International Journal of Innovative Research and Scientific Studies, 8(5) 2025, pages: 408-416

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Educational AI tools for ensuring inclusive education

Kuanysh Temirov[1], Dameli Kapanova[2], Kaliya Kariyeva[3], Altynay Jakina[4], Zhanat Kopeyev[5*]

[1,3,5]*L.N. Gumilyov Eurasian National University, Astana, Kazakhstan.*
[2]*Academy of Physical Education and Mass Sports, Astana, Kazakhstan.*
[4]*A. Margulan Pavlodar Pedagogical University, Pavlodar, Kazakhstan.*

Corresponding author: Zhanat Kopeyev (*Email: zhanat_kb@mail.ru*)

Abstract

The article explores the opportunities and challenges associated with the use of artificial intelligence (AI) tools in the context of inclusive digital education in higher education institutions. The aim is to identify the potential of AI technologies in creating a flexible learning environment that accommodates the individual needs of students with special educational requirements. The study involves a review of academic literature and an analysis of existing AI solutions, including adaptive learning platforms, digital assistants, and content generation tools. Particular attention is given to assessing their effectiveness, accessibility, and impact on student learning outcomes. The findings highlight both the positive effects, such as personalized learning, increased engagement, and access to educational materials and the significant challenges, including high costs, limited platform compatibility, algorithmic bias, and privacy concerns. The study concludes that a comprehensive approach to AI integration is essential, encompassing ethical regulation, staff training, and infrastructure development. The results emphasize that, when implemented properly, AI can become a key instrument in transforming inclusive education, ensuring equal learning opportunities for all categories of students.

Keywords: Artificial intelligence, Educational tools, Inclusive education, New technologies, Students.

DOI: 10.53894/ijirss.v8i5.8674
Funding: This study received no specific financial support.
History: Received: 2 June 2025 / **Revised:** 8 July 2025 / **Accepted:** 10 July 2025 / **Published:** 18 July 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

The rapid development of artificial intelligence (AI) technologies has become a key driver of the near-complete automation of many areas of our lives. It also has a significant impact on various aspects of education and is increasingly recognized by educators [1]. Overall, AI is being actively utilized and regarded as an effective tool for enhancing and streamlining teaching and learning processes. AI not only personalizes the learning experience but also provides high-

quality feedback, contributing to the creation of a more inclusive and efficient educational environment. Inclusive digital education offers substantial benefits for both students and educators by addressing the unique needs of each learner through modern technologies.

Guillemot et al. [2] define digital education as a means of enabling students with disabilities to learn alongside their non-disabled peers.

In many countries, legislation or policies are in place to support and integrate students with special needs into the educational environment [3].

In Kazakhstan, the state is committed to creating conditions within the education system that enable children with special educational needs to receive education, taking into account their individual developmental characteristics [4].

Modern AI-based tools offer extensive opportunities for students, educators, and academic institution administrators, contributing to the advancement of inclusive digital education. However, some higher education institutions have expressed concerns that the use of AI in the educational system may challenge the authenticity of student work.

The purpose of this study is to identify and analyze the benefits and challenges associated with the use of advanced AI-based tools in higher education. Particular attention is given to inclusive digital education, the potential advantages offered by AI technologies, and the issues that arise during their integration into the pedagogical environment of universities.

The relevance of this research is driven by the increasing number of students with special educational needs who require innovative approaches to organizing the learning process. Traditional teaching methods often fail to meet their individual ways of perceiving information and levels of development. To ensure effective education, it is necessary to develop personalized learning trajectories, which is only possible through the active implementation of modern information and communication technologies (ICT) and new teaching methodologies.

The authors of the article pose the following research question: *What are the benefits and challenges associated with the use of AI-based tools to ensure inclusive digital education in higher education institutions?*

To address this question, an analysis of related studies on this issue will be conducted. The article will begin by outlining the methods used and the research assumptions, which encompass various aspects of inclusive digital education. This will be followed by an examination of well-known approaches used in the development and implementation of inclusive digital education. Particular attention will be given to AI tools, their role in inclusive education, as well as the benefits and emerging challenges associated with their use.

2. Literature Review

Inclusive education is increasingly regarded as a vital element of sustainable development, ensuring equal access to learning for all categories of students regardless of their physical, mental, sensory, cognitive, social, or cultural characteristics. According to the United Nations Convention on the Rights of Persons with Disabilities [5], states are obligated to provide an inclusive educational system in which every learner has the opportunity to develop within a supportive and adaptive learning environment. Against this backdrop, AI technologies are gaining growing recognition as tools capable of significantly transforming educational practices and enhancing the effectiveness of inclusive approaches.

Recent literature emphasizes the potential of AI in adapting educational content, creating personalized learning pathways, and eliminating barriers that hinder equal student participation in the learning process. Authors such as Pedro et al. [6] and Alam [7] highlight that AI can become a powerful instrument for implementing inclusive pedagogy due to its capacity to analyze large datasets, adapt materials, and provide timely feedback. This is particularly relevant when working with students with special educational needs, for whom traditional teaching methods often prove ineffective.

As emphasized by Dalton [8] and Mag et al. [9], the inclusive model involves the active participation of children with a wide range of disabilities, from physical to mental, in general education settings. this necessitates the adaptation of curricula and teaching methods. the authors underscore the importance of creating a safe and developmentally supportive environment that allows every child to realize their potential. inclusive education fosters social integration, cultivating a sense of belonging and satisfaction among students.

Among the most promising AI tools in the context of inclusion are adaptive learning systems. Platforms such as Squirrel AI (China), Century Tech (UK), and Knewton use machine learning algorithms to analyze student behavior, identify knowledge gaps, and deliver individualized assignments. According to Zhang et al. [10] the use of such systems leads to increased motivation and academic performance, including among students who struggle with attention or content assimilation.

Speech synthesis and recognition technologies (TTS and STT) play a particularly important role in supporting learners with visual, hearing, or motor impairments. Tools such as Microsoft Immersive Reader and Read & Write offer text-to-speech conversion, visual content adaptation, and grammar simplification, significantly enhancing the accessibility of learning materials for students with dyslexia, low vision, and other perceptual limitations.

The integration of AI-based automatic translation and subtitling services such as Google Translate or Otter.ai helps to overcome language barriers in multicultural classrooms and among migrant children. These technologies enable students to access materials in their native language, thereby improving comprehension and reducing stress associated with learning in a new linguistic environment.

Robotic solutions such as NAO and Kaspar are being used in educational settings with children on the autism spectrum. Research by Martinez-Martin et al. [11] and Cabibihan et al. [12] confirms that social robots contribute to the development of communication skills, reduction of anxiety, and formation of positive behavior in interactive environments. These technologies are a valuable addition to pedagogical strategies, especially when an individualized approach is required.

In addition, AI technologies are being employed to assess student engagement and emotional states by analyzing non-verbal signals. According to Holmes et al. [13], computer vision-based tools can detect signs of fatigue, loss of interest, or difficulty, enabling teachers to adjust their instructional strategies accordingly. However, the authors also warn of the need to adhere to ethical standards and ensure data privacy when using such technologies.

The use of AI is also being integrated with the concept of Universal Design for Learning (UDL), which aims to provide equal access to education through the creation of flexible and adaptive learning environments. AI tools support multimodal information delivery, task differentiation, and student support at all stages of the educational process. However, effective implementation of these solutions requires teacher training, methodological support, and a willingness to shift away from traditional educational practices.

Numerous publications raise concerns about the risks associated with the implementation of AI in inclusive education. Authors such as Holmes et al. [13] and Selwyn [14], and others note that AI algorithms may perpetuate social biases if trained on unbalanced datasets. Furthermore, the lack of transparency in many AI systems makes it difficult for teachers and parents to understand how these technologies operate.

Digital inequality remains a significant barrier to the effective use of AI in education. The UNESCO report [15] highlights that students in low-income countries often lack access to digital infrastructure, internet connectivity, and digital literacy. In such contexts, the introduction of AI tools must be accompanied by comprehensive government policies aimed at bridging the digital divide and improving technological accessibility.

Recent studies [16-18] indicate a growing interest in the development of ethically sound, culturally sensitive, and locally relevant AI solutions. Special attention is being paid to the creation of explainable AI (XAI) models, which help educators and learners better understand the rationale behind the system's decisions and thereby build trust in the technology.

Finally, an important area of research is the preparation of teachers for the use of AI tools. Studies by Petko et al. [19] and Hwang et al. [20] stress that the successful integration of AI into inclusive education is impossible without proper professional development. Educators must be not only technically competent but also knowledgeable about inclusion principles, digital ethics, and methods for adapting curricula to meet the specific needs of learners.

In conclusion, the reviewed literature demonstrates that AI tools hold substantial potential for enabling inclusive education. They support the consideration of individual learning needs, enhance the accessibility of educational materials, and assist teachers in implementing personalized instructional strategies. However, realizing this potential effectively requires a comprehensive approach that includes infrastructure development, teacher training, adherence to ethical standards, and active involvement of all stakeholders in the digital transformation of education.

3. Methods

As part of the study, an analysis of scientific publications, a review of existing solutions, and their functional capabilities were conducted. To identify research and examples of the use of AI tools to support inclusive education, a comprehensive literature review was performed on online platforms such as Scopus, EBSCO, Elsevier, Mendeley, and Google Scholar.

4. Materials

Recent studies confirm the significant impact of AI on educational processes. Research focused on the application of AI in inclusive education is rapidly gaining global attention [21, 22]. However, as noted by Kazimzade et al. [21] and colleagues in their book chapter [21], there is a lack of interaction between research in the fields of AI and disability. In this regard, we propose the integration of Learning Analytics technologies and AI to more effectively manage the learning process of students with special educational needs within the context of inclusive education.

Inclusive digital education aims to create a learning environment that ensures equal access to education for all students, including those with special educational needs.

The relevance of inclusive education is supported by international standards and initiatives, such as the United Nations Convention on the Rights of Persons with Disabilities, which emphasizes the right of all children to access education [23].

It should be emphasized that the implementation of these principles requires a comprehensive approach, which includes the professional training of educators, active engagement with families and the community, as well as the integration of modern technologies.

Inclusive digital education aims to leverage technology to eliminate learning barriers such as geographical remoteness, economic constraints, social and cultural obstacles, as well as developmental characteristics and the specific needs of learners. The significance of inclusive education lies in providing equal opportunities for all students, regardless of their physical, intellectual, or emotional differences. This approach offers learners a flexible, personalized, and accessible educational experience tailored to their individual needs and interests. The use of artificial intelligence in education opens up new possibilities for personalized learning by creating adaptive educational environments that respond to the unique needs of each student. For example, machine learning algorithms can analyze data on student behavior and academic performance, providing teachers with valuable insights for designing individualized learning plans. This is particularly important in the context of inclusive education, where attention to detail plays a critical role in ensuring student success [24].

Digital accessibility plays a key role in creating an inclusive educational environment. It ensures equal opportunities for all learners, including individuals with disabilities, those with health-related limitations, and those facing temporary or situational barriers. When digital content is not designed with accessibility principles in mind, students with special needs

may encounter significant obstacles in the learning process, leading to unequal educational outcomes. Technologies developed in accordance with the principles of universal design help eliminate barriers for learners with special needs and provide equal access to knowledge.

Accessible digital content in education offers numerous benefits, including:

- Improved readability and navigation: content designed with accessibility in mind is more convenient and user-friendly for all students;
- Enhanced engagement and comprehension: accessible materials help learners better absorb information and maintain focus;
- Support for inclusion and diversity: ensuring equal access to all educational resources regardless of students' physical abilities.
- For example, to make digital educational materials accessible to students with visual impairments, several aspects of accessibility must be considered:
- Screen reader-accessible content and audio description: include text that can be read by screen reader programs, provide alternative text for images, diagrams, and charts, and offer audio versions of texts;
- Contrast and scalable text: use high-contrast color schemes and enlarged fonts;
- Tactile and 3D solutions: integrate raised tactile materials;
- Navigation and control: ensure compatibility with keyboard and voice control systems.

5. Results and Discussion

The foundations for ensuring inclusive digital education are based on the Index for Inclusion developed by Booth and Ainscow [25] For implementing the principles of inclusion in school practice, this index encompasses three interconnected dimensions: policy, culture, and practice of inclusive education Figure 1.

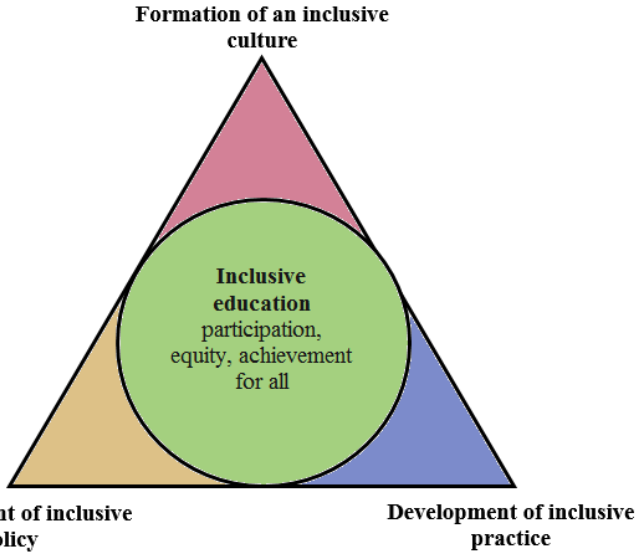

Figure 1.
Dimensions of the Index for Inclusion.

For the integration of the Index for Inclusion into real educational ecosystems, pedagogical approaches such as Universal Design for Learning (UDL) and Differentiated Instruction (DI) are widely applied [26]. These approaches provide a structural framework for adapting the educational process to the diverse needs of learners Figure 2.

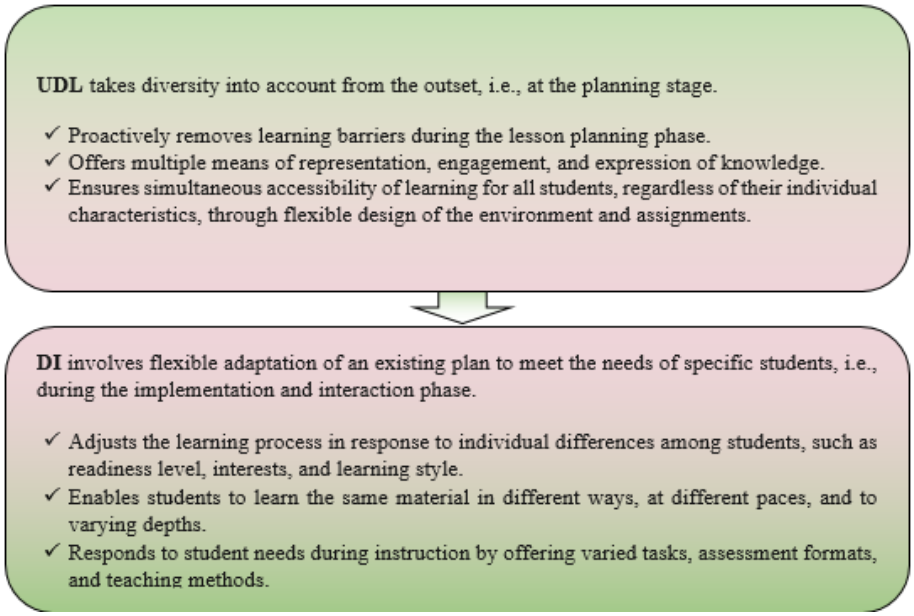

Figure 2.
UDL and DI: The foundation of flexible and inclusive education

Figure 2 illustrates how the combined application of two contemporary pedagogical approaches contributes to the formation of an inclusive, effective, and stimulating educational environment tailored to meet the learning needs of every student.

In the context of rapid digital technology development and the growing emphasis on accessible education for all learner categories, the use of AI has become a key factor in shaping an inclusive educational environment. Modern AI tools allow for the consideration of a wide range of individual differences, including prior knowledge, cognitive characteristics, learning styles, and the needs of students with disabilities.

Among these tools are intelligent tutoring systems, adaptive learning platforms, automated assessment tools, analytics dashboards, and digital assistants [27, 28]. These technologies not only support personalized learning but also provide flexibility in content delivery, diverse forms of feedback, and the capability for continuous monitoring of educational progress. Tools designed for generating visual and audio content further expand access to educational materials for learners with various sensory and cognitive needs [29-31].

Thus, the integration of AI tools into educational practice facilitates the realization of inclusive principles, ensuring equal conditions and opportunities for all participants in the educational process, regardless of their individual characteristics. In this regard, specific AI-based solutions aimed at implementing inclusive digital education acquire particular significance.

AI-Based Tools for Inclusive Digital Education Tables 1-3 help adapt learning materials, automate support, and personalize the learning process.

Table 1.
Characteristics of the Tools.

Tool Name	Technology Type	Category	Platforms (web, mobile, desk, etc.)	Notes and Licensing
ChatGPT (openai.com)	Generative AI	Language learning and writing support	Web, mobile	Free version with limited functionality; paid subscription
Duolingo AI (duolingo.com)	Adaptive AI	Language learning	Mobile, web	Free basic access; Duolingo Plus subscription
Seeing AI (microsoft.com)	Visual AI	Support for people with visual impairments	Mobile	Free, available only on iOS
Microsoft Immersive Reader (microsoft.com)	Natural Language Processing (NLP)	Reading and writing support	Web, desk	Free for educational organizations
Bookshare (bookshare.org)	Text-to-Speech Technology	Access to books for people with visual impairments	Web, mobile	Free for registered users with special needs
Khan Academy AI (khanacademy.org)	Generative AI	Learning across various disciplines	Web, mobile	Free, Creative Commons license
Jasper AI (jasper.ai)	Generative AI	Content creation and learning support	Web	Paid subscription with a 5-day trial period
Google Bard (bard.google.com)	Generative AI	Problem solving and creative writing	Web	Free, available for Google users

Table 2.
Advantages of AI Tools for Inclusive Education.

Tool Name	Advantages for Education	Advantages of Inclusive Education
ChatGPT	Fast access to explanations of complex topics, assistance with writing	Supports students with language barriers, helps create accessible materials
Duolingo AI	Personalized learning, gamified approach	Supports learners with varying levels of language proficiency
Seeing AI	Recognizes objects, text, and faces for people with visual impairments	Supports individuals with disabilities in educational settings
Microsoft Immersive Reader	Enhances text comprehension, adds visual cues	Assists students with dyslexia and text perception difficulties
Bookshare	Access to books in audio format	Expands access to learning materials for students with visual impairments
Khan Academy AI	Discipline-based learning at an individual pace	Personalized support for students with diverse learning needs
Google Bard	Fast and accurate answers, works in multiple languages	Supports cross-cultural learning and linguistic diversity
Jasper AI	Creates high-quality texts for educational purposes	Assists students with limited writing skills

Table 3.
Challenges of AI Tools for Inclusive Education

Tool Name	Challenges for Education	Challenges for Inclusive Education
ChatGPT	Possible inaccuracies in responses, lack of context	Limited access for students without internet, language bias
Duolingo AI	Limited content for rare languages, high subscription cost	Advanced features are unavailable to students from low-income families
Seeing AI	Available only on iOS, limited language functionality	Inaccessible for Android users, language barriers in text recognition
Microsoft Immersive Reader	Tied to the Microsoft ecosystem	Restrictions for users of other platforms
Bookshare	Requires proof of disability	Access limitations in countries with underdeveloped infrastructure
Khan Academy AI	Does not always provide detailed explanations	Limited usefulness without internet access
Google Bard	Limitations in multitasking	Possible errors when processing complex texts
Jasper AI	High subscription cost	Inaccessible to students with low income

The analysis of the presented tables demonstrates that AI tools possess significant potential to support inclusive education through personalized learning, the creation of accessible content, and the removal of barriers for students with special needs. For instance, tools such as *Seeing AI* and *Bookshare* provide access to educational materials for individuals with visual impairments, while *Microsoft Immersive Reader* supports learners with dyslexia. Additionally, AI tools enhance formative assessment by offering both educators and students opportunities for effective analysis and improvement of learning outcomes. However, several substantial limitations have also been identified: high cost (e.g., *Jasper AI*), limited platform compatibility (*Seeing AI* is available only on iOS), and the requirement for internet access and disability verification (in the case of *Bookshare*). Therefore, for the full implementation of inclusive digital education, it is essential to consider not only the technical capabilities of AI but also access barriers, socio-economic disparities, and infrastructure limitations.

Thus, the integration of AI into education indeed opens new horizons for personalization, adaptive platforms, and support for students with special educational needs (SEN). However, alongside these prominent advantages lie significant challenges, particularly in the context of inclusion. The educational environment faces a number of issues when implementing AI and new technologies in inclusive education.

- Technological challenges include difficulties in integrating AI systems into the existing educational infrastructure, technical incompatibilities, and resistance from educators and institutions to adopting innovations.
- Pedagogical challenges are related to algorithmic bias and errors in AI models, which can distort predictions of academic performance and the optimization of learning strategies, thereby negatively affecting the personalization of learning [32].
- Data and privacy issues arise from the need to collect and process large volumes of students' personal data. To ensure data security, educational institutions must implement strict protection measures and develop transparent data collection and usage policies [33].
- Cultural and social challenges arise from the risk of cultural bias in AI systems, particularly when the cultural and socio-economic characteristics of students are not adequately considered [34]. AI is currently unable to fully integrate cultural context into the educational process, which can lead to social isolation and reduced interpersonal interaction between students and teachers [35].

Nevertheless, despite the aforementioned challenges and issues, the integration of artificial intelligence technologies into the educational process opens up broad opportunities for enhancing learning effectiveness. AI contributes to improving the quality of education, increasing student productivity and engagement through personalized approaches, timely feedback, and individualized support. One of the main benefits for students is the increase in motivation and interest in learning, as well as the creation of a more interactive and engaging educational environment [36].

AI technologies also offer new opportunities for inclusive education by promoting individualized learning, enhancing cognitive and communicative activity, and fostering the development of key competencies among students. Research confirms the positive impact of AI on the educational outcomes of students with disabilities and those from socially vulnerable groups, due to access to personalized educational platforms that help overcome learning barriers [37].

AI technologies provide educators with tools for professional development, including means for self-analysis and the improvement of teaching methods. Adaptive learning systems allow for a more precise consideration of individual student characteristics, while the automation of assessment and feedback reduces routine workload and enhances the effectiveness of pedagogical interaction [38].

AI holds particular significance in the education of children with special educational needs. Adaptive learning algorithms and visual support contribute to improved reading skills in children with dyslexia and to academic progress among students with autism spectrum disorders [39].

Thus, artificial intelligence is becoming a key tool in implementing an inclusive approach, ensuring accessibility, flexibility, and quality of education for all learner categories.

6. Conclusion

The conducted analysis confirmed that artificial intelligence tools possess significant potential in shaping inclusive digital education. The use of AI contributes to the personalization of the learning process, broadens access to educational resources, and adapts instruction to the individual needs of students with special educational needs. Specifically, the integration of intelligent assistants, adaptive platforms, and digital accessibility tools enables the creation of a flexible, supportive, and motivating educational environment.

However, alongside these evident advantages, the implementation of AI is accompanied by a number of systemic challenges ranging from technological and pedagogical limitations to issues of ethics, privacy, and cultural sensitivity. These identified challenges underscore the need for a comprehensive approach to the digital transformation of education, which includes improving the regulatory framework, developing digital infrastructure, and preparing educators to work with AI systems.

Thus, when properly integrated, AI can become not merely a technological solution but a key driver of inclusive education transformation. Its potential lies not only in removing learning barriers but also in rethinking the very approach to educational inclusion, making it more flexible, personalized, and equitable. Future research should focus on the development of ethically sustainable, inclusively oriented, and pedagogically grounded AI tools that can ensure equal access to quality education for all learner categories and contribute to the sustainable development of educational systems on a global scale.

References

[1] X. Chen, H. Xie, D. Zou, and G.-J. Hwang, "Application and theory gaps during the rise of Artificial Intelligence in Education," *Computers and Education: Artificial Intelligence*, vol. 1, p. 100002, 2020. https://doi.org/10.1016/j.caeai.2020.100002

[2] F. Guillemot, F. Lacroix, and I. Nocus, "Teachers' attitude towards inclusive education from 2000 to 2020: An extended meta-analysis," *International Journal of Educational Research Open*, vol. 3, p. 100175, 2022. https://doi.org/10.1016/j.ijedro.2022.100175

[3] C. S. Lozano, S. Wüthrich, J. S. Büchi, and U. Sharma, "The concerns about inclusive education scale: Dimensionality, factor structure, and development of a short-form version (CIES-SF)," *International Journal of Educational Research*, vol. 111, p. 101913, 2022. http://dx.doi.org/10.1016/j.ijer.2021.101913

[4] Republic of Kazakhstan, "On amendments and additions to certain legislative acts of the republic of Kazakhstan on improving the licensing system," 2011. https://online.zakon.kz/document

[5] United Nations, "Toolkit on disability for Africa: Inclusive education," 2017. https://www.un.org/esa/socdev/documents/disability/Toolkit/Inclusive-Education.pdf

[6] F. Pedro, M. Subosa, A. Rivas, and K. Valverde, *Artificial intelligence in education: Challenges and opportunities for sustainable development*. Paris, France: UNESCO, 2019.

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

[8] E. M. Dalton, "Beyond universal design for learning: Guiding principles to reduce barriers to digital & media literacy competence," *Journal of Media Literacy Education*, vol. 9, no. 2, pp. 17-29, 2017.

[9] A. G. Mag, S. Sinfield, and T. Burns, "The benefits of inclusive education: New challenges for university teachers," in *MATEC web of conferences*, 2017, vol. 121: EDP Sciences, p. 12011.

[10] X. Zhang, F. Zhu, K. Wang, G. Cao, Y. Xue, and M. Liu, "Bring the intelligent tutoring robots to education: A systematic literature review," *IEEE Transactions on Learning Technologies*, 2024.

[11] E. Martinez-Martin, F. Escalona, and M. Cazorla, "Socially assistive robots for older adults and people with autism: An overview," *Electronics*, vol. 9, no. 2, p. 367, 2020.

[12] J.-J. Cabibihan, H. Javed, M. Ang Jr, and S. M. Aljunied, "Why robots? A survey on the roles and benefits of social robots in the therapy of children with autism," *International Journal of Social Robotics*, vol. 5, no. 4, pp. 593-618, 2013. https://doi.org/10.1007/s12369-013-0202-2

[13] W. Holmes, M. Bialik, and C. Fadel, *Artificial intelligence in education*. Geneva, Switzerland: Globethics Publications, 2023.

[14] N. Selwyn, *Should robots replace teachers?: AI and the future of education*. Hoboken, NJ, USA: John Wiley & Sons, 2019.

[15] International Commission on the Futures of Education, "Reimagining our futures together: A new social contract for education. UNESCO," 2021. https://www.unesco.org/en/articles/reimagining-our-futures-together-new-social-contract-education

[16] W. Yang, "Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation," *Computers and Education: Artificial Intelligence*, vol. 3, p. 100061, 2022.

[17] N. Nurdyansyah, M. B. U. B. Arifin, I. R. I. Astutik, and P. Rais, "Online inclusive school: A technological breakthrough in inclusive education during the Covid-19 period," *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, vol. 8, no. 4, pp. 806-816, 2022.

[18] G. Makwana, "The concept of inclusive education in India," 2022. https://www.researchgate.net/publication/362546631_The_Concept_of_Inclusive_Education_in_India

[19] D. Petko, D. Prasse, and A. Cantieni, "The interplay of school readiness and teacher readiness for educational technology integration: A structural equation model," *Computers in the Schools*, vol. 35, no. 1, pp. 1-18, 2018.

[20] G.-J. Hwang, H. Xie, B. W. Wah, and D. Gašević, "Vision, challenges, roles and research issues of artificial intelligence in education," *Computers and Education: Artificial Intelligence*, vol. 1, p. 100001, 2020.

[21] G. Kazimzade, Y. Patzer, and N. Pinkwart, "Artificial intelligence in education meets inclusive educational technology—the technical state-of-the-art and possible directions," in Artificial Intelligence and Inclusive Education: Speculative Futures and Emerging Practices, J. Knox, Y. Wang, and M. Gallagher Eds. Singapore: Springer Singapore, 2019, pp. 61-73. https://doi.org/10.1007/978-981-13-8161-4_4

[22] S. Z. Salas-Pilco, K. Xiao, and J. Oshima, "Artificial intelligence and new technologies in inclusive education for minority students: A systematic review," *Sustainability*, vol. 14, no. 20, p. 13572. https://doi.org/10.3390/su142013572.

[23] United Nations, "Convention on the rights of persons with disabilities (CRPD)," n.d. https://www.un.org/ru/documents/decl_conv/conventions/disability.shtml
[24] M. Anis, "Leveraging artificial intelligence for inclusive English language teaching: Strategies and implications for learner diversity," *Journal of Multidisciplinary Education Research*, vol. 12, no. 6, pp. 54–70, 2023.
[25] T. Booth and M. Ainscow, *Index for inclusion: Developing learning and participation in schools*. Bristol, UK: CSIE, 2002.
[26] B. Šumak *et al.*, "AI-based education tools for enabling inclusive education: Challenges and benefits," in *2024 47th MIPRO ICT and Electronics Convention (MIPRO)*, 20-24 May 2024 2024, pp. 472-477. 10.1109/MIPRO60963.2024.10569714.
[27] T. Adiguzel, M. H. Kaya, and F. K. Cansu, "Revolutionizing education with AI: Exploring the transformative potential of ChatGPT," *Contemporary Educational Technology*, vol. 15, no. 3, 2023. https://doi.org/10.30935/cedtech/13152
[28] Z. Zulpykhar, K. Kariyeva, A. Sadvakassova, R. Zhilmagambetova, and S. Nariman, "Assessing the Effectiveness of Personalized Adaptive Learning in Teaching Mathematics at the College Level," *International Journal of Engineering Pedagogy*, vol. 15, no. 4, pp. 4-22, 2025. https://doi.org/10.3991/ijep.v15i4.52797
[29] K. Mukhamediyeva, Z. Nurbekova, G. Nurgazinova, and G. Aimicheva, "Enhancing engineering thinking skills of pre-service IT teachers through cross-cutting educational technologies and stem projects," *International Journal of Education and Practice*, vol. 13, no. 2, pp. 669-687, 2025.
[30] N. Karelkhan, D. Meiirbekkyzy, and P. Gapbarova, "High-performance parallel computing on the Param Bilim supercomputer in higher education," *World Transactions on Engineering and Technology Education*, vol. 22, no. 2, pp. 137–143, 2024.
[31] A. Z. Assambayev, Z. Y. TAICHIK, and G. Sharapidenovna, "Interactive educational digital resources for computer science in terms of transition to the trilingual training," *Espacios*, vol. 38, no. 40, pp. 5-5, 2017.
[32] C. European Commission, "Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators," Publications Office of the European Union Luxembourg, 2022.
[33] UNESCO, "Draft text of the recommendation on the ethics of artificial intelligence," Intergovernmental Meeting of Experts (Category II), 2021.
[34] M. A. Lliego, "Contextual adaptability and cultural sensitivity in AI-driven education," 2023. https://www.teacherph.com/contextual-adaptability-cultural-sensitivity-ai-driven-education/
[35] O. o. E. T. U.S. Department of Education, *Artificial intelligence and future of teaching and learning: Insights and recommendations*. Washington, DC: U.S. Department of Education, 2023.
[36] R. Zhilmagambetova, Z. Kopeyev, A. Mubarakov, and A. Alimagambetova, "The role of adaptive personalized technologies in the learning process: Stepik as a tool for teaching mathematics," *International Journal of Virtual and Personal Learning Environments*, vol. 13, no. 1, pp. 1-15, 2023. https://doi.org/10.4018/IJVPLE.324079
[37] M. Jain, P. Kumar, I. Bhansali, Q. V. Liao, K. Truong, and S. Patel, "FarmChat: A conversational agent to answer farmer queries," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, vol. 2, no. 4, pp. 1-22, 2018. https://doi.org/10.1145/3287048
[38] A. Anil Yasin and A. Abbas, "Role of gamification in Engineering Education: A systematic literature review," in *2021 IEEE Global Engineering Education Conference (EDUCON)*, 21-23 April 2021 2021, pp. 210-213, doi: 10.1109/EDUCON46332.2021.9454038.
[39] M. Chassignol, A. Khoroshavin, A. Klimova, and A. Bilyatdinova, "Artificial Intelligence trends in education: a narrative overview," *Procedia Computer Science*, vol. 136, pp. 16-24, 2018. https://doi.org/10.1016/j.procs.2018.08.233