# BIOLOGIYA FANINI O‘QITISHDA TALABALAR O‘ZLASHTIRISH DARAJASINI SUN’IY INTELLEKT VOSITALARI ASOSIDA BAHOLASH (GENETIKA MISOLIDA)

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ОЦЕНКА УРОВНЯ ПОМОЩИ УЧАЩИМИСЯ В ПРЕПОДАВАНИИ БИОЛОГИИ С ИСПОЛЬЗОВАНИЕМ ИНСТРУМЕНТОВ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА (НА ПРИМЕРЕ ГЕНЕТИКИ)

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ASSESSMENT OF STUDENTS' DEVELOPMENT IN BIOLOGICAL SCIENCE TEACHING BASED ON ARTIFICIAL INTELLIGENCE TOOLS (IN THE EXAMPLE OF GENETICS)

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**Annotatsiya:** Ushbu maqolada biologiya fanining genetika bo‘limini o‘qitishda sun’iy intellekt (SI) texnologiyalarining qo‘llanilishi va talabalar bilimini baholash jarayonini avtomatlashtirish imkoniyatlari o‘rganiladi. Tadqiqot SI asosida adaptiv test tizimlarini ishlab chiqish va ularning an’anaviy baholash usullari bilan solishtirilgan natijalarini tahlil qiladi. Genetika fanining murakkab tushunchalarini o‘zlashtirishda SI vositalari talabalar individual o‘zlashtirish darajasini aniqlash, ta’lim jarayonini optimallashtirish va o‘qitish sifatini oshirishda samarali ekani asoslab beriladi. Ushbu maqola mazkur yondashuvning nazariy asoslari, metodologiyasi, olingan natijalar va xorijiy tajribalar asosida keng qamrovli tahlilini taqdim etadi. Shuningdek, maqola

biologiya fanining innovatsion texnologiyalar orqali o‘qitilishining ijtimoiy-iqtisodiy ahamiyatiga alohida e‘tibor qaratadi. O‘zbekiston Respublikasining davlat siyosatida ta’lim sifatini oshirishga qaratilgan islohotlar, ayniqsa, Harakatlar strategiyasi, "O‘zbekiston-2030" strategiyasi hamda O‘zbekiston Respublikasi Prezidentining tegishli farmon va qarorlari doirasidagi tadbirlar ushbu maqolaning dolzarbligini belgilaydi

**Kalit so‘zlar:** sun’iy intellekt, genetika, talabalar bilimini baholash, ta’lim texnologiyalari, adaptiv ta’lim tizimi.

**Abstract:** This article examines the application of artificial intelligence (AI) technologies in teaching the genetics section of biology and the possibilities of automating the process of assessing students' knowledge. The study analyzes the development of adaptive testing systems based on AI and their results compared with traditional assessment methods. It is argued that AI tools are effective in determining the level of individual students' mastery of complex concepts of genetics, optimizing the educational process and improving the quality of teaching. This article presents a comprehensive analysis of the theoretical foundations, methodology, results obtained and foreign experience of this approach. The article also pays special attention to the socio-economic significance of teaching biology through innovative technologies. Reforms aimed at improving the quality of education in the state policy of the Republic of Uzbekistan, in particular, measures within the framework of the Action Strategy, the "Uzbekistan-2030" strategy, and relevant decrees and resolutions of the President, determine the relevance of this article.

**Keywords:** artificial intelligence, genetics, student assessment, educational technologies, adaptive learning system.

**Аннотация** В данной статье рассматривается применение технологий искусственного интеллекта (ИИ) в преподавании генетики в биологии и возможности автоматизации процесса оценки знаний студентов. В исследовании разработаны адаптивные тестовые системы на основе ИИ и проведен анализ их результатов в сравнении с традиционными методами оценки. Доказано, что инструменты ИИ эффективны для определения индивидуального уровня усвоения студентами сложных генетических концепций, оптимизации образовательного процесса и повышения качества обучения. В статье представлен комплексный анализ данного подхода с учетом его теоретических основ, методологии, полученных результатов и зарубежного опыта. В статье также уделяется особое внимание социально-экономическому значению преподавания биологии с использованием инновационных технологий. Реформы, направленные на повышение качества образования в государственной политике Республики Узбекистан, в частности, меры в рамках Стратегии действий, стратегии «Узбекистан-2030», соответствующих указов и

постановлений Президента, определяют актуальность этой статьи.

**Ключевые слова:** искусственный интеллект, генетика, оценка знаний студентов, образовательные технологии, адаптивная система обучения.

**Introduction.** In today's era of globalization, the education system faces various problems and new opportunities. The Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP-4947 "On the Action Strategy for five priority areas of development of the Republic of Uzbekistan in 2017-2021" and the Resolution of the President of the Republic of Uzbekistan dated April 29, 2019 No. PP-4319 "On measures for the further development of education and science in the Republic of Uzbekistan" defined important directions for the widespread introduction of innovative technologies in the field of education [Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP-4947. "Action Strategy on Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021," Resolution of the President of the Republic of Uzbekistan No. PP-4319 dated April 29, 2019. "On Measures for the Further Development of Education and Science in the Republic of Uzbekistan." Also, in the Decree of the President of the Republic of Uzbekistan dated May 11, 2022 No. PP-229 "On Measures to Further Accelerate the Digitalization of the Education System," great attention is paid to the development of modern educational technologies [Decree of the President of the Republic of Uzbekistan dated May 11, 2022 No. PP-229]. "On Measures for Further Accelerating the Digitalization of the Education System"].

The role of technologies in the modern educational process is increasing, in particular, artificial intelligence takes pedagogical activity to a new level. Genetics is one of the main and complex branches of biology, requiring a deep understanding by students. Interactive technologies play an important role in the effective assimilation of topics such as DNA replication, gene expression, mutations, and hereditary diseases. In particular, AI-driven adaptive learning platforms (AI-controlled adaptive learning platforms) are widely used in genetics education in the USA, Japan, and European countries. For example, Harvard University and Stanford University are using artificial intelligence to automate genetic testing and implement adaptive assessment systems.

Also, in studies conducted by MIT (Massachusetts Institute of Technology), it was noted that the results of assessing genetic knowledge using artificial intelligence are more accurate than traditional methods. The European Union's Horizon 2020 program is aimed at integrating artificial intelligence tools into the teaching process of genetics.

The main goal of this study is to scientifically substantiate the effectiveness of assessing students' knowledge through the use of AI tools in genetics and compare it with traditional assessment systems.

Interactive technologies play an important role in the effective assimilation of topics such as DNA replication, gene expression, mutations, and hereditary diseases. The main goal of this study is to scientifically substantiate the effectiveness of assessing students' knowledge through the use of AI tools in genetics and compare it with traditional assessment systems.

Methodology The research was conducted experimentally, in which 45 students studying in the field of biology from UrSPI took part. Participants were divided into two groups:

1. Experimental group - knowledge of DNA structure, gene expression, and mutations was tested using an adaptive assessment system based on AI.

2. Control group - the level of mastery of genetics was assessed using the traditional test and oral assessment system.

The study analyzed the results based on the following evaluation criteria:

• Genetic test results - the average results of the tests conducted in both groups were compared.

• Adaptability level - the ability of the AI system to adapt to the level of individual assimilation of students was assessed.

• Level of student satisfaction - a survey was conducted among the participants and the effectiveness of the AI system was assessed.

• Teachers' attitude towards the AI system - interviews and feedback were collected among teachers.

Results The research results have proven that AI-based assessment systems are more effective than traditional methods:

• The average test results of students in the experimental group were 20% higher than in the control group.

• 50% of students' academic performance, assessed through the AI system, increased significantly thanks to an individualized learning approach.

• According to the survey results, 88% of students noted that the use of the AI system facilitated the learning process and increased motivation.

• 80% of teachers highly appreciated the effectiveness of the AI assessment system, recognizing its objectivity and the possibility of an individual approach.

Discussion The research results showed that the system for assessing students' knowledge in genetics using artificial intelligence has several advantages over traditional approaches. AI-based assessment systems:

• Provides a deeper understanding of DNA, RNA, and hereditary diseases by approaching each student appropriately.

• Provides individual explanations according to students' incorrect answers.

• By automating the educational process, it reduces the burden on teachers and minimizes assessment errors.

However, some problems were also identified during the study:

• There is a possibility of incorrect or incomplete assessment of AI systems.

• Cases of student manipulation of results may be observed.

• AI systems still need improvement to evaluate advanced concepts in genetics.

Conclusion Artificial intelligence technologies have great potential for the effective organization of the assessment process in genetics education. The research results showed that the use of adaptive assessment systems based on AI contributes to increasing the level of assimilation of students and the application of individual learning strategies. In the future, it is necessary to conduct in-depth research on the further development of AI systems and improve the skills of teachers in working with these technologies.

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