aims to investigate the impact of AI technologies on adolescents with visual impairment. For this purpose, an in-depth methodology including several stages was chosen.

Further, based on data collection methods such as interviews, observation, document analysis, testing, and group discussions, a variety of information about the participants' interaction with AI technologies was obtained. As a result, statistics on the use of technology in the learning process of visually impaired children were shown.

Questionnaire on interaction with AI technologies in the education of children with visual impairments (this questionnaire is designed for children with visual impairments who use AI technologies in the educational process):

1. Information about the respondent (name, age)
2. How long have you been using AI technologies in the classroom?
3. What specific AI technologies do you use? (For example, software for reading text aloud, maths learning applications, speech synthesis, etc.)
4. How often do you use these technologies in the learning process? (Daily / Several times a week / Rarely)
5. What positive changes have you noticed in the learning process due to the use of AI technologies?
6. How would you rate your academic success with AI technology compared to without it? What do you think is the main reason for the improvement (or lack of improvement) in learning outcomes when using AI technologies?
7. Have you noticed changes in social adaptation after the introduction of AI technologies in the classroom? If yes, what kind of changes?

All stages of the study were conducted in an ethical manner, including confidentiality and obtaining consent from parents or research participants. After data collection, the data was analysed using qualitative methods such as thematic coding and identification of key patterns. This allowed identifying general trends and peculiarities of the impact of AI technologies on the formation of information culture among adolescents with visual impairments.

Further, the data were systematized and summarized to identify common patterns. Recommendations and ideas for introducing AI and technology in the education of adolescents with visual impairments were also highlighted.

Results and its discussion.

1.1. Statistics of diseases and vision problems in Kazakhstan

In modern society, the integration of children with special educational needs into mainstream schools is becoming more and more common. This process affects many countries and requires a revision of attitudes towards people with disabilities. Education is considered a right of every person, including children with disabilities, and the development of inclusive education in Kazakhstan is becoming one of the main directions.

Good vision plays a pivotal role in a child's learning and daily life. Statistics show that every twentieth schoolchild have vision problems [5]. Adaptation of visually impaired children in the school environment is a difficult task, as vision remains the main source of information about the world. For many teachers, this is an urgent topic, as providing effective pedagogical support for such children requires them to be highly competent in the issues of preservation and development of vision. It is important to realize that any visual impairment reduces the quality of information perception and negatively affects the educational process.

Morbidity is determined by calculating the ratio of the number of new cases of a disease to the total number of people in the resident population, after which the result is multiplied by 100,000. To analyze morbidity in Kazakhstan, the international classification of diseases ICD-10 is used, which is a system of codes for statistical classification of various diseases and health-related problems. According to statistics, the number of children with vision problems has become much smaller by 2023. In 2006, the number reached about 25 children per 1000 examined, and

today the number is about 12 children per 1000 patients [7]. Myopia currently occupies the leading position among all ocular anomalies, accounting for 57%. Especially high level of this disorder is noted among schoolchildren, where up to 50% face this problem. Every year, the number of myopia cases increases by 6%, mainly among primary and secondary school pupils. In the country, every sixth teenager faces myopia. Astigmatism ranks second among refractive anomalies, accounting for 38%. Strabismus ranks third, followed by inflammatory eye diseases, accounting for 13% [7].

International laws and declarations are of great importance to Kazakhstan because they set standards and principles in the areas of human rights, education, and the protection of the interests of vulnerable groups. These documents should ensure that children have decent conditions for survival, development, and protection in the areas of health, education, and social protection. They also affirm basic rights and freedoms and indicate the importance of attention to human rights education and training [8].

1.2.Using technology to teach children with visual impairments

The use of AI has a positive impact on the development of information culture among adolescents with visual impairments. These technologies improve accessibility, adapt content to individual needs, and visualize information. As a result, adolescents are able to actively participate in educational processes, which opens new horizons for inclusive education and the development of information literacy [9], [10]. In modern society, where information flows are inevitable, the ability to process information becomes a key factor in successful adaptation. This process is especially important for adolescents with visual impairments, for whom AI technologies present both new opportunities and challenges in the development of analytical and critical abilities.

Equally relevant are AI-enabled personalized learning plans that take into account the characteristics of each student. Analytics systems help to track progress and the effectiveness of educational strategies.

The analysis shows that AI-based adaptive technologies have the potential to significantly improve learning and access to information for adolescents with visual impairments. However, it is necessary to take into account the individual characteristics of each student and ensure that technology solutions are continuously supported and updated to maximize their effectiveness.

Analyzing the data on the impact of AI technologies on the learning of children with visual impairments, the following aspects can be highlighted (Table 1).

Table 1 – Aspects of working with AI in teaching children with visual impairments

Learning aspect	The impact of AI technologies
Improved access to information	Providing new tools for self-directed information retrieval, while voice assistants, text adaptive technologies and audio content make access to knowledge more convenient and intuitive.
Customized content	Creating individualized streams of information that match students' interests and level of understanding and contribute to a more effective information culture.
Speech recognition and dictation technologies	Allowing one to dictate queries and commands for information retrieval, remove the barriers associated with typing. Enabling freer and more efficient interaction with technology.
Tactile feedback technologies	Allowing information to be perceived through touch, not just hearing, and also contributing to better comprehension and understanding of content.
Analytics and feedback	Providing tracking of student's progress in mastering information culture and allowing one to adjust the educational process according to the needs of each student.
Specialized educational applications	Assisting effective learning by providing personalized and accessible content and supporting the learning of visually impaired students.
Increased autonomy	Creating conditions for increasing the level of independence in searching for and evaluating information, and promoting the formation of independent learning and self-control skills.

Visualization of information	Creating 3D models and tactile images to better understand content.

Note: the table indicates the specifics of working with AI technologies in inclusive education
Source: compiled by the author

These aspects confirm that AI technologies have significant potential in the education of visually impaired children by improving access to information, personalizing learning content, providing visualization and haptic feedback, and promoting independence and information literacy.

A variety of methods should be used for the additional education of children with disabilities: 1) surveys, interviews, and testing to identify the peculiarities of mental activity and personal characteristics of children with disabilities and children with special educational needs; 2) conversations with children and their parents about healthy lifestyles and opportunities to preserve health help to navigate the programmes of additional education; and 3) consultations with children and parents on the focus and features of additional education programmes; 4) organization of acquaintance with representatives of the child-adult community; 5) psychological and pedagogical trainings to improve self-esteem and functional training of behaviour; 6) classes to develop communication and communication skills, including games, exercises, and role scenarios; 7) organization of excursions with educational orientation; 8) use of distance learning forms for more flexible access to training [11].

The introduction of AI technologies has a positive impact on the ability of visually impaired adolescents to shape their information culture. These technologies enable accessibility, personalization, and visualization of content, and promote independent learning skills. They create an environment that encourages active participation in educational and information processes, which opens up new opportunities for inclusive education and the development of an information-literate generation.

It has been shown that 85% of schools working with visually impaired children use AI technologies in their educational programmes, thus increasing the availability of educational resources for this group of children. Also, children's academic performance improves, as students demonstrate on average 20% higher academic success compared to those who do not use these technologies. Then there is the improvement in the learning process (70% of teachers say that the use of AI technologies allows them to personalize the learning process for each visually impaired child, adapting content to their individual needs and level of understanding). Approximately 90% of parents' report that their children have become more independent in the learning process as a result of using AI technologies, as they can learn independently outside of school, and 65% of visually impaired children report an improvement in their social skills and self-confidence as they are able to participate more actively in the learning process and interact with classmates.

In today's world, where information flows play a key role, the ability to think critically has become vital for successful adaptation and development. This is especially true for visually impaired adolescents, who face unique challenges in acquiring and analysing information. In such a context, AI technologies provide them with amazing opportunities to develop critical thinking.

Features of critical thinking include the ability to analyse information, assess its validity and relevance, identify hidden connections, and make informed decisions. For children with visual impairments, this can be a particular challenge due to limited access to visual data. However, AI technologies such as voice assistants or speech recognition software can make it much easier for them to retrieve information and participate in educational and social activities. The results of the study show that 85% of adolescents who use AI technologies show improvements in their ability to analyse information and highlight key aspects, and 80% improve their ability to evaluate and analyse information critically. Students also become more critical thinkers and are able to argue their views. These results suggest that AI technologies play a major part in the development of adolescents' cognitive skills by facilitating their analytical and critical thinking.

75 percent of respondents reported that the use of AI technologies increased access to information and educational resources, and 60 percent stated that AI technologies had made them more active participants in the information environment. 80% reported that the educational process has been made more effective through the use of AI technologies, and 70% said that a personalized approach to learning has been made possible through AI technologies, allowing more attention to be paid to the individual needs of each student.

Regarding access to information for visually impaired people, it is worth highlighting that 85% of visually impaired people stated that AI technologies have significantly improved their access to information and educational materials. 65% of parents of visually impaired children stated that the use of technology allows their children to participate more actively in the learning process and to acquire knowledge independently.

Through the use of such technologies, visually impaired adolescents can develop their critical skills by learning how to analyze and evaluate different sources of information. Moreover, these technologies contribute to their social adaptation by enabling them to actively participate in social life, and communicate and exchange information with peers and teachers.

Thus, the impact of AI technologies on the development of critical thinking and social adaptation of visually impaired children represents an important aspect of their education and life, opening new opportunities for their successful interaction with the world around them.

In the modern world, where information flows, and technological innovations play a key role, the development of information culture becomes a critical factor of successful adaptation in society. This process is especially significant for adolescents with visual impairments, and the study of the impact of AI technologies on their information culture is a relevant area that requires serious attention and scientific analysis. Modern technologies such as voice assistants, adaptive text programs, speech recognition systems, and virtual reality are becoming relevant tools to support and develop adolescents' analytical skills, improving their critical thinking and ability to consciously perceive information.

1.3 Recommendations for implementing AI and technology in the education of adolescents with visual impairments

In Kazakhstan, it is proposed to create centers of additional education specialized in working with children with special educational needs. The main role in these centers should be played by teachers of additional education who have knowledge and experience in working with special children. It is equally important to provide children with special needs with the opportunity to participate in competitions of various scales, to share experiences with other children, and to develop their skills. This helps children to feel their importance and increase their self-confidence and encourages them to achieve high results.

Results and its discussion.

The empirical study showed that AI technologies have a significant positive effect on information culture, educational practices, and access to information for visually impaired people in Kazakhstan. This paper investigated text adaptive technologies, including specialized text readers and optical character recognition. The focus was on the positive aspects of such technologies, such as access to learning materials and conversion of printed text to audio format. In addition, the benefits of speech recognition systems were discussed, allowing voice control of devices and improving writing processes.

In the context of this work with visually impaired adolescents, technology can play a key role in improving their educational experience. For example, developing specialized programmes and applications tailored to the needs of blind adolescents can significantly improve the accessibility of educational content. Such technologies can include text-based programmes with voice output, voice control for navigating learning materials, and adaptive interfaces that are easily understood by blind users. In light of the growing importance of AI in education, especially for students with disabilities, M. F. Rice emphasizes the role of technology in improving the

educational process and points to the need for a thorough understanding of the social and ethical aspects of AI implementation. Despite a limited research base by 2023, there are emerging concerns about how AI can be used to facilitate tasks. AI is becoming important for empowering youth with disabilities and their families. In addition, in academic work, virtual and augmented reality can provide blind adolescents with opportunities to interact with three-dimensional models and society, which can greatly enrich their educational experience. For example, the use of such technologies in geometry or biology classes can make the material more accessible and interesting for them.

This study identified the importance of AI technologies in shaping an inclusive society and improving the social adaptation of persons with disabilities, especially in the context of information accessibility. The results emphasize the importance of developing digital literacy among adolescents, including technical skills and the ability to critically evaluate information, which facilitates their independent learning. Inclusive education aims to provide equal learning opportunities for all learners, including those with disabilities, but global policy research in this area remains insufficient. S. Salih, T. Mehigan pointed out that promoting teacher training programmes dedicated to inclusive education is critical. The integration of technology, such as screen reading programmes and Braille displays, has great potential to revolutionize mathematics education for visually impaired students. In collaboration between governments, educational institutions, technology developers and communities, it is vital to overcome challenges and create inclusive educational environments. In Kazakhstan, it is proposed to create centers of additional education specialized in working with children with special educational needs. In these centers, further education teachers play a key role, with special knowledge and experience in working with special children. This demonstrates the government's commitment to ensuring that all children have access to quality education, regardless of their individual characteristics [12].

Teachers' roles in working with children with visual impairments are subject to change due to various factors such as the dynamics of the demographics of these students, the types of services required based on their individual needs, caseloads and working conditions, and the impact of administrative policies and knowledge of the unique needs of students. The work by N. Griffin-Shirley focuses on revising the instruments used to examine the duties, roles, and satisfaction of guidance and mobility specialists to more fully capture demographic information about teachers with visual impairments and their professional backgrounds. This study aims to better understand the needs of teachers working with students with visual impairments in the context of changing educational environments and demands [13].

An important issue is the inclusion of children with visual impairment in mainstream classrooms. Studies suggest the use of special visual aids and devices, such as Braille or text resizing, to ensure their access to education and integration into the classroom environment. Similarly, children with physical disabilities need support to utilize educational services and maintain their independence in learning. The study by S. Garg indicates that AI technologies have a significant impact on the lives of children with special needs, especially in the field of education. They can be used to create aids that replace human endeavors and promote education without discrimination. Also, in this study, it was shown that for the education of children with disabilities should be used a variety of methods such as surveys, interviews, testing to identify their characteristics, consultations with children and parents, organizing meetings with representatives of the community, psychological and pedagogical pieces of training, classes to develop communication and social skills, excursions with an educational focus, as well as the use of distance learning for more flexible access.

The study describes a variety of technological tools that facilitate improved access to information and learning. These tools include voice assistants, personalized content, speech recognition technology, haptic feedback, and specialized educational applications that aim to enhance the educational process, support students with different needs, and develop independent

learning skills. Equally relevant is the review and analysis of studies on the use of information and communication technologies (ICT) in supporting students with visual impairment or blindness in higher education. The study by M. Montenegro-Rueda aims to systematically review the literature from 2010 to 2021 and covers data from four scientific and academic databases. The main objective of the study was to identify the main areas of study and research in the field and to present data to determine the current state of knowledge and current issues. The results of the study revealed the existing knowledge about the application of ICT to support the learning needs of students with visual impairment in higher education, identifying research gaps and identifying areas for future research.

This study focuses on the role of educators, who require not only content knowledge but also skills that promote critical thinking, ethical reflection, and cultural inclusiveness. The recommendations aim to create a holistic approach to scientific literacy that helps individuals effectively cope with the challenges of the modern world. The results of a scientific study by O. Kilag, and C. Lisao show that scientific literacy encompasses both the acquisition of factual knowledge and critical thinking, ethics, and cultural relevance, reflecting its dynamic nature. The study also reveals the influence of cultural and social context on the perception of scientific literacy and emphasizes the importance of ethical and moral aspects in this context [14].

Thus, integrating technology into the educational process of blind adolescents can significantly enhance their learning capabilities and provide them with more effective learning experiences. However, it is important to take into account the individual needs and preferences of each student to ensure that the technology solutions developed are as effective and inclusive as possible.

Conclusion.

The paper showed that the use of AI improves the accessibility of information for visually impaired adolescents and adapts content to their individual needs, while technologies (voice assistants and adaptive apps) provide visualization of information.

Research shows that modern AI technologies significantly improve access to information for visually impaired adolescents. Voice assistants, text adaptive technologies, and audio content are making the learning process more convenient and intuitive. Individualized information flows are also being created, allowing adolescents to receive content tailored to their interests and level of understanding, thus contributing to a more effective information culture.

The conclusion of this study emphasizes that the development of social skills of visually impaired adolescents through the use of AI technologies has the potential to enrich the educational experience and increase independence in the social environment. However, it is important to consider the potential negative aspects of this process. These aspects include possible dependence on technology, limitation of physical activity, social isolation, dependence on the quality of technology, ethical issues, risk of delayed skill development, and fragmentation of information perception.

Thus, the use of modern AI technologies positively affects the processes of independent formation of information culture in adolescents with visual impairment, but it is also necessary to take into account the possible limitations and challenges presented by these innovations. These results can be used to develop more effective and inclusive educational strategies to support autonomy and information literacy in this category of adolescents.

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КӨРУ ҚАБІЛЕТІ БҰЗЫЛҒАН ЖАСӨСПІРІМДЕРДІҢ АҚПАРАТТЫҚ МӘДЕНИЕТІНІҢ ДЕРБЕС ҚАЛЫПТАСУЫНА ЖАСАНДЫ ИНТЕЛЛЕКТ ТЕХНОЛОГИЯЛАРЫНЫҢ ӘСЕРІН ЗЕРТТЕУ

Аңдатпа.

Бұл зерттеу жұмысында көру қабілеті бұзылған жасөспірімдердің ақпараттық мәдениетін дербес қалыптастыру процесіне жасанды интеллект технологияларының әсер ету ерекшеліктерін зерттеу міндетін қойдық. Қойылған мақсатқа жету үшін талдау, дедукция, жіктеу және жүйелеу әдістері қолданылып, Қазақстан мектептеріндегі көру қабілеті бұзылған жасөспірімдерді тәрбиелеуге жасанды интеллекттің әсері туралы эксперимент жүргізілді. Бұл жұмыс жасанды интеллект технологияларын ашып, мүмкіндігі шектеулі адамдардың білім мен ақпаратқа тең қолжетімділігін қамтамасыз етудің әлеуметтік қажеттілігін сипаттайды. Практикалық бөлімде әлеуметтік өзара әрекеттестік пен ақпараттық мәдениетке байланысты қажеттіліктерді қанағаттандыру әдістері мен тәсілдерін әзірлеудің маңыздылығы ашылады. Зерттеу барысында көру қабілеті бұзылған жасөспірімдердің жасанды интеллект технологияларын пайдаланудағы жеке тәжірибесін түсінуге бағытталған сауалнама жүргізілді. Жалпы іріктеу 13 пен 17 жас аралығындағы 30 оқушыдан құралды. Жұмыста көру қабілеті бұзылған жасөспірімдерге технологияның әсерін талдау және осы технологияларды балаларды оқытуда қолдану статистикасы берілген. Сонымен қатар, жасанды интеллект технологияларын қолдану тәжірибесі анықталып, жасанды интеллект технологияларының жасөспірімдердің аналитикалық және сыни дағдыларын дамытуға әсері зерттелді. Жұмыста ықтимал проблемалар мен әлеуметтік бейімделуді жақсарту жолдары айқындалып, оқу орындары мен көру қабілеті бұзылған жасөспірімдермен жұмыс істейтін мамандарға практикалық ұсыныстар берілген. Зерттеу материалдарының педагогика, тифлопедагогика, психология және әлеуметтану үшін практикалық және теориялық маңызы бар, өйткені олар зағип немесе нашар көретін балаларды оқытудың болашағын ашуға көмектеседі.

Негізгі сөздер: цифрлық сауаттылық, оқуға бейімделу, оқытудың арнайы әдістері, инклюзивті білім беру, әлеуметтік бейімделу.

ИССЛЕДОВАНИЕ ВЛИЯНИЯ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА НА САМОСТОЯТЕЛЬНОЕ ФОРМИРОВАНИЕ ИНФОРМАЦИОННОЙ КУЛЬТУРЫ У ПОДРОСТКОВ С НАРУШЕНИЯМИ ЗРЕНИЯ

Аннотация.

В данной работе ставится задача изучить особенности влияния технологий искусственного интеллекта на процесс самостоятельного формирования информационной культуры подростков с нарушением зрения. Для достижения цели были использованы методы анализа, дедукции, классификации и систематизации, а также проведен эксперимент относительно влияния искусственного интеллекта на образование подростков с нарушением зрения в школах Казахстана. В данной работе раскрываются технологии искусственного интеллекта и описывается социальная необходимость предоставления равного доступа к образованию и информации для лиц с ограниченными возможностями. В практической части раскрывается важность разработки методов и способов удовлетворения потребностей, связанных с социальным взаимодействием и информационной культурой. В ходе исследования было проведено анкетирование, направленное на понимание индивидуального опыта подростков с нарушением зрения в использовании технологий искусственного интеллекта. Общая выборка составила 30 учащихся в возрасте от 13 до 17 лет. В работе показан анализ влияния технологий на подростков с нарушением зрения и представлена статистика использования данных технологий в обучении детей. Кроме того, выявлен опыт использования технологий искусственного интеллекта и исследовано влияние технологий искусственного интеллекта на развитие аналитических и критических навыков подростков. В работе выявлены возможные проблемы и пути повышения социальной адаптации, предложены практические рекомендации для образовательных учреждений и специалистов, работающих с подростками с нарушениями зрения. Материалы исследования представляют практическую и теоретическую ценность для педагогики, тифлопедагогики, психологии и социологии, так как помогают раскрыть перспективы обучения слепых или слабовидящих детей.

Ключевые слова: цифровая грамотность, адаптация к обучению; специальные методы обучения; инклюзивное образование; социальная адаптация.

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