

**OPEN ACCESS**

SUBMITTED 30 June 2025

ACCEPTED 29 July 2025

PUBLISHED 31 August 2025

VOLUME Vol.05 Issue08 2025

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Application of Artificial Intelligence Technologies in Teaching Biology at School

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Abstract: The article examines the application of artificial intelligence (AI) technologies in teaching biology at school. It describes modern AI tools and their capabilities, including modeling of biological processes, visualization of invisible objects, adaptive learning, and automation of routine tasks. The study demonstrates that AI integration facilitates the individualization of the educational process, enhances visualization of content, develops critical and analytical thinking, and fosters students' research skills. The main advantages and challenges of AI implementation in educational practice are identified.

Keywords: Artificial intelligence, biology, digital technologies, adaptive learning, visualization, research skills, personalized learning, education effectiveness.

Introduction: The rapid development of digital technologies has led to the emergence of new tools that radically transform teaching approaches and open previously inaccessible opportunities for teachers and students. One of the most promising and actively developing areas today is the use of artificial intelligence (AI) in education.

AI has already moved beyond being an abstract concept in high technology and has firmly entered the practice of teaching various subjects. Its potential is particularly evident in biology, a science that combines complex theoretical concepts, practical experimentation, and the need for systematic thinking and analysis of interrelationships within living systems.

In the context of the accelerated digitalization of education, AI is becoming not merely an auxiliary tool but a powerful instrument capable of fundamentally

transforming the structure and content of the learning process. It helps teachers automate routine tasks, effectively analyze student performance, select optimal teaching methods, and adapt material to the individual needs of each learner.

As a result, biology education is taking on new forms: it becomes more interactive, visually rich, and engaging, relying on scientifically grounded methods. The integration of AI not only enhances student motivation but also prepares them for contemporary challenges requiring critical thinking, research skills, and the ability to work with large datasets.

AI Tools in Biology Education

Currently, a wide range of AI-based tools is used in education, including intelligent learning platforms, adaptive testing systems, virtual laboratories, and 3D model and simulation generators. In teaching biology, they enable:

- ✚ modeling of complex biological processes (e.g., cellular mechanisms or population dynamics);
- ✚ visualization of objects invisible to the human eye (viruses, molecules, cell organelles);
- ✚ selection of learning materials according to each student's preparedness level;
- ✚ automation of assignment checking and performance tracking.

One of the key benefits of AI integration is adaptive learning. AI algorithms analyze each student's progress, identify knowledge gaps, offer personalized tasks, and adjust the format of content delivery.

This approach helps:

- ✚ quickly address difficulties in mastering topics;
- ✚ motivate students through engaging formats (videos, interactive models, simulations);
- ✚ develop independence and research skills.

AI and Research-Based Learning in Biology

Biology as a science presupposes active research activity. With the help of AI, students can:

- ✚ conduct virtual experiments without requiring complex laboratory equipment;
- ✚ forecast changes in ecosystems using large datasets;
- ✚ analyze observational and experimental results with intelligent analytical tools.

The main advantages of AI in biology education include:

- ✚ improved clarity through high-quality visualization;
- ✚ saving teacher time on routine tasks;

- ✚ enabling self-paced learning;
- ✚ increasing student engagement and interest in the subject.

Challenges of AI Integration

Despite its advantages, integrating AI into biology education poses several challenges:

- ✚ the need for technical equipment in schools;
- ✚ training teachers to work with new tools;
- ✚ the risk of excessive reliance on technology, potentially reducing the development of independent thinking.

CONCLUSION

The use of artificial intelligence in teaching biology offers broad prospects for improving the quality of education. When integrated effectively, AI becomes not just an auxiliary instrument but an active participant in the learning process, turning lessons into engaging research activities and fostering critical and analytical thinking among students.

Furthermore, AI allows for deeper immersion into the subject through interactive simulations, three-dimensional visualization of biological processes, and automatic selection of tasks according to each student's knowledge level. Such personalization not only eliminates learning gaps but also develops students' strengths.

Automation of routine tasks such as test grading or processing laboratory results frees up teacher time for creative and research-oriented activities. As a result, the learning process becomes more flexible, dynamic, and tailored to the needs of a specific class or individual learner.

Thus, the integration of AI in teaching biology goes beyond being a technological innovation—it is a strategic direction that contributes to the development of 21st-century skills, including information literacy, research competence, and the ability to make informed decisions.

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