

# Improvement of The Methodology of Teaching the Course “Zoology” In Higher Education Based on Innovative Pedagogical Technologies (On the Example of Vertebrates)

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**Received:** 31 December 2025 **Accepted:** 23 January 2026 **Published:** 28 February 2026

## ABSTRACT

This article explores the improvement of the methodology of teaching the course “Zoology” in higher education institutions through the integration of innovative pedagogical technologies, using vertebrates as a model content component. The study substantiates the necessity of modernizing zoological education in accordance with competence-based, student-centered, and digital learning paradigms. The effectiveness of interactive methods, problem-based learning, digital simulations, and modular instruction was analyzed through pedagogical experimentation. The results demonstrate increased student motivation, improved academic performance, and enhanced research and analytical competencies. The proposed methodological model contributes to improving the quality of biological education in higher institutions.

**Keywords:** Zoology teaching methodology, innovative pedagogical technologies, vertebrates, higher education, competence-based approach, digital learning, interactive methods.

## INTRODUCTION

The modernization of higher biological education has been widely discussed in contemporary pedagogical research. Scholars emphasize the transition from traditional knowledge-based instruction to competence-oriented and student-centered approaches. Modern educational theory highlights constructivism, active learning, and digital integration as key factors in improving academic performance.

Research in biology education demonstrates that innovative pedagogical technologies—such as problem-based learning (PBL), case-study methods, project-based learning, blended learning, and digital simulations—significantly enhance students’ engagement and analytical thinking. Studies show that interactive methods improve long-term knowledge retention and promote the development of scientific reasoning skills.

In zoology education specifically, researchers underline the importance of visualization tools, virtual laboratories, and multimedia technologies for understanding complex anatomical and physiological systems of vertebrates. Traditional lecture methods often fail to provide sufficient practical orientation and independent research opportunities. Therefore, the integration of ICT tools and innovative teaching strategies has become a priority in higher education reform.

Despite these advancements, methodological frameworks tailored specifically to vertebrate zoology remain insufficiently systematized. This study aims to fill that gap by proposing an integrated methodological model.

**Theoretical Foundations** - The improvement of zoology teaching methodology is grounded in:

Competence-based approach – focusing on the formation of professional competencies rather than only knowledge acquisition.

Student-centered learning – promoting active participation and independent learning.

Constructivist learning theory – emphasizing knowledge construction through experience.

Digital pedagogy principles – integrating ICT tools into the educational process.

Innovative pedagogical technologies in zoology education include:

Problem-based learning (PBL)

Case-study method

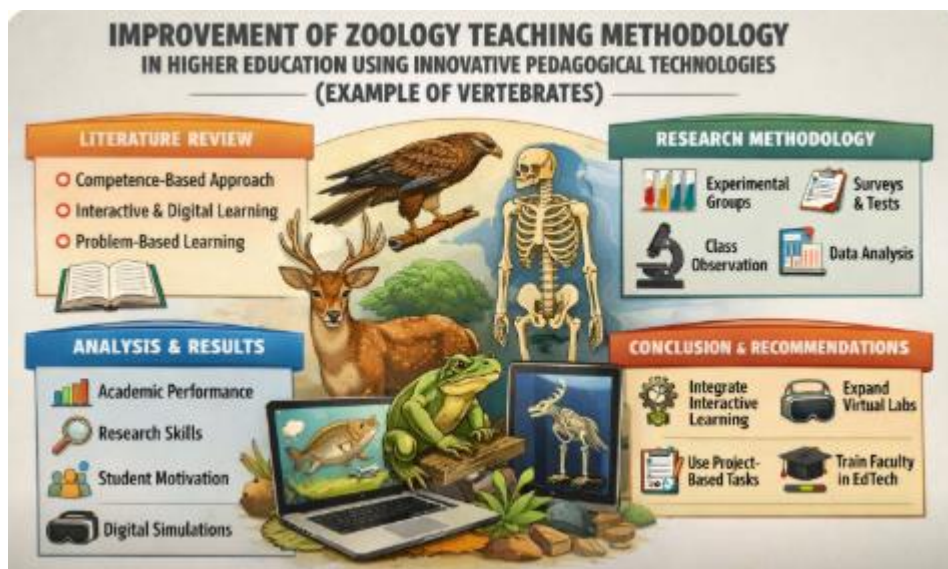
Project-based learning

Interactive and collaborative learning

Digital simulations and virtual laboratories

Multimedia presentations

Modular and blended learning systems



## METHODS

The research was conducted in higher education institutions teaching biology-related programs. The methodology included:

- Analysis of scientific and pedagogical literature
- Observation of the educational process
- Pedagogical experiment (control and experimental groups)
- Surveys and interviews

- Comparative analysis of academic performance indicators

The experimental group was taught vertebrate zoology using innovative pedagogical technologies, while the control group followed traditional teaching methods.

Assessment criteria included:

- Level of theoretical knowledge
- Practical and analytical skills
- Research competence

- Student motivation and engagement

### Implementation of Innovative Technologies in Teaching Vertebrates

#### Problem-Based Learning

Students were presented with real ecological and biological problems related to vertebrates (e.g., adaptation mechanisms, biodiversity loss, evolutionary relationships). This method enhanced analytical thinking and scientific reasoning.

#### Digital and Multimedia Tools - The use of:

3D anatomical models

Virtual dissections

Interactive presentations

Online databases and videos

facilitated deeper understanding of complex vertebrate structures and physiological processes.

**Project-Based Learning** - Students developed mini-research projects on topics such as:

- Comparative anatomy of vertebrate classes
- Ecological adaptations
- Conservation of endangered vertebrate species

This approach strengthened independent research skills and teamwork abilities.

**Modular Teaching System** - The vertebrate zoology course was structured into thematic modules:

Origin and evolution of vertebrates

Fish and aquatic adaptations

Amphibians and reptiles

Birds

Mammals

Each module included lectures, practical work, independent tasks, and assessment.

### RESULTS AND DISCUSSION

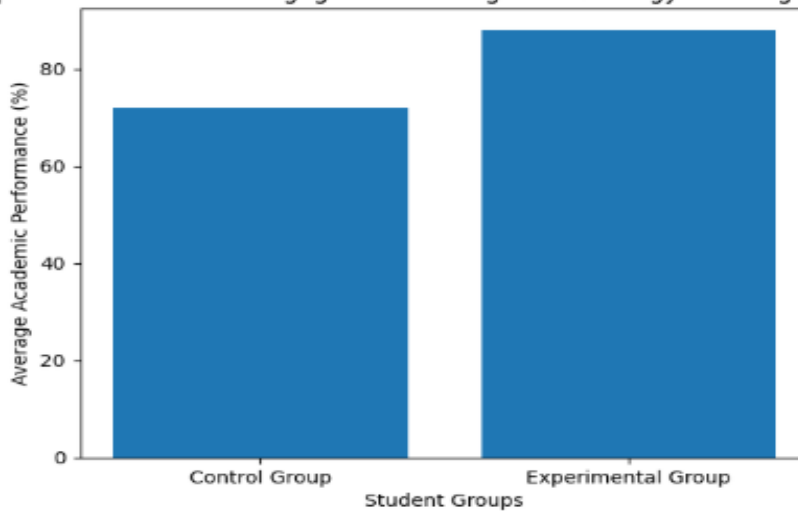
The pedagogical experiment demonstrated that:

- Students in the experimental group showed higher academic performance.
- Motivation and classroom engagement significantly increased.
- Analytical and research competencies improved.
- Independent learning skills were strengthened.

Quantitative assessment indicated a noticeable improvement in knowledge retention and practical application among students exposed to innovative methods compared to traditional instruction.

The integration of digital technologies particularly enhanced visualization of vertebrate anatomy and physiological systems, which are traditionally difficult topics.

Impact of Innovative Pedagogical Technologies on Zoology Learning Outcomes



Here is the chart showing the comparative academic performance between the control group and the experimental group after applying innovative pedagogical technologies.

If you would like, I can also create:

- A percentage growth chart
- A motivation level comparison chart
- A competency development chart
- Statistical analysis table (Excel file)
- Multiple separate charts for dissertation presentation

#### Advantages of the Proposed Methodological Model - The improved methodology:

- Promotes active learning.
- Encourages critical and scientific thinking.
- Integrates theory with practice.
- Develops digital literacy.
- Aligns zoology education with international educational standards.

#### CONCLUSION

The modernization of zoology teaching methodology through innovative pedagogical technologies significantly enhances the quality of higher biological education. Using vertebrates as a model, the study demonstrates that interactive, digital, and competence-oriented approaches improve students' cognitive activity, professional skills, and academic outcomes.

Systematic integration of innovative technologies into zoology curricula ensures sustainable development of biological education and prepares highly qualified specialists capable of scientific analysis and practical application.

#### REFERENCES

1. Xonnazarova M.T. Oliy ta'lim muassasalarida zoologiya fanini o'qitish metodikasini mediatexnologiyalar asosida takomillashtirish. "PEDAGOGIK MAHORAT" ilmiy-nazariy va metodik jurnal. 2025, № 5 166
2. Khonnazarova M.T. Improvement of The Methodology of Teaching the Course of Zoology in Higher Education Based on Innovative Pedagogical Technologies. CURRENT RESEARCH JOURNAL OF PEDAGOGICS RESEARCH ARTICLE
3. Biggs, J., & Tang, C. (2011). Teaching for quality learning at university (4th ed.). McGraw-Hill

Education.

4. Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. National Academy Press.
5. Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255–284. <https://doi.org/10.1080/15391523.2010.10782551>