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ARTIFICIAL INTELLIGENCE IN KAZAKHSTAN'S EDUCATION SYSTEM: ANALYSIS AND PROSPECTS

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Abstract. The article explores the impact of artificial intelligence (AI) on Kazakhstan's education system and its potential to fundamentally transform learning and administrative processes. AI's ability to analyze big data allows educators to gain deeper insights into student performance, predict outcomes, and develop strategies to improve academic achievement. It also enhances personalized learning by offering students tailored educational content that matches their individual knowledge levels and learning pace. The automation of administrative tasks such as scheduling and grading significantly improves the efficiency of educational institutions, allowing teachers more time for direct engagement with students. The article thoroughly examines both the benefits and challenges of AI integration, including issues of digital inequality, access to modern technologies, and the need for ongoing professional development for teachers. Ethical considerations related to the protection of student data are also emphasized. Examples of successful AI implementation in international education platforms are provided, offering valuable insights for Kazakhstan. The article discusses opportunities for further investment in educational infrastructure and outlines key areas for digital development.

Keywords: artificial intelligence, big data, education, Kazakhstan, personalized learning, automation, data analytics.

Introduction. In the era of digital transformation and rapid technological advancement, artificial intelligence (AI) has become an integral part of educational systems worldwide. Kazakhstan, following global trends, is actively integrating AI into its educational processes as part of its digitalization program. The relevance of this topic is due to the necessity of adapting the education system to new challenges related to increasing demands for quality and accessibility of

educational services. Digital transformation in Kazakhstan is aimed at enhancing educational processes, personalizing learning, and improving the management of educational institutions. AI enables the analysis of large amounts of data generated during the educational process, opening new opportunities for monitoring student performance, adapting curricula, and improving interactions between students and teachers.

The education system in Kazakhstan, similar to many other countries, faces numerous challenges, including disparities in access to quality education between urban and rural areas, varying levels of technological literacy among teachers and students, and the need to update outdated educational infrastructure. AI has the potential to address many of these issues by offering scalable, adaptive, and efficient solutions. For example, AI-powered tools can provide students in remote regions with access to high-quality educational content, regardless of the availability of local resources or teaching expertise. These tools can also personalize learning experiences, allowing students to learn at their own pace and focus on areas where they need improvement [1].

Moreover, AI systems can provide valuable insights to educators by analyzing student performance data in real-time. This allows teachers to identify struggling students early on and intervene with targeted support. Predictive analytics, driven by AI, can forecast student outcomes based on historical data, helping educational institutions to develop strategies to reduce dropout rates and improve overall academic success. AI also assists in identifying trends and patterns in student behavior, enabling institutions to adjust curricula to better align with student needs and societal demands.

In addition to improving the learning experience, AI has significant potential to optimize administrative operations within educational institutions. Tasks such as scheduling, grading, and administrative paperwork can be automated using AI, freeing up valuable time for educators to focus on teaching and student engagement. AI-based systems can streamline the management of large educational datasets, ensuring that records are accurately maintained and easily accessible for future use. Furthermore, AI can be used to create dynamic, real-time updates on educational metrics, helping decision-makers quickly identify areas that require attention [2].

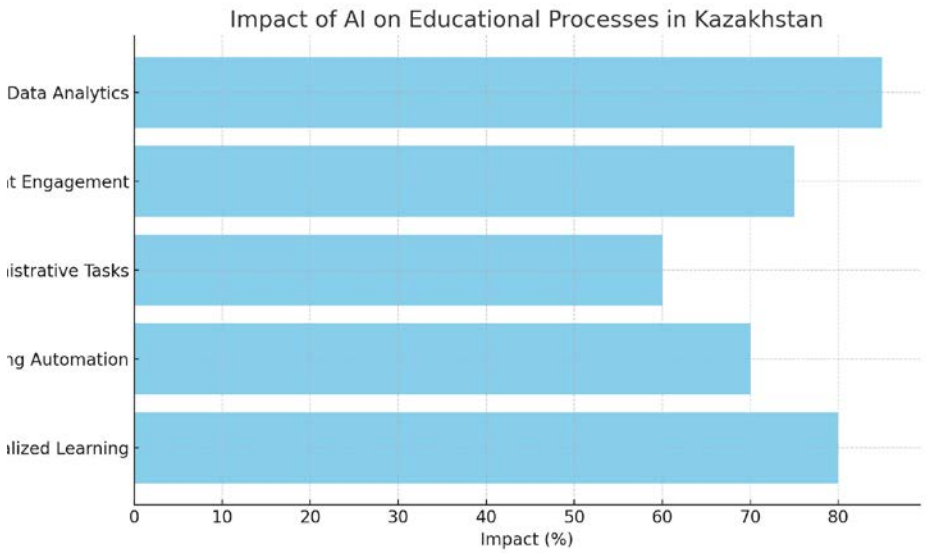

Figure 1 - Impact of AI on Educational Processes in Kazakhstan

AI has the potential to address various challenges in Kazakhstan's education system, including disparities in access to quality education between urban and rural areas, and varying levels of technological literacy. For example, AI-powered tools can provide students in remote regions with access to high-quality educational content, regardless of the availability of local

resources. AI also helps to personalize learning experiences, allowing students to learn at their own pace and focus on areas where they need improvement.

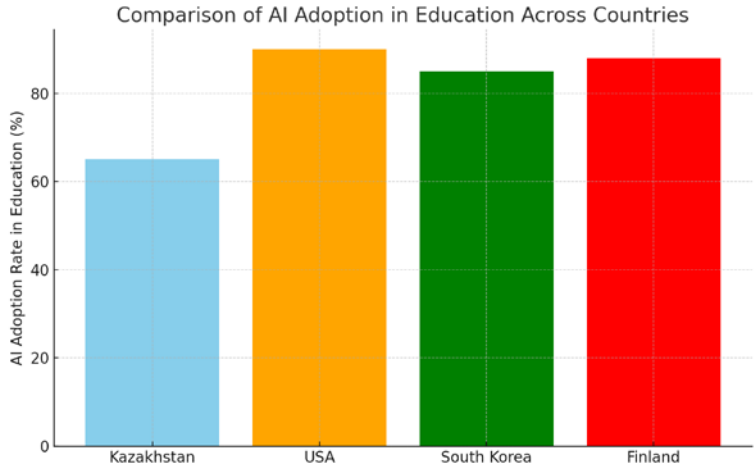

Figure 2 - Comparison of AI Adoption in Education Across Countries

Several AI-driven platforms have already been successfully implemented in Kazakhstan, showcasing the transformative power of this technology. For instance, AI-powered learning management systems (LMS) are being used to deliver personalized learning experiences, while intelligent tutoring systems provide additional academic support to students who need it. These platforms help students stay engaged and motivated by offering interactive content, instant feedback, and adaptive learning paths.

Despite the clear advantages, integrating AI into education is not without challenges. One of the main obstacles is the digital divide, which persists in many parts of Kazakhstan, particularly in rural areas where internet connectivity and access to modern technologies are limited. To fully realize the potential of AI in education, it is essential to ensure that all students and teachers have access to the necessary digital infrastructure. This may involve significant investments in broadband internet expansion, particularly in remote regions, and providing teachers with ongoing professional development to help them incorporate AI tools into their teaching practices effectively [3].

Ethical considerations are also critical when discussing the implementation of AI in education. AI systems rely on vast amounts of data, including personal information about students and teachers. Ensuring the privacy and security of this data is paramount, as is the need to prevent algorithmic biases that could lead to unequal treatment of students based on their background, gender, or other characteristics. Policymakers must establish clear guidelines and regulations regarding the ethical use of AI in education to protect the rights of students and educators.

Additionally, the integration of AI into education requires collaboration between various stakeholders, including government bodies, educational institutions, technology companies, and the broader public. In Kazakhstan, the government has already made significant strides in fostering an environment conducive to AI development, including the creation of the Astana Hub, a leading tech and innovation ecosystem. However, continued efforts are needed to ensure that AI technologies are accessible, scalable, and used in ways that align with the country's educational goals and values.

The implementation of AI in education also provides opportunities for the development of new educational models. With the ability to simulate real-world scenarios and provide immersive learning experiences through virtual reality (VR) and augmented reality (AR) technologies, AI can revolutionize the way students learn about complex topics. For example, students studying medicine can use AI-powered simulations to practice surgical procedures in a virtual environment, while engineering students can design and test prototypes using AI-enhanced modeling tools [4].

Furthermore, AI can play a pivotal role in fostering lifelong learning and upskilling initiatives, which are becoming increasingly important in a rapidly changing global economy. As traditional job roles evolve due to automation and technological advancements, there is a growing demand for continuous education and skill development. AI-driven educational platforms can provide flexible, personalized learning experiences for professionals seeking to acquire new skills or transition into new career fields. These platforms can adapt to individual learning preferences, offer real-time feedback, and track progress, ensuring that learners achieve their goals efficiently. Artificial intelligence holds immense promise for transforming Kazakhstan's education system by improving access to quality education, personalizing learning experiences, and optimizing administrative processes [5]. However, to fully harness the potential of AI, it is crucial to address the challenges related to digital infrastructure, ethical considerations, and collaboration among stakeholders. With the right strategies and investments, AI can play a key role in shaping the future of education in Kazakhstan, ensuring that the country remains competitive in the global knowledge economy.

Materials and methods. This study used the following data sources: government programs and reports from the Ministry of Education and Science of Kazakhstan, international studies and reports from organizations such as UNESCO and the World Bank, which reflect global trends and successful examples of AI use in education, as well as academic articles and publications on the use of AI for personalized learning, big data analysis, and automation of administrative processes [6].

The research methodology included a literature review and a comparative analysis of examples of AI implementation in educational systems in various countries, such as the USA, Finland, and South Korea. Particular attention was paid to programs and platforms applied in Kazakhstan, including the Astana Hub project, which promotes digitalization and AI development in the country. The study aimed to identify current trends, opportunities, and challenges associated with AI integration into educational processes, as well as to analyze how AI can improve the quality of education in Kazakhstan.

Results and discussion. The results of the study showed that Kazakhstan is actively developing its digital infrastructure and integrating artificial intelligence into educational processes. One example is the launch of the digital platform Astana Hub, which supports startups and innovative projects in the field of AI. This platform plays a significant role in promoting AI technologies in the education system by offering various solutions for personalized learning and distance education.

AI is already being used in Kazakhstan to automate routine administrative tasks such as scheduling and student enrollment. AI-powered software also helps teachers analyze student performance, identify knowledge gaps, and tailor educational programs to individual needs.

The main findings of the study include improvements in education quality due to the use of predictive analytics, increased efficiency of educational processes through the automation of administrative tasks, and adaptive learning that allows students to receive educational materials tailored to their level of knowledge and learning pace [7].

Despite positive results, the implementation of AI faces several challenges, such as insufficient infrastructure, a shortage of qualified personnel, and the need to develop ethical standards to protect student data.

Moreover, one of the key indicators of AI development is the volume of IT product exports from Kazakhstan, which showed significant growth. In 2023, the volume of exports reached $546.7 million, with $315.4 million attributed to participants of Astana Hub. These companies exported services and products to 86 countries, including the United States, Russia, Ireland, and others. Out of 1,400 registered IT companies, 394 (28%) are export-oriented, highlighting Kazakhstan's significant potential in the global market [8].

Despite successes, the share of artificial intelligence in the total export volume remains relatively small, which opens up new opportunities for development. AI implementation can

significantly accelerate IT export growth, create new innovative projects, and help the country reach a new level in high-tech industries.

Conclusions. The integration of artificial intelligence (AI) into Kazakhstan's education system offers significant potential to improve the quality of learning, automate administrative tasks, and provide personalized education. AI can help educators better analyze student performance, customize learning materials, and improve institutional efficiency. Predictive analytics and automation can also help reduce student dropout rates and make learning more adaptive to individual needs.However, realizing AI's full potential requires substantial investments in digital infrastructure, particularly in rural areas where access to modern technology remains limited. Addressing this digital divide is essential to ensure equal opportunities for all students.Moreover, the development of a robust regulatory framework is crucial. This includes data protection policies and guidelines to prevent algorithmic biases that could disadvantage certain student groups. Clear standards are needed to ensure the ethical use of AI while safeguarding the privacy of both students and educators.

Teacher training is another critical area. Educators need to be equipped with the necessary digital skills to effectively integrate AI into their teaching practices. Without sufficient support and training, the adoption of AI tools may face significant challenges.Finally, ethical considerations, especially around data privacy and security, must be a priority. Protecting personal information and ensuring fairness in AI-driven decisions are key to maintaining trust in these systems.

In conclusion, while challenges remain, AI presents an exciting opportunity to modernize Kazakhstan's education system. By addressing infrastructure, regulatory, and training needs, the country can harness AI's power to create a more equitable, efficient, and personalized learning environment.

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ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ В СИСТЕМЕ ОБРАЗОВАНИЯ КАЗАХСТАНА: АНАЛИЗ И ПЕРСПЕКТИВЫ

Аннотация. В статье исследуется влияние искусственного интеллекта (ИИ) на систему образования Казахстана и его способность коренным образом изменить процессы обучения и управления. Особое внимание уделено использованию ИИ для анализа больших данных, что позволяет педагогам глубже понимать успеваемость студентов, прогнозировать их результаты и разрабатывать стратегии для улучшения академической успеваемости. ИИ также играет ключевую роль в персонализированном обучении, предоставляя каждому студенту учебные материалы, адаптированные под его уровень знаний и темп усвоения. Автоматизация административных процессов, таких как составление расписания и оценка, позволяет существенно повысить эффективность управления образовательными учреждениями, высвобождая время для преподавателей на взаимодействие с учениками. В статье подробно рассматриваются как преимущества, так и вызовы внедрения ИИ, включая вопросы цифрового неравенства, доступности современных технологий и необходимости профессионального развития преподавателей. Этические аспекты, связанные с защитой данных студентов, требуют особого внимания. В качестве примеров приводятся успешные международные практики использования ИИ в образовании, которые могут быть полезны для Казахстана. Обсуждаются перспективы цифрового развития и направления для дальнейших инвестиций в образовательную инфраструктуру.

Ключевые слова: искусственный интеллект, большие данные, образование, Казахстан, персонализированное обучение, автоматизация, аналитика данных.

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ҚАЗАҚСТАННЫҢ БІЛІМ БЕРУ ЖҮЙЕСІНДЕГІ ЖАСАНДЫ ИНТЕЛЛЕКТ: ТАЛДАУ ЖӘНЕ ПЕРСПЕКТИВАЛАР

Аңдатпа. Мақалада Қазақстанның білім беру жүйесіне жасанды интеллекттің (ЖИ) әсері және оның оқыту мен басқару процестерін түбегейлі өзгерту мүмкіндігі талқыланады. ЖИ-ды үлкен деректерді талдауда қолдану арқылы педагогтар студенттердің оқу үлгерімін тереңірек түсініп, олардың нәтижелерін болжауға және академиялық жетістіктерді арттыру стратегияларын әзірлеуге мүмкіндік алады. ЖИ сондай-ақ жеке оқытуды жетілдіруге ықпал етеді, әрбір студентке оның білім деңгейі мен оқу қарқынына бейімделген оқу материалдарын ұсынады. Әкімшілік процестерді автоматтандыру, мысалы, сабақ кестесін жасау және бағалау сияқты міндеттерді жеңілдету арқылы білім беру мекемелерінің тиімділігін айтарлықтай арттырады. Мақалада ЖИ енгізудің артықшылықтары мен қиындықтары, соның ішінде цифрлық теңсіздік, заманауи технологияларға қолжетімділік және мұғалімдердің кәсіби дамуының қажеттілігі мәселелері кеңінен қарастырылады. Студенттердің деректерін қорғауға қатысты этикалық аспектілерге ерекше назар аударылды. Халықаралық тәжірибеде білім беруде ЖИ-дың табысты енгізілу мысалдары келтіріліп, Қазақстан үшін пайдалы ұсыныстар жасалды. Білім беру инфрақұрылымына инвестиция салу және цифрлық дамудың негізгі бағыттары анықталады.

Кілт сөздер: жасанды интеллект, үлкен деректер, білім беру, Қазақстан, жекелендірілген оқыту, автоматтандыру, деректерді талдау.