



PEDAGOGICAL AND METHODOLOGICAL FOUNDATIONS OF IMPLEMENTING AN INTEGRATIVE APPROACH IN TEACHING ZOOLOGY

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ABSTRACT

This article analyzes the theoretical and methodological foundations of implementing an integrative approach in zoology education. The integration of zoology with biology, ecology, chemistry, and information technologies is examined through the example of an endemic antelope — a representative of the vertebrate group — found in Uzbekistan. The 5E instructional model is proposed as a practical framework for designing integrative lessons.

1. Introduction

The Modern Education System Is Increasingly Advancing The Demands For Interdisciplinary Integration. Teaching Individual Subjects In Isolation Leads Not Only To Fragmented Knowledge, But Also To Students' Inability To Perceive Meaningful Connections With Real Life.¹ In Particular, An Integrative Approach Is Especially Important For A Complex Biological Discipline Such As Zoology: Animal Anatomy And Physiology Are Intrinsically Linked To Chemistry, Animal Ecology To Biological Geography, And Systematics To Information Technologies.²

The Higher Education Standards Of Uzbekistan Have Also Established The Principle Of Interdisciplinary Connectivity. However, In Practice, Zoology Courses Are Often Limited To The Provision Of Morphological And Taxonomic Information, While Animal Ecology, Conservation, And Geographical Distribution Are Pushed To The Background.³ This Situation Creates The Risk Of Students Failing To Develop Critical Thinking Skills In Relation To Ecological Problems.⁴

The Purpose Of This Article Is To Elucidate The Theoretical And Methodological Foundations Of The Integrative Approach And To Propose Practical Models For Its Implementation, Utilizing The Endemic Fauna Of Uzbekistan As A Pedagogical Resource.

2. Theoretical Foundations Of The Integrative Approach

¹Dewey J. (1938). Experience and Education. New York: Macmillan.

²Qodirov M.M. (2020). Integrative Approach in Biology Education. Tashkent: O'zbekiston nashriyoti.

³Ministry of Higher Education of the Republic of Uzbekistan (2022). Biology Education Standard. Tashkent.

⁴Nazarov O'. (2019). Modern Pedagogical Technologies in Teaching Zoology. Tashkent: TDPU Publishing House.

The Integrative Approach In Education Has Given Rise To The Convergence Of Several Independent Scholarly Directions. First, J. Dewey's Theory Of Experience-Based Learning Views The Student Not As A Passive Recipient Of Information, But As An Active Researcher.⁵ Second, L.S. Vygotsky's Concept Of The Zone Of Proximal Development Provides A Theoretical Rationale For Expanding Students' Cognitive Potential Through Interdisciplinary Connections.⁶

B. Bloom's Taxonomy Of Cognitive Development Serves As A Methodological Foundation For Defining Integrative Learning Objectives Within A Hierarchical System. The Levels Of Knowledge, Comprehension, Application, Analysis, Synthesis, And Evaluation Must Be Systematically Cultivated Across Zoology Lessons.⁷

The 5e Instructional Model (Engage, Explore, Explain, Elaborate, Evaluate) Is Considered The Most Suitable Methodological Framework For Designing Integrative Lessons.⁸ This Model Is Applied In A Zoology Lesson As Follows: During The Introductory Phase, Students Are Presented With A Problem-Based Question About An Animal; During The Exploration Phase, They Engage With Ecological, Anatomical, And Geographical Data; During The Explanation Phase, Theoretical Frameworks Are Constructed; During The Elaboration Phase, Knowledge Is Transferred To New Contexts; And During The Evaluation Phase, Analytical Tasks Are Used To Assess Outcomes.⁹

3. Integration Through Endemic Fauna: The Case Of The Saiga Antelope

The Saiga Antelope (Saiga Tatarica), Found On The Ustyurt Plateau And In The Kyzylkum Desert Of Uzbekistan, Is A Symbolic Representative Of The Central Asian Ecosystem. The Anatomy, Ecology, And Conservation Of The Saiga Simultaneously Offer Numerous Interdisciplinary Learning Opportunities.¹⁰

Directions Of Integration:

- Anatomy + Chemistry: The Saiga's Distinctive Nasal Structure Demonstrates The Combined Effect Of Thermodynamic And Chemical Factors In Optimizing Respiration.
- Ecology + Geography: The Saiga's Seasonal Migrations Are Analyzed In Relation To Climate Change And Landscape Geography.
- Systematics + Information Technologies: Using The Gbif And Inaturalist Databases, Students Compile Maps Of The Saiga's Geographical Distribution.

⁵Dewey J. (1938). *Experience and Education*. New York: Macmillan.

⁶Vygotsky L.S. (1978). *Mind in Society: Development of Higher Psychological Processes*. Cambridge: Harvard University Press.

⁷Bloom B.S. (1956). *Taxonomy of Educational Objectives. Handbook I: Cognitive Domain*. New York: David McKay Co.

⁸Bybee R.W. et al. (2006). *The BSCS 5E Instructional Model: Origins and Effectiveness*. Colorado Springs: BSCS.

⁹Begmatov A. (2021). Integration of Ecology and Animal Geography with the Zoology Course. *Biology and Chemistry Education*, 3(2), 12–18.

¹⁰Sultanova M., Toshmatova Z. (2023). Saiga Antelope: A Key to the Steppe Ecosystem of Central Asia. *Uzbekistan Zoology Journal*, 1(1), 45–52.

- Conservation Biology + Social Sciences: The Economic And Social Factors Contributing To The Decline In The Species' Population Are Examined.

An Integrative Lesson On The Saiga Antelope, Structured According To The 5e Model, Takes The Following Form: Engage — The Lesson Begins With The Question «Is The Saiga On The Verge Of Extinction In Uzbekistan?»; Explore — Students Collect Data On Saiga Population Dynamics From Interactive Maps And Scientific Articles; Explain — The Species' Nomenclature, Morphology, And Adaptations Are Systematically Elucidated; Elaborate — Students Develop A Conservation Proposal Project For The Saiga; Evaluate — Group Presentations Are Assessed Against Critical Criteria.

4. Principles Of Implementing The Integrative Approach

The Following Principles Are Recommended For The Effective Implementation Of The Integrative Approach In Zoology Education.

1. Systematicity: Integration Must Not Be Incidental, But Should Be Planned Within The Framework Of The Curriculum.
2. Coherence: Content Alignment Between The Disciplines Being Integrated Must Be Ensured.
3. Student-Centeredness: Students Must Actively Participate In The Process Of Solving Problems And Must Not Remain Passive Listeners.
4. Locality: Incorporating Uzbekistan's Flora And Fauna Into Instructional Materials Enhances Educational Motivation.
5. Assessment Alignment: Integrative Learning Outcomes Must Be Evaluated Through Integrative Assessment Methods.

It Is Necessary To Consider Establishing Sustained Methodological Collaboration Between The Department Of Zoology And The Departments Of Ecology, Biological Geography, And Information Technologies Within Higher Education Institutions.¹¹ Such Collaboration May Be Realized Through The Joint Design Of Shared Curricula, Laboratory Workshops, And Field Practice Sessions.

5. Recommendations

Higher Education Institutions Are Encouraged To Adopt The Following Measures To Ensure The Sustainability Of The Integrative Approach In Zoology Teaching:

1. Develop Joint Interdepartmental Zoology Curricula That Formally Incorporate Modules From Ecology, Geography, And Digital Sciences.
2. Introduce The 5e Instructional Model As A Standard Framework For Lesson Planning Within Zoology Methodology Courses.
3. Establish Faculty Working Groups Responsible For Updating Integrative Course Content Annually, Incorporating Current Findings On Uzbekistan's Endemic Fauna.
4. Prioritize The Use Of Open Biodiversity Platforms Such As Gbif And Inaturalist In Practical And Laboratory Instruction.
5. Design Assessment Rubrics That Evaluate Students On Both Disciplinary Knowledge And Cross-Disciplinary Synthesis Competencies.

¹¹Rashidova N. (2022). Problem-Based Teaching Methods in Zoology in Higher Education. Pedagogy and Psychology, 4(1), 33–39.

6. Conclusion

The Integrative Approach Is Recognized As One Of The Key Directions Of Methodological Renewal In Zoology Education. Uzbekistan's Rich And Diverse Fauna, Particularly Its Endemic Species, Constitutes A Natural Didactic Resource For This Approach. Examining Local Ecological Issues — Such As Those Concerning The Saiga Antelope — Through The Intersecting Lenses Of Zoology, Chemistry, Geography, And The Social Sciences Simultaneously Fosters Students' Critical Thinking, Scientific Worldview, And Ecological Responsibility.¹²

In The Future, It Is Planned To Conduct Large-Scale Pedagogical Experiments Aimed At Empirically Demonstrating The Effectiveness Of This Approach Through Comparative Studies Using Control Groups And The Measurement Of Learning Outcomes.¹³

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