesiyle kişiselleştirilmiş öğrenme yolu sunabilmektedir. Bu bağlamda bu makalede Türkiye'de kullanılan Yapay Zekâ ve Eğitim Uygulamaları hakkında bir bilgi verilmesi, avantajları ve özellikle teknolojiye erişim zorluğu yaşayan öğrencileri nasıl etkilediği konusunda dezavantajları incelenmesi hedeflenmektedir.

Anahtar Kelimeler: Yapay Zekâ, Eğitim, Yapay Zekâ Destekli Eğitim, Öğretim Materyalleri, Eğitimde Dijital Dönüşüm

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INTRODUCTION

The discipline of Artificial Intelligence (AI) is centered on imparting cognitive capabilities and adaptable learning similar to those exhibited by humans to computer systems. AI has demonstrated its utility in various educational domains, including learning management systems, student tracking systems, content analysis, automatic assessment, and personalized instruction (Chen, 2020; Lu, 2019; Schramm et al., 2023; Pokrivcakova, 2019; Zhang & Lu, 2021). Integration of technology enhances education by facilitating the monitoring of students' academic advancements and providing constructive feedback to them, thereby simplifying the task of educators. Utilization of educational applications that are backed by AI can provide several advantages to students, such as convenient access to educational materials, interactive educational content, customized learning approaches, and prompt feedback. Implementation of such software has the capacity to customize educational experiences to correspond with the unique interests and requirements of pupils, ultimately leading to increased levels of drive towards learning. In addition, the implementation of AI in education can facilitate the monitoring of students' academic progress, the identification of their areas of weakness, and the provision of tailored learning strategies, thereby enhancing the efficacy of the learning process (Chen, 2020; Erokhin, 2019; İçen, 2022; Lu, 2019; Pokrivcakova, 2019; Sharma et al., 2020; Zhang & Lu, 2021). Nevertheless, it is imperative to acknowledge certain drawbacks associated with the implementation of AI in educational settings. The presence of disparities in technology access can pose a considerable impediment, particularly for students residing in rural regions or households with limited financial resources. Moreover, it is imperative that AI applications do not aim to entirely supplant human teachers or eradicate human interaction. The implementation of AI ought to function as a supplementary mechanism to bolster the responsibilities of educators while simultaneously acknowledging the significance of interpersonal communication. In recent years, the field of education has undergone a significant transformation due to the emergence of AI and educational technologies (Chen, 2020; Erokhin, 2019; İçen, 2022; Lu, 2019; Schramm et al., 2023; Sharma et al., 2020; Pokrivcakova, 2019; Zhang & Lu, 2021). Utilization of online education platforms and AI-supported learning techniques provides students with interactive and customized learning opportunities that surpass the limitations of conventional classroom settings, resulting in a novel educational paradigm (Chen, 2020; Erokhin, 2019; İçen, 2022; Lu, 2019; Schramm et al., 2023; Sharma et al., 2020; Pokrivcakova, 2019; Zhang & Lu, 2021).

The objective of this research is to examine the impacts and benefits of AI and educational applications implemented in Türkiye, with the purpose of highlighting the significance of technology in the realm of education and establishing a foundation for forthcoming investigations. The promotion of additional research and development in the realm of AI and its application in education endeavors to examine the impacts and benefits of these technological advancements in the educational sphere.

ARTIFICIAL INTELLIGIENCE

AI is a technological application that emulates human-like intelligence and learning abilities in computer systems. The aforementioned technology enables computer programs to effectively address intricate issues and render decisions through the utilization of techniques

such as data analysis, pattern recognition, machine learning, and deep learning. AI has the capability to effectively analyze vast quantities of data, recognize recurring patterns, generate forecasts, and acquire knowledge autonomously (Davenport & Kalakota, 2019; Mainzer, 2020; Mou, 2019;). AI presents a diverse range of applications across various sectors such as healthcare, transportation, finance, education, and others. The primary objective of AI is to replicate or potentially exceed human cognitive abilities, thereby offering a technological remedy for intricate challenges (Davenport & Kalakota, 2019; Mainzer, 2020; Mou, 2019; Sharma et al., 2020).

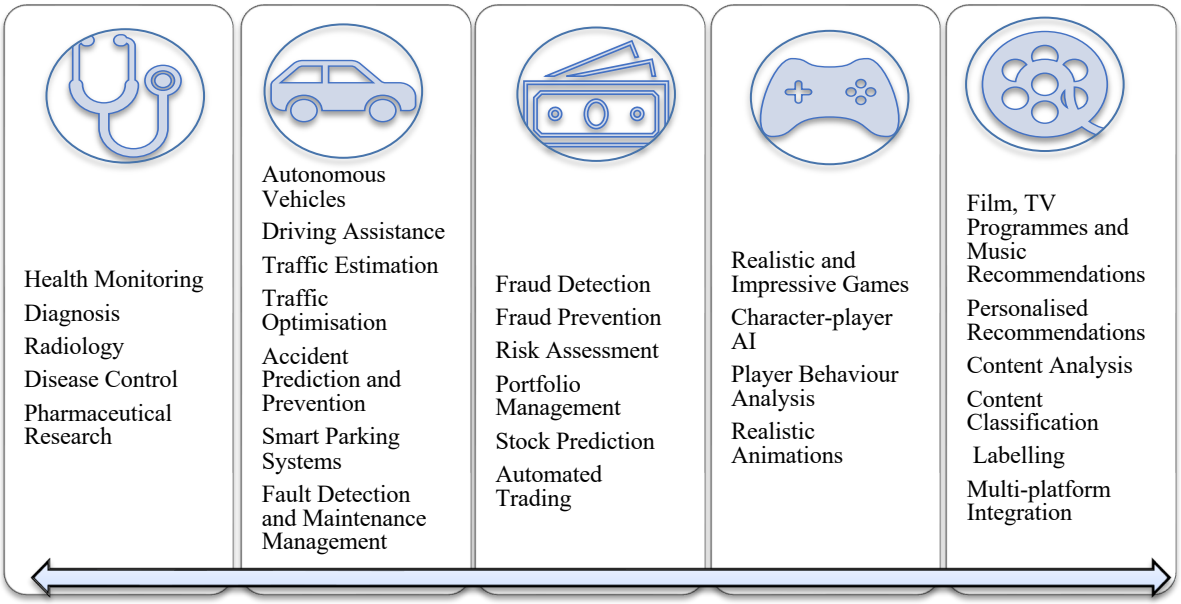

Figure 1. Areas of using AI

Figure 1 summarizes the areas of (Bin Sulaiman, 2018; Davenport & Kalakota, 2019; Hilpisch, 2020; Mou, 2019; Lau & Staccini, 2019; Sharma et al., 2020; Yakan, 2022; Owoc et al., 2021) use of AI in the health, transport, finance, gaming, and entertainment sectors.

Artificial Intelligence in Education Sector

Baker, T., & Smith, L. (2019) categorized Educational AI into three groups in 2019. These are Educational AI Tools for the System, Educational AI Tools for Students, and Educational AI Tools for Teachers. By analyzing students' individual requirements and learning styles, AI-enabled tools geared toward the learner create individualized learning experiences. Using software such as adaptive learning management systems or Intelligence Measurement Systems, these tools identify students' learning pace and interests and adapt learning materials accordingly. The use of AI tools for teachers to reduce their workload and enhance the teaching process. It offers assistance to educators by leveraging automation and data analysis capabilities. For instance, automated test assessment software expedites the evaluation process, and software that detects plagiarism enables instructors to monitor academic integrity. Data

analysis and insights are offered by system-oriented AI technologies for large educational institutions. Student outcomes, absenteeism rates, and educator effectiveness are only some of the data captured by these instruments. This allows for better administration inside academic institutions (Baker & Smith, 2019).

Using AI in the classroom can help teachers create lessons that are specifically designed to meet the requirements of each student. Students' strengths and areas of improvement can be targeted so that they receive instruction and resources that are most beneficial to them. Automated grading of homework and tests is a possibility thanks to AI implementation. Educators' time and mental energy requirements can be reduced if they are given consistent and timely feedback. This facilitates expedited evaluation and prompt response to students (Li et al., 2022; Nazaretsky et al., 2022).

The utilization of AI possesses the capability to assist educators in effectively managing their classrooms. The system has the capability to monitor and analyze the level of students' engagement, concentration, and progress in their academic pursuits. This resource enables educators to more effectively direct their students and provide targeted interventions based on individualized requirements (Colchester et al., 2017; Holmes et al., 2023; Roll & Wylie, 2016).

By utilizing AI for data analysis in the field of education, learning analytics facilitates the monitoring of students' academic advancement and the delivery of informative feedback to instructors. By conducting an assessment of the aptitudes and limitations of students, the educational program can be customized in a more efficient manner, and educators can be provided with chances to intervene based on the specific needs of each student (Alonso & Casalino, 2019; Cruz-Jesus et al., 2020).

The domain of language translation exhibits significant potential for the implementation of AI. The utilization of language translation tools can aid students in understanding texts written in various languages and surmounting obstacles to efficient communication. In multicultural classrooms or in the context of learning a foreign language, this provides a significant benefit (Baumgärtner et al., 2020; Kolhar & Alameen, 2021; Mishra & Singh, 2021).

The utilization of AI has the potential to facilitate the creation of educational materials and content. The technology has the capability to generate personalized educational content that caters to the specific requirements of learners and facilitates the efficient delivery of instructional materials. This facilitates educators in maximizing their time and resources (Bekeš & Galzina, 2022).

Table 1. AI Technology- Application (Ezzaim et al., 2022).

AI Applications in Education	**AI Technology**
Expert Systems	AI-Based Rules
Suggestion Systems	Rule-Based Reasoning, Machine Learning, Topic Modelling, Labelling Techniques
Virtual Learning Environments	Artificial Neural Network, Data Mining Algorithms
Smart Tutoring Systems	Rule Based Reasoning, Fuzzy Rules
Adaptive Learning Systems	Data Mining Algorithms, Regression Techniques, Machine Learning, Naive Bayes, Decision Tree, K-Nearest Neighbours, Support Vector Machine

Table 1 shows that summarizes AI Applications in Education and Technology.

Expert Systems include computer-based tools which utilize the knowledge of people who have specialized knowledge in a certain field to make choices and solve issues (Leondes, 2001). Recommendation systems, which are frequently utilized in e-commerce, music, and film platforms, offer customers recommendations based on their preferences (Li et al., 2023). Virtual learning environments are places where students can access educational content online and engage in interactive learning (Reisoğlu et al., 2017). Intelligent tutoring systems, facilitated by AI, provide students with tailored course materials to meet their individual learning needs and monitor their advancement (Wang et al., 2023). Adaptive learning systems are computer-based educational platforms that offer personalized learning resources to students according to their unique requirements, inclinations, and cognitive styles (Choudhary et al., 2023). Rule-Based Within the realm of computer science, the process of reasoning involves utilizing logical deduction to generate outcomes based on a predetermined set of principles (Masri et al., 2019). The subfield of AI known as "machine learning" facilitates the ability of computer systems to acquire knowledge and improve performance through the analysis of data. These systems utilize data analysis to identify patterns and relationships, enabling them to make predictions about future data. The technique of topic modeling in machine learning is utilized to identify and examine underlying themes present in textual data. This methodology leverages the natural inclination of words within textual materials to cluster together, thereby discerning patterns and themes (Gandomi, 2022; Munir et al., 2022). The process of categorizing and assigning descriptors to data is accomplished through the utilization of labeling techniques within the field of data analysis. These techniques have various uses, including but not limited to data categorization, manipulation of visual information, and analysis of human language (Li et al., 2023). An artificial neural network is a type of AI that was based on how the human brain works. Deep learning uses artificial neural networks, which are known for their ability to handle data and spot patterns (Aggarwal et al., 2022). A collection of techniques and algorithms known as data mining algorithms are used to glean valuable information and patterns from big data collections. These methods are employed in the categorization, grouping, regression, and association finding phases of data analysis (Tenali & Babu, 2023). A statistical analysis technique called regression techniques is used to look at the connections between data and forecast the dependent variable (Montgomery et al., 2021). An technique based on probabilities called Naive Bayes is used in machine learning and natural language processing to handle categorization issues. The Decision Tree algorithm is utilized for resolving classification and regression problems. It generates a collection of decision rules founded on the attributes of the data and anticipates the outcomes. The K-Nearest Neighbours algorithm is a computational method utilized in the resolution of classification and clustering predicaments. The process of analyzing the neighbors of a data point is utilized for the purpose of classifying or grouping a new data point. The Support Vector Machine is a machine learning algorithm that is commonly employed in the resolution of classification and regression problems. The technique endeavors to partition data by generating classification or regression hyperplanes and visually presenting the data in a spatial context (Kusal et al., 2023).

Artificial Intelligence in the Education Sector: Opportunities

In the light of the studies conducted in the literature, the advantages of AI are found in 6 basic categories as shown in Figure 2.

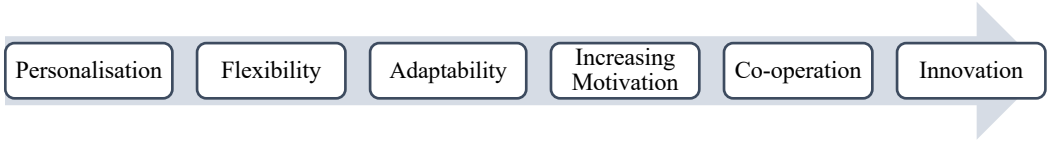

Figure 2. Opportunities Of AI In Education

AI offers increased flexibility in the process of learning. These approach lets people learn at their own pace and adapt the information to their own needs. The program helps kids move forward at different levels and speeds (Chen et al., 2020; Su et al.,2023). Using AI makes it possible to tailor the learning experience to each student's wants and preferences, which makes them more adaptable. Through an analysis of a student's learning style, aptitudes, and limitations, it is feasible to provide them with resources, materials, and instructional approaches that are optimally suited to their individual needs (Chiu, 2021; Minn, 2022; Taylor et al., 2021). Implementation of AI has the potential to enhance students' engagement in the learning process. The implementation of gamification in the educational setting has the potential to enhance student engagement and enjoyment in the learning process through the incorporation of game-like elements. A mechanism of incentivization can be established by monitoring the academic performance of students, which can serve as a means of acknowledging their achievements upon reaching their set objectives (Chrysafiadi & Virvou, 2013; Kem, 2022). AI facilitates collaborative work and communication among students. The pedagogical approach fosters collaborative learning among students through the utilization of group assignments, dialogic exchanges, and interactive instructional spaces. Additionally, it provides educators with valuable insights that can aid in monitoring their students' collaborative efforts and interactions within group settings. AI has the potential to provide a customized educational experience by catering to the unique learning styles and individual needs of students. Through the identification of students' individual strengths and weaknesses, tailored content, assignments, and feedback can be provided. Therefore, it facilitates the acquisition of knowledge by students in a more efficient manner (August & Tsaima, 2021; Chiu, 2021; Chrysafiadi & Virvou, 2013; Kem, 2022; Minn, 2022; Su et al., 2023; Taylor et al., 2023). AI has the potential to facilitate innovative applications within the education sector. The provision of innovation is evident in various domains, including the generation of educational resources, the advancement of pedagogical techniques, and the mechanization of assessment procedures. The utilization of AI-based applications has been found to facilitate the identification of novel and efficacious methodologies in the realm of education (August & Tsaima, 2021; Chen et al., 2020; Chiu, 2021; Chrysafiadi & Virvou, 2013; Kem, 2022; Lu, 2019; Minn, 2022; Su et al., 2023; Taylor et al., 2023; Zhang & Lu, 2021).

Artificial Intelligence in the Education Sector: Challange

In the light of the studies conducted in the literature, the challanges of AI are found in 6 basic categories as shown in Figure 3.

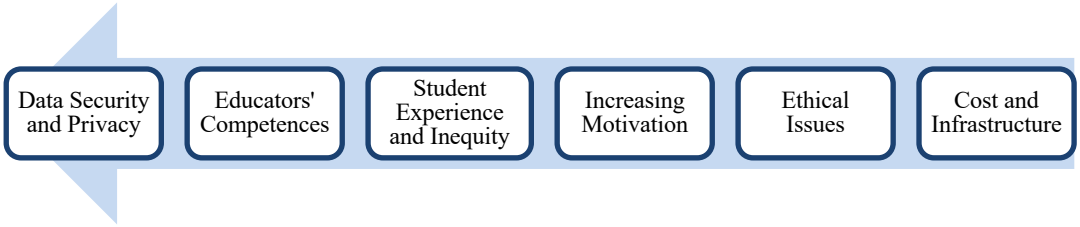

Figure 3. Challanges Of AI In Education

AI systems require substantial data sets to operate efficiently. The dataset in question may comprise confidential information, encompassing student records, performance assessments, and personal data. Consequently, there are concerns regarding data security and privacy. It is imperative to implement data protection policies and measures, as well as take necessary precautions to prevent unauthorized Access (Holmes et al., 2023; Pedro et al., 2019). The effective comprehension and utilization of AI-based systems by educators is of paramount significance. Educators require training and skills development programs to acquire the necessary competencies for utilizing and administering these technologies. By adopting this approach, it is possible to empower educators to appropriately and efficiently incorporate AI tools (Alam, 2021; Chiu, 2021). The implementation of AI systems has the potential to enhance students' educational experiences. However, it is important to acknowledge that this development may also expose certain disparities. Lack of access to AI-based tools or inadequate technological infrastructure may place certain students at a disadvantage. Hence, it is imperative to guarantee that each student is provided with access to AI and that its implementation adheres to the principle of equity (Ahmad et al., 2023; Holmes et al., 2023). The implementation of AI systems in education may give rise to certain ethical concerns. It is imperative to take into account various concerns, including the establishment of ethical guidelines for the utilization of student data, the avoidance of algorithmic partiality, and the equitable treatment of students. Ensuring adherence to principles of justice, transparency, and human values is a crucial aspect of developing AI systems (Holmes et al., 2023; Su et al., 2023).

The implementation of AI-based systems may entail expenses and pose technological infrastructure obstacles. Educational institutions may encounter difficulties due to the high expenses associated with hardware and software requirements, infrastructure upgrades, and maintenance costs. Hence, it is imperative to investigate cost-efficient alternatives and optimize resource utilization (Ahmad et al., 2023; Chiu, 202; Holmes et al., 2023; Pedro et al., 2019; Su et al., 2023).

DISCUSSION

The utilization of AI in educational applications has been noted to provide considerable benefits within the Turkish education industry. The utilization of such applications has the

potential to enhance the efficacy of learning through the provision of a tailored educational encounter for individual students (İçen, 2022).

The observation has been made that students who encounter challenges in accessing technology may not derive optimal benefits from education applications that are supported by AI. This phenomenon has the potential to exacerbate disparities and result in certain students experiencing academic setbacks (Zhang & Deng, 2022).

It is imperative to devise remedies for students who encounter challenges in obtaining technology. The proposed solutions encompass enhancing technological infrastructure, furnishing internet connectivity, and proffering educational tools at reduced or no cost (Mbodila et al., 2016).

Enhancing the proficiency of educators and educational administrators in utilizing AI technologies is crucial for the broader and more efficient integration of such applications in the field of education (Alam, 2021; August & Tsaima, 2021; Chiu, 2021; Chrysafiadi & Virvou, 2013; Kem, 2022; Minn, 2022; Pedro et al., 2019; Taylor et al., 2021). Recommended that educational staff receive training on the utilization of AI applications, and that awareness be heightened in this regard.

Recommended to establish mechanisms for continuous monitoring and feedback in order to assess and enhance the effectiveness of education applications that are supported by AI. By assessing the efficacy of the applications, enhancements can be implemented (Alonso & Casalino, 2019, Cruz-Jesus et al., 2020).

There is a need for increased promotion and backing of research endeavors pertaining to the intersection of AI and education within the Turkish education industry. Further investigation, advancement, and collaboration are necessary to enhance the synergy between AI and education. The implementation of these recommendations has the potential to enhance the inclusivity, efficacy, and sustainability of AI-supported educational practices in Türkiye.

In conclusion, it is evident that the utilization of AI and educational applications holds substantial promise for the education industry in Türkiye. Applications supported by AI have the potential to provide an interactive and stimulating educational setting that is more responsive to the requirements of learners. Nonetheless, a drawback of these applications is that students who encounter challenges in accessing technology may not be able to fully reap their benefits.

Within this particular context, it is imperative to prioritize endeavors aimed at resolving the issue of technology accessibility in the realm of education, while concurrently mitigating disparities. It is recommended that measures be implemented to enhance technological infrastructure, facilitate internet accessibility, and provide low-cost or complimentary educational resources.

Furthermore, enhancing the proficiency of educators and educational leaders in utilizing AI-assisted tools and increasing their consciousness is crucial. It is imperative that educational personnel receive adequate training in the utilization of AI applications, and that efforts are made to increase awareness regarding the potential of this technology.

It is imperative to establish mechanisms for continuous monitoring and feedback in order to evaluate and enhance the efficacy of education applications supported by AI. Thus, the

assessment of the effects of the applications can be quantified and enhancements can be implemented.

Ultimately, it is crucial to promote and facilitate research endeavors pertaining to the intersection of AI and education within the Turkish context, while also providing ample resources and assistance to scholars pursuing such inquiries. Enhanced exploration, advancement, and cooperation have the potential to amplify the interdependence between AI and education, thereby facilitating progress in the field of education.

The convergence of these various endeavors holds promise for the enhancement of AI-powered applications within Türkiye's education sector, rendering them more comprehensive, efficacious, and enduring. Consequently, the educational quality will be enhanced, and the learning experiences of students will be improved.

REFERENCES

Aggarwal, K., Mijwil, M. M., Al-Mistarehi, A. H., Alomari, S., Gök, M., Alaabdin, A. M. Z., & Abdulrhman, S. H. (2022). Has the future started? The current growth of artificial intelligence, machine learning, and deep learning. Iraqi Journal for Computer Science and Mathematics, 3(1), 115-123.

Ahmad, A., Tariq, A., Hussain, H. K., & Gill, A. Y. (2023). Equity and Artificial Intelligence in Surgical Care: A Comprehensive Review of Current Challenges and Promising Solutions. BULLET: Jurnal Multidisiplin Ilmu, 2(2), 443-455.

Alam, A. (2021, November). Possibilities and apprehensions in the landscape of artificial intelligence in education. In *2021 International Conference on Computational Intelligence and Computing Applications (ICCICA)* (pp. 1-8). IEEE.

Alonso, J. M., & Casalino, G. (2019). Explainable artificial intelligence for human-centric data analysis in virtual learning environments. In *Higher Education Learning Methodologies and Technologies Online: First International Workshop, HELMeTO 2019, Novedrate, CO, Italy, June 6-7, 2019, Revised Selected Papers 1* (pp. 125-138). Springer International Publishing.

August, S. E., & Tsaima, A. (2021). Artificial intelligence and machine learning: an instructor's exoskeleton in the future of education. *Innovative Learning Environments in STEM Higher Education: Opportunities, Challenges, and Looking Forward*, 79-105.

Baker, T., & Smith, L. (2019). Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges.

Baumgärtner, L., Jauss, S., Maucher, J., & Zimmermann, G. (2020, November). Automated Sign Language Translation: The Role of Artificial Intelligence Now and in the Future. In *CHIRA* (pp. 170-177).

Bekeš, E. R., & Galzina, V. (2022, May). Utilizing smart digital technology and artificial intelligence in education for transforming the way content is delivered. In *2022 45th Jubilee International Convention on Information, Communication and Electronic Technology (MIPRO)* (pp. 573-578). IEEE.

Bin Sulaiman, R. (2018). Artificial intelligence based autonomous car. Artificial Intelligence Based Autonomous Car (April 23, 2018).

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *Ieee Access*, *8*, 75264 75278.

Chiu, T. K. (2021). A holistic approach to the design of artificial intelligence (AI) education for K-12 schools. *TechTrends*, *65*(5), 796-807.

Choudhary, A., Singh, A., Mishra, P., & Sharma, M. S. (2023). THE FUTURE OF COMPUTER ASSISTED LEARNING. *FUTURE*, *52*(4).

Chrysafiadi, K., & Virvou, M. (2013). Student modeling approaches: A literature review for the last decade. *Expert Systems with Applications*, *40*(11), 4715-4729.

Colchester, K., Hagras, H., Alghazzawi, D., & Aldabbagh, G. (2017). A survey of artificial intelligence techniques employed for adaptive educational systems within e-learning platforms. *Journal of Artificial Intelligence and Soft Computing Research*, *7*(1), 47-64.

Cruz-Jesus, F., Castelli, M., Oliveira, T., Mendes, R., Nunes, C., Sa-Velho, M., & Rosa-Louro, A. (2020). Using artificial intelligence methods to assess academic achievement in public high schools of a European Union country. *Heliyon*, *6*(6), e04081.

Davenport, T., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. *Future healthcare journal*, *6*(2), 94.

Erokhin, S. D. (2019). A review of scientific research on artificial intelligence. 2019 Systems of Signals Generating and Processing in the Field of on Board Communications, 1-4.

Ezzaim, A., Kharroubi, F. ., Dahbi, A. ., Aqqal, A. ., & Haidine, A. . (2022). Artificial intelligence in education- State of the art. International Journal of Computer Engineering and Data Science (IJCEDS), 2(2). Retrieved from https://www.ijceds.com/ijceds/article/view/37

Gandomi, A. H., Chen, F., & Abualigah, L. (2022). Machine learning technologies for big data analytics. *Electronics*, *11*(3), 421.

Hilpisch, Y. (2020). Artificial Intelligence in Finance. O'Reilly Media.

Holmes, W., Bialik, M., & Fadel, C. (2023). Artificial intelligence in education. Globethics Publications.

İçen, M. (2022). The future of education utilizing artificial intelligence in Turkey. *Humanities and Social Sciences Communications*, *9*(1), 1-10.

Kem, D. (2022). Personalised and adaptive learning: Emerging learning platforms in the era of digital and smart learning. *International Journal of Social Science and Human Research*, *5*(2), 385-391.

Kolhar, M., & Alameen, A. (2021). Artificial intelligence based language translation platform. *Middle East*, *1*, 4.

Kusal, S., Patil, S., Choudrie, J., Kotecha, K., Vora, D., & Pappas, I. (2023). A systematic review of applications of natural language processing and future challenges with special emphasis in text-based emotion detection. *Artificial Intelligence Review*, 1-87.

Lau, A. Y., & Staccini, P. (2019). Artificial intelligence in health: new opportunities, challenges, and practical implications. Yearbook of medical informatics, 28(01), 174-178.

Leondes, C. T. (Ed.). (2001). Expert systems: the technology of knowledge management and decision making for the 21st century. Elsevier.

Li, D., Chen, J., Wang, Z., & Song, Y. (2023). LSTM Deep Neural Network Based Power Data Credit Tagging Technology. Tehnički vjesnik, 30(1), 324-334.

Li, X., Sun, L., Ling, M., & Peng, Y. (2023). A survey of graph neural network based recommendation in social networks. *Neurocomputing*, 126441.

Li, Z., Guang, Z., & Sun, W. (2022). Evaluation and Analysis of Assisted Instruction and Ability Improvement Based on Artificial Intelligence. *Journal of Sensors*, *2022*.

Lu, Y. (2019). Artificial intelligence: a survey on evolution, models, applications and future trends. *Journal of Management Analytics*, *6*(1), 1-29.

Mainzer, K. (2020). Introduction: What Is AI?. *Artificial intelligence-When do machines take over?* 1-5.

Masri, N., Sultan, Y. A., Akkila, A. N., Almasri, A., Ahmed, A., Mahmoud, A. Y., ... & Abu-Naser, S. S. (2019). Survey of Rule-Based Systems. *International Journal of Academic Information Systems Research (IJAISR)*, *3*(7), 1-23.

Mbodila, M., Bassey, I., Kikunga, M., & Masehele, L. (2016). On overcoming transitional challenges of first year students in technology-based educational settings. *International Journal of Modern Education and Computer Science*, *8*(11), 28.

Minn, S. (2022). AI-assisted knowledge assessment techniques for adaptive learning environments. *Computers and Education: Artificial Intelligence*, 100050.

Mishra, A., & Singh, M. (2021). Influence of technology in learning macro skills of English in a multicultural classroom: a case study of students' perception.

Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). *Introduction to linear regression analysis*. John Wiley & Sons.

Mou, X. (2019). Artificial intelligence: investment trends and selected industry uses. *International Finance Corporation*, *8*.

Munir, H., Vogel, B., & Jacobsson, A. (2022). Artificial intelligence and machine learning approaches in digital education: a systematic revision. Information, 13(4), 203.

Nazaretsky, T., Bar, C., Walter, M., & Alexandron, G. (2022, March). Empowering teachers with AI: Co-designing a learning analytics tool for personalized instruction in the science classroom. In *LAK22: 12th International Learning Analytics and Knowledge Conference* (pp. 1-12).

Owoc, M. L., Sawicka, A., & Weichbroth, P. (2021, August). Artificial intelligence technologies in education: benefits, challenges and strategies of implementation. In Artificial Intelligence for Knowledge Management: 7th IFIP WG 12.6 International Workshop, AI4KM 2019, Held at IJCAI 2019, Macao, China, August 11, 2019, Revised Selected Papers (pp. 37-58). Cham: Springer International Publishing.

Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development.

Pokrivcakova, S. (2019). Preparing teachers for the application of AI-powered technologies in foreign language education. Journal of Language and Cultural Education, 7(3), 135-153.

Reisoğlu, I., Topu, B., Yılmaz, R., Karakuş Yılmaz, T., & Göktaş, Y. (2017). 3D virtual learning environments in education: A meta-review. Asia Pacific Education Review, 18, 81-100.

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, *26*, 582-599.

Schramm, S., Wehner, C., & Schmid, U. (2023). Comprehensible artificial intelligence on knowledge graphs: A survey. *Journal of Web Semantics*, *79*, 100806.

Sharma, G. D., Yadav, A., & Chopra, R. (2020). Artificial intelligence and effective governance: A review, critique and research agenda. *Sustainable Futures*, *2*, 100004.

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

Taylor, D. L., Yeung, M., & Bashet, A. Z. (2021). Personalized and Adaptive Learning (pp. 17–34).

Tenali, N., & Babu, G. R. M. (2023). A systematic literature review and future perspectives for handling big data analytics in COVID-19 diagnosis. New Generation Computing, 41(2), 243-280.

Wang, H., Tlili, A., Huang, R., Cai, Z., Li, M., Cheng, Z., ... & Fei, C. (2023). Examining the applications of intelligent tutoring systems in real educational contexts: A systematic literature review from the social experiment perspective. *Education and Information Technologies*, 1-36.

Yakan, S. A. (2022). Analysis of development of artificial intelligence in the game industry. International Journal of Cyber and IT Service Management, 2(2), 111-116.

Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, *23*, 100224.

Zhang, K., & Deng, P. (2022, May). Exploring the Technology and Problems of Artificial Intelligence Education Applications. In *2022 4th International Conference on Computer Science and Technologies in Education (CSTE)* (pp. 265-268). IEEE.