The OSCAR PUBLISHING Services
International Journal of Pedagogics

VOLUME Vol.06 Issue02 2026
PAGE NO. 88-91
DOI 10.37547/ijp/Volume06Issue02-22

Artificial Intelligence In General Education: Opportunities And Future Directions In Biology Teaching

Pulatova Elnora Kodirovna
Tashkent Region Branch of Astrakhan State Technical University, Uzbekistan

Received: 22 December 2025; **Accepted:** 14 January 2026; **Published:** 18 February 2026

Abstract: This article examines the use of artificial intelligence (AI) technologies in the general education system. AI tools help personalize the learning process according to individual student needs, automate assessments, and reduce the workload of teachers. The article analyzes examples of AI integration in schools, such as adaptive learning platforms, virtual assistants, and automated testing systems. It also discusses the challenges of implementing AI in general education and suggests practical solutions.

Keywords: Artificial intelligence, general education, intelligent technologies, automated assessment, adaptive platforms, digital learning.

Introduction: In recent years, digital technologies and artificial intelligence (AI) have been widely applied in the field of education. Artificial intelligence is a set of technologies that enable computer systems to imitate human intellectual abilities and plays a significant role in improving the quality of education, individualizing learning processes, and automating assessment in general education institutions. In particular, in the teaching of natural sciences, including biology, AI tools contribute to increasing students' interest, creating an active learning environment, and supporting the effective acquisition of practical knowledge.

1. The Role of Artificial Intelligence in General Education.

It is observed that AI technologies are used in education in various directions, including:

Adaptive learning platforms, which provide tasks and learning materials in accordance with the learner's level of knowledge;

Automated assessment systems, which automatically evaluate tests, essays, and other types of academic work;

Virtual assistants and robotic teachers, which explain lessons in a question-and-answer format;

Speech and image recognition technologies, which enable information retrieval through spoken words or images [1].

2. Application of Artificial Intelligence Technologies in Biology Teaching.

Biology is a discipline that integrates theoretical and practical knowledge and requires observation and experimentation. Therefore, the application of AI technologies in biology education is considered particularly effective.

Virtual laboratories and simulators.

AI-based virtual laboratories enable students to perform complex experiments safely without the need for real laboratory conditions. For example, Labster is an AI-powered virtual laboratory platform for biology and chemistry. It allows students to study topics such as cell structure, DNA replication, and evolutionary processes through interactive simulations.

Image and speech recognition capabilities.

With the help of AI, plant and animal species can be automatically identified [2]. For instance, mobile applications such as PlantNet and iNaturalist assist students in identifying plants through images. This practice brings biology lessons closer to real-life natural

environments.

Personalized learning.

AI-based platforms analyze each student's level of knowledge and develop individualized learning plans accordingly. For example, if a student has difficulty understanding the topic of "organ systems," the system offers simplified explanations, practice tests, and additional video materials.

3. Assessment Process through Artificial Intelligence Tools.

AI tools enable the automatic evaluation of student performance during the learning process. This includes:

Automatic analysis of test results;

Identification of students' errors and suggestions for correction;

Providing approximate evaluations for open-ended questions using neural network-based algorithms.

Such AI-assisted assessment allows teachers to focus more on personalized interaction and fostering an active learning environment.

4.Challenges and Solutions.

The implementation of AI in general education schools faces a number of obstacles. The main challenges and issues associated with introducing artificial intelligence in general education schools are as follows:

1. Lack of technical infrastructure.

Explanation: Many schools are not adequately equipped with the infrastructure required for the use of AI technologies, such as modern computers, high-speed internet, interactive screens, or server equipment.

Example: In rural schools, interruptions in electricity supply, absence of Wi-Fi networks, or a shortage of laptops limit the ability to use virtual laboratories or adaptive learning platforms. For instance, teaching biology with 3D simulations requires computers with minimum graphical capabilities, which are lacking in many schools.

2. Insufficient teacher preparedness.

Explanation: Many teachers lack adequate knowledge of artificial intelligence and digital learning technologies, or they are hesitant to use them. This leads to reluctance in adopting new technologies.

Example: In some regions of Uzbekistan, biology teachers do not have the technical skills to effectively use interactive educational platforms. For example, to use platforms such as Eduten, Khan Academy, or Labster, teachers must first learn to register on the system, design lesson scenarios, and analyze results—requiring additional preparation and training.

3.Lack of Localized Learning Content.

Explanation: Most AI-based educational platforms operate in English or Russian. Content in Uzbek is limited and often incomplete, which makes it difficult for students to use these platforms effectively.

Example: Studying the topic of "Cell Structure" in biology via Labster is highly engaging; however, students may not fully understand the texts and terminology, reducing the effectiveness of the platform. Thus, language barriers hinder the learning process.

4. Financial Constraints.

Explanation: Some AI platforms operate on a license basis, requiring subscription payments for their services. This imposes additional costs for public schools.

Example: Platforms like Labster or Eduten offer free versions, but to access full functionality, an annual license must be paid for each student, which can be a significant burden on school budgets.

5. Psychological and Cultural Resistance.

Explanation: New technologies, especially artificial intelligence, are often met with concerns such as "replacing human teachers" or "students studying alone." This can lead to negative attitudes toward AI among parents, teachers, and even school administration.

Example: Some teachers insist that "students should learn through human interaction, not robots," while parents may worry that "my child will damage their eyes learning from a tablet," and therefore resist the use of AI tools.

6. Data Security and Privacy.

Explanation: AI platforms collect information about students, including learning pace, test results, and areas of interest. If this data is not properly protected, personal information may be at risk.

Example: If a platform's server is located abroad, it may conflict with national information security regulations. In such cases, cooperation with these platforms may be considered risky.

In conclusion, although AI technologies offer significant opportunities for implementation in general education schools, their practical adoption faces multiple challenges, including technical, financial, psychological, and methodological issues. Addressing these challenges requires: improving school infrastructure, providing teacher training courses, creating content in the Uzbek language, developing national platforms, and promoting the advantages of digital education to the population.

Application of Artificial Intelligence in General Education in Uzbekistan [3, 4, 5]

1. Experience with the Eduten Platform.

In 2023, UNICEF, in collaboration with the Ministry of Public Education of the Republic of Uzbekistan, conducted a pilot of the Eduten platform. This platform is an AI-based digital tool for teaching mathematics. The results of the pilot demonstrated that students' mathematics proficiency increased on average by 16.9%. Teachers adapted the platform to the learning process, providing tasks tailored to the individual needs of each student. This experience highlights the effectiveness of artificial intelligence in enhancing educational outcomes.

2. Application of Artificial Intelligence and Robotics in Biology Education.

Research conducted by teachers at the State Pedagogical Institute emphasized that AI and robotics tools play a crucial role in creating interactive teaching methods in biology education. For example, using virtual laboratories and simulations allows students to study cell structure and identify biological processes. These tools increase student engagement and contribute to improving the quality of education.

3. Digital Education and Artificial Intelligence in Uzbekistan.

Within the framework of the "Digital Uzbekistan 2030" strategy, considerable attention is being paid to the implementation of digital educational tools. The strategy aims to enhance education quality, improve students' learning outcomes, and individualize the learning process through the introduction of AI and digital learning platforms. These initiatives contribute to modernizing the education system in accordance with contemporary requirements.

The Role of Artificial Intelligence in Teaching Biology

1. Personalized Learning.

Artificial intelligence platforms provide tasks and learning materials tailored to the student's level of knowledge. This enables instruction that meets the individual needs of students and increases their engagement and interest in the learning process.

2. Automated Assessment Systems.

AI-based assessment systems allow rapid and efficient evaluation of student work. This reduces teachers' workload and provides them with more time to focus on personalized interaction with students.

3. Interactive and Visual Learning Tools.

Through virtual laboratories, 3D modeling, and animations, biology instruction becomes more accessible and engaging for students. These tools allow biological processes to be presented clearly and comprehensibly, enhancing student understanding and active participation.

CONCLUSION

In conclusion, the application of artificial intelligence in the general education system, particularly in teaching biology, contributes to improving the quality of education, providing personalized learning tailored to individual student needs, and facilitating the individualization of the learning process. In Uzbekistan, reforms and research in this field play a significant role in modernizing the education system in line with contemporary standards.

Thus, artificial intelligence creates significant opportunities in the general education system, particularly in subjects such as biology, which require extensive analysis and hands-on experimental experience. AI tools play a crucial role in individualizing the learning process, creating engaging and interactive learning environments, and facilitating effective assessment. At the same time, the successful implementation of AI requires particular attention to infrastructure development, teacher training, and the creation of national-language educational conten

REFERENCES

1. Bahromov, A. Sh. (2024). Artificial intelligence and its opportunities in the educational process. Education and Innovative Research, (2)5, 45–52.
2. Rasulov, D. (2023). Artificial intelligence in teaching biology in secondary schools. American Journal of Pedagogical and Educational Research, 3(11), 28–33.
3. UNICEF. (2023). Eduten platform pilot experience in Uzbekistan. Retrieved June 10, 2025, from https://www.unicef.org/uzbekistan
4. Pankratova, N. D. (2022). Artificial intelligence: Technologies and prospects. Moscow: Nauka.
5. Goncharov, S. V. (2023). Application of artificial intelligence in the educational process. Modern Problems of Science and Education, (6), 94–98.