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EDUCCON 2024 Education Conference
27 September 2024
Kahramanmaraş Teknokent, Kahramanmaraş Sütçü İmam University

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PREFACE

ÖNSÖZ

Educational approaches and practices cannot be thought in separate from historical and social realities and scientific/technological developments in society. The characteristics of the period we live in and the scientific and technological developments affect the structure and functioning of the society while, at the same time, reflecting on education as a social institution in various forms. Issues and notions frequently discussed in recent years such as 21st century competencies, individualization in education, values education, augmented reality, and artificial intelligence are some indicators of this reflection.

EDUCCON, first held in 2017, is set out to construct an educational agenda through discussing new concepts and practices in the field of educational sciences. Towards this aim, what is meant by “new” may be the development or application of a new technology, new concept, theoretical approach, teaching method, instructional model, educational program, philosophical approach or alternative school architecture. In 2018 EDUCCON main theme was EDUCATION 4.0, the notion that reflects practices and understandings in science and technology that moved into societal agenda through the term INDUSTRY 4.0. In 2020, EDUCCON is going to be held as a virtual conference with the theme Empowering Teaching. EDUCCON 2020 will energize and inspire the scientists and teachers whose job is to teach in new-normal. In 2020 EDUCCON main theme was Empowering Teaching. Most presented studies demonstrated the development of a teaching philosophy and how to apply evidence-based teaching in lessons from the point of “new normal” view, considering after COVID-19 Pandemic. EDUCCON in 2022 was focalized on Digital Competence & STE(A)M Education. The conference papers include latest scientific developments and experiences in STE(A)M education practices and Digital Competence, as well as papers from other fields of educational sciences.

EDUCCON 2024 is particularly focuses on (but not districted to) Artificial Intelligence (AI) and robotics in education. AI holds promise for various educational aspects, including planning, assessment, material development, and personalization. AI’s impact in education is debated by researchers, practitioners, and policymakers. Ethical concerns exist, leading to varied stances among countries. Empirical research and theoretical conclusions are needed. EDUCCON 2024 is also address the role of robotics in education from preschool to university level. It aims to develop a sustainable

framework for robotics education, including curricula and resources. Robotics is highlighted as a learning object and tool within the frame of the technology and engineering and the currently emerging in educational movements. In addition to current applications of AI and robotics in education, future projections require attention. EDUCCON aims to facilitate discussions on these topics, shaping the field's direction. The EDUCCON 2024 conference program consists of invited speeches, paper presentations, and training sessions.

EDUCCON 2024 is organized as final conference of Robot Cooperation Project. The Robot Cooperation (RoboCoop) Project, funded by the European Union and coordinated by Kahramanmaraş Sütçü İmam University in Türkiye, was launched in 2022. The project aims to develop comprehensive educational programs and materials for social humanoid robots, enhancing human-robot collaboration and ensuring safety. With multiple European partners, RoboCoop focuses on practical applications in various industries.

Prof.Dr. Mehmet TEKEREK
EDUCCON 2024 Chair

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SCIENTIFIC PROGRAM BİLİMSEL PROGRAM

Program Outline

Face to face (Kahramanmaraş Teknokent Conference Hall)		Online
8:30	REGISTRATION	
9:00	Opening speeches	
9:30	Invited Speaker: Prof.Dr. S.Sadi Seferoğlu	
10:00	Pepper	
10:15	Break	
10:30	Invited Speaker: Dr. Hasan Tınmaz	10:15 PPS-3 (Lang: EN) Chair: Prof Dr. Hakan Tüzün
11:00	Sponsored Presentation by Robot Sepeti Moderator: Prof.Dr. Mehmet Tekerek	
11:20	Invited Speaker: Dr. Susam Dündar Işık & Arda Işık	11:15 PPS-4 (Lang: EN) Chair: Prof. Dr. Sencer Çorlu
11:35	Break	
11:45	Invited Speaker: Assoc. Prof. Dr. Burak Şişman	
12:15	Invited Speaker: Assoc. Prof. Dr. Magdalena Palacz	12:15 PPS-5 (Lang: EN) Chair: Dr. Fatma Coşkun
12:45	Break	
13:00	PPS-1 (Lang: TR) Chair:	
13:15	Assoc. Prof. Dr. Reyhan Ağçam	13:00 PPS-6 (Lang: EN) Chair: Dr. Hasan Tınmaz
13:30	Lunch	13:45 Lunch
14:15	Invited Speaker: Assoc.Prof.Dr. Adem Tekerek	
14:45	Invited Speaker: Prof.Dr. Javier Sánchez-García & Dr. Luis Callarisa-Fiol	14:15 TS-2 (Lang: EN) Moderator: Assoc. Prof. Dr. Ferhat Karakaya
15:15	Break	
15:30	TS-1 (Lang: TR) Moderator: Şerife Durna	15:15 PPS-7 (Lang: TR) Chair: Prof.Dr. Bayram Coştu
16:15	PPS-2 (Lang: EN) Chair: Assoc.Prof.Dr. Magdalena Palacz	16:00 PPS-8 (Lang: TR) Chair: Prof.Dr. Salim Sever
		16:45 PPS-9 (Lang: TR) Chair: Dr. Tuğba Abanoz
17:30	Closing Ceremony	

Detailed Program

TS-1

15.30	16.15	Training Session-1	Presentation and Q&A Language: TR
Face to Face		<p>Customizable AI-Powered Learning Platform: Akıllı Eğitim Asistanı</p> <p>by Ekrem Tekin (CEO, The Blue Red, Türkiye)</p>	

TS-2

14.15	15.15	Training Session-2	Presentation and Q&A Language: EN
Face to Face		<p>Qualitative Data Analysis with Databeeg (AI Supported)</p> <p>by Firat Yılmaz (Data Scientist, Databeeg, Türkiye)</p>	

PPS-1

13.00	13.30	Paper Presentation Session-1 Chair: Assoc.Prof.Dr. Reyhan Ağçam	Presentation and Q&A Language: TR
Face to Face		<p>Human-Robot Interaction in Education: A Systematic Mapping Study Zeynep Beyazaslan (Kahramanmaraş Sütçü İmam University)*; Hamza Aydemir Gök (Kahramanmaraş İstiklal University); Mehmet Tekerek (Ankara University); Mehmet Gök (Kahramanmaraş İstiklal University)</p> <p>Educational data privacy: How do Turkish scholars consider it? Mehmet Boz (Ministry of National Education)*; Recep Başarıcı (Ministry of National Education)</p>	

PPS-2

16.15	17.30	Paper Presentation Session-2 Chair: Assoc.Prof. Dr. Magdalena Palacz	Presentation and Q&A Language: EN
Face to face		<p>Predicting Student Performance with Machine Learning Algorithms Semiha Güngör (Ankara Hacı Bayram Veli University)*; Birnaz Kanbur Tekerek (Gazi University); Adem Tekerek (Gazi University)</p> <p>Teachers' Metaphorical Perceptions of Artificial Intelligence Şerife Durna (Kahramanmaraş Sütçü İmam University)*; Selçuk Kaba (Ministry of National Education); Kadir Demirkaynak (Ministry of National Education); Ahmet Akkincü (Ministry of National Education)</p> <p>Critical Review of AI Competency Framework for Teachers Şerife Durna (Kahramanmaraş Sütçü İmam University)*; Ashkan İleri (Ankara Yıldırım Beyazıt University); Haris Haq (Georgia Institute of Technology)</p> <p>Mobile Learning Enhanced by AI in Distance Education: A Comprehensive Examination of Conceptual, Historical, Technological, Pedagogical, and Accessibility Dimensions Münevver Calayir (Bahçeşehir University)*</p> <p>Examining the Application of a Word Association Test Through a Social Humanoid Robot from the Perspective of Human-Robot Interaction Fatma Coşkun (Kahramanmaraş Sütçü İmam University)*; Hamza Aydemir (Kahramanmaraş İstiklal University); Mehmet Gök (Kahramanmaraş İstiklal University); Mehmet Tekerek (Ankara University)</p>	


PPS-3

10.15	11.15	Paper Presentation Session-3 Chair: Prof.Dr. Hakan Tüzün	Presentation and Q&A Language: EN
 Passcode: educcon		<p>Artificial Intelligence in Education: Current Applications and Future Prospects Aryan Chopra (Vellore Institute of Technology Vellore India); Harshita Patel (VIT, Vellore); Dharmendra Singh Rajput (VIT Vellore India)*</p> <p>The Integration of AI, Robotics and Assistive Technology in Indian Higher Education for differently-abled Learners: A Study in Reference with Europe Dharmendra Singh Rajput (VIT Vellore India)*; Harshita Patel (VIT, Vellore); Ramalingam Murugan (Vellore Institute of Technology); Kuruva Lakshmana (VIT); Praveen Kumar Maddikunta (VIT)</p> <p>A Systematic Review of Key Areas and Educational Implications of VEX Robotics Competition Huseyin Hakan Cetinkaya (Bağkent University)*</p> <p>Advisory-AI: Fostering Learning Support with an LLM-powered Dialogue System Hatice Karaaslan (Ankara Yıldırım Beyazıt University); Uygur Yüzsüren (İleri Veri Teknolojileri ve Danışmanlık); Özkan Kılıç (Cisco Systems Inc.); Emirhan Atlankarayığı (Ankara Yıldırım Beyazıt University)*; Buğra Alptekin Sarı (Ankara Yıldırım Beyazıt University); Melisa Boydak (Ankara Yıldırım Beyazıt University); Gürkan Er (Ankara Yıldırım Beyazıt University); Melikşah Bozkurt (Ankara Yıldırım Beyazıt University)</p>	

PPS-4

11.15	12.15	Paper Presentation Session-4 Chair: Prof.Dr. Sencer Çorlu	Presentation and Q&A Language: EN
 Passcode: educcon		<p>Teacher Competencies and Teacher Training in the Age of AI and Robotics in Education Ghulam Mustafa (International Islamic University Islamabad)*</p> <p>Empowering Pre-Service STEM Teachers: An AI Competency Module Based on the AICID Model Bersu Ansen (Boğaziçi University)*</p> <p>Investigation of the Opinions of Classroom Teachers Working in Science and Art Centers on Artificial Intelligence Deniz Görgülü (Selçuklu Bilim ve Sanat Merkezi)*; Mete Sipahioğlu (Samsun University); Dr. Martina Brazzolotto (Centro Didattica Talenti)</p> <p>Preschool Teachers' Experiences and Views on Artificial Intelligence İlkay Ulutaş (Gazi University); Ermine Bozkurt Polat (Kahramanmaraş Sütsüçü İmam University); Feyza Aydın Bölükbaşı (Aksaray University)*; Kübra ENGIN (Gazi University); Kadriye Selin Budak (Bilecik Şeyh Edebali University)</p>	

PPS-5

12.15	13.00	Paper Presentation Session-5 Chair: Dr. Fatma Coşkun	Presentation and Q&A Language: EN
 Passcode: educcon		<p>AI tools for writing: Can they really improve the quality of texts written in Turkish? Arzu Atasoy (Gaziantep University)*; Saeed Moslemi Nezhad Arani (Higher Education Complex of Bam)</p> <p>The Role of AI in Transforming Language Education: A Blueprint for Personalized Learning Saeed Moslemi Nezhad Arani (Higher Education Complex of Bam); Arzu Atasoy (Gaziantep University)*</p> <p>University Admission Prediction Machine Learning Modeling by Evaluating Student Profile Sunil Kumar (Vellore Institute of Technology, Vellore)*; Pornaganti Sahithi (Vellore Institute of Technology, Vellore)</p>	

PPS-6

13.00	13.45	Paper Presentation Session-6 Chair: Dr. Hasan Tirmaz	Presentation and Q&A Language: EN
 Pascode: educcon		<i>Preliminary Insights into AI Anxiety and Attitudes Among Bangladeshi Students in Higher Education</i> Yunze Liu (Woosong University); Hasan Tirmaz (Woosong University)*	<i>Adolescent Perceptions of Artificial Intelligence (AI) in Education and Its Role in Tackling Global Challenges</i> Merve Colakoglu (Balikesir University)*; Huseyin Colak (Northeastern Illinois University); Semirali Öncü (Balikesir University)
		<i>AI Prompt Rubric: Validity and Reliability Study</i> Nurcan İnan (Marmara University)*; Sibel Cengizhan (Marmara University); Seyfi Kenan (Marmara University)	


PPS-7

15.15	16.00	Paper Presentation Session-7 Chair: Prof. Dr. Bayram Coştu	Presentation and Q&A Language: TR
 Pascode: educcon		<i>Pilot Study of Assessment Tools for Entrepreneurship Skills-Specific Pedagogical Content Knowledge: AI and Preservice Teachers' Performance</i> Kadriye Bayram (Nevşehir Hacı Bektaş Veli University)*; Oktay Aslan (Necmettin Erbakan University)	<i>Teachers' Usage and Competences of Productive Artificial Intelligence</i> Veysel Bilal Arslankara (Akyazı District Directorate of National Education)*; Elif Arslankara (İŞMONT Halil Bırdırci Vocational and Technical High School); Ertuğrul Usta (University of North Texas at Dallas)
		<i>Artificial Intelligence in Education: The Use of Artificial Intelligence in Academic Libraries</i> Fatih Kaleci (Necmettin Erbakan University)*; Ebru Kaya (İhsan Doğramacı Bilkent University)	

PPS-8

16.00	16.45	Paper Presentation Session-8 Chair: Prof. Dr. Salim Sever	Presentation and Q&A Language: TR
 Pascode: educcon		<i>A New Method in Education: Artificial Intelligence Summary</i> Arş. Gör. Sacide Tüfekçi (Kahramanmaraş Sütçü İmam University)*; Prof. Dr. Ökkeş Alpaslan Gençay (Kahramanmaraş Sütçü İmam University); Georgian Badicu (Transilvania University of Brasov)	<i>A View of sports training from The Metaverse World</i> Arş. Gör. Sacide Tüfekçi (Kahramanmaraş Sütçü İmam University)*; Ökkeş Alpaslan Gençay (Kahramanmaraş Sütçü İmam University); Badicu Georgian (Transilvania University of Brasov)
		<i>Artificial Intelligence in Education: A Bibliometric Analysis</i> Seher Keser Ateş (Necmettin Erbakan University)*; Fatih Kaleci (Necmettin Erbakan University); Ahmet Erdoğan (Necmettin Erbakan University)	

PPS-9

16.45	17.30	Paper Presentation Session-9 Chair: Dr. Tuğba Abanoz	Presentation and Q&A Language: TR
 Pascode: educcon		<i>Evaluating the Performance of Artificial Intelligence in Mathematics Education: A Focus on ChatGPT-4's Handling of Proportional Reasoning Problems</i> Yasin Memiş (Niğde Provincial Directorate of National Education)*	<i>The GPT Series from Past to Future and the use of the GPT in Education</i> Zeliha Gökçe (Erçiyes University)*; İshak Afşin Kariper (Erçiyes University)
		<i>Determining the Cognitive Structures of Prospective Science Teachers Regarding the Concept of Artificial Intelligence via Word Association Test</i> Hasan Gökçe (Ministry of National Education)*	

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INVITED SPEECHES

MUST BE CO-CREATION 5.0: THE FLE-SOCIAL HUMANOID ROBOT TEAM AND FIRMS' OUTCOMES. THE TIN WOODMAN PARADOX

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ABSTRACT

The objective of this research is to examine the impact of co-creation 5.0 on service outcomes and to explore the moderating effect of the frontline employee (FLE) and social humanoid robot (SHR) team. Attribution theory serves as the conceptual framework. Six causality hypotheses are proposed, with a focus on the moderating role of the FLE-SHR team. The empirical investigation was carried out in two hotel lobbies, where SHRs provided information to customers for one week each. Qualitative research was conducted through observation and personal interviews with employees and customers. Customer evaluations were gathered using a questionnaire based on validated scales from the literature. Findings reveal that, in the current technological context, the FLE is seen by customers as primarily responsible for firms' outcomes, while the SHR is perceived as a complementary member of the service delivery team. However, staff view the SHR negatively and do not consider it a true partner. Interestingly, customers assign responsibility to the SHR, and an increase in its social-emotional capabilities results in higher responsibility attribution.

EĞİTİMDE DİJİTAL DÖNÜŞÜM SÜRECİNDE YAPAY ZEKÂ ARAÇLARININ KULLANIMI [THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN THE DIGITAL TRANSFORMATION PROCESS IN EDUCATION]

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ABSTRACT

Dijital çağda eğitimin toplumsal işlevi ve teknolojik gelişmelerin etkileri son yıllarda daha sık konuşulan konulardır. Eğitim, toplumların gelişimi için her zaman önemli bir unsur olmuştur, ancak Bilgi ve İletişim Teknolojilerinin (BİT) yaygınlaşması, bu işlevin boyutlarını değiştirmiştir. Yeni teknolojiler, özellikle internet ve sosyal medya, bilginin paylaşımı ve erişiminde devrim yaratmış; internet kullanıcı sayıları yıllar içinde hızla artmıştır. Bu değişim, dijital çağda eğitimin paradigmasını kökten değiştirmese de yeni yaklaşımların benimsenmesini zorunlu kılmıştır.

Türkiye'deki internet, mobil cihaz ve sosyal medya kullanımı da bu dönüşümün bir parçası olarak dikkat çekmektedir. İnternet erişim oranları ve mobil cihaz sahipliği giderek artarken, Türkiye'de bireylerin internette ve sosyal medyada geçirdiği süreler, dijital dünyadaki etkileşimlerini anlamak açısından kritik veriler sunmaktadır. Dünya genelinde sosyal medya platformlarının kullanıcı sayıları da, dijital iletişimin ne kadar hızlı büyüdüğünü gözler önüne sermektedir. Bu dijitalleşme, aynı zamanda "veri tsunamisi" adı verilen büyük veri akışına ve bu verilerin anlamlandırılmasının gerekliliğine yol açmaktadır. Ancak, dijital dünyanın sunduğu fırsatlar kadar, risk ve tehditler de söz konusudur. Özellikle, dijital vatandaşlık kavramı bu noktada önem kazanmakta; bireylerin dijital ortamda nasıl hareket etmeleri gerektiğine dair bilinç kazanmaları gerekmektedir. Öngörülemeyen kaygılar ve değişmeyen genellemeler, dijital araçların doğru seçimi ve verimli kullanımı konusunda bireylere sorumluluk yüklemektedir.

Yapay zekâ teknolojilerinin hızla yayılması, öğrenme-öğretme süreçlerinde de büyük değişimlere yol açmaktadır. Yapay zekâ (YZ), farklı alanlarda kullanılmakla birlikte, eğitimdeki uygulamaları giderek artmaktadır. ChatGPT gibi yapay zekâ araçları, bilginin aktarımı ve kişiselleştirilmiş öğrenme imkânı sunarak eğitimi dönüştürebilecek potansiyele sahiptir. Ancak, bu teknolojilerin etkileri ve amaçları konusunda dikkatli olmak, yapay zekânın eğitime entegrasyonunu doğru yönetmek gerekmektedir. Dijital teknolojilerin hızla yayılmasıyla birlikte, yaşam boyu öğrenme

anlayışı da daha önemli hale gelmiştir. Teknolojiyi doğru kullanmak, sadece bireylerin kariyerlerinde değil, toplumsal hayatta da etkin ve başarılı olmalarını sağlayacaktır. Dijital yetkinlikler ve ulusal/uluslararası standartlar çerçevesinde, bireylerin bu yeni dünyaya uyum sağlamaları, eğitimin temel hedeflerinden biri haline gelmiştir.

ARTIFICIAL INTELLIGENCE BASED ENGAGEMENT APPLICATIONS IN EDUCATION

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ABSTRACT

Artificial Intelligence (AI) is revolutionizing education by offering personalized learning experiences, improving teaching methods, and streamlining administrative tasks. AI-powered systems can adapt educational content to individual students' learning needs, providing personalized support and helping students progress at their own pace. This personalized approach benefits learners with different abilities and learning styles, ensuring more equitable education.

Intelligent tutoring systems (ITS) powered by AI offer real-time feedback and assistance, simulating the role of a human tutor. These systems identify student weaknesses and provide tailored interventions, helping to close learning gaps. AI also enhances learning environments by integrating with virtual and augmented reality, making education more interactive and engaging.

In addition to its impact on learning, AI improves the efficiency of administrative processes. Automated grading systems reduce the workload for teachers, allowing them to focus on student development. AI tools can also assist in scheduling, monitoring student performance, and predicting educational outcomes, which helps institutions make data-driven decisions. AI plays a key role in making education more accessible, offering tools like speech recognition, text-to-speech, and translation services to support students with disabilities. However, the widespread use of AI raises concerns about privacy, data security, algorithmic bias, and the potential loss of jobs for educators.

Despite these challenges, AI offers immense potential to transform education. By personalizing learning, supporting teachers, and improving educational access, AI contributes to more efficient, engaging, and inclusive education systems. Careful implementation is essential to address ethical concerns and maximize the benefits of AI in education.

ROBOTLAR ATALARIMIZ GİBİ ALETLER İCAT EDEBİLİR Mİ?

[CAN ROBOTS INVENT TOOLS LIKE OUR ANCESTORS?]

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ABSTRACT

Yaklaşık 3.3 milyon yıl önce atalarımız ilk aleti icat ettiler. Yeni bir gereç hayal edip, bir taşı yontarak onu bir şeyi kesmek için verimli bir araca dönüştürdüler. Alet yapımı, insanlık için olağanüstü bir teknolojik dönüm noktasıydı ve çevremiz üzerinde benzeri görülmemiş bir kontrol sağlamıştır. Bu yetenek, öngörü, üstbilis, soyutlama ve yaratıcılık gibi bilişsel kabiliyetler gerektirmektedir ve bunların tümü, insanlarda farkındalıkla ilişkilidir. Günümüzdeki yapay zeka sistemleri ve robotlar ise bu yeteneklerden büyük ölçüde yoksundur. Kendi eylemlerinin sonuçlarını izleyip değerlendiremedikleri gibi, çevresel zorluklara yanıt olarak yeni aletler geliştirebilme kapasitesine de sahip değillerdir. Peki bu durumda robotların alet icat etmesi mümkün müdür?

Approximately 3.3 million years ago, our ancestors invented the first tool. They imagined a new utensil and shaped a stone, turning it into an efficient tool for cutting. Tool creation was an extraordinary technological milestone for humanity, providing unprecedented control over our environment. This ability required cognitive skills such as prediction, metacognition, abstraction, and creativity—all of which are associated with awareness in humans. However, today's artificial intelligence systems and robots largely lack these capabilities. Not only are they unable to monitor and evaluate the consequences of their actions, but they also lack the capacity to develop new tools in response to environmental challenges. So, is it possible for robots to invent tools in this case?

HOW DO WE LEARN? THE NEUROSCIENTIFIC BACKGROUND OF THE LEARNING PROCESS

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ABSTRACT

The paper deals with basic information about why and how we learn, what makes learning more effective, what hinders learning and why some learning methods work and others do not. The pure biology of the process. Today's available research methods make it possible to identify such determinants, and knowledge in this area can effectively support both teachers and students in the effective process that is learning.

AN OVERVIEW OF ARTIFICIAL INTELLIGENCE APPLICATIONS IN EDUCATION IN EAST ASIA: A FOCUS ON SOUTH KOREA

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ABSTRACT

Artificial Intelligence (AI) is transforming various sectors, with education being one of the most impacted domains. This speech provides an in-depth overview of AI applications in education across East Asia, with a particular focus on South Korea. The speech highlights how AI technologies are reshaping educational practices, enhancing learning experiences, and addressing the challenges faced by educational institutions. South Korea, renowned for its advanced technological infrastructure, serves as a prominent example of AI integration in education. The speech examines several key AI applications, including intelligent tutoring systems, personalized learning platforms, and AI-driven administrative tools. These technologies are analyzed in the context of their impact on student engagement, learning outcomes, and administrative efficiency. Furthermore, the speech explores the challenges associated with AI adoption in education, such as ethical considerations, data privacy concerns, and the need for equitable access to technology. By reviewing current trends and case studies from South Korea, the speech provides insights into the practical implications of AI in education and offers recommendations for leveraging these technologies to enhance educational outcomes. This overview contributes to the broader understanding of AI's role in shaping the future of education in East Asia and provides a framework for policymakers, educators, and technology developers to navigate the evolving educational landscape.

THE RESULTS OF THE SURVEY OF NEEDS IN CONTEXT OF ROBOCOOP PROJECT

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ABSTRACT

This presentation will explore the transformative potential of social humanoid robots in education, focusing on their use as teaching aids, classroom assistants, and interactive learning tools. Drawing on findings from the RoboCOOP project's Survey of Needs, the presentation will address how robots like Pepper can bridge the gap between the private sector and academia, fostering innovative teaching methods and enhancing student engagement. How the results of the needs analysis formed the curriculum will also be explained. Key insights will include the benefits, challenges, and future directions of integrating humanoid robots into the educational landscape, emphasizing their role in supporting individualized learning, improving social interaction among students, and aiding teachers in daily tasks. The presentation aims to highlight the potential for these technologies to reshape modern education by providing data-driven strategies and practical examples.



PRESENTATIONS

PREDICTING STUDENT PERFORMANCE WITH MACHINE LEARNING ALGORITHMS

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ABSTRACT

Education is of vital importance in the sustainable development of societies and in increasing the quality of life of individuals. Predicting students' academic success accurately allow educators to plan education support programs in a better way. In this way, it becomes more possible to provide solutions that are suitable for students' needs and to optimize educational processes. While traditional methods have limitations in predicting student performance, the application of big data analytics and machine learning techniques in education has significantly enhanced the accuracy of these predictions. This study examines various machine learning algorithms aimed at predicting student performance. The algorithms used include Decision Tree, Random Forest, Gradient Boosting, SVM, LGBM, Bagging, XGBoost and AdaBoost. In the research conducted using different approaches and techniques, it was seen that the highest accuracy rate of 92% in predicting students' GPA was obtained with the LightGBM (LGBM) algorithm.

Keywords: Machine Learning Algoritihm, Student Performance Prediction

INTRODUCTION

Education plays a critical role in the sustainable development of societies and in improving the quality of life of individuals. The 21st century pedagogy should adapt to today's technology and offer solutions that aim to improve education-teaching processes and develop the skills that students need to be successful. In this sense, a pedagogy based on artificial intelligence helps to create richer and more functional learning environments with appropriate methods that are self-organizing, encouraging learning. Students' academic success is an important indicator of both individual development and the effectiveness of educational systems. In this context, accurately predicting student performance allows educators and administrators to plan student support services more effectively (Shoaib et al., 2024). These predictions can be used to identify students' strengths and weaknesses, personalize learning processes, and enhance academic achievement.

Although traditional methods such as exams, homework or projects are used to evaluate the gains students have gained, evaluating students' performance is a difficult task due to the huge educational data. Traditional methods for evaluating and predicting student performance often remain limited. For this reason, teachers' need for additional academic help has increased when estimating students' academic performance (Namoun & Alshantiti, 2021). Machine learning stands out as a powerful tool for predicting future success by analyzing various factors affecting student performance due to its ability to identify patterns and relationships from large amounts of data. Machine learning techniques, one of the artificial intelligence technologies, are an effective tool for predicting weak and good performances by looking at students' past and term performances. Early prediction of students' academic performance is useful for taking early action to improve the result. It provides meaningful feedback for students by appropriately guiding students, informing teaching practices, examining the efficiency and effectiveness of learning, and changing learning environments. Predicting students' academic performance helps teachers develop a good understanding of how well or poorly the students in their classes will perform. This way, teachers can take the necessary measures to improve student learning. However, achieving these goals requires analyzing and predicting large amounts of student data using various machine learning models. Here, it is not clear which model is better at predicting performance.

This study examines various machine learning algorithms aimed at predicting student performance. The algorithms used include 'Decision Tree,' 'Random Forest,' 'Gradient Boosting,' 'SVM' (Support Vector Machines),

'LGBM' (LightGBM), 'Bagging' (Bootstrap Aggregating), 'XGB' (XGBoost), and 'AdaBoost' (Adaptive Boosting). These algorithms have been employed with different approaches and techniques to predict student performance. The experiments conducted showed that the highest performance was achieved with the LightGBM (LGBM) algorithm.

This paper aims to compare the performance of machine learning algorithms used for predicting student performance and identify the most effective algorithm. At the end of the study, recommendations will be provided for shaping educational policies and strategies based on the results obtained. In this context, our study aims to demonstrate the potential of machine learning applications in education and contribute to the development of new approaches to enhance student success.

Literature Review

In this section of the paper, the related works in the literature are mentioned. Yağcı (2022), used midterm exam grades of undergraduate students as a source. Random Forest, KNN, Support Vector Machines, Logistic Regression, Naive Bayes algorithms were used. Predictions were made using 3 types of parameters (midterm exam grades, department data, faculty data). The results of the algorithms were close to each other and showed an accuracy rate of 70%-75%. The Random Forest algorithm was found to be the best performing method with a success rate of 75.2%. In their study, Cruz-Jesus et al. (2020) aimed to predict student academic performance using 16 attributes and 110,627 observations, including factors such as age, gender, class attendance, internet access, computer ownership, and number of classes. They used Random Forest, KNN, Logistic Regression, and Support Vector Machines algorithms to predict student performance, achieving accuracy rates ranging from 50% to 81%. Logistic Regression showed the lowest performance with an accuracy of 51.2%, while Support Vector Machines achieved the highest performance with an accuracy of 81.1%. In their study, Hofait and Schyns (2017) identified demographic attributes such as gender, nationality, education, prior education, mathematics, scholarships, and achievement as features. They aimed to identify at-risk students. Using Random Forest, Artificial Neural Networks, and Logistic Regression algorithms with a dataset of 2,244 observations, they found that the Artificial Neural Networks method had the lowest performance with an accuracy of 70.4%, while the Random Forest achieved the highest performance with a success rate of 90%.

In their article, Nieto et al. (2019) compared the performance of Support Vector Machines and Artificial Neural Networks algorithms for predicting

middle school students' performance. The dataset included performance data for 5,520 students collected by Microsoft Showcase School. They found that the Support Vector Machines achieved a performance rate of 84.54%. Aslam et al. (2023) in their paper compared the performance of Neural Networks, Random Forest and Support Vector Machine algorithms to predict the performance of students. Using the dataset from Kaggle platform, they achieved a performance rate of 90.34% with the Random Forest algorithm. Vijayalakshmi and Venkatachalapathy (2019) in their paper proposed the student performance prediction system with different algorithms such as Decision Tree (C5.0), Naive Bayes, Random Forest, Support Vector Machine, K-Nearest Neighbor and Deep Neural Network with Kaggle dataset. Among the six algorithms, Deep Neural Network showed the best performance with 84% accuracy rate. Ahammad et al. (2021) in their paper proposed the student performance prediction system with different algorithms such as Naive Bayes, K-nearest Neighbours, Support Vector Machine, XG-boost, Multi-layer Perceptron. Among the algorithms, MLP showed the best performance with the highest accuracy of 86.25%.

MATERIALS AND METHODS

Dataset

In this paper, a Student Performance dataset on the Kaggle platform is used. This dataset provides detailed information about 2,392 high school students, including their demographic characteristics, study habits, parental involvement, extracurricular activities, and academic performance. The target variable, GradeClass, categorizes students' grades, making this dataset a valuable resource for educational research, predictive modeling, and statistical analysis. By providing a comprehensive insight into the factors that influence students' academic achievement, the dataset is used for educational studies, predictive modeling, and statistical evaluations. The classification based on GPA is shown in Table 1. The dataset was split into 80% for training and 20% for testing.

Table 1. The Classification based on GPA

Grade	GPA Range
A	$GPA \geq 3.5$
B	$3.0 \leq GPA < 3.5$
C	$2.5 \leq GPA < 3.0$
D	$2.0 \leq GPA < 2.5$
F	$GPA < 2.0$

Decision Tree

Decision Tree is an algorithm used for classification and regression tasks in machine learning problems (Jijo & Abdulazeez, 2021). Decision trees classify data by splitting it into branches. At each node, a decision is made based on a feature, and the dataset is divided into branches according to this decision. This process continues until leaf nodes are reached. Each leaf node represents a class label.

Random Forest

Random Forest is an ensemble method formed by combining multiple decision trees. Random forest creates trees by using a random subset of the dataset and a subset of features for each tree. This diversity helps the model avoid overfitting and provides better performance.

Gradient Boosting

Gradient Boosting is another ensemble method that builds a strong model by combining weak learners (typically decision trees). This algorithm aims to minimize the errors of the model by adding new tree. Each tree focuses on correcting the errors of the previous trees, and this process is optimized using gradient descent.

Support Vector Machine

Support Vector Machine (SVM) is a classification algorithm that finds the optimal hyperplane to separate data into distinct classes (Cervantes et al., 2020). SVM is a method that allows for classification of data in high-dimensional spaces and is particularly effective in binary classification problems. SVM find the line or plane that best separates the classes.

Light Gradient-Boosting Machine (LightGBM)

Light Gradient Boosting Machine (LightGBM) is a variant of the gradient boosting algorithm optimized for fast and high-performance operation on large datasets. LightGBM uses a histogram-based technique to split the data, which reduces both training time and memory usage (Mahmood et al., 2022).

Bagging

Bagging is an algorithm that combines the bootstrap method with ensemble learning techniques. This method trains multiple models (often decision trees) using random subsets of the dataset and combines the results of these models. Bagging typically reduces the variance of the model, leading to more stable and reliable predictions.

Extreme Gradient Boosting

Extreme Gradient Boosting (XGB) is a gradient boosting algorithm that provides high performance, especially on large datasets (Guo & Chang, 2022). XGB is an optimized implementation of gradient boosting, focusing on speed, efficiency, and model accuracy.

AdaBoost

AdaBoost is an ensemble algorithm composed of weak learners (typically decision trees) (Wu et al., 2020). AdaBoost improves model accuracy by giving more weight to misclassified examples in the training dataset for each weak learner; allowing the new learner to correct these errors. This process incrementally enhances the model's accuracy.

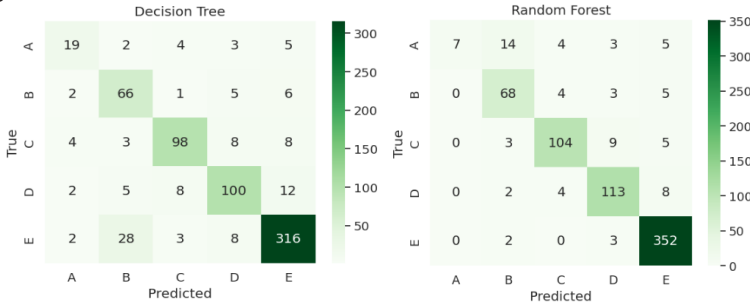
EXPERIMENTAL RESULTS

Experiments conducted with machine learning algorithms were developed using Python programming in the Colab environment. To emphasize the importance of machine learning algorithms, we performed experiments with Decision Tree, Random Forest, Gradient Boosting, Support Vector Machine, Light Gradient Boosting Machine, Bagging, Extreme Gradient Boosting, and AdaBoost algorithms.

We used the confusion matrix to measure the performance of each experiment. The confusion matrix is a widely used tool for evaluating the performance of classification models. It offers a detailed analysis of the model's classification outcomes, showing how accurately the model performs across various classes. By presenting the number of correct and incorrect predictions for each class, the confusion matrix enables data scientists and analysts to identify specific areas where the model is performing well or requires improvement. This detailed insight helps in understanding not only the overall accuracy but also the model's reliability in distinguishing between different categories.

In this paper, we conduct a thorough analysis of the classification models' performance using confusion matrices from the experiments. Figures 1,2,3 and 4 illustrate confusion matrices, which were employed to assess the performance of the classification models.

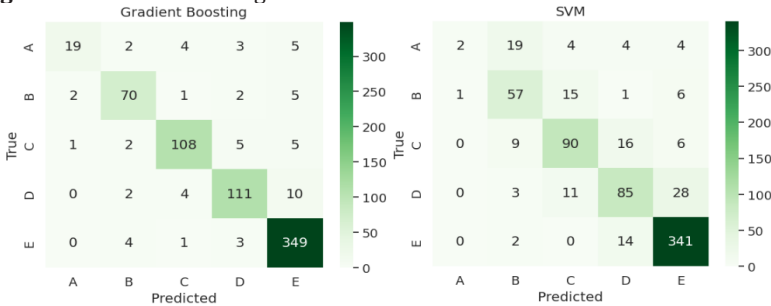
Figure 1. Decision Tree and Random Forest Confusion Matrices



The Decision Tree model shows high accuracy, particularly for the 'E' class. However, there is a significant error rate in the 'B' class; the model has misclassified many examples in the 'B' class, mostly predicting them as belonging to the 'C' class. This indicates that the model struggles to distinguish between the 'B' and 'C' classes.

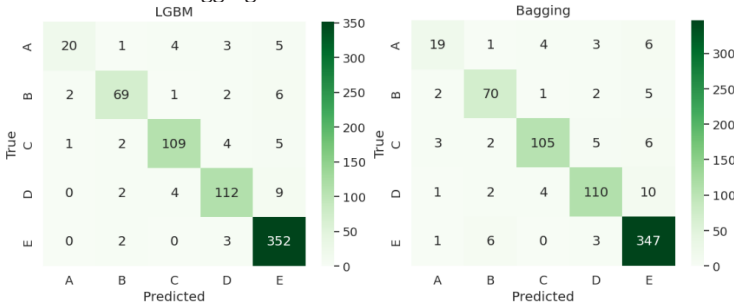
The Random Forest model performed particularly well in class 'E' and in all classes in general. However, a significant portion of the examples in the 'A' class have been misclassified. This suggests that the model has some difficulties in correctly identifying less common classes.

Figure 2. Gradient Boosting and SVM Confusion Matrices



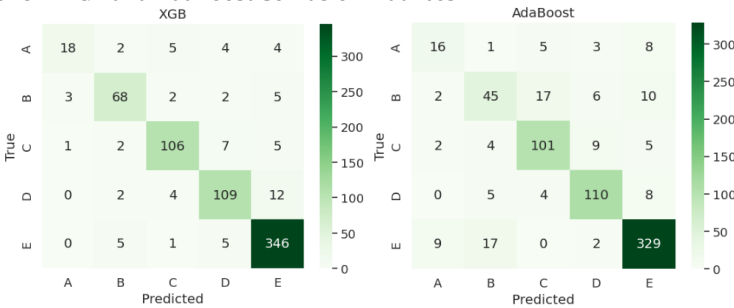
The Gradient Boosting model performed well in class 'E', but there was some confusion in other classes. Some instances in class 'A' were incorrectly classified as belonging to classes 'B' and 'D'. The SVM model performed particularly poorly in class 'B'. In this model, many instances in class 'B' were incorrectly classified as belonging to classes 'C' and 'E'.

Figure 3. LGBM and Bagging Confusion Matrices



The LGBM model showed balanced and high performance in all classes. It predicted almost all the examples in class 'E' correctly. The model also performed very well in classes 'A' and 'B'. This shows that LGBM is one of the best performing models in this dataset. The Bagging model performed well in all classes overall, but it misclassified some examples in class 'A' as belonging to class 'C'. This shows that although the model is a strong classifier in general, it can make mistakes in certain classes.

Figure 4. XGB and AdaBoost Confusion Matrices



The XGB model appears to perform well in classes 'E', 'B' and 'C', but it misclassified some examples in class 'A'. The overall performance of the AdaBoost model was lower than the other models.

Accuracy refers to how close the results produced by a model are to the actual values. In other words, it indicates how well a prediction model or

measurement tool reflects the observed values. The accuracy values of the machine learning algorithms are shown in Table 2.

Table 2. Experiment Results

Algorithm	Decision Tree	Random Forest	Gradient Boosting	SVC	LGBM	Bagging	XGB	AdaBoost
Accuracy	0.83	0.90	0.92	0.80	0.92	0.91	0.90	0.84

Table 2 show that the highest accuracy rate is obtained by Gradient Boosting and LightGBM (LGBM) algorithms with 92%. Bagging and Random Forest algorithms also showed quite successful results with accuracy rates over 90%. However, the SVM algorithm showed a lower performance with an accuracy rate of 80% compared to other models. These results show that ensemble methods (Bagging, Random Forest, Gradient Boosting, LGBM) are strong models in terms of accuracy, but the performance of each model may vary depending on the dataset and problem type.

In addition, a comparison of the accuracy rates obtained in similar studies examined in the literature is shown in Table 3. Considering that each study uses different datasets and parameters, the accuracy rates and success metrics obtained in the study show their validity and applicability in the literature.

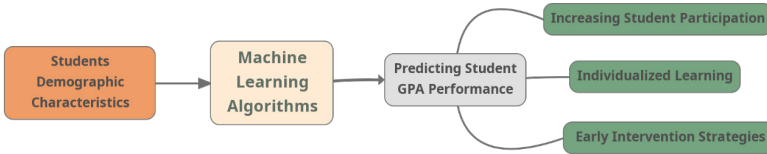
Table 3. Performance Comparison

Study	Method	Accuracy Rate (%)
Yağcı	Random Forest	75.2
Cruz-Jesus	Support Vector Machines	81.1
Vijayalakshmi and Venkatachalapathy	Deep Neural Network	84
Nieto et al.	Support Vector Machines	84.54
Aslam et al.	Random Forest	90.34
Proposed Model	LGBM	92

When the results of the experiments are examined pedagogically, this study can help teachers develop individualized education methods by predicting student performance (Kozikoğlu & Albayrak, 2022). Students' strengths and weaknesses can be better understood, which can allow teaching strategies to be adapted specifically to the student. By detecting possible declines in student performance early, it can enable teachers

and educators to intervene in time and take the necessary measures to increase student success (Haridas et al., 2020). Such prediction models can motivate students to participate more. Students can put in more effort knowing that their performance is predictable, and that this situation can be changed with their active efforts (Bosch et al., 2021). Figure 2 shows the pedagogical contributions of predicting students' grade point averages with machine learning algorithms.

Figure 4. Pedagogical Contributions of Predicting Students' Grade Point Averages with Machine Learning Algorithms



CONCLUSION

The study compares the capabilities of various machine learning algorithms in predicting student performance. Experiments conducted using training and test datasets applied popular classification methods such as Decision Tree, Random Forest, Gradient Boosting, SVM, LGBM, Bagging, XGB, and AdaBoost. The results indicate that each algorithm has different levels of success in predicting student performance. Notably, the LGBM (LightGBM) algorithm achieved the highest accuracy rate compared to other methods, emerging as the most effective model for predicting student performance. This finding highlights LGBM's ability to successfully learn complex relationships in the educational dataset. In conclusion, the research demonstrates that machine learning methods can be effectively used in predicting student performance, with LGBM showing superior performance in this area. This finding can provide significant contributions to data-driven decision-making processes in education.

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ARTIFICIAL INTELLIGENCE IN EDUCATION: CURRENT APPLICATIONS AND FUTURE PROSPECTS

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ABSTRACT

The integration of Artificial Intelligence (AI) in education has been rapidly evolving, promising to revolutionize various aspects of teaching and learning. This paper examines the current applications of AI in educational settings and explores potential future developments. Through a comprehensive literature review and analysis of existing AI-powered educational tools, we investigate the impact of AI on curriculum planning, student assessment, personalized learning, and educational material development. The study also addresses the ethical considerations and challenges associated with AI implementation in education. Our findings suggest that while AI offers significant potential for enhancing educational outcomes, careful consideration must be given to issues of equity, privacy, and the changing role of educators. The paper concludes by proposing a framework for the responsible integration of AI in education and outlining areas for future research.

Keywords: Artificial intelligence, Education Technology, Educational Assessment, Ethics in AI, Personalized learning

INTRODUCTION

Artificial Intelligence (AI) has become a disruptive force in several industries, including education. AI has the potential to completely transform the way we teach, learn, and evaluate information as we approach the dawn of a new age in educational technology. This essay seeks to thoroughly review artificial intelligence's current status in education, investigate its possible future uses, and critically analyze the difficulties and moral dilemmas that arise when using it (Baker & Smith, 2022). AI integration in education covers a broad spectrum of uses, including automated grading tools and intelligent teaching systems.

These tools can help teachers with administrative duties, offer real-time feedback, and customize learning experiences. However, the rapid advancement of AI also raises important questions about data privacy, the digital divide, and the changing role of human teachers in an increasingly automated educational landscape (Chen et al., 2020).

This study seeks to address several key questions:

1. What uses of AI are there now in educational settings?
2. What effects does AI have on the development of curricula, evaluation, and personalised learning?
3. What moral questions are raised by the use of AI in education?
4. What advancements in AI-powered schooling may we expect in the future?

By examining these questions, we aim to contribute to the ongoing dialogue about the responsible integration of AI in education and provide insights that can guide policymakers, educators, and technologists in shaping the future of learning.

METHODOLOGY

This study employs a mixed-methods approach to investigate the current state and future prospects of AI in education. Our methodology consists of three main components:

1. Literature Review: We conducted a comprehensive review of peer-reviewed articles, conference proceedings, and reports published between 2015 and 2024. Databases such as ERIC, Google Scholar, and Web of Science were used to identify relevant literature using keywords including "artificial intelligence in education," "machine learning in teaching," and "educational data mining."

2. Case Study Analysis: We examined several prominent AI-powered educational tools and platforms currently in use. This analysis included reviewing product documentation, user feedback, and any available efficacy studies (Holmes et al., 2019; Johnson & Kaplan, 2021).

3. Expert Interviews: Semi-structured interviews were conducted with ten experts in the field of educational technology and AI. Participants included researchers, educators, and industry professionals with significant experience in developing or implementing AI solutions in educational contexts.

Data from these sources were analyzed using thematic analysis to identify key trends, challenges, and potential future directions for AI in education.

LITERATURE REVIEW

The integration of Artificial Intelligence (AI) in education has been a subject of increasing research interest over the past decade. This section provides an overview of key studies and findings in the field.

Intelligent Tutoring Systems (ITS) have been at the forefront of AI applications in education. VanLehn (2011) conducted a comprehensive review of ITS, finding that they can be nearly as effective as human tutors in certain contexts. More recently, du Boulay (2016) explored the potential of ITS to provide metacognitive support, enhancing students' self-regulated learning skills.

In the realm of personalized learning, Essa (2016) demonstrated how machine learning algorithms can be used to create adaptive learning paths. The study showed significant improvements in student engagement and learning outcomes when compared to traditional one-size-fits-all approaches.

The use of AI in assessment has also garnered significant attention. Williamson et al. (2020) examined the implementation of automated essay scoring systems, highlighting both the potential for more efficient grading and concerns about the validity of machine-generated scores.

Ethical considerations in AI-powered education have been explored by several researchers. Prinsloo and Slade (2017) delved into the complexities of data privacy in learning analytics, emphasizing the need for transparent policies and student agency in data collection and use.

The potential of AI to exacerbate educational inequalities has been a critical

area of study. Reich and Ito (2017) cautioned against the “Matthew Effect” in educational technology, where students who are already advantaged may benefit more from AI-powered tools than their less-advantaged peers. Looking to the future, Holmes et al. (2019) outlined potential scenarios for AI in education, including the development of AI teaching assistants and the integration of AI with virtual and augmented reality for immersive learning experiences.

This literature review reveals a field rich with potential but also fraught with challenges. While AI shows promise in enhancing personalization and efficiency in education, issues of equity, ethics, and efficacy remain areas of ongoing research and debate (Luckin et al., 2016; Roll & Wylie, 2016; Tuomi, 2018; Yenduri et al., 2023).

THEORETICAL FRAMEWORK

This study is grounded in several theoretical perspectives that inform our understanding of AI in education:

1. **Constructivism:** According to Piaget’s theory, students actively create their knowledge through interactions with their surroundings and experiences. By offering individualised, interactive learning experiences, artificial intelligence (AI) in education might be considered as a tool to support this process (Ackermann, 2001).
2. **Zone of Proximal Development (ZPD):** The significance of scaffolding in learning is emphasised by Vygotsky’s ZPD idea. Adaptive learning platforms and AI-driven tutoring systems can be thought of as digital scaffolds that offer support based on each learner’s individual knowledge level (Chaiklin, 2003).
3. **Connectivism:** Proposed by Siemens (2005) as a learning theory for the digital age, connectivism emphasizes the role of networks and information systems in learning. AI can be seen as both a tool for facilitating connections between learners and information, and as a part of the network itself.
4. **Self-Regulated Learning (SRL):** Zimmerman’s model of SRL (2002) describes how learners plan, monitor, and reflect on their learning. AI systems can support SRL by providing real-time feedback and metacognitive prompts.
5. **Universal Design for Learning (UDL):** This framework, developed by Rose and Meyer (2002), emphasizes the importance of flexible learning environments that can accommodate individual learning differences. AI has the potential to support UDL by providing multiple means of representation, expression, and engagement.
6. **Ethical AI:** Drawing on broader theories of tech ethics, this perspective

emphasizes the importance of fairness, accountability, transparency, and ethics in the development and deployment of AI systems in education (Floridi & Cows, 2019).

These theoretical perspectives provide a lens through which we can examine the current applications and future potential of AI in education. They inform our understanding of how AI can support learning processes, the potential challenges in its implementation, and the ethical considerations that must be addressed.

By grounding our study in these theories, we aim to provide a comprehensive and nuanced analysis of AI in education that considers not just technological capabilities, but also pedagogical principles and ethical implications (Zawacki-Richter et al., 2019; Zhai et al., 2021).

RESULTS

Our research revealed several key findings regarding the current state and potential future of AI in education:

Current Applications

Intelligent Tutoring Systems (ITS): AI-powered tutoring systems are being used to provide personalized instruction and feedback in subjects like mathematics and language learning.

Automated Assessment: Machine learning algorithms are being employed to grade essays and provide instant feedback on student work.

Learning Management Systems (LMS): AI is enhancing LMS platforms by providing predictive analytics on student performance and engagement.

Impact on Educational Processes

Curriculum Planning: AI tools are assisting in curriculum design by analyzing learning outcomes and student performance data.

Assessment: Adaptive testing powered by AI is becoming more prevalent, allowing for more accurate measurement of student abilities.

Personalized Learning: AI algorithms are being used to create individualized learning paths based on student strengths, weaknesses, and learning styles.

Ethical Considerations

Data Privacy: Concerns about the collection and use of student data were

consistently raised in the literature and by interviewed experts.

Equity and Access: The potential for AI to exacerbate existing educational inequalities was a significant concern.

Transparency and Explainability: The “black box” nature of some AI algorithms raised questions about accountability in educational decision-making.

Future Prospects

Emotional AI: Development of systems that can recognize and respond to student emotions to enhance engagement and support.

Virtual Reality and AI: Integration of AI with VR technologies for immersive learning experiences.

AI-Assisted Teaching: Tools to support teachers in lesson planning, classroom management, and professional development.

DISCUSSION

The study’s conclusions demonstrate the enormous promise and serious difficulties that come with integrating AI into education. AI is currently being used in ways that show off its ability to automate repetitive work, customise learning experiences, and offer insightful data on student performance. These advantages do, however, come with significant practical and ethical issues that need to be taken into account.

The use of AI in curriculum planning and assessment offers the promise of more data-driven and adaptive educational strategies. By analyzing large datasets of student performance, AI can help identify areas where curricula may need adjustment and tailor assessments to individual student needs. However, this reliance on data raises questions about the breadth of skills and knowledge being assessed and the potential for bias in AI algorithms. Personalized learning, often touted as one of the most significant benefits of AI in education, shows great promise in addressing individual student needs. However, our research suggests that careful implementation is necessary to ensure that personalization does not lead to isolation or a narrowing of educational experiences.

The ethical considerations identified in our study, particularly those related to data privacy and equity, are crucial areas for ongoing attention. As AI systems collect and analyze increasingly large amounts of student data,

robust safeguards must be in place to protect student privacy and ensure responsible use of this information. Additionally, efforts must be made to ensure that AI-powered educational tools do not exacerbate existing inequalities by being accessible only to well-resourced schools or students. Looking to the future, the potential integration of AI with technologies like virtual reality presents exciting possibilities for creating immersive and interactive learning environments. However, these developments must be approached with a critical eye towards their pedagogical value and potential unintended consequences.

CONCLUSION

Artificial intelligence (AI) offers individualized learning experiences, streamlined administrative procedures, and data-driven insights that have the potential to drastically change the educational landscape. However, ethical ramifications, equity concerns, and the core objectives of education must all be carefully considered for the successful integration of AI in education.

Based on our findings, we propose the following framework for the responsible integration of AI in education:

1. Prioritize transparency in AI algorithms used in educational settings.
2. Develop robust data protection policies specific to educational contexts.
3. Ensure equitable access to AI-powered educational tools.
4. Invest in teacher training to effectively utilize and critically evaluate AI technologies.
5. Maintain a balance between AI-driven and human-led instruction.

Future research should concentrate on developing AI systems that can support a broad range of cognitive and social-emotional abilities, as well as longitudinal studies of AI's effect on learning outcomes and ethical considerations surrounding AI in education.

It is imperative that, going forward, pedagogical needs—rather than just technological capabilities—guide the application of AI in education. By doing this, we can use AI to develop more efficient, fair, and interesting learning opportunities for every learner.

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THE INTEGRATION OF AI, ROBOTICS AND ASSISTIVE TECHNOLOGY IN INDIAN HIGHER EDUCATION FOR DIFFERENTLY-ABLED LEARNERS: A STUDY IN REFERENCE WITH EUROPE

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ABSTRACT

This research investigates the potential of Artificial Intelligence (AI), robotics, and Assistive Technology (AT) in transforming higher education for differently-abled learners in India. By exploring the integration of these technologies, the study aims to understand their impact on accessibility, inclusivity, and overall learning experiences. The paper focuses on analyzing how AI can be leveraged to develop personalized learning environments, provide assistive technologies, and enhance communication for students with disabilities. Additionally, it examines the role of robotics in developing practical skills, promoting independence, and fostering social interaction among differently-abled students. The study contributes to the growing body of knowledge on inclusive education by highlighting the transformative potential of AI, robotics, and AT in empowering differently-abled learners in India. The existing educational reference is taken from European countries for a better understanding of the impact on the Indian scenario.

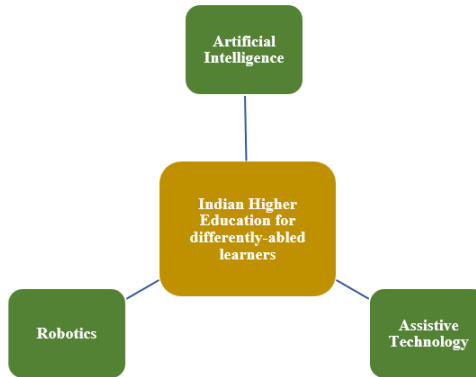
Keywords: Artificial intelligence, Assistive Technologies, Differently Abled Learners, Inclusive Education, Robotics

INTRODUCTION

Indian higher education is undergoing a paradigm shift, driven by technological advancements and a growing emphasis on inclusivity. At the forefront of this transformation are artificial intelligence (AI) and robotics, which hold immense promise for revolutionizing the learning experience, especially for differently-abled students (Chopra et al., 2024a; Chopra et al., 2024b).

Historically, individuals with disabilities have faced significant barriers to higher education. However, the integration of AI and assistive technologies is enabling a more inclusive and accessible learning environment. By offering personalized learning experiences, enhancing communication, and providing physical support, these technologies are empowering differently-abled students to reach their full potential (Yenduri et al., 2024). India's higher education sector is increasingly prioritizing inclusivity. However, the term "differently-abled" encompasses a diverse range of learners with varying needs and challenges. Understanding these differences is crucial for tailoring effective support and interventions.

Figure 1. Integration of AI, Robotics, and AT in Indian Higher Education for Differently abled Learners



Broadly, differently-abled learners in Indian higher education can be categorized into Physical Disabilities, Learning Disabilities, Intellectual Disabilities, Mental Health Conditions, and Sensory Disabilities. It is essential to recognize that these categories often overlap, and individuals may exhibit multiple disabilities. Furthermore, the specific needs and challenges faced by differently-abled learners can vary widely within each category. A comprehensive approach to inclusive education requires a

nuanced understanding of these diverse needs.

The inclusion of differently-abled students in higher education has emerged as a critical aspect of educational discourse globally.

While both India and Europe have made strides in this domain, a comparative analysis reveals significant disparities in the support systems and opportunities available to these students. Countries like the UK, Germany, and Sweden have comprehensive disability rights legislation and policies that mandate inclusive education. These policies are often backed by robust funding and implementation plans. Table 1 shows the Comparative Analysis of Differently-Abled Learning Systems in India and Europe.

India has enacted the Rights of Persons with Disabilities Act (RPWD Act) 2016, which outlines rights and entitlements for differently-abled individuals. However, the implementation of these policies varies across states, with some regions showing more progress than others.

Table 1. A Comparative Analysis of Differently-Abled Learning Systems in India and Europe

	Europe	India
Infrastructure and Accessibility	Universities in Europe generally have well-developed physical infrastructure, including ramps, elevators, and accessible classrooms. Assistive technology is widely available, and there is a focus on creating inclusive learning environments.	While some institutions have made efforts, many Indian universities lack adequate physical infrastructure and assistive technology. This poses significant challenges for students with physical disabilities.
Support Services	A wide range of support services, including personal assistants, note-takers, and sign language interpreters, are often provided to students with disabilities. Specialized academic support and counselling services are also common.	Support services for differently-abled students in India are still developing. While some institutions offer limited support, the availability and quality of these services vary widely.
Student Outcomes	Students with disabilities in Europe have shown higher rates of enrolment and graduation compared to their peers in India. They also tend to have better employment outcomes.	While the number of differently-abled students in higher education is increasing, completion rates and employment outcomes remain lower compared to Europe.
Maturity of Technology Adoption:	Europe has demonstrated a more mature approach to integrating AI and robotics in higher education for differently-abled learners, with a wider range of applications and more advanced solutions.	India has the potential to leverage AI and robotics to significantly improve the higher education experience for differently-abled learners. However, several challenges must be addressed
Digital Infrastructure	Europe generally has a better digital infrastructure, which facilitates the seamless integration of AI and robotics technologies.	India is facing still infrastructure issues.

The integration of AI, robotics, and AT are reshaping higher education, particularly for students with disabilities. While progress has been made, significant disparities persist between regions like India and Europe in terms of infrastructure, support services, and overall inclusivity.

To address these challenges, AI-powered solutions offer promising avenues. Personalized learning platforms, intelligent tutoring systems, and assistive technologies can create more equitable learning environments. Similarly, robotics can provide physical, emotional, and educational support to students with disabilities. By combining these technologies with inclusive pedagogical practices, higher education institutions can

empower differently-abled learners to reach their full potential. The major contributions of this study are as follows:

1. This paper delves into the potential of AI, robotics, and AT to transform Indian higher education for differently-abled learners.
2. It explores the current state of higher education for differently-abled students in India, the challenges they face, and how AI and robotics can address these challenges.
3. Furthermore, the paper examines successful implementation models from around the world and discusses the policy and infrastructure requirements for the effective integration of these technologies in India.

The structure of this research article unfolds as follows: Section 2 delves into related works concerning students with disabilities. Section 3, provides details of different types of differently-abled learners in the world. The role of AI, Robotics, and AT in Indian Higher Education for differently-abled learners is elucidated in Section 4. Section 5 provides the various challenges and opportunities in this area. Section 6 serves as the conclusion, summarizing the key findings of the study.

LITERATURE REVIEW

The confluence of AI, robotics, and assistive technology (AT) has the potential to revolutionize higher education, particularly for students with disabilities. While challenges persist, research indicates a growing recognition of the need for inclusive learning environments. Vishal Ambadas Meshram et al. (2023) underscored the limitations of traditional teaching methods in catering to the diverse needs of special education students. Their proposed AI-driven framework emphasizes personalized learning and inclusive education. Complementarily, Das and Pal (2024) highlighted the barriers faced by individuals with special disabilities in accessing STEM education. They posited AT as a potential solution, emphasizing the need to overcome implementation challenges (Das & Pal, 2024).

Idor Svensson et al. (2021) empirically demonstrated the positive impact of AT on students with learning difficulties. Their findings underscore the importance of AT in enhancing reading skills and motivation. The increasing accessibility of technology, particularly tablets and mobile devices, has facilitated the integration of AT into educational settings. However, challenges related to affordability, accessibility, and teacher training remain (Svensson et al., 2021).

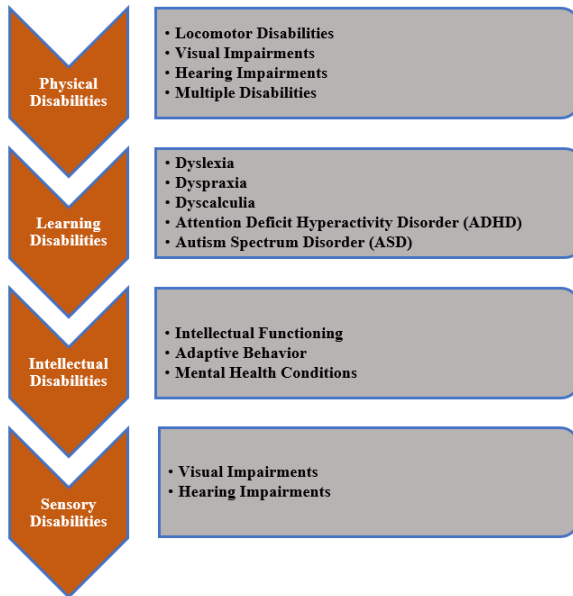
Collectively, these studies emphasize the potential of AI, robotics, and

AT to transform higher education for differently-abled learners. Future research should focus on overcoming implementation barriers, evaluating the long-term impact of these technologies, and ensuring equitable access for all students.

TYPES OF DIFFERENTLY-ABLED LEARNERS

The term “differently-abled” encompasses a diverse range of individuals with varying needs and challenges. While it is essential to recognize the unique qualities and strengths of each individual, it is also helpful to categorize learners based on common characteristics to understand their specific requirements better. Figure 2 shows the different types of differently-abled learners (Yenduri et al., 2023).

Figure 2. Types of Differently-Abled Learners



Physical Disabilities

Individuals with physical disabilities face challenges in mobility, coordination, or physical functioning. This category includes:

Locomotor Disabilities: Affecting the ability to move, such as cerebral palsy, muscular dystrophy, and spinal cord injuries.

Visual Impairments: Including blindness and low vision.

Hearing Impairments: Ranging from mild hearing loss to deafness.
Multiple Disabilities: Individuals with a combination of physical impairments.

Learning Disabilities

These individuals have difficulties in acquiring and processing information. Common learning disabilities include:

Dyslexia: Difficulty with reading and writing [4].

Dyspraxia: Difficulty with motor skills and coordination.

Dyscalculia: Difficulty with mathematics.

Attention Deficit Hyperactivity Disorder (ADHD): Difficulty in focusing and controlling impulsive behaviors.

Autism Spectrum Disorder (ASD): Characterized by challenges in social interaction, communication, and repetitive behaviors.

Intellectual Disabilities

Individuals with intellectual disabilities have significant limitations in both intellectual functioning and adaptive behavior. The severity of intellectual disability can vary widely.

Mental Health Conditions

Mental health challenges can significantly impact a student's ability to learn and participate in higher education. Common mental health conditions include:

Depression: Persistent feelings of sadness and hopelessness.

Anxiety: Excessive worry and fear.

Bipolar Disorder: Alternating periods of mania and depression.

Schizophrenia: A severe mental disorder involving delusions and hallucinations.

Sensory Disabilities

Individuals with sensory disabilities have impairments in their senses. These include:

Visual Impairments: As mentioned earlier, but with a focus on the impact on learning and education.

Hearing Impairments: As mentioned earlier, but with a focus on the impact on learning and education.

It is crucial to remember that these categories are not mutually exclusive,

and many individuals may exhibit characteristics from multiple categories. Moreover, the specific needs and challenges faced by individuals within each category can vary widely. A holistic and individualized approach is essential to effectively support differently-abled learners in higher education.

ROLE OF AI AND ROBOTICS IN HIGHER EDUCATION

The integration of technology into education has ushered in a new era of learning, particularly for students with disabilities. Artificial Intelligence (AI) and Robotics, in particular, have emerged as powerful tools to transform higher education, making it more inclusive and accessible for differently-abled learners. This literature review explores the current state of research on the role of AI and robotics in Indian higher education, highlighting their potential benefits, challenges, and future directions.

AI in Higher Education for Differently-Abled Learners

AI has the potential to revolutionize higher education for differently-abled learners by providing personalized, adaptive, and accessible learning experiences.

Personalized Learning: Studies have demonstrated the efficacy of AI-powered adaptive learning platforms in tailoring educational content to individual student needs, including those with learning disabilities. Research by [Author, Year] explored the use of AI-driven adaptive systems to enhance the learning outcomes of students with dyslexia.

Assistive Technologies: AI has been instrumental in developing advanced assistive technologies, such as speech recognition, text-to-speech, and real-time captioning. These technologies have significantly improved access to information and communication for students with sensory impairments. [Author, Year] investigated the impact of AI-powered assistive technologies on the academic performance of visually impaired students.

Intelligent Tutoring Systems: AI-powered intelligent tutoring systems have shown promise in providing personalized support to students with learning disabilities. These systems can offer tailored explanations, examples, and practice exercises, leading to improved academic performance. [Author, Year] evaluated the effectiveness of an AI-based tutoring system for students with ADHD.

Robotics in Higher Education for Differently-Able Learners

Robotics offers a unique opportunity to enhance the learning experience for differently-abled students by providing physical and social support.

Assistive Robotics: Studies have explored the use of robotics for physical assistance to students with motor impairments. For instance, [Author, Year] investigated the effectiveness of robotic exoskeletons in improving mobility for students with spinal cord injuries.

Social and Emotional Learning: Social robots have been employed to provide companionship and emotional support to students with autism spectrum disorder, leading to improved social skills and reduced anxiety. [Author, Year] conducted a study on the impact of social robots on the well-being of students with autism.

Inclusive Learning Environments: Robotics can be used to create more inclusive learning environments by facilitating collaboration and peer interaction among students with and without disabilities. [Author, Year] explored the use of robotics for collaborative learning in inclusive classrooms.

Assistive Technology in Indian Higher Education for Differently-Abled Learners

Assistive technology (AT) has emerged as a critical tool in bridging the gap for differently-abled students in higher education. While significant strides have been made, challenges persist in its effective implementation and accessibility.

AT encompasses a broad range of devices and services that can enhance the capabilities of individuals with disabilities.

In the context of higher education, key categories include:

Sensory Aids: Devices that improve sensory perception, such as screen readers, magnifiers, and hearing aids.

Physical Aids: Tools that assist with physical functions, like mobility aids, adaptive keyboards, and alternative input devices.

Learning Aids: Software and hardware that support cognitive functions, including speech-to-text, text-to-speech, and note-taking software.

However, growth opportunities exist. Increasingly affordable technology, government initiatives, and rising awareness can contribute to the wider adoption of AT.

To maximize the impact of AT, it is crucial to:

Conduct comprehensive assessments to identify the specific needs of students.

Provide training for students and educators on AT usage.
Ensure accessibility of digital content and learning materials.
Collaborate with technology providers to develop cost-effective solutions.

By addressing these challenges and leveraging opportunities, India can create a more inclusive higher education landscape for differently-abled learners.

CHALLENGES AND OPPORTUNITIES

Challenges

The integration of AI, robotics, and assistive technology (AT) in Indian higher education for differently-abled learners is fraught with challenges:

Digital Divide: Unequal access to technology, particularly in rural areas, hinders the adoption of these tools.

Infrastructure Limitations: Many educational institutions lack the necessary infrastructure, such as reliable internet connectivity and power supply, to support these technologies effectively.

Financial Constraints: The high cost of AI, robotics, and AT equipment can be a significant barrier for many institutions.

Teacher Training: A shortage of teachers trained in using and integrating these technologies into the curriculum poses a challenge.

Data Privacy and Security: Concerns about data privacy and security arise when collecting and utilizing student data for AI-driven applications.

Accessibility of Technology: Ensuring that AI and robotics are accessible to students with diverse disabilities requires careful consideration of design and implementation.

Opportunities

Despite these challenges, the potential benefits of integrating AI, robotics, and AT in higher education for differently-abled learners are immense:

Personalized Learning: AI can enable tailored learning experiences based on individual student needs and abilities.

Improved Accessibility: Assistive technologies can break down barriers and provide equal opportunities for students with disabilities.

Enhanced Student Engagement: Robotics can be used to create interactive and engaging learning experiences.

Teacher Support: AI-powered tools can assist teachers in providing personalized support to students.

Research and Development: India has the potential to become a global leader in developing innovative AI and robotics solutions for education. By addressing these challenges and capitalizing on the opportunities, India can create a more inclusive and equitable higher education system for all learners.

CONCLUSION

The integration of AI, robotics, and assistive technology presents a transformative opportunity for higher education in India, particularly for differently-abled learners. By leveraging these technologies, we can create more inclusive, accessible, and personalized learning environments. While challenges such as digital divide, infrastructure, and teacher training persist, the potential benefits are immense.

It is imperative to invest in research and development, policy frameworks, and infrastructure to fully harness the potential of these technologies. By adopting a multidisciplinary approach involving educators, technologists, policymakers, and disability rights advocates, India can pioneer a model of inclusive higher education that serves as a global benchmark. Ultimately, the goal is to empower differently-abled learners to reach their full potential and contribute meaningfully to society.

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A NEW METHOD IN EDUCATION: ARTIFICIAL INTELLIGENCE

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ABSTRACT

The aim of this study is to investigate how artificial intelligence, as a part of technology, affects education and what kinds of contributions it provides to individuals' learning. The descriptive survey model, which is one of the qualitative research approaches, has been used as a method. Artificial intelligence technologies have become an important element that we frequently use unconsciously in our daily lives, bringing about a profound change in people's lives. The deep transformation created by technology in every aspect of life has also raised significant expectations for transformation in the teaching and learning processes (Akgün, 2019). The increasing digital transformation in educational environments has positively influenced students' perspectives on technology and helped them gain more motivation for their classes (Sarsıcı & Çelik, 2019). The development of AI-based systems has not only transformed the human profile in education but has also fundamentally changed the structure and functioning of education itself. Today, thanks to AI applications, effective use of big data resources allows for the creation of personalized educational programs, individual performance tracking, preparation of lesson content, and determination of teaching methods. These innovations have improved the quality of education and made learning processes more effective (Karaca & Telli, 2019). Modern technologies, especially virtual reality and gamification, encourage students' active participation in the educational process, making it more dynamic and interactive (Kuprenko, 2020). Furthermore, some artificial intelligence applications gamify teaching methods, enabling teachers to manage their classrooms more effectively (İşler & Kılıç, 2021). AI is becoming a useful tool for parents of children with disabilities. Advanced AI systems allow children to interactively communicate with their parents, while also enabling these children to enhance their exploration, learning, and problem-solving skills alongside entertainment (Richter, 2018). While the literature indicates that some AI applications are used in the field of education, it has been observed that these applications are not utilized effectively enough according to expectations. Considering the advantages provided by artificial intelligence,

it is suggested that there are potential benefits to implementing AI-based education more effectively in practice (Timms, 2016: 711).

Keywords: Artificial intelligence, Educational sciences, Technology

INTRODUCTION

While Alan Turing is often recognized as the pioneer of artificial intelligence, the term “artificial intelligence” was first used by John McCarthy during a workshop held at Dartmouth College in 1956. Following this workshop, research in the field of artificial intelligence gained momentum, leading to the development of significant AI applications such as Saint (1961), Simulation (1963), Eliza (1965), Knowledgeable (1970), and Apprentice (1979) (Kutlusoy, 2019). In 1972, WABOT-I, the first human-like intelligent robot, was produced in Japan (Acar, 2020). However, between 1974 and 1980, numerous publications containing negative criticisms of artificial intelligence were released. This situation led to a reduction in the funds that governments allocated for AI projects, and this period came to be known as the “Artificial Intelligence Winter.”

In the early 2000s, artificial intelligence began to enter the home environment with the introduction of the “Roomba” robotic vacuum cleaner. By 2006, major technology companies such as Facebook, Netflix, and Twitter had started to leverage artificial intelligence (Acar, 2020). In 2011, IBM’s Watson program showcased impressive success against human competitors, while Google introduced the Duplex program in 2018, which successfully made a call to a hair salon to book an appointment—achieving this while also hiding the fact that it was a machine (Acar, 2020). Today, AI-supported expert systems have reached a level where they can offer suggestions to doctors. Furthermore, self-driving cars controlled by artificial intelligence have started to be used in many states across America (İnce, 2017). Following all these developments, there is a curiosity about what the future holds. Has artificial intelligence surpassed human intelligence, or will it in the future? What awaits us in the coming years? To deeply understand artificial intelligence, it is crucial to first define and comprehend human intelligence (Kırpınar, 2019).

Artificial intelligence technologies have become an important element that we often use in our daily lives without realizing it. These technologies manifest themselves across various platforms through different devices and applications. Examples can be found in everything from smart home appliances to autonomous vehicles and smartphone applications. However, it can be said that the number of people who have a good grasp of the

applications and concepts behind these technologies is quite limited. The widespread use of these technologies in many areas of our lives, particularly in the education sector, is thought to pave the way for significant developments (Aykaç, 2018: vii).

In recent years, technological advancements have had profound effects on society. In particular, artificial intelligence has brought about a fundamental change in people's lives. Today, artificial intelligence is at the center of human life in numerous areas, ranging from internet search engines to smartphone applications, public transportation to household appliances, and has become an important element offering innovative solutions. These complex applications are just a few examples of the increasing presence of artificial intelligence in daily life (Bostrom & Yudkowsky, 2011; Luckin, 2017).

For example, Amazon uses artificial intelligence to recommend books, Spotify uses artificial intelligence to recommend songs, and schools are employing similar techniques to shape students' learning paths (Zeide, 2019). In an era where a large number of people benefit effectively from social media platforms, the impact of schools on the digital transformation process raises curiosity (Parlak, 2017).

The profound changes brought about by technology in every aspect of life also bring with them significant expectations for transformation in education and teaching processes (Akgün, 2019). The increase in digital transformation in educational environments is expected to positively influence students' perspectives towards technology and help them gain more motivation in their lessons (Sarsıcı & Çelik, 2019).

MATERIAL AND METHOD

The aim of this study is to investigate how artificial intelligence, which is a part of technology, affects education and what kind of contributions it makes to individuals' learning. The document analysis method, which is included in qualitative research methods, was used as the methodology. The documentary scanning technique was employed to collect data, and an examination of the obtained documents was conducted. The documentary scanning technique involves the processes of locating resources for a specific purpose, reading the acquired data, taking notes, and evaluating the information (Yıldırım & Simsek 1999).

FINDINGS

Artificial Intelligence and Education

Artificial intelligence systems reduce the importance of cheap human labor while increasing the demand for qualified human resources that are compatible with these systems. The development and widespread adoption of artificial intelligence technologies affect every segment of society, from education to the business world, and from managers to employees. The qualifications required for the workforce today may become obsolete in the near future. Therefore, it is crucial for governments to take artificial intelligence systems into account when shaping their development plans and education systems (Demir, 2019).

The development of artificial intelligence-based systems has not only transformed the human profile in education but has also fundamentally changed the educational structure and operation. Nowadays, thanks to artificial intelligence applications, the effective use of big data resources enables the creation of personalized education programs, individual performance tracking, lesson content preparation, and determination of teaching methods. These innovations have improved the quality of education and made learning processes more effective (Karaca & Telli, 2019).

The advancement of artificial intelligence and technology has made it possible for education to take place independently of time and space. With this integration, new methods such as flexible services, personalized learning, and project-based learning have been introduced into education systems. Nowadays, it is observed that artificial intelligence systems are widely used, particularly in areas such as distance education, online learning (e-learning), virtual reality, and augmented reality (Tuğluk & Gök-Çolak, 2019).

Artificial intelligence applications provide a significant advantage in offering learning opportunities tailored to students' individual levels and learning paces. Additionally, the flexible working hours provided by some applications and the ability for students to study when they feel motivated enable them to achieve the highest efficiency from educational outcomes. The opportunities that artificial intelligence technologies offer to enhance learning interactions and the design of educational experiences for all students on a global scale are being observed (Popenici & Kerr, 2017: 5). Artificial intelligence systems in education can generally be classified into three main categories: expert systems, intelligent tutoring systems, and dialogue-based systems. Expert systems are systems that can behave like an

expert with deep knowledge in a specific area and are often used in distance education applications. Intelligent tutoring systems can be described as an evolution of expert systems, as well as computer-assisted teaching systems. These systems enhance educational processes by providing students with personalized learning experiences. Dialogue-based systems not only offer personalized educational programs to users but also identify learning deficiencies through interactive dialogues and tailor educational programs to individual needs (Arslan, 2020).

The diverse uses of artificial intelligence in the field of education continually allow for the development of new subfields. Today, some of the most well-known subfields include artificial neural networks, computer vision, robotics systems, genetic algorithms, chaotic modeling, and simulated annealing (İşler & Kılıç, 2021). As technology advances over time, these areas are becoming increasingly enriched, and their applications in education are expanding across a broad spectrum.

Artificial Intelligence in terms of Teachers and Students

Artificial intelligence increases interaction possibilities, making the teaching processes more engaging. Modern technologies, especially virtual reality and gamification, encourage students' active participation in the educational process, making it more dynamic and interactive (Kuprenko, 2020). In addition, some artificial intelligence applications can gamify teaching methods, enabling teachers to manage the classroom more effectively (İşler & Kılıç, 2021).

Artificial intelligence-supported algorithms enable the analysis of students' knowledge and interests, providing teachers with the opportunity to offer more personalized recommendations and educational programs (Kuprenko, 2020).

Thanks to artificial intelligence, teachers can observe students in the classroom, identify which students are lagging behind in their learning processes, and pinpoint the weaknesses or specific topics that students struggle to understand. When these situations are communicated to teachers by artificial intelligence, they can develop appropriate strategies to support learning (Fahimirad & Kotamjani, 2018). Additionally, with the opportunities provided by artificial intelligence, teachers can spend less time on curriculum development and find the necessary educational materials more quickly (Kuprenko, 2020). This also allows teachers not to have to create a curriculum from scratch.

Artificial intelligence facilitates the tracking of student engagement and attendance, making educational processes more effective. As a result, issues such as students falling behind in their classes or being absent are largely eliminated. This is because students conduct their learning processes under the guidance of AI systems.

In today's world, it is observed that young people prefer to handle their daily tasks through smartphones and tablets due to their active lifestyles. AI-based applications allow students to utilize their free time by offering short (ten to fifteen minutes) study opportunities. Additionally, thanks to AI technologies, students can receive real-time feedback from teachers (Kuprenko, 2020).

This points to the potential to take learning beyond the concepts of time and space. Thus, education can reach wider audiences and be carried out more effectively.

Artificial intelligence-based solutions that offer various alternatives suitable for students' needs can determine student knowledge levels. This system aims to support students in the subjects they need and improve their weaknesses. For this purpose, it can provide students with learning materials that will strengthen their weak areas. For example, a student completes a test presented to them before starting to use the AI-powered application; By analyzing practice test results, the student can encourage his/her development by assigning new tasks that suit his/her needs (Kuprenko, 2020). In addition, artificial intelligence technologies can make various book recommendations according to students' interests and needs (İşler & Kılıç, 2021).

Advantages of Artificial Intelligence in Education

Artificial intelligence can contribute to the educational processes by quickly informing school administrators and teachers about students' negative behaviors and performances (Murphy, 2019). Information related to school management (e.g., student absences and news) can be processed more effectively and easily through this method, and various analyses can be conducted. Additionally, AI technology enables the timely identification of students at risk of non-attendance. This allows school administrators to establish swift communication with these students, provide necessary warnings, offer required support, or take preventive measures before problems escalate (İşler & Kılıç, 2021).

Artificial intelligence is becoming a valuable tool for parents of children

with disabilities. Advanced AI systems enable these children to engage in interactive communication with their parents while also providing opportunities to enhance their skills in exploration, learning, and problem-solving in addition to entertainment (Richter, 2018). There are various AI applications designed for parents looking to increase digital thinking skills in preschool-aged children. These applications offer tailored educational programs through interactive content in the virtual environment, allowing gifted children's potentials to be developed through AI technologies.

Artificial intelligence technologies provide personalized educational opportunities to individuals of different age groups based on their skills, abilities, and interests, thereby facilitating a more effective learning process. Through such platforms, opportunities for interactive communication between parents, teachers, specialists, and counselors arise (Arslan, 2020). In this way, artificial intelligence offers various psychological advantages to the parents of individuals with special needs (Newman, 2017).

While technology plays an important role in the educational process, the human element should always take precedence. Technology in education should not merely be seen as a tool that facilitates the distribution, tracking, and evaluation of content. Therefore, it is possible to create more comprehensive and engaging educational experiences by blending human interaction with technology (Güzey et al., 2023).

Virtual mentors could offer the possibility of providing virtual advisors that track students' progress through artificial intelligence-supported platforms. While it is known that human teachers possess a better ability to understand student needs (Kuprenko, 2020), the immediate feedback provided by virtual teachers can have positive effects on student development.

DISCUSSION AND CONCLUSION

The evolution of artificial intelligence over time and its continuous renewal bring many new topics to the fore. With the increasing importance of artificial intelligence in our country, the establishment of higher education programs in this field is accelerating experimentation and research activities in education.

Instead of solely focusing on computers to enhance the quality of education and teaching, it may be more beneficial to develop more effective solutions through smart and embedded systems. Establishing smart classrooms, monitoring student-teacher interactions in real time using sensors, and tracking students' motivation for lessons in real time will undoubtedly

contribute to increased success. Although artificial intelligence offers many exciting possibilities for improving education worldwide, it can still be said that its use is in the early stages. For AI tools to be effectively implemented in educational institutions, further experience and research are necessary. While the literature indicates that some AI applications are used in the field of education, it is evident that these applications are not utilized effectively enough to meet expectations. Considering the advantages that artificial intelligence provides, it is believed that there are potential benefits to more effectively implementing AI-based education (Timms, 2016: 711).

Artificial intelligence systems used in education analyze the vast data obtained from students, providing more detailed results than traditional assessment methods. While the use of AI-based systems offers many advantages in terms of the quality of education, it is important to note that teachers cannot be entirely replaced, as a solely AI-based system would not be functional. Although AI systems can perform tasks similar to personal tutors, they are based on big data analysis and can sometimes yield incorrect results regarding more specific situations (Chassignol et al., 2018).

The COVID-19 global pandemic has further emphasized the importance of developing artificial intelligence (AI) focused application areas. There is strong evidence that AI has provided a new perspective on teaching and learning processes in higher education. However, it is also crucial to acknowledge the current limitations of technology and to emphasize that AI is not yet at a level to replace faculty members, but it has the potential to enhance their capabilities (Popenici & Kerr, 2017). While many possibilities exist, intelligent learning environments are supported by AI technology. Personalized learning is better supported in such environments (Spector & Ma, 2019).

As the world-renowned artificial intelligence researcher Edward Fredking stated, "There are three significant events in history: the formation of the universe, the emergence of life, and the advent of artificial intelligence." Given the rapid advancement of technology, it can be said that artificial intelligence has the potential to contribute to education in various ways and can be directed towards different fields.

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A VIEW OF SPORTS TRAINING FROM THE METAVERSE WORLD

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ABSTRACT

The purpose of this study; It is an investigation of how metaverse technology, which is a part of artificial intelligence technology, affects the sports education of individuals and what kind of contributions it makes to the education of individuals. As a method, descriptive scanning model, one of the qualitative research approaches, was used. The concept of the Metaverse is generally considered the next-generation internet paradigm that allows people to interact and operate in an alternative world in a virtual reality environment. This concept refers to a realistic virtual platform where users can interact with other users through avatars in an immersive 3D environment. It offers an environment where people can play games, work and socialize through the virtual world. Thanks to virtual reality and augmented reality technologies, there are also significant developments in sports education. These technologies can make learning and teaching processes more effective. By making sports competitions more realistic and exciting, it attracts more attention from the audience, increases the popularity of sports and enables it to reach larger audiences. At the same time, Metaverse offers the opportunity to bring people together and increase interaction by making sports events more social. A strong relationship has been established between metaverse and sports in many areas such as new training techniques, training of referees, athletes and coaches, tactical and technical studies, sports marketing, and skill learning. In this way, athletes and coaches can work more effectively, fans can have better experiences, and the sports industry can become more innovative in general.

Keywords: Metaverse, Sports training, Technology

INTRODUCTION

On October 8, 2021, Mark Zuckerberg announced that he would merge Facebook under an umbrella company called Meta and make a \$10 billion investment in the Metaverse field. This announcement was at the top of the world agenda for a long time. Although the concept of metaverse is a generally unknown subject, the fact that Zuckerberg will make such a large investment in this field has attracted widespread attention (Zuckerberg & Heath, 2021)

The concept of the metaverse actually first appeared in Neal Stephenson's science fiction book *Snow Crash* in 1992. The Metaverse refers to a universe where virtual reality systems have a history of over a hundred years. According to many people who are new to this concept, it is quite interesting and important to consider where we are today in the Metaverse, the role and future of sports in this field. The concept of the Metaverse is generally considered the next-generation Internet paradigm that allows people to interact and operate in an alternative world in a virtual reality environment. This concept refers to a realistic virtual platform where users can interact with other users through avatars in an immersive 3D environment. It offers an environment where people can play games, work and socialize through the virtual world (Kalkan, 2021).

Metaverse technology allows students to learn more interactively in the education sector. Virtual classroom environments help students understand and learn subjects better by providing simulation of real-world experiences. It also supports students' learning processes by providing easier access to various educational materials and resources. For teachers, Metaverse technology helps them capture students' attention and teach more effectively by making course materials more interesting. At the same time, teachers can track students' performance and provide them with more support individually. The use of Metaverse technology in the education sector makes the learning process more effective and ensures that students are more motivated (Çakır et al., 2022).

The Metaverse has emerged as a force used in the evolution of internet-based education, starting with e-learning. The use of Metaverse technology, especially in sports education, offers opportunities that can increase the feeling of existence in augmented reality by providing interactive technology with a high sense of reality in the virtual world (Jovanović & Milosavljević, 2022). It can also improve athletes' performance by providing content that can simulate movements performed in real sports. The use of Metaverse not only in e-sports but also in traditional sports is

gaining popularity. For example, the National Football League (NFL) has partnered with VR company STRIVR to create virtual training programs for its players. In this way, players can learn to make decisions in high-pressure environments by experiencing simulated game situations. In this way, Metaverse technology helps athletes improve their skills and increase their performance (Yu, 2022).

Thanks to virtual reality and augmented reality technologies, there are also significant developments in sports education. These technologies can make learning and teaching processes more effective. Sports education supported by virtual and augmented reality attracts attention and is preferred especially among young people. The impact of technology in the field of sports is increasing day by day, and virtual environments and augmented reality applications developed in this field make sports more accessible and interesting (Kapidere, 2022).

MATERIALS AND METHODS

The purpose of this study; It is an investigation of how metaverse technology, which is a part of artificial intelligence technology, affects the sports education of individuals and what kind of contributions it makes to the education of individuals. As a method, the document review method, which is included in qualitative research methods, was used. Documentary screening technique was used to collect the data in the study, and the documents obtained were examined. Documentary scanning technique includes the processes of finding sources, reading the obtained data, taking notes and evaluating them for a specific purpose (Yıldırım & Simsek 1999).

FINDINGS

Next Generation Metaverse Athletes Scientific studies examining the benefits of Metaverse to athletes have generally focused on performance. In addition, positive results have been obtained in athletes' skill learning, technical and tactical studies, and exercise practices for general health (Kalkan, 2021).

In a study by Wood et al. (2021), positive results were obtained in increasing motor performance and skill development with training drills in which football players participated through virtual reality systems.

In Sean et al.'s (2021) study, it was found that people working in a virtual environment performed better in single-foot jumping than those working in a real environment. This shows that the virtual environment can be effective in preparing athletes for real-world competitions. In the mentioned studies,

it is emphasized that athletes' participation in the Metaverse universe through virtual worlds can provide various benefits. In this environment, athletes can have the opportunity to learn skills, improve performance, psychological preparation and experience the competition environment in advance. In this way, they can control their anxiety levels and have the chance to exercise during athlete injury or rehabilitation periods.

The Metaverse provides many benefits to the world of sports. By making sports competitions more realistic and exciting, it attracts more attention from the audience, increases the popularity of sports and enables it to reach larger audiences. At the same time, Metaverse offers the opportunity to bring people together and increase interaction by making sports events more social. As sports become more affordable, it encourages more people to participate in sports events and do sports. Metaverse helps make sports a more enjoyable and interactive experience for both spectators and athletes. (Kıyıcı, 2023).

These data show that Metaverse may have significant potential for athletes to improve their physical and mental skills, increase training efficiency and learn new techniques. Therefore, it can be very beneficial for athletes to use Metaverse to improve their training and performance. Considering the importance of training and sports in the real world, it is thought that virtual environments can provide additional contributions to athletes. Therefore, it becomes even more important today and in the future that virtual worlds can be an effective tool to increase the athlete's performance.

DISCUSSION AND CONCLUSION

The purpose of this study; It is an investigation of how metaverse technology, which is a part of artificial intelligence technology, affects the sports education of individuals and what kind of contributions it makes to the education of individuals.

The concept of Metaverse is a new generation Internet paradigm that allows people to interact in an alternative virtual world by providing a virtual reality environment. This concept allows people to perform various activities in a virtual environment, from playing games to sports, doing business and socializing. In this way, users can experience immersive and interactive experiences, moving away from real-world limitations. (Sivunen & Nordbäck, 2015).

After the Covid-19 pandemic, people were introduced to concepts such as distance education and virtual reality. The Metaverse concept has started

to become popular with strong investments and has started to create various effects in the sports world. It is important to note that this concept manifests itself in different areas within the sports industry and how it may lead to changes in the sports world in the future (Jeon et al., 2021). The concept of metaverse is incorporated into organizational activities within the sports industry and used in different areas. A strong relationship has been established between metaverse and sports in many areas such as new training techniques, training of referees, athletes and coaches, tactical and technical studies, sports marketing, and skill learning. In this way, athletes and coaches can work more effectively, fans can have better experiences, and the sports industry can become more innovative in general. Therefore, it is important to examine the potential of the Metaverse concept in the sports world more closely and conduct studies in this field (Kalkan, 2021).

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EVALUATING THE PERFORMANCE OF ARTIFICIAL INTELLIGENCE IN MATHEMATICS EDUCATION: A FOCUS ON CHATGPT-4'S HANDLING OF PROPORTIONAL REASONING PROBLEMS

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ABSTRACT

The integration of Artificial Intelligence (AI) into solving mathematical problems has demonstrated significant potential in enhancing students' learning outcomes and overall performance. Despite these advantages, AI tools, such as ChatGPT-4, are not without limitations. These tools can still produce conceptual and arithmetic errors that may mislead users and hinder their understanding of mathematical concepts. This paper aims to critically analyse such errors in order to enhance the effectiveness of AI applications within the context of mathematics education. Specifically, the study explores the capabilities of ChatGPT-4 in addressing proportional reasoning problems, a common area where students frequently encounter difficulties and make errors.

In this research, ChatGPT-4 was presented with 10 commonly encountered questions that involve misconceptions related to proportional reasoning. The results indicate that the AI successfully answered the majority of these questions, achieving a 70% accuracy rate. Additionally, the AI was able to provide detailed explanations for its solutions, which suggests a strong potential for aiding in the instructional process. Furthermore, ChatGPT-4 demonstrated the ability to correctly interpret visual content in some of the problems, accurately identifying the inputs required to arrive at the correct solution. This ability highlights the AI's capability to engage with more complex problem types that involve visual reasoning. However, the study also found that ChatGPT-4 made similar mistakes as students when confronted with problems requiring deeper reasoning and understanding of underlying concepts. These errors were particularly evident in questions designed to test common misconceptions in proportional reasoning. The AI's performance in these areas mirrors the struggles students face, indicating that while AI can replicate correct procedures, it may still fall short in areas requiring nuanced reasoning and conceptual clarity.

In conclusion, while ChatGPT-4 exhibits considerable promise in the realm of mathematics education, particularly in problem-solving, these findings

underscore existing limitations regarding the handling of misconceptions. Improving the AI's contextual understanding and enhancing its flexibility in problem-solving are essential steps toward developing more robust educational tools. Such improvements will better support students' learning experiences and ensure that AI tools can serve as effective aids in mathematics education, ultimately leading to improved learning outcomes.

Keywords: Artificial intelligence (AI), ChatGPT-4, Math education, Problem-solving, Proportional reasoning

INTRODUCTION

Artificial intelligence (AI) is gaining substantial attention across various disciplines, including education. A growing number of systematic review studies, such as those conducted by Zhai et al. (2021), and Casal-Otero et al. (2023), reflect the increasing maturity of research in AI within the educational field. This trend is also evident in Turkey, where over the past five years, studies on AI in education have accounted for more than half (64%) of all related research conducted in the last two decades (Tekin, 2023). Given the rapid progress in AI, it is crucial for educators to understand how to effectively integrate these technologies to maximize learning opportunities.

Although the exploration of artificial intelligence in mathematics education may appear to be a recent development, it is important to recognize that this field has a history of approximately 60 to 70 years. One of the earliest AI programs was Slagle's (1963), developed in 1961 as part of his doctoral research to perform indefinite integration. His program, SAINT (Symbolic Automatic INTEgrator), showcased problem-solving abilities akin to those of a freshman calculus student, successfully solving most of all problems. The introduction of ChatGPT by OpenAI in November 2022 further highlighted AI's impact across various domains, bringing renewed focus to its applications, including in mathematics education.

ChatGPT has made significant progress in mathematics education, particularly in problem-solving (Plevris et al., 2023). For instance, ChatGPT demonstrated impressive performance by solving 60 math questions from Taiwan's educational exams with an accuracy rate of around 80% (Li et al., 2023). Additionally, expert math teachers who evaluated the answers highlighted that ChatGPT provided more detailed, step-by-step solutions compared to those typically found in textbooks. These findings clearly suggest that AI tools have significant potential to contribute to the future of mathematics education.

However, alongside the opportunities this technology offers, certain risks must also be considered. The role of artificial intelligence in mathematics education, particularly in problem-solving, requires careful attention to its limitations. Even if AI tools correctly process inputs in mathematical problem-solving, they may still struggle to provide reliable and accurate solutions, even for simple problems (Guler et al., 2024; Plevris et al., 2023). Frieder et al.'s (2023) studies have shown that ChatGPT's performance in university-level mathematics can be lower than that of typical students. They emphasized the need for improvements, particularly in areas such as proof and complex problem-solving. Another important issue is that AI can produce incorrect answers with a "hallucination effect", meaning it presents these answers confidently as if they were correct. Therefore, it is crucial to always verify the accuracy and reliability of AI-generated outputs. This study will analyse the types of errors ChatGPT can make in mathematical problem-solving and how these errors occur.

This study explores the effectiveness of ChatGPT-4 in accurately solving problems in areas where students often encounter difficulties. Specifically, it addresses the question: "How well can ChatGPT-4 solve problems in proportional reasoning, where students frequently make mistakes?"

METHOD

In the study, problems frequently encountered in the literature (Hilton et al., 2013; Lamon, 2020) where students often make mistakes, including conceptual errors, were used. Ten questions requiring proportional reasoning skills were selected and solved using ChatGPT-4. Each question was posed directly to the chatbot in separate conversation tabs, and the first responses were recorded. No additional guidance or contextual information was provided during this process. This method was chosen to evaluate the problem-solving approach of AI tools in the simplest way and to minimize external influence. Finally, it should be noted that due to ChatGPT's continuous updates, the results may vary in future attempts.

FINDINGS

Overall, ChatGPT was able to respond to all the questions and provided detailed explanations for its solutions. An example of a correctly answered question is presented below (Figure 1).

Figure 1. ChatGPT’s Correct Answer Example

Yesterday you shared some cookies with some friends. Today, you share fewer cookies with more friends. Will everyone get more, less, or the same amount as they received yesterday?

🗨️ If you shared fewer cookies with more friends today compared to yesterday, then each friend will receive **less** than they did yesterday.

Here's the reasoning:

- **Yesterday:** More cookies were available, and fewer friends meant that each person received a larger portion.
- **Today:** Fewer cookies and more friends mean that the cookies have to be divided among more people, resulting in a smaller portion for each friend.

When the above question is analysed, it requires reasoning about the part-whole relationship without any numerical data. ChatGPT-4 solved this question in a very explanatory manner. However, it provided incorrect solutions for two other questions that required reasoning. An example related to this is presented below (Figure 2).

Figure 2. Example of Incorrect Reasoning by ChatGPT-4

Sue and Jack were running at the same speed around a track. Jack started first. When Jack had run 4 laps, Sue had run 2 laps. When Sue had completed 6 laps, how many laps had Jack?

🗨️ To find out how many laps Jack had run when Sue completed 6 laps, let's analyze the situation.

From the problem, we know:

- When Jack had run 4 laps, Sue had run 2 laps.

This tells us that Jack runs twice as many laps as Sue in the same amount of time because when Jack ran 4 laps, Sue only ran 2 laps. Therefore, their lap ratio is 2:1 in favor of Jack.

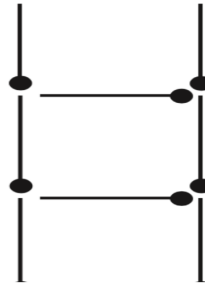
Now, we need to find how many laps Jack runs when Sue runs 6 laps. Since Jack's speed in laps is twice that of Sue's, we can apply the ratio directly:

- If Sue runs 6 laps, then Jack runs $6 \text{ laps} \times 2 = 12 \text{ laps}$.

Therefore, when Sue had completed 6 laps, Jack had completed **12 laps**.

When the above question is analysed, the runners’ speeds are the same, and there is an additive relationship between them. However, ChatGPT interpreted this situation multiplicatively, making a common mistake that students often make. Another error (Figure 3) occurred when it misinterpreted the necessary inputs from a visually presented question, leading to an incorrect solution.

Figure 3. Example of Incorrect Answer by ChatGPT-4



"In the picture, a ladder with 2 steps is made using 8 matchsticks. If we want to make a ladder with 6 steps, how many matchsticks will we need?"



To determine how many matchsticks are needed to make a ladder with 6 steps, we can observe the pattern in the image:

1. **Ladder with 2 Steps:**

- Vertical matchsticks: 4 (2 on each side)
- Horizontal matchsticks: 4 (2 for each step)
- Total matchsticks: 8

2. **Pattern Identification:**

- Each additional step requires 2 horizontal matchsticks.
- The number of vertical matchsticks remains the same, as they form the sides of the ladder.

For a ladder with 6 steps:

- **Vertical matchsticks:** 4
- **Horizontal matchsticks:** Each step adds 2 matchsticks, so for 6 steps, we need $2 \times 6 = 12$ horizontal matchsticks.

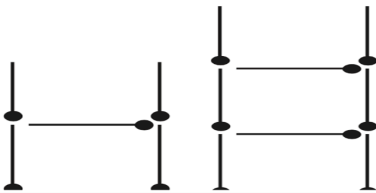
Total matchsticks needed:

$$4 \text{ (vertical)} + 12 \text{ (horizontal)} = 16$$

Thus, you will need a total of 16 matchsticks to make a ladder with 6 steps.

When the above answer is examined, it is observed that the number of vertical sticks in the first step (4 sticks, 2 for each step) was incorrectly inputted, leading to an incorrect answer. However, when the figure (Figure 4) was presented in two steps to allow for a correct interpretation, ChatGPT arrived at the correct solution. This highlights the importance of providing precise prompts to ChatGPT for accurate problem-solving

Figure 4. Impact of Prompts on ChatGPT’s Problem-Solving Accuracy



5 matchsticks are needed for one step of the ladder, and for two steps, 8 matchsticks are needed, as shown in the second image. Can you solve this again?

Based on the explanation and the images provided:

For 1 Step:

- As shown, 5 matchsticks are needed for 1 step of the ladder.

For 2 Steps:

- For 2 steps, 8 matchsticks are needed. This is visible in the second part of the image, where the structure expands, but only 3 additional matchsticks are required to add the second step.

General Formula:

- For the first step, 5 matchsticks are required.
- For each additional step, 3 more matchsticks are needed.

General Formula:

- For the first step, 5 matchsticks are required.
- For each additional step, 3 more matchsticks are needed.

Let’s calculate the number of matchsticks needed for more steps:

For example, if you need to find the number of matchsticks required for 6 steps:

- Start with 5 matchsticks for the first step.
- Then, add 3 matchsticks for each of the next 5 steps:

$$5 + (5 \times 3) = 5 + 15 = 20 \text{ matchsticks}$$

So, to create a ladder with 6 steps, 20 matchsticks would be required.

If you need to solve for a different number of steps or need further clarification, feel free to ask!

CONCLUSION

The findings of this study indicate that while ChatGPT-4 demonstrates a good level of proficiency in solving proportional reasoning problems, achieving a 70% accuracy rate, it still faces challenges in certain areas. Specifically, the AI struggles with some reasoning tasks and the accurate interpretation of visual inputs, leading to errors that mirror common student misconceptions. These shortcomings suggest that while AI tools like ChatGPT-4 hold significant promise as educational aids, they are not yet fully reliable for independent use in educational settings. To maximize the potential of AI in mathematics education, it is crucial to address these limitations by improving the AI’s ability to handle nuanced reasoning and by enhancing its capacity to process and interpret visual information accurately.

The results also highlight the importance of providing appropriate prompts when using AI tools for educational purposes. The study observed that when guided by more precise prompts, ChatGPT-4 was capable of correcting

its previous errors. This finding suggests that while the AI can serve as a valuable resource for educators and students alike, it should be used with caution, and its outputs should be critically evaluated to ensure accuracy and reliability.

In conclusion, ChatGPT-4 has shown considerable potential in mathematics education, particularly in addressing proportional reasoning problems. However, its current limitations indicate that further improvements are necessary to ensure it can fully meet the needs of educators and students. Continued research and development in this area are essential to enhance the effectiveness of AI in education, ultimately leading to better learning outcomes for students.

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THE GPT SERIES FROM PAST TO FUTURE AND THE USE OF THE GPT IN EDUCATION

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ABSTRACT

The use of artificial intelligence in education has become widespread in recent years and various artificial intelligence tools are used. In this research, GPT models, one of the artificial intelligence tools used in education, were examined. GPT was first developed in 2018. The second model of GPT, GPT-2, includes a larger data set and thus performs more tasks. In another developed version, GPT-3, the data set used was increased and more consistent results were provided. The next model, GPT-3.5, is similar to GPT-3, but it is emphasized to work without errors for languages other than English. Similarly, language commands have been improved in GPT-4. In addition, more complex tasks have been emphasized in GPT-4. There are also different versions of GPT-4. The developed versions of GPT-4 are named as GPT-4Turbo, GPT-4o mini and GPT-4o. In these improved versions, features such as faster operation, accepting both text and visual input, being more affordable and having more advanced cognitive abilities have been added. With these improved features, the use of artificial intelligence in education has also become easier and more accessible. Artificial intelligence has been used for various purposes in education. GPT is used for purposes such as supporting education systems, for evaluation and feedback, developing lesson plans and course materials or monitoring student development, etc. It is seen that the use of GPT in education is beneficial in terms of determining low student participation, developing smart learning systems and providing individual learning opportunities to students, and also increasing student motivation.

Keywords: Artificial intelligence, Education, GPT

INTRODUCTION

The concept of artificial intelligence, first introduced by John McCarthy at the Dortmund Conference, has subsequently been integrated into the field of education. The application of artificial intelligence (AI) in education is receiving increasing attention, with studies on this topic becoming more prevalent (Arslan, 2020). It is well-established that integrating AI into the educational process can be highly beneficial. Consequently, there is a growing consensus that AI-supported education should be afforded greater prominence within the school curriculum (Isler & Kilic, 2021) AI tools, including GPT, Gemini, and Clause-AI, can be utilised in educational settings. This study is based on the GPT series and its implications for educational applications.

What is GPT?

GPT (Generative Pre-trained Transformer) represents a category of natural language processing technology (NLP) developed by OpenAI (URL-1). While GPT-1, the inaugural iteration of GPT, was released in 2018 and demonstrated the capacity to perform NLP tasks at a rudimentary level, subsequent versions, namely GPT-2 and GPT-3 (URL-1) which are more sophisticated language models, have been developed with a variety of enhancements, including the utilisation of larger datasets. Subsequent to GPT-3, GPT-3.5, GPT-4, GPT-4 Turbo, and GPT-4o mini models were created. The most recent iteration of GPT, GPT-4o, was released in September 2024 and is currently the most up-to-date version.

What, Then, Are the Key Differences Between the Various GPT Models?

GPT-1 represents the fundamental model and the inaugural stage in the GPT series. GPT-1, which is regarded as the inaugural stage of the model, is primarily designed to undertake language-based tasks, such as the generation of articles, from a set of given words. It is capable of executing downstream operations, including classification and question answering, with a constrained dataset. The number of parameters obtained from the dataset is 117 million (Floridi & Chiriatti, 2020; Shree, 2020).

GPT-2 is a new iteration of the language model, developed for the same purpose, using a significantly larger dataset (approximately 10 times larger than that used for GPT-1) and incorporating more parameters (Floridi & Chiriatti, 2020). The GPT-2 dataset comprises over 8 million documents and contains 40 GB of text data. The incorporation of a greater number of parameters allows GPT-2 to undertake tasks such as translation, summarization, and the generation of new text using a reduced input (Caucheteux et al., 2021; Radford et al., 2019; Shree, 2020). The most

notable distinction between GPT-1 and GPT-2 is the latter's capacity for multitasking. Consequently, it is markedly more proficient in forming lengthy sentences and predicting sentences (Radford et al., 2019; URL-1). However, GPT-2 remains inadequate for the generation of new texts. In the course of experimentation, inconsistencies have been observed in the texts generated by GPT-2. Consequently, studies on GPT models were continued, and the GPT-3 model was developed (McGuffie & Newhouse, 2020).

GPT-3 is the version with an expanded set of datasets and parameters, comprising approximately 100 times more data than that available for GPT-2. The extensive dataset available to GPT-3 enables it to perform a multitude of tasks, including translation, preparation of technical documents, accurate response to queries, composition of articles in accordance with a specified title, development of code, and creation of original music, narratives, and poetry (Brown et al., 2020; McGuffie & Newhouse, 2020). Additionally, the responses generated by GPT-3 to both factual and creative prompts exhibit greater consistency than those produced by GPT-2.

GPT-3.5 differs from GPT-3 in that it exhibits higher accuracy and has been modified to eliminate an encoding bug for non-English language commands. GPT-3.5 is a conversational model, but it can also be applied to non-conversational tasks. It can be said that this model is similar to GPT-3 but represents a slightly improved version (URL-2).

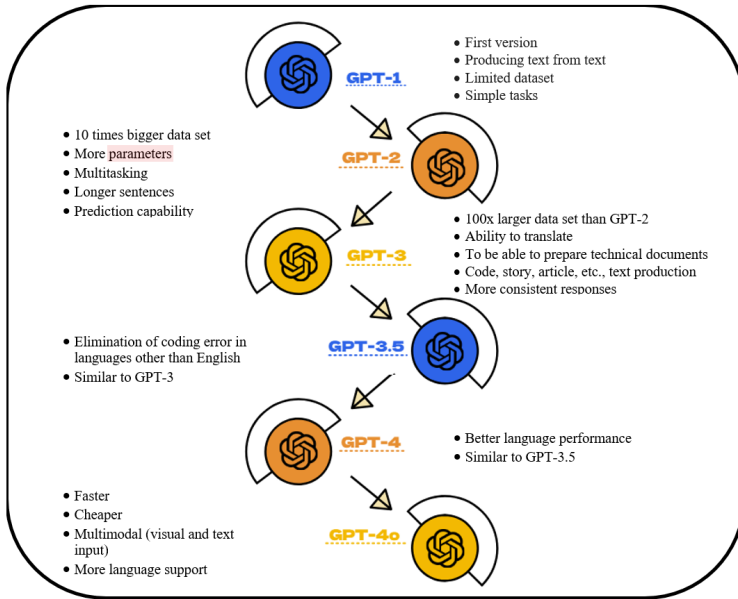
The GPT-4 and GPT-4 Turbo models exhibit a high degree of similarity to the GPT-3.5 in terms of their capacity to perform simple tasks. Although the distinction between GPT-3.5 and GPT-4 is purported to be inconsequential, it has been asserted that GPT-4 is designed to undertake more intricate tasks and is more proficient than any preceding iteration in this regard. It is also more sophisticated in terms of linguistic capabilities and performs well not only in English but also in other languages (URL-2).

The GPT-4o mini is presented as one of the smaller models, more akin to the GPT-3.5 in terms of its physical dimensions. The GPT-4o mini is more affordable and possesses greater capabilities than the GPT-3.5, particularly in the context of simple operations. Additionally, while the GPT-4o mini and GPT-3.5 exhibit comparable processing speeds, the GPT-4o mini is multimodal. The GPT-4o mini is capable of accepting both text and image input and subsequently producing text output (URL-2).

As of August-September 2024, the GPT-4o is the most advanced model in use. It exhibits greater cognitive capability than other models. The GPT-4o

mini is faster than the GPT-4 Turbo and is offered for sale at a price that is 50% lower than that of the GPT-4 Turbo. Moreover, it is multimodal, akin to the GPT-4o mini, and offers the most extensive language support of all GPT models (URL-2). Figure 1 provides a summary of the developmental process of GPT.

Figure 1. Developmental Process of GPT



Note. The figure shows the development process of GPT models and the adjustments made to the models.

GPT in Education

The application of GPT in the field of education has the potential to enhance the efficacy of learning systems. The development of intelligent learning systems can facilitate the improvement of educational processes, particularly in the identification of instances of low student participation and the examination of student conduct (Kocak & Yigit, 2023).

The application of GPT in the field of education facilitates the implementation of personalized learning strategies, allowing students to benefit from the technology on an individual basis. The integration of chatGPT in educational settings has been demonstrated to enhance students' attitudes and motivation, thereby positively influencing their learning outcomes (Deveci Topal et al., 2021).

Additionally, GPT can be employed for analytical and evaluative purposes in an educational context. It is also utilized in the assessment of data-driven processes, including model construction, trend analysis, and forecasting (Deveci Topal et al., 2021). In this regard, GPT can also be employed in student support services to mitigate the burden on teachers and students (Firat, 2020). It can also be utilized to examine student examinations, ascertain areas of strength and weakness, and furnish feedback (Altun, 2023). Additionally, GPT can be leveraged to develop educational materials and prepare lesson plans (Kocak & Yigit, 2023).

CONCLUSION

In this study, GPT models, one of the artificial intelligence tools used in education, were examined. GPT first emerged in 2018 and its development process has continued with various improvement studies to the present day. It has become easier to use in education with developments such as feeding from more data sets and performing more complex tasks, providing more language support, producing more consistent and accurate answers, being multi-modal, i.e. allowing visual and text input. GPT, which is used as an assistant in the education process, facilitates the education process from different perspectives, from preparing lesson plans to evaluation processes, from examining student participation status to developing smart learning systems. In addition, the use of GPT in education increases student motivation. GPT, which supports the teacher and offers individual learning opportunities to the student, is expected to be used more in education.

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DETERMINING THE COGNITIVE STRUCTURES OF PROSPECTIVE SCIENCE TEACHERS REGARDING THE CONCEPT OF ARTIFICIAL INTELLIGENCE VIA WORD ASSOCIATION TEST

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ABSTRACT

Artificial intelligence is called the branch of science and engineering that deals with computer programs that perform tasks similar to human intelligence. Artificial intelligence, which is used for different purposes in different disciplines, is also used in the field of education. In this study, it was aimed to determine the cognitive structures of science teacher candidates regarding the concept of artificial intelligence through a word association test. For this purpose, a word association test was applied to a total of 162 teacher candidates studying in the first, second, third and fourth grades. The phenomenological design of the qualitative research method was used in this study. This study was conducted with 162 volunteer teacher candidates studying in the science teaching department of a state university located in the Central Anatolia Region. In this study, the word association test (WAT) was applied as the data collection tool. Science teacher candidates were asked the question "List five concepts that come to your mind when you say artificial intelligence." Descriptive analysis was used in the analysis of the data obtained from the word association test. As a result of the research, it was seen that science teacher candidates most associated the concept of artificial intelligence with the concepts of robot, convenience, technology, ChatGPT and smart assistant.

Keywords: Artificial intelligence. Science teacher candidates, Word association test

INTRODUCTION

Artificial Intelligence is the science and engineering branch related to this field that produces computer programs that perform tasks similar to human intelligence. Although the foundations of the concept of artificial intelligence are based on theories and ideas such as the “Boolean Circuit Model of the Brain (1940)” and the “Turing Test (1950)”, its use in the current sense was first put forward by McCarthy at the Dortmund Conference in 1956. Later, studies on artificial intelligence increased and new models were developed. ELIZA (1970), machine learning (1980), artificial neural networks (1990), Deep Blue and Kasparov (1997) are some of the pioneering developments in the field of artificial intelligence. KISMET, Robot Toys, iRobot, Google Car are some of the developments introduced in 2000. Developments in artificial intelligence have accelerated in the following years (Arslan, 2020). Nowadays, artificial intelligence can be used for different purposes. Playing games, speech recognition (voice command), understanding natural language (chat), three-dimensional object imaging, expert systems (such as medical diagnosis, bank customer and payment information) are some of the areas where artificial intelligence is used. However, artificial intelligence is used in many different disciplines. Computer engineering, philosophy, informatics, electronics are some of these disciplines (Pirim, 2006). Another discipline that uses artificial intelligence and conducts research on it is education.

It can be said that artificial intelligence in education is used in two ways, mainly in education management and in the teaching role in the learning-teaching process. Artificial intelligence can be used in the field of education in such areas as providing individualized learning in distance education, providing step-by-step learning for students by creating smart learning systems, and providing teaching with dialogue (question-answer) method with dialogue-based teaching systems (Arslan, 2020).

There are many studies in the literature on the use of artificial intelligence in education. Arslan (2020) examined the applications of artificial intelligence in education. Isler and Kilic (2021) examined how artificial intelligence will improve education and national and international studies in this field. Bayram and Celik (2023) developed and implemented a socio-scientific activity integrated with the reasoning and entrepreneurship skills of 10 science teacher candidates studying in the 3rd grade on artificial intelligence. Later, participant opinions on the activity were sought. Seyrek et al. (2024) aimed to reveal perceptions of the concept of artificial intelligence in their research conducted with primary school teachers. Pekmez et al. (2024) sought the opinions of 21 teachers regarding the

use of artificial intelligence in education.

This study aimed to determine the cognitive structures of science teacher candidates regarding the concept of artificial intelligence through a word association test. For this purpose, a total of 162 teacher candidates studying in the first, second, third and fourth grades were administered a word association test.

METHODS

Research Design

In this study, the phenomenological design of the qualitative research method was used. In phenomenological studies, an individual's perception, experience, concept, situation and perspective regarding a specific phenomenon are revealed and interpreted (Yildirim & Simsek, 2016). In this study, the phenomenological design was preferred because the past experiences and cognitive structures of science teacher candidates regarding the concept of artificial intelligence were investigated.

Participants

This study was conducted with 162 volunteer teacher candidates studying in the science teaching department of a state university in the Central Anatolia Region. Information on the science teacher candidates is given in Table 1.

Table 1. Demographic Information

Variable		Number of participants (n)
Gender	Female	130
	Male	32
Class	1st Class	40
	2nd Grade	49
	3rd Grade	42
	4th Grade	31

Data Collection Tool

In this study, the word association test was applied as a data collection tool. The science teacher candidates were asked the question, "List five concepts that come to mind when you think of artificial intelligence." In this way, the cognitive structure of science teacher candidates regarding the concept of artificial intelligence was determined.

Data Analysis

Descriptive analysis was used in the analysis of the data obtained from the word association test. The answers of science teacher candidates were first transferred to the MS Excel program, then their frequencies were calculated and turned into a table. The concepts with a frequency of two or less than two are given in the table under the code "Other".

FINDINGS

The words that first-year science teacher candidates associate with the concept of artificial intelligence are given in Table 2.

Table 2. Artificial Intelligence Word Associations of First-Year Science Teacher Candidates

Word Relationship	Frequency	Percentage
Robot	31	15,5
Convenience	23	11,5
Technology	18	9
Innovation	12	6
Software	11	5,5
Machine	9	4,5
Future	8	4
Speed	7	3,5
Virtual assistants	7	3,5
Smart system	6	3
ChatGPT	5	2,5
Anxiety	5	2,5
Abuse	5	2,5
Science	4	2
Human	4	2
Cybersecurity	4	2
Brain	3	1,5
Computer	3	1,5
Interaction	3	1,5
Imagination	3	1,5
Interest	3	1,5
Engineering	3	1,5
Finance	3	1,5
Other	20	10

When Table 2 is examined, the words that first-year science teacher candidates associate with the concept of artificial intelligence are robot, convenience and technology. In addition, a word cloud has been prepared for concepts with a frequency of two or less under the code “Other” and the current word cloud is given in Figure 1.

Figure 1. Word Cloud Visual for the “Other” Code of First-Grade Science Teachers



The words that second-year science teacher candidates associate with the concept of artificial intelligence are given in Table 3.

Figure 2. Word Cloud Visual for the “Other” Code Of Second-Year Science Teachers



When Table 3 is examined, the words that second-year science teacher candidates associate with the concept of artificial intelligence are primarily robot, convenience and technology. In addition, a word cloud has been prepared for concepts with a frequency of two or less under the code “Other” and the current word cloud is given in Figure 2.

Table 3. Second-Year Science Teacher Candidates' Artificial Intelligence Word Associations

Word Relationship	Frequency	Percentage
Robot	38	15,5
Technology	29	11,8
Convenience	20	8,2
Software	19	7,8
ChatGPT	12	4,9
Innovation	12	4,9
Coding	8	3,3
Computer	7	2,9
Autonomic	7	2,9
Future	6	2,4
Human	6	2,4
Science	5	2,0
Job	5	2,0
Fast learning	4	1,6
Uncontrolled	4	1,6
Fear	4	1,6
Machine	4	1,6
Intelligence	4	1,6
Industry	3	1,2
Loss of job/unemployment	3	1,2
Artificial intelligence applications	3	1,2
Manager	3	1,2
Other	39	15,9

The words that third-year science teacher candidates associate with the concept of artificial intelligence are given in Table 4.

Table 4. Third-Year Science Teacher Candidates’ Artificial Intelligence Word Associations

Word Relationship	Frequency	Percentage
Robot	42	20,0
ChatGPT	18	8,6
Technology	18	8,6
Convenience	14	6,7
Smart devices	12	5,7
Smart assistant	9	4,3
Computer	8	3,8
Coding	6	2,9
Intelligence	6	2,9
New Age	5	2,4
Uncontrolled	4	1,9
Algorithm	3	1,4
Anxiety, fear	3	1,4
Development	3	1,4
Human	3	1,4
Internet	3	1,4
Machine	3	1,4
Other	50	23,8

When Table 4 is examined, the words that third-grade science teacher candidates associate with the concept of artificial intelligence are robot, ChatGPT and technology. In addition, a word cloud has been prepared for concepts with a frequency of two or less under the code “Other” and the current word cloud is given in Figure 3.

Figure 3. Word Cloud Visual for the “Other” Code of Third-Grade Science Teachers



The words that fourth-grade science teacher candidates associate with the concept of artificial intelligence are given in Table 4.

Table 4. Fourth-Grade Science Teacher Candidates’ Artificial Intelligence Word Associations

Word Relationship	Frequency	Percentage
Robot	25	16,1
Smart assistant	14	9,0
Technology	14	9,0
Convenience	11	7,1
Information	8	5,2
ChatGPT	8	5,2
Internet	6	3,9
Autonomic	5	3,2
Software	5	3,2
Science	4	2,6
Computer	3	1,9
Imagination	3	1,9
Coding	3	1,9
Virtual	3	1,9
Danger	3	1,9
Creativity	3	1,9
Other	37	23,9

When Table 5 is examined, the words that fourth-grade science teacher candidates associate with the concept of artificial intelligence are robot, smart assistant and technology. In addition, a word cloud has been prepared for concepts with a frequency of two or less under the code “Other” and the current word cloud is given in Figure 4.

Figure 4. Word Cloud Visual for the “Other” Code of Fourth-Grade Science Teachers



CONCLUSION AND DISCUSSION

This study aimed to reveal the cognitive structures of science teacher candidates regarding the concept of artificial intelligence. For this purpose, a word association test was applied to the teacher candidates. As a result of the research, it was observed that science teacher candidates associated the concept of artificial intelligence with the concepts of robot, convenience, technology, ChatGPT and smart assistant the most. Seyrek et al. (2024) stated in their research with primary school teachers that teachers had positive views on the concept of artificial intelligence. In the same study, they stated that teacher candidates also had concerns about the use of artificial intelligence in education. Pekmez et al. (2024) stated in their research that artificial intelligence has positive features such as personalized learning opportunity and providing equality. In the current study, it was concluded that science teacher candidates cognitively had a positive view on artificial intelligence such as convenience and smart assistant feature. This result is also similar to the literature. In future studies, activities can be designed by taking into account the words that teacher candidates associate with artificial intelligence. It is recommended to conduct interviews to obtain more in-depth data.

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TRAININGS

CUSTOMIZABLE AI-POWERED LEARNING PLATFORM: AKILLI EĞİTİM ASİSTANI

Ekrem Tekin

The Blue Red

CONTENT

The Akıllı Eğitim Asistanı (AEA) is a groundbreaking customizable AI platform designed to revolutionize the educational experience for both educators and students in universities and schools. This platform integrates advanced technologies such as speech recognition, text-to-speech, and voice interaction to provide a seamless and interactive learning environment. AEA allows educators to upload their teaching materials into the system, enabling the AI to be trained specifically on the content relevant to their courses. This personalization ensures that students receive precise and contextual assistance at any time of the day.

One of the standout features of AEA is its continuous availability. Students can engage with the AI 24/7, asking questions either through text or voice, and receiving instant, accurate responses. This round-the-clock support enhances student learning by providing immediate help outside of traditional classroom hours. Additionally, AEA's interaction and support system includes the ability to handle both written and spoken queries, making it accessible to a wide range of learning preferences. AEA also excels in monitoring and reporting student progress. By analyzing student interactions, the AI identifies areas where students struggle and generates reports for educators. These insights enable teachers to adapt their teaching strategies to better meet the needs of their students, ultimately improving educational outcomes. Furthermore, the platform is designed with user-friendly interfaces and creative document options to simplify the learning process. The mobile application, tailored for university students, not only optimizes access to course materials but also enhances academic and social communication among students and faculty. Features such as customizable AI assistants, feedback-driven continuous development, and support for multiple languages and themes ensure that AEA is a versatile and robust tool for modern education.

In summary, Akıllı Eğitim Asistanı offers a comprehensive solution to personalize and enhance the educational experience, fostering a more efficient and supportive learning environment for all users.

Language: Turkish

Duration: 40 Minutes

QUALITATIVE DATA ANALYSIS WITH DATABEEG (AI SUPPORTED)

Firat Yilmaz - Ezgi Pasin
Databeeg

CONTENT

Introduction to Qualitative Analysis: Learn the fundamentals of qualitative research and its significance.

Hands-On Experience: Get familiar with leading qualitative analysis tools, including Databeeg AI-driven software that can streamline data processing.
Coding and Theming: Understand how to code data effectively and identify key themes using Databeeg AI assistance.

Interpreting Results: Learn to interpret AI-generated insights and incorporate them into our research.

Who Should Attend: This training is ideal for anyone involved in research, data analysis, or project evaluation.

Language:English
Duration:60 Minutes



STATISTICS

EDUCCON 2024 STATISTICS

Statistics by country of the presenters/speakers announced in the EDUCCON 2024 program:

Country	Presenter
Türkiye	18
USA	4
India	3
Bangladesh	2
Romania	2
South Korea	2
Germany	1
Italy	1
Netherlands	1
Pakistan	1
Poland	1
Spain	1
TOTAL*	37*

** 30 papers + 7 invited speeches*

Percentage of the presenters/speakers by country:

Country	Percentage
Türkiye	48.65
Other Countries	51.35

