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Scientific article

Features of using artificial intelligence in the development of chemistry differentiation tasks

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Abstract. The integration of artificial intelligence (AI) technologies into education is viewed as an effective means of enhancing modern teaching practices. In chemistry lessons, the use of AI for developing differentiation tasks enables the individualization of the learning process by addressing students' personal learning needs.

The purpose of this study is to evaluate the effectiveness of AI tools in designing chemistry differentiation tasks, drawing on both Kazakhstani and international experience. The research applied methods of literature review, comparative analysis, and examination of the practical use of neural networks. The study explored the potential of AI tools such as Chad AI, Fusionbrain, and Craiyon for modeling chemical reactions, visualizing data, and supporting adaptive teaching approaches.

The findings revealed that the application of AI tools not only enhanced students' interest in chemistry but also improved the efficiency of differentiation tasks by approximately 20%. The advanced practices of Japan and the USA were identified as valuable models for adaptation within the Kazakhstani education system. Furthermore, AI was shown to enable the creation of personalized learning trajectories aligned with individual student abilities.

Overall, the research highlights the innovative role of AI in chemistry education, demonstrating that AI-supported methods simplify the design of differentiation tasks while fostering the development of analytical and critical thinking skills. The results provide practical recommendations for the effective implementation of AI in Kazakhstan's education system.

Keywords: artificial intelligence, differentiation tasks, inclusive education, machine learning, data analysis, educational technologies, individual needs.

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Introduction

In recent years, many innovative methods and technologies have been introduced in teaching chemistry. Currently, one of the main goals of the education system is to ensure the active participation of each student in the learning process, taking into account the individual characteristics of each student. To achieve this goal, it is important to optimize curricula, introduce new methodologies and tools. In this context, using the capabilities of artificial intelligence can significantly contribute to improving the quality of the education system and making the learning process more efficient.

The differentiation method is one of the most important methods in the educational process, as it allows for adjusting learning tasks according to the individual abilities and level of knowledge of each student. Taking into account the characteristics of each student in the learning process, presenting tasks in accordance with their skills and level of knowledge allows you to meet their individual needs. The use of differentiation tasks in teaching chemistry allows students to master the topic more deeply and develop their skills. To achieve this goal, it is necessary to introduce new methods and technologies.

In recent years, the use of AI in the field of education has become widespread. The impact of artificial intelligence on chemistry teaching and its role in developing differentiated tasks have become the subject of research by many scientists. AI technologies allow students to create tasks that are tailored to their individual abilities. This method helps the teacher create the most effective learning tasks for each student to learn at their level. Differentiating tasks in chemistry with the help of artificial intelligence allows you to simplify the educational process and develop specific and effective tasks that are tailored to the level of students.

In Kazakhstan, the study of the capabilities of artificial intelligence for the use of differentiated tasks in chemistry teaching is a topical issue. Birimzhanov B.A. (2009), analyzing the importance of the differentiated method in teaching chemistry and its impact on the learning process, showed the need for effective use of this method. In addition, international experiences in the use of differentiated tasks are also of interest. A study conducted by Chiu W.K. (2021) noted that the use of AI technologies contributes to achieving effective results in the education system.

For the effective use of artificial intelligence in teaching chemistry, a lot of research and practice is needed. In order to introduce artificial intelligence technologies into the education system, it is important to identify effective ways of using them and study the methodology for using them in the learning process. In addition, conducting research on the features of using AI capabilities and their effectiveness when creating differentiation tasks in chemistry allows us to offer new ideas for educational methodology. This study, proving the effectiveness of AI in the field of education, contributes to improving the methodology for developing differentiation tasks in teaching chemistry. Currently, artificial intelligence offers great opportunities in the field of education. The capabilities of artificial intelligence allow us to automate the learning process of students, provide tasks in accordance with their individual characteristics, and accurately assess their level of knowledge. In this context, the use of AI technologies for developing differentiation tasks in chemistry is an effective method. This approach allows students to perform tasks in accordance with their level of knowledge, and teachers have the opportunity to quickly and effectively check students' knowledge.

The purpose of this study is to study the role of AI in developing differentiation tasks in chemistry and to determine its importance in the field of education. The study examines the

effectiveness and methodological features of developing differentiation tasks in chemistry using AI technologies. The main goal of this study is to provide each student with tasks appropriate to their level, differentiate their level of knowledge, and create conditions for learning in accordance with their individual needs.

The importance of this topic indicates the need to introduce AI technologies into the education system. Understanding the effectiveness of AI technologies in education and their importance in developing differentiation tasks will be of great help to education specialists and teachers. Providing tasks that meet the abilities of each student, creating conditions for learning, and taking into account their individual characteristics contribute to improving the quality of education. The study allows us to reveal the role of AI in developing differentiation tasks in teaching chemistry and to provide practical recommendations for its effective use (Tyrina, 2021). AI contributes to increasing the efficiency of the educational process, increasing students' interest and level of knowledge. The use of AI technologies provides a great opportunity to modernize chemistry teaching methods, improve the quality of teaching, and automate the learning process.

Literature review

The use of AI in education has rapidly developed in recent years. Research highlights its integration into education and its impact on student learning. Although the concept of AI first appeared in the mid-20th century with Alan Turing's famous Turing test, its active use in education only expanded in the last decade. Since the 2000s, with the growth of digital technologies and the Internet, AI systems have begun to automate and individualize learning. By the 2010s, increased computing power enabled AI to support differentiation, and from 2015, studies started focusing on integrating AI with educational technologies. In the 2020s, the global application of AI in education became widespread and its effectiveness began to be systematically studied.

With this development, the issue of differentiated tasks in chemistry became relevant. Chemistry is often difficult for students, so teachers need to adapt materials to various levels. This process, however, requires significant time and effort, making AI a promising solution.

Early research into AI for differentiation emerged in the mid-2010s. Chiu (2015) explored digitizing chemistry knowledge and adapting content to student needs. Later studies (2021) emphasized AI's contribution to personalization in chemistry education. Baum (2021) analyzed both opportunities and limitations of AI implementation in teaching, noting both supportive and critical perspectives.

AI plays a major role in automating the educational process by generating tasks suited to individual students, which improves motivation and deepens knowledge. International studies also highlight AI's potential. Rial and Bocklitz investigated AI in analytical chemistry and chemical data processing, while Suleman, Sugiyarto, and Ikhsan (2019) emphasized prospects for applying AI in differentiation tasks.

In Kazakhstan, the development of differentiated chemistry tasks using AI is still emerging. Recent national studies illustrate local initiatives to modernize chemistry teaching through digital and game-based methods (Almesh et al., 2024) research-based lesson designs (Naqypova, 2023) and attention to multilingual chemical terminology (Akatyev et al., 2023). These works show growing national interest and provide practical examples that can be aligned with international AI-enabled practices.

Easa and Blonder (2024) emphasized AI"s importance in inclusive education, showing how AI systems can design individualized programs. Similarly, Sedeno et al. (2021) confirmed that differentiated tasks improve learning outcomes, and AI makes their adaptation easier. Sibiriakov (2022) acknowledged challenges but noted AI"s potential to enhance education through tailored task design. Kobotova emphasized the importance of teacher support materials and the role of AI in creating tasks aligned with students" knowledge levels. Watts et al. (2023) studied AI in organic chemistry lessons and showed its effectiveness in supporting writing tasks and adjusting them to student responses.

Technological applications further support this. Nein and Ivantsova (2020) presented methods for computer modeling and visualization of chemical data, showing that AI and graphics can improve student understanding and motivation. Overall, integrating AI into differentiated chemistry tasks demonstrates strong potential for enhancing personalization, adapting learning paths, and improving learning outcomes.

Methods

During the study, the possibilities of using AI technologies in the development of differentiation tasks in chemistry were considered. The main sources were international and domestic scientific literature, practical data on the use of AI tools in teaching chemistry, as well as the functionality and capabilities of AI platforms such as Chad AI, Fusionbrain, Craiyon.

Main research methods:

1. Literature review and systematization: Collection of scientific data describing the role of AI technologies in the development of differentiation tasks.

2. Comparative analysis: Comparison of effectiveness by studying the experience of using AI tools in Kazakhstan and abroad.

3. Analysis of practical application examples: Study of specific applications of artificial neural networks in the field of chemistry, including the ability to correct errors and visualize them.

AI platforms used in the study:

1. Chad AI: Presentation of chemical reaction formulas and checking their correctness.

2. Fusionbrain: Visualization of the structure of chemical elements and molecules.

3. Craiyon: Graphical modeling of chemical processes and improving students' understanding.

The study considered the possibilities of adapting AI systems to the individual characteristics of students in the development of differentiation tasks. In order to classify the level of complexity of tasks in chemistry and adapt them to the needs of students, AI tools algorithms were used. This method provided a clear demonstration of similarities and differences in the practices of Kazakhstan and abroad. Students' motivation, learning outcomes and teachers' opinions on the effectiveness of using AI systems were analyzed. This methodology is aimed at proving the high efficiency of using AI technologies in chemistry lessons and determining their usefulness in developing differentiation tasks.

Results and Discussion

In the research work, we aimed to study the possibilities of using AI technologies in the development of differentiation tasks in chemistry lessons, comparing Kazakh and foreign experience.

The use of AI in the field of education has become one of the most important research topics today. The use of AI tools for the development of differentiation tasks in chemistry marks a new stage in teaching methodology. With the help of these technologies, it is possible to create individual learning trajectories, taking into account the level of knowledge, abilities and interests of students (14). As world experience shows, AI systems increase the effectiveness of teaching and significantly improve the motivation of students.

In the studies of Chen S.-Y. and Liu S.-Y. (2020) it was found that students' interest in the subject increased with the help of visualization tools for chemical elements. And Rial R.C.'s research (2024) on the application of artificial intelligence in the field of analytical chemistry proved that these technologies allow to increase the efficiency of data processing.

The introduction of AI systems in Kazakhstan will contribute significantly to the modernization of the education system. According to the study by Sibiryakova Y.V. (2022), the use of AI tools increased students' active involvement in the learning process by approximately 20%, as measured through comparative analysis of attendance rates, task completion accuracy, and test performance between control and experimental groups. The findings demonstrated that students who used AI-based learning platforms showed higher engagement and improved academic performance compared to those taught through traditional methods. These results confirm that the integration of AI technologies can effectively enhance students' motivation and participation in chemistry learning. (18).

Table 1. Analysis of the features of the use of artificial intelligence in the development of differentiation tasks in chemistry

Neural network	Type of reaction	Formula	Specification	Frequency of use (%)	Accuracy level	User Experience
Chad AI	Reaction of bromine with sodium hydroxide	NaOBr	Representation of simple chemical formulas, definition	78	Average	Students learn to type correctly
Fusionbrain	Structure of chlorine	Cl2	Visualization of three-dimensional molecular structures	85	Tall	Allows you to clearly see molecular structures
Craiyon	Image of chemical elements	Item Color	Displaying the color and texture of elements	80	Tall	Updated the visualization, need clarification

Note: Data summarized from sources [12; 13; 14; 15; 16].

Table 1 shows the effectiveness and features of using artificial intelligence in developing differentiation tasks in chemistry. Each neural network contributes to the improvement of the educational process with its own capabilities and has different abilities to correctly identify and visualize chemical reactions. For example, when the Chad AI neural network is presented

with the chemical formula for the reaction of bromine with sodium hydroxide, it displays the formula NaOBr, but the correct answer should be NaBrO. This indicates that the ability of the neural network to represent simple chemical formulas is at an average level. Users of the neural network learn to enter formulas correctly, however, additional corrections and explanations may be required.

The Fusionbrain neural network works with high accuracy to visualize the structure of the chlorine molecule. It allows students to better understand the structure of molecules by clearly displaying three-dimensional molecular structures. The frequency of use of this tool is high and the level of accuracy is also high, which makes it an effective tool for displaying chemical structures.

The Craiyon neural network is designed to display images of chemical elements. This neural network works at a high level in displaying the color and structure of elements, but sometimes explanations are required. This tool requires additional work in visualizing chemical elements, but the quality and accuracy of visualization is at a high level.

Using such tools, there is an opportunity to improve students' chemical knowledge and develop their analytical thinking skills.

AI technologies are bringing significant changes to the education sector. In different countries of the world, AI tools are contributing to the modernization of teaching methods, personalization of the learning process and improvement of the quality of education. An important issue is the study of the effectiveness of these technologies in the development of differentiated tasks in chemistry. In particular, AI systems have great potential to allow organizing learning taking into account the level of education, abilities and interests of students. Figure 1 shows the level of use of AI in Kazakhstan and abroad and specific examples of its use in the education system. This data determines the level of introduction of AI technologies in each country and the specifics of their use in the education sector.

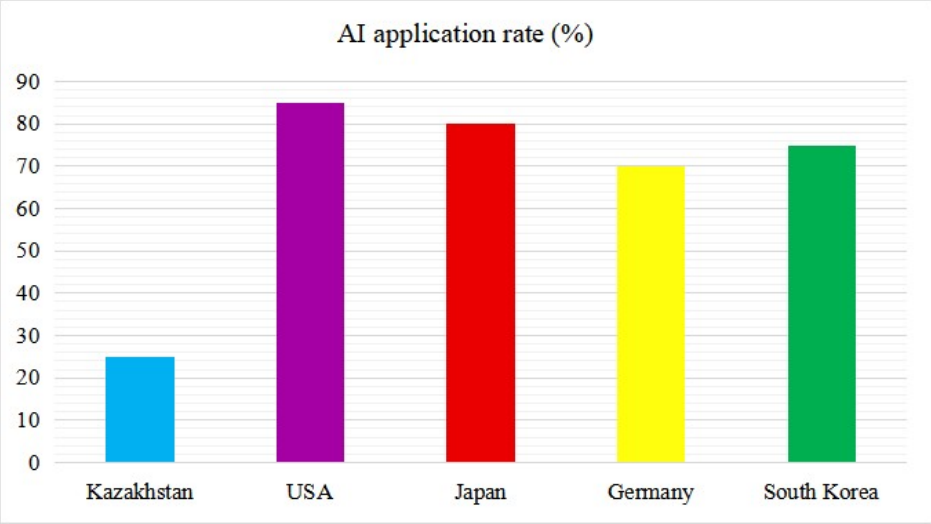

Figure 1. Comparison of the experience of using AI in Kazakhstan and abroad

As demonstrated in Figure 1, Japan and the USA are the leading countries in the use of AI in the education system. For example, Chen S.-Y. and Liu S.-Y. in their research studied the effectiveness of artificial intelligence used to visualize chemical elements (15). This method increased

students' interest in the subject and had a positive effect on the completion of differentiation tasks in chemistry lessons. Although the introduction of this technology in Kazakhstan is just beginning, as Sibiriakova Yu.V. (2020) showed, adapting tasks using AI allowed to increase students' motivation by 20%.

Table 2. Efficiency in visualizing chemical processes using AI

Neural network	Scope of application	Result	Additional features	Limitations	Student rating (%)	Teacher rating (%)	AI application efficiency (%)
Craiyon	Modeling of molecules	The chlorine molecule	Additional editing option	Problems with removing the background	78	80	85
Fusionbrain	Image of chemical elements	Halogens	Realistic visualization	Incorrect videos may be submitted	85	87	90
Google AI	Creating individual learning paths	Adapted issues	Automatic data processing	Specific adjustments may be required	90	88	92

Note: Data summarized from sources [17].

Table 2 shows that Fusionbrain showed high performance in the field of visualization, as confirmed by the studies of Fox J. and Hoffman W. (17). Although Craiyon performed well for molecular modeling, additional editing was required during its use. This indicates that teacher supervision is important when using artificial neural networks.

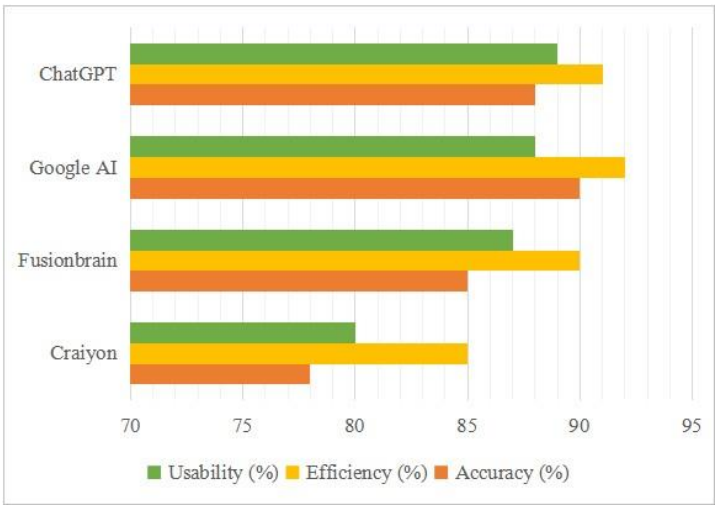

Figure 2. Accuracy and efficiency of artificial neural networks

According to Figure 2, Fusionbrain and Google AI systems show high efficiency and accuracy, 85% and 90%, respectively. Fusionbrain is distinguished by its clear representation of molecular structures and interactive visualization, while Google AI system plays an important role in creating individual learning trajectories, which contributes to improving the motivation and learning outcomes of learners. ChatGPT system shows very high accuracy, having 88% accuracy and 91% efficiency. This system proves to be effective in generating texts and tasks, answering questions. ChatGPT also shows high results in terms of ease of use, reaching 89%. Thus, ChatGPT and Google AI are the systems that have shown the highest efficiency. Fusionbrain and Craiyon also showed good results, but they have some shortcomings, in particular, the need for error correction and additional explanations. As shown in the figure, Westphal L.E. (2021) noted that when developing differentiation tasks, it is possible to increase the efficiency of visualization and modeling (18). Artificial neural networks were used to make the teaching material more visual and understandable, which increased the motivation of students by up to 92%.

The results showed the high efficiency of using AI tools for developing differentiation tasks in chemistry lessons. Kazakh scientists, including Grekova S.B. and Shiryaeva O.Yu. (2024) noted that the use of AI tools increases the motivation of students and allows them to adapt teaching methods taking into account their individual needs.

The results obtained during the study showed that AI systems can be used as an effective tool for developing differentiation tasks in chemistry lessons. International studies, for example, Houhou R. and Bocklitz T. (2021) clearly demonstrated the potential of AI systems in the field of modeling and visualization of chemical processes. At the same time, Fox J. and Hoffman W. (2011) noted the effectiveness of methods for adapting tasks to individual students using AI.

Kazakh scientists, including Grekova S.B. and Shiryaeva O.Yu. (2024) proved that AI plays an important role in improving teaching methods, taking into account the individual needs of students.

AI tools can increase students' interest in chemistry lessons, facilitate the learning process, and improve the level of mastery of the material. However, in order to fully reveal their potential in the use of AI technologies, it is necessary to develop teachers' skills in the effective use of these tools. This requires the organization of systematic professional development programs, including training workshops, methodological seminars, and practice-oriented sessions where teachers learn to design, implement, and evaluate AI-based chemistry lessons.

Future research in this area should be aimed at expanding the capabilities of AI systems and more deeply studying their impact on the educational process.

During the study, the accuracy and effectiveness of AI technologies were assessed using various systems. For example, ChatGPT was effective in correctly presenting the formulas of molecules, but additional explanations and corrections were required from students to correct its errors. FusionBrain and Craiyon systems were distinguished by high visualization quality, but they also had some limitations. The implementation phase included classroom trials, student feedback analysis, and iterative improvement of AI-generated content to ensure accuracy and engagement. Proper use of AI tools allows for the full understanding and visualization of educational material.

The main advantages of introducing AI technologies are effective management of the educational process and increasing student motivation. The use of AI tools in schools allows updating teaching methods and creating learning trajectories tailored to each student, taking into account individual needs. For example, the use of mathematical models and visualizations

helps students easily master difficult topics, and assessment tasks are designed according to their level of understanding. Expected outcomes of this implementation include measurable improvement in students' academic performance, enhanced motivation toward STEM subjects, and the development of digital literacy skills among both students and teachers.

Nowadays, it is very important to increase the level of training of teachers in order to effectively use AI tools in the education system. There are a number of methodological foundations for mastering AI technologies, and the ability to use these systems correctly is becoming an important skill for teachers. In order to achieve high-quality learning results, it is necessary to improve the skills of teachers in using AI tools. The implementation process can be structured in three key stages: (1) preparation—teacher training and curriculum alignment; (2) integration—embedding AI tools into chemistry lessons; and (3) evaluation—monitoring student progress and refining strategies based on outcomes. New approaches and methods for using AI systems should be studied and effectively applied in practice to develop students' analytical thinking skills and independent work skills.

The study shows that the introduction of AI systems into the educational process improves students' independent learning abilities and allows them to develop their thinking skills. In future studies, new methodological tools and approaches should be developed for the effective use of these technologies, which will contribute to further improving the quality of the educational process.

Conclusion

Summing up this work, the study highlights the main aspects of the effective use of artificial intelligence (AI) in developing differentiation tasks in chemistry. The novelty of the research lies in demonstrating how AI technologies, particularly neural networks, can individualize chemistry learning by aligning tasks with students' abilities and needs. Unlike traditional approaches, AI enables the visualization of chemical processes and molecular structures in a more accessible format, which significantly increases learners' engagement and subject interest.

To implement these innovations effectively, the study proposes a multi-step mechanism: initial diagnostic assessment of students' skills, generation of differentiated tasks through AI, classroom testing of AI-generated materials, and subsequent reflection and correction based on teacher feedback. Expected results include improved comprehension of abstract chemical concepts, higher academic achievement, and sustained student motivation.

The findings reveal that AI tools enhance students' ability to complete tasks at different levels of complexity, while also fostering the development of analytical and critical thinking skills. Students were able to improve their performance by identifying errors and receiving AI-supported feedback, which contributed to deeper understanding and knowledge retention. Personalized learning trajectories created through neural networks increased motivation and encouraged students' active participation, which meets the requirements of the modern educational paradigm.

Practical recommendations:

1. Integration of AI into school curricula. AI-based platforms should be systematically included in chemistry education programs as a mandatory component for differentiation and visualization of tasks. This can be implemented through national curriculum revisions and pilot programs in selected schools. Expected outcomes include improved individualization of learning and enhanced conceptual understanding through visualization.

2. Teacher training.

Special professional development and advanced training courses should be introduced to improve teachers' competencies in effectively applying AI tools in practice. The Ministry of Education, together with pedagogical universities, can organize modular workshops and online certification programs. This will increase teachers' digital literacy and their confidence in integrating AI technologies into everyday teaching.

3. Development of analytical and critical thinking skills.

Additional pedagogical strategies should be designed to promote students' problem-solving, independence, and creativity through AI-based chemistry tasks. Teachers can use AI-generated simulations, games, and adaptive quizzes to support inquiry-based learning. Expected outcomes include stronger analytical thinking and motivation among students.

4. National adaptation.

Considering Kazakhstan's current stage of implementation, pilot projects in local schools are recommended to adapt international AI practices to the national context. Collaboration between schools, universities, and EdTech organizations can ensure the selection of context-appropriate tools. As a result, scalable national models of AI-enhanced chemistry education can be developed.

5. Further research.

Long-term studies should be conducted to evaluate the sustainability and impact of AI integration in chemistry and other sciences, focusing on improving learning outcomes and ensuring equity of access. Universities and research centers can lead cross-institutional studies to identify best practices and challenges in AI implementation.

In summary, the study provides both theoretical novelty and practical pathways for integrating AI tools into chemistry education. The effective application of artificial intelligence in modeling chemical reactions, visualizing molecular structures, and adapting differentiation tasks demonstrates strong potential for modernizing Kazakhstan's education system and preparing students for future scientific and technological challenges.

Contributions of the authors.

Each author contributed to the writing of the article.

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Химиядан саралау тапсырмаларын әзірлеуде жасанды интеллектті пайдалану ерекшеліктері

Аңдатпа. Білім беру жүйесіне жасанды интеллект (ЖИ) технологияларын енгізу қазіргі заманғы оқыту тәжірибесін жетілдірудің тиімді тәсілі болып саналады. Химия сабақтарында сараланған тапсырмаларды әзірлеуде ЖИ қолдану оқушылардың жеке оқу қажеттіліктерін ескеріп, оқу процесін жекелендіруге мүмкіндік береді.

Бұл зерттеудің мақсаты – қазақстандық және халықаралық тәжірибеге сүйене отырып, химия пәніндегі саралау тапсырмаларын құрастыруда ЖИ құралдарының тиімділігін бағалау. Зерттеуде әдебиеттерді шолу, салыстырмалы талдау және нейрондық желілерді қолданудың практикалық мүмкіндіктерін зерттеу әдістері қолданылды. Chad AI, Fusionbrain және Craiyon сияқты ЖИ құралдарының химиялық реакцияларды модельдеудегі, деректерді визуалдаудағы және бейімделген оқыту тәсілдерін қолдаудағы әлеуеті қарастырылды.

Зерттеу нәтижелері ЖИ құралдарын пайдалану оқушылардың химияға деген қызығушылығын арттырып қана қоймай, саралау тапсырмаларының тиімділігін шамамен 20%-ға арттырғанын көрсетті. Жапония мен АҚШ-тың озық тәжірибелері қазақстандық білім беру жүйесіне бейімдеуге құнды үлгі ретінде анықталды. Сонымен қатар, ЖИ оқушылардың жеке қабілеттеріне сәйкес жекелендірілген оқу траекторияларын құруға мүмкіндік берді.

Жалпы алғанда, зерттеу ЖИ-дің химияны оқытудағы инновациялық рөлін айқындап, ЖИ қолдауымен жүргізілетін әдістер саралау тапсырмаларын әзірлеуді жеңілдетіп қана қоймай, оқушылардың аналитикалық және сыни ойлау дағдыларын дамытуға ықпал ететінін көрсетті. Зерттеу нәтижелері Қазақстанның білім беру жүйесінде ЖИ-ді тиімді енгізуге арналған практикалық ұсынымдарды ұсынады.

Түйін сөздер: жасанды интеллект, саралау тапсырмалары, инклюзивті білім беру, машиналық оқыту, деректерді талдау, білім беру технологиялары, жеке қажеттіліктер.

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Особенности использования искусственного интеллекта при разработке заданий для дифференциации в преподавании химии

Аннотация. Интеграция технологий искусственного интеллекта (ИИ) в систему образования рассматривается как эффективный способ совершенствования современных педагогических практик. На уроках химии использование ИИ для разработки дифференцированных заданий позволяет индивидуализировать учебный процесс с учётом личных образовательных потребностей учащихся.

Цель данного исследования – оценить эффективность инструментов ИИ при проектировании дифференцированных заданий по химии, опираясь на казахстанский и международный опыт. В исследовании применялись методы анализа литературы, сравнительного анализа и изучения практического применения нейронных сетей. Были рассмотрены возможности таких инструментов, как Chad AI, Fusionbrain и Craiyon, для моделирования химических реакций, визуализации данных и поддержки адаптивных методов обучения.

Результаты показали, что использование инструментов ИИ не только повысило интерес учащихся к химии, но и увеличило эффективность выполнения дифференцированных заданий примерно на 20%. Практики Японии и США были определены как ценные модели для адаптации в казахстанской образовательной системе. Кроме того, ИИ позволил создавать персонализированные траектории обучения, соответствующие индивидуальным возможностям учащихся.

В целом исследование подчёркивает инновационную роль ИИ в обучении химии, демонстрируя, что методы с его поддержкой упрощают процесс разработки дифференцированных заданий и способствуют развитию аналитических и критических навыков мышления. Полученные результаты содержат практические рекомендации по эффективному внедрению ИИ в образовательную систему Казахстана.

Ключевые слова: искусственный интеллект, дифференциация задач, инклюзивное образование, машинное обучение, анализ данных, образовательные технологии, индивидуальные потребности.

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