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The use of artificial intelligence in the field of inclusive education institutions

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Abstract

The Republic of Kazakhstan places paramount importance on universal values, the potential for a good life, respect for human rights, and ensuring complete freedom for personal growth, just like any other state proud to be democratic, secular, lawful, and social. This essay explores one of the key priorities in this domain: ensuring equal opportunities for all groups of people. All students, including those with special needs, have equal access to education through inclusive education. By leveraging artificial intelligence technologies, educators can better tailor their courses to the needs of each student, optimize the learning process, and enhance feedback and assessment tools. The essay examines the potential of artificial intelligence in inclusive education, as well as its benefits for improving student performance and personalizing the learning process. It also considers the challenges associated with using AI. The research findings suggest that the effective application of AI technology to enhance inclusive education is promising and opens new opportunities for the education system.

Keywords: Artificial intelligence, Computer science education, Education, Educational program, Inclusion, Special educational needs.

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1. Introduction

Teachers recognize and appreciate how artificial intelligence (AI) has transformed nearly every aspect of education. The long-term use of AI in education could become one of the most significant innovations of the century. Overall, artificial intelligence (AI) is widely acknowledged as a powerful tool that enhances and accelerates learning. AI is also crucial to educational research, curriculum development, and technological advancement. Artificial intelligence has the

potential to enhance individual-oriented learning and feedback transmission techniques. This aids in the development of an inclusive learning environment.

This contributes to the development of inclusive education. All children should receive a first-class education that enables them to successfully master the core curriculum in local schools and participate in community activities, regardless of any obstacles. This is the goal of inclusive education [1].

Although inclusive education holds an important place in the field of education, it requires extensive efforts as it demands changes to curricula, care, and the creation of an equitable educational system for all students. Organizational, methodological, moral, psychological, and technological changes are just a few examples of what is needed. While artificial intelligence has revolutionized education, this technology cannot be used in isolation to achieve the desired educational outcomes. To ensure the sustainable development and integration of artificial intelligence in educational institutions, it is essential to have a comprehensive understanding of its impact on the existing education system.

Thus, the purpose of this study is to examine the impact of AI on inclusive education through a review and analysis of the literature. This will involve exploring various case studies, analyzing both the positive and negative consequences of AI integration, and identifying best practices for creating an inclusive educational environment. By highlighting the challenges and opportunities associated with artificial intelligence, the study aims to provide valuable insights for educators and policymakers alike. Few studies have specifically examined the effects of AI on inclusive education, as well as the many advantages and uses of AI in inclusion, according to a review of the literature. To fill this gap, this theoretical study provides a critical review of the impact of AI on inclusive education. The main objective is to summarize the key paradigms and offer guidance for future research by describing relevant theoretical foundations, conceptual studies, and practical implementations.

2. Literature Review

Inclusive education has become one of the priorities of global education policy in recent decades. According to Khan [2], inclusion involves creating conditions under which students with special educational needs can study on an equal basis with their peers. Against this background, there is a growing interest in using technologies, in particular artificial intelligence (AI), to improve the accessibility and quality of educational services.

AI is regarded as a powerful tool for personalizing learning. Research indicates that adaptive AI-based educational platforms, such as recommendation learning systems, can address the individual needs of students, including those with various forms of disabilities [3]. Such systems analyze the student's behavior, the speed of completing tasks, and the style of information perception, and based on this data, suggest the optimal way to master the material.

The works of emphasize that AI can become a significant factor in overcoming barriers to learning for people with disabilities, especially in the context of visual, hearing, and cognitive impairments. For example, voice assistants and text-to-speech systems are already actively used to support students with visual impairments.

However, the introduction of AI into an inclusive educational environment is accompanied by a number of challenges. As noted, there is a danger of algorithm bias that may exacerbate pre-existing educational inequalities. There is also an insufficiently developed ethical and legal framework governing the use of AI in the educational process, especially when working with vulnerable categories of students.

Despite this, the general direction of research confirms the potential of AI in transforming inclusive education. The development of collaborative learning systems, emotion recognition systems for engagement monitoring, and automatic progress assessment tools all demonstrates the potential for creating a more accessible and equitable educational environment.

3. Materials and Methods

According to the United Nations [4] cornerstones of inclusive education are providing all pupils with access to relevant and practical information and adhering to moral standards, attitudes, and behaviors, regardless of their religious beliefs. The UN emphasized that ensuring equal access to education for every student is a key goal of inclusive education. In 2017, the UN recognized the importance of inclusivity and outlined its fundamental principles [5]. Regardless of a student's skin color, race, ethnic origin, geography, or disability, the fundamental tenet of inclusion is to educate them all [6].

The need to create an inclusive environment that provides all students with equal opportunities, regardless of their physical or mental limitations, is one of the most pressing issues facing modern education. The implementation of the Concept for the Development of Preschool, Secondary, Technical, and Vocational Education in the Republic of Kazakhstan for 2023–2029 [7] is at the center of this issue in Kazakhstan. This is particularly relevant for the implementation, which involves creating inclusive learning conditions. Inclusive education requires a deep understanding and analysis of various situations associated with special educational needs. This approach covers a wide range of diagnoses that require adapted teaching strategies, creating conditions for the effective learning of all students (Figure 1).

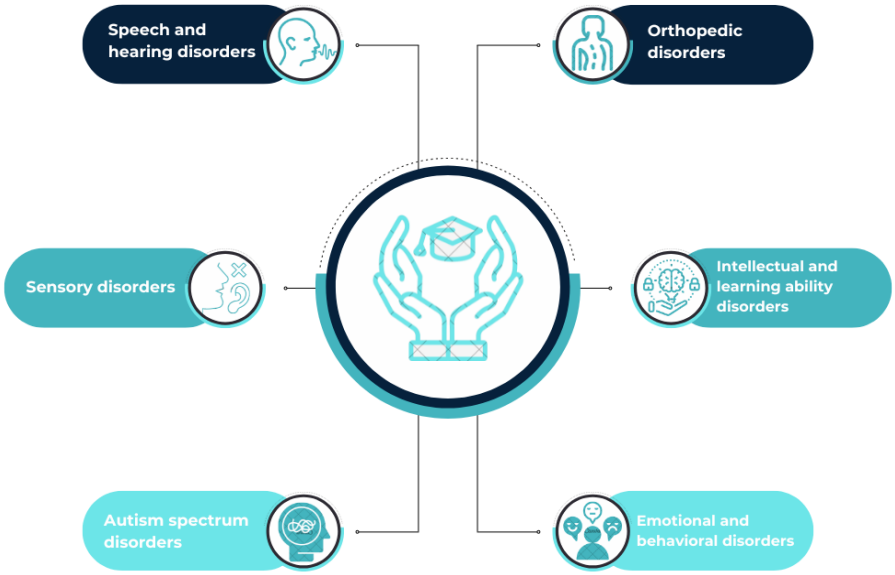

Figure 1.
Categories of Disorders Requiring Special Educational Support.

In the Republic of Kazakhstan, there has been rapid development of inclusive education, as evidenced by the significant increase in the number of students involved in inclusive education programs. In 2019, over 50,000 students were engaged in the inclusive education system, indicating that it was implemented with the support of government initiatives in this area. By 2023, the number of students with special educational needs exceeded 162,000, of whom more than 50,000 had access to inclusive programs. Figure 2 shows the number of students with special educational needs. Such growth is associated with the active development of state policy aimed at expanding inclusive education. The majority of students with special educational needs study in special institutions or inclusive groups. To ensure equal access to their education and social adaptation, special programs and methods adapted to their individual needs are being developed and implemented.

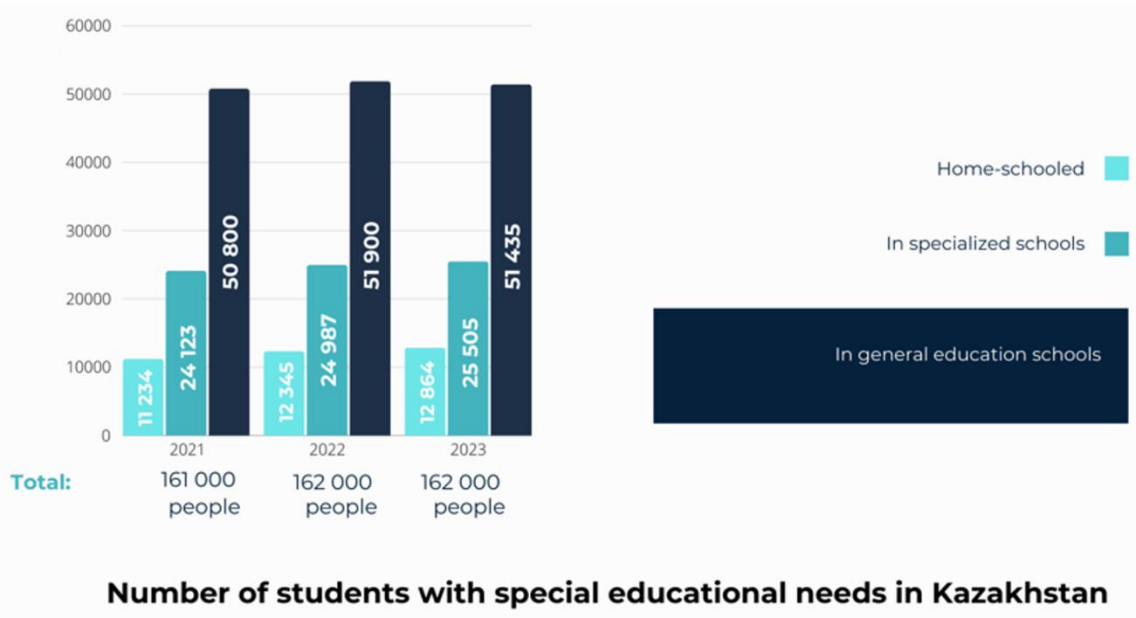

Figure 2.
Statistics of students with inclusive education needs.

It is important to create an inclusive environment to ensure equal education. Teachers must make every effort to ensure that students receive proper education. The curriculum should be revised to meet the needs of all students. It is necessary to create conditions in which all students can freely develop their abilities. Students with special educational needs should feel comfortable and confident during the learning process.

Educational institutions take on the task of adapting the learning process and making necessary changes to meet the needs of all students. This requires teachers to have a deep understanding of their students and the ability to adapt the learning material according to individual needs. Such an approach not only improves the quality of education but also contributes to the effective use of the research potential of educational institutions.

In this context, bibliometrics is recognized as a significant methodological tool, representing a quantitative research approach that employs mathematical and statistical techniques to evaluate the prevalence and influence of scientific publications. The use of the Bibliometrix package in the R programming environment for analyzing information from databases facilitates the extraction of valuable information about the scientific activities of countries, renowned institutions, leading authors, and influential journals and publications. Therefore, the analysis of scientific data in educational institutions serves as a fundamental resource for improving the educational process and promoting research initiatives [8].

Bibliometrix was developed using keywords in accordance with research questions in the environment. After several test searches, some keywords were changed, and a list of cities was shown by the authors who conducted a scientific study on these keywords. As a result, the latest keywords used in all scientific databases were employed. In the database search tool, we selected the following keywords: "inclusive education," "artificial intelligence," "people with disabilities," "students with intellectual disabilities and health limitations," and "teaching methods in inclusive education," as shown in Figure 3. Titles, abstracts, keywords, and conclusions can be used to assess the significance of each found item. In this analysis, we divided the articles into three categories: (1) those that fully align with our topic; (2) those that are indirectly related to the topic; (3) those that are completely excluded as irrelevant. The next step is to carefully examine all the texts of the selected articles, accept them, and prepare them according to our specific criteria.

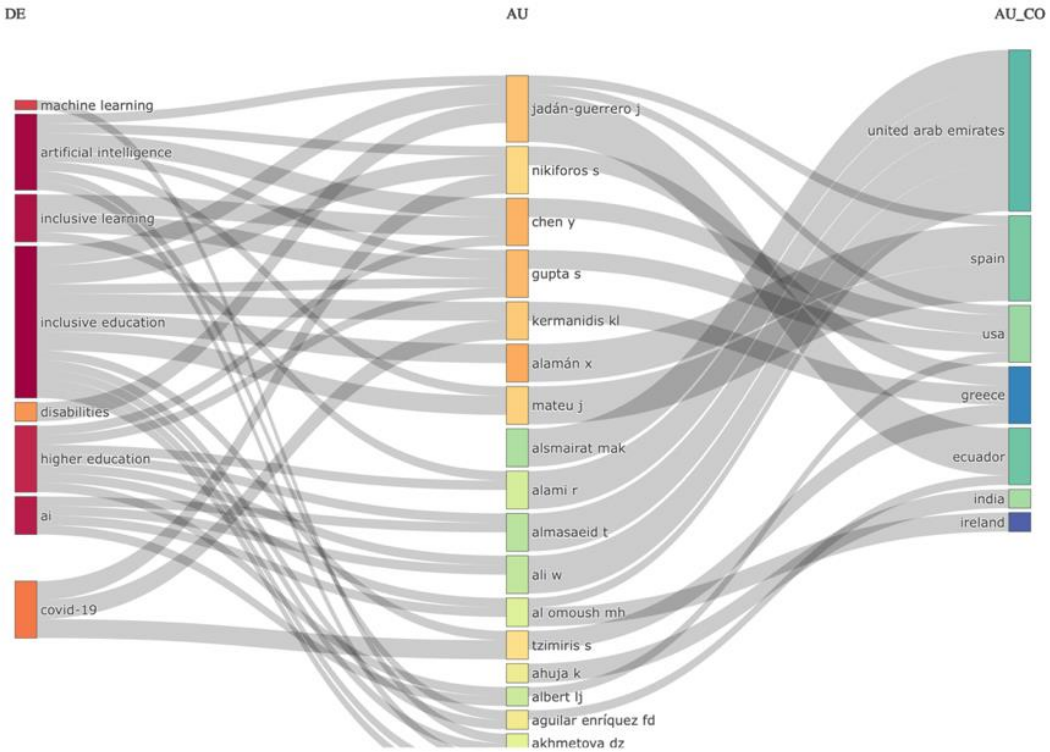

Figure 3.
Keywords in databases, article authors and a list of cities.

The analysis period covers 2004-2024. To ensure important documents are not overlooked, the search criteria included "all years (2004-2024)" and "all documents." The evaluation process, including the criteria for selecting documents, is shown in Table 2. The study's scope encompasses all issues related to inclusive education, particularly the use of artificial intelligence technologies in teaching students with special needs. Table 1 summarizes the bibliometric data: this study includes 29 articles, 34 conference materials, 4 review articles and 8 book chapters.

Table 1.
Summary of bibliometric objects.

Main Information About Data	
Timespan	**2004:2024**
Sources (Journals, Books, etc)	58
Documents	75
Annual Growth Rate %	18.34
Document Average Age	1.91
Average citations per doc	6.093
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	530
Author's Keywords (DE)	299
AUTHORS	
Authors	259
Authors of single-authored docs	4
AUTHORS COLLABORATION	
Single-authored docs	4
Co-Authors per Doc	3.56
International co-authorships %	24
DOCUMENT TYPES	
article	29
book chapter	8
conference paper	34
review	4

The 21st century is characterized by a technological revolution and informatization, particularly the rapid development of artificial intelligence and machine learning. Artificial intelligence (AI) refers to the execution of specific intellectual tasks using computer tools. AI systems are technical systems that continuously replicate various aspects of human intelligence, implemented in computer programs through specialized logical systems [9].

One of the main definitions of artificial intelligence is the skilled imitation of human behavior. Over the years, definitions of artificial intelligence have evolved to include more detailed information about technologies and their applications, as shown in Figure 4 [10]. Artificial intelligence can perform a vast number of diverse calculations, make complex decisions at incredible speeds, and uncover new knowledge and trends from vast amounts of data. However, the essence of the definition of artificial intelligence has not changed, and one of the main goals of AI is that the skilled imitation of human behavior has not been fully realized.

SOURCE AND YEAR	DEFINITION OF AI
Dictionary of the English language, 1979.	Not specified.
Oxford Dictionary, 1991.	Artificial subheading: the application of computers to areas that usually require human intelligence.
Cambridge Dictionary of advanced learners, 2003.	Complete record: study how to build machines that have some of the qualities of the human mind, such as the ability to understand language, recognize images, solve problems, and learn.
Online search-Oxford Dictionary, 2018.	Complete recording: theory and development of computer systems capable of performing tasks that require human intelligence, such as visual perception, speech recognition, decision making, and translation between languages.

Figure 4.
Dictionary of the definition of GI.

Today, artificial intelligence is transforming not only fields such as finance, security, human resources, and healthcare but also education. It creates a student-centered learning environment, offering various solutions for personalization, adaptation, and flexibility.

AI systems enable students to develop personalized learning paths by analyzing data such as academic performance, preferences, and learning styles. This approach can be especially advantageous for students with special needs, disabilities, or language barriers. Artificial intelligence can also substantially enhance accessibility by automatically generating transcripts, converting text to speech, or transforming visual content into alternative formats. These features allow students with sensory or cognitive impairments to access information and actively participate in the learning process.

Artificial intelligence has the potential to revolutionize inclusive education by offering innovative solutions to meet the diverse learning needs of students. Figure 5, shown below, shows progress in creating an inclusive educational environment with artificial intelligence applications.

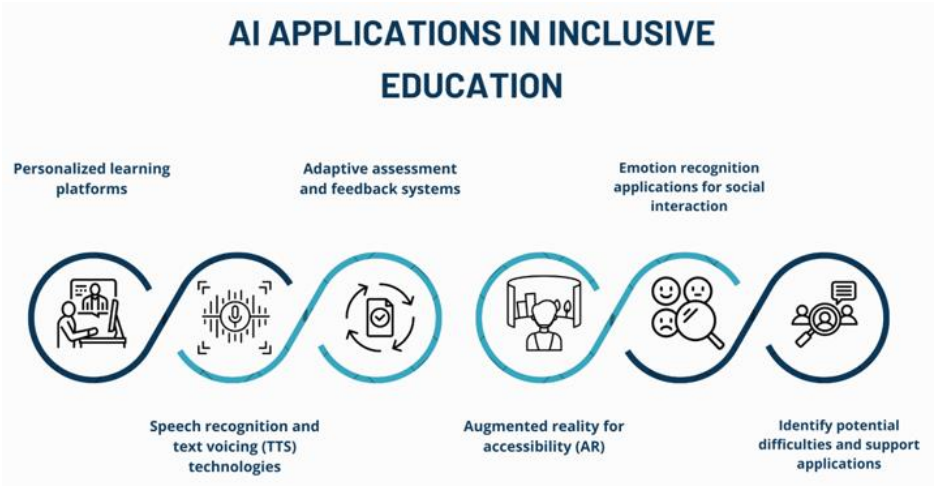

Figure 5.
Applications of AI in inclusive education.

Personalized learning platforms based on artificial intelligence analyze each student's progress, learning pace, and benefits. This allows teachers to adapt the content and methods of training to the needs of each student. Artificial intelligence-based speech recognition and TTS technologies help learners with different learning abilities, such as dyslexia or speech disorders. These tools create an inclusive group environment by transforming spoken language into written text and vice versa. Artificial intelligence-controlled adaptive assessment tools evaluate students' knowledge and skills, provide real-time feedback, and adapt them to the complexity of tasks according to their abilities. This ensures an assessment process that meets the capabilities of each student. Augmented Reality applications can provide virtual support and additional information and increase availability. For example, Augmented Reality can provide sign language translation or additional information related to activities in the group, which is useful for students with different learning needs. Emotion recognition tools based on artificial intelligence help teachers understand the emotional state of students. This is especially important when supporting learners with autism or emotional disorders, as well as promoting the creation of an empathic and inclusive learning environment. Artificial intelligence can contribute to the early detection of learning difficulties and disorders. By analyzing patterns in student performance and behavior, AI systems identify potential challenges and enable teachers to intervene in a timely manner and provide targeted support. This approach will prevent academic difficulties and help all students succeed [1].

4. Results and Discussion

The international experience of implementing inclusive education in general education schools opens up new opportunities for people with disabilities. Today, similar educational methods are used in more than 40 countries around the world. In Germany, Norway, France, Spain, the USA, Canada, and several other developed countries, the issues of educating people with disabilities are addressed using inclusive educational methods [11].

At the initial stages, artificial intelligence (AI) helped students with disabilities and English language learners. However, AI must meet the needs of all students. Teachers must ensure that AI is beneficial in teaching and learning, prioritizing the needs of all students. It is important for students to participate in various stages such as designing, developing, testing, improving, implementing, and managing AI-supported educational technologies. This includes studying existing AI tools, methods of data usage, and developing new AI applications based on teacher feedback [12].

In addition, they need to conduct trial research, evaluate tools, and collaborate with developers to improve the system's reliability. Students need to interact with specialists in the field of education and technological decision-making. These include teachers, educational leaders, students, parents, technologists, researchers, and policymakers. Listening to suggestions, gathering ideas, and participating in discussions contribute to the integration of AI in teaching and learning.

According to Margetts and Dorobantu [13], AI has the ability to use behavioral data about students to provide individualized and customized educational services that meet each student's needs. AI also helps with learning, planning and more precise prediction.
The same paper claims that certain UK local governments are already utilizing predictive analytics to foresee future requirements in fields like children's social services and SE. Students who are deemed to be "at risk" can also be identified using this prediction [14, 15]. Canada, New Zealand, and the United States already have such warning systems in place.

Artificial intelligence can be a valuable tool for teachers to support, develop, and improve students' learning, but it cannot completely replace the work of teachers. AI allows teachers and students to concentrate on important areas such as guidance, emotional support, motivation, and the development of creativity and critical thinking through automation of repetitive tasks and qualitative data analysis [16].

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According to the scientific literature, AI cannot replace teachers because it does not have the ability to fully reproduce human intelligence and creativity. Since it has no consciousness or emotions, AI has a limited capacity to fully understand complex human experiences and perform creative tasks. However, in some cases, hybrid human-AI work is more likely to be adopted. AI can support human resources in key tasks such as delivering educational programs, advising students, providing socio-psychological support, and evaluation.

In order to effectively use AI to improve teaching and learning, it is always necessary to centralize teachers (ACE-Always Center Educators). In practice, following the "ACE in AI" principle means focusing on a more humane approach to learning. The ACE principle tells the Department of Education, "Will AI replace teachers?" and allows you to answer a firm "no" to the question: "What is it?" This principle not only facilitates the work of teachers but also allows teachers to understand students more deeply and respond creatively in the course of training [18, 19].

The use of artificial intelligence in the field of education contributes to increasing student interaction, improving their ability to acquire knowledge, and developing information research skills. At the same time, artificial intelligence tools enable students to gain experience in the learning process and achieve full development. Statistics on the use of artificial intelligence in education in foreign practice are shown in pie chart 1 [20, 21].

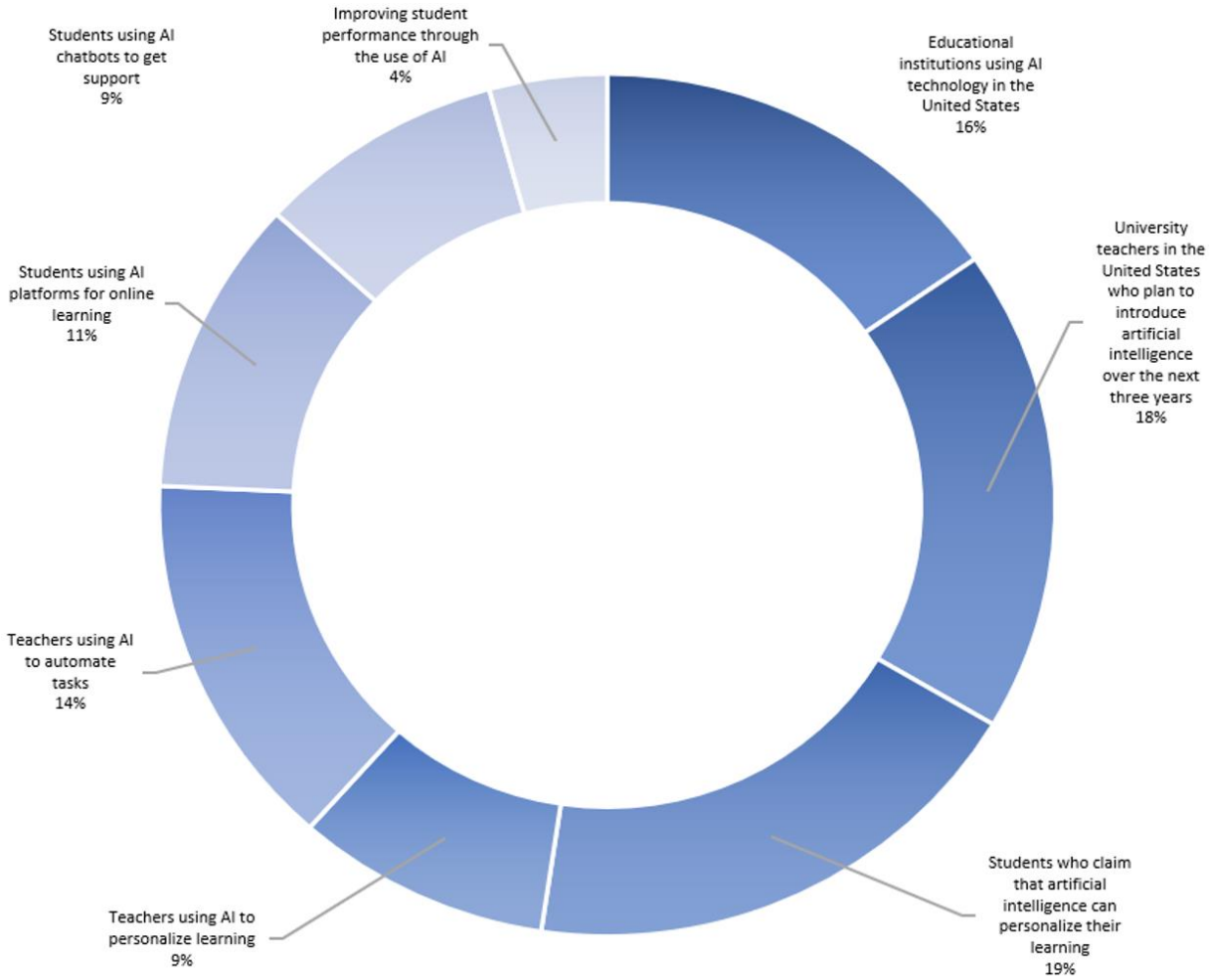

Figure 6.
Statistics on the use of artificial intelligence in Education (Foreign experience).

According to the available data for 2024, the use of artificial intelligence in the education system in Kazakhstan is still at the initial stage of development. However, there is a rapid increase in the use of artificial intelligence technologies in various facets of education. This trend is expected to continue and develop in the coming years.

5. Conclusion

Artificial intelligence (AI) technologies significantly enhance education, but special attention should be given to inclusivity to reach all students and ensure quality education. AI technologies can play an important role in supporting inclusivity because technologies do not work in isolation from society; rather, they complement each other.

This article presents and discusses a general overview of the state of application of AI technologies in inclusive education. It has been established that various types of AI and new technologies are used for inclusive education support and to develop inclusion. Therefore, AI has the main advantages that increase the overall abilities of students and stimulate their capabilities. AI plays an important role in promoting inclusive education, affirming inclusive education, and improving the teaching and learning process.

In conclusion, artificial intelligence technologies can become an important component of inclusive education, facilitating the creation of flexible and personalized learning paths for students with disabilities. However, effective use requires a comprehensive approach based on scientific data, technological support, and interdisciplinary collaboration.

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