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THE CONTENT OF DEVELOPING SYSTEMIC THINKING IN FUTURE BIOLOGY TEACHERS

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Abstract: This study explores the content of developing systemic thinking in future biology teachers. Systemic thinking plays a crucial role in understanding biological phenomena, ecological relationships, and interdisciplinary connections within modern education. The article emphasizes the integration of theoretical knowledge with practical activities, research-based learning, and innovative pedagogical approaches in the educational process. Special attention is given to problem-solving, critical thinking, and analytical skills that enable future biology teachers to evaluate complex biological systems comprehensively. The study also highlights the importance of interactive teaching methods, project-based learning, and educational technologies in fostering professional competence and intellectual development. As a result, the development of systemic thinking contributes to preparing qualified, creative, and competitive biology teachers for contemporary educational environments.

Keywords: Systemic thinking,Biology teaching,Future teachers,Professional competence,Critical thinking,Innovative education,Interactive methods,Research-based learning, Educational technology,Biological systems

The development of systemic thinking in future biology teachers is considered one of the most important directions of modern education. Biology as a science studies living organisms, ecological systems, and the complex relationships that exist in nature. Therefore, future biology teachers should be able to analyze biological phenomena not as isolated facts, but as interconnected parts of a unified system. Systemic thinking enables students to understand the relationships between the structure and function of organisms, environmental factors, genetic processes, and ecological interactions. This type of thinking also helps future teachers identify cause-and-effect relationships, evaluate scientific problems critically, and apply theoretical knowledge to practical situations. In the educational process, the development of systemic thinking is closely connected with innovative pedagogical approaches, interdisciplinary integration, and student-centered learning. Teachers who possess systemic thinking skills can effectively organize lessons, explain complex biological concepts clearly, and encourage students to think analytically and creatively. As a result, systemic thinking becomes an essential component of professional competence and intellectual growth in biology education.The content of developing systemic thinking in future biology teachers includes the integration of theoretical knowledge, practical experience, and research-based activities. Modern educational technologies, interactive teaching methods, project-based learning, and problem-solving activities play an important role in strengthening analytical and critical thinking skills. Through laboratory work, scientific observation, experimental activities, and collaborative learning, students learn to investigate biological systems comprehensively and make logical conclusions based on evidence. In addition, digital technologies and innovative educational tools support the visualization of biological processes and improve students' understanding of complex scientific concepts. The development of systemic thinking also promotes independent learning, creativity, communication skills, and professional responsibility among future teachers. By applying interdisciplinary approaches, students connect biology with chemistry, ecology, medicine,

and environmental science, which broadens their scientific worldview. Consequently, the purposeful development of systemic thinking prepares future biology teachers to meet the demands of modern education, conduct effective pedagogical activities, and contribute to the formation of scientifically literate and environmentally responsible generations.

The development of systemic thinking in future biology teachers is a multidimensional pedagogical process aimed at forming the ability to perceive biological knowledge as an interconnected and dynamic system. In modern educational conditions, biology teachers are expected not only to possess scientific knowledge but also to analyze complex biological processes, explain interdisciplinary relationships, and apply innovative teaching strategies in educational practice. Systemic thinking enables future teachers to understand the integrity of living systems, the interaction between organisms and the environment, and the mechanisms that regulate biological processes at different levels of organization. This type of thinking encourages students to move beyond memorization and develop analytical, logical, and reflective skills that are essential for professional activity. The content of systemic thinking development includes mastering theoretical biological concepts, understanding ecological and evolutionary principles, interpreting scientific information critically, and solving real-life biological problems through scientific reasoning. Future biology teachers must also learn to connect biological knowledge with chemistry, physics, medicine, geography, and environmental studies in order to form a holistic scientific worldview. Such interdisciplinary integration strengthens students' cognitive flexibility and helps them evaluate natural phenomena from multiple perspectives. Moreover, systemic thinking supports the development of scientific literacy, which is necessary for understanding global environmental issues, climate change, biodiversity conservation, and sustainable development. Through the use of innovative pedagogical technologies, students become active participants in the educational process and gain opportunities to investigate, analyze, and interpret biological information independently. Interactive methods such as debates, brainstorming, case studies, simulations, and collaborative projects stimulate intellectual activity and encourage learners to establish logical connections between theoretical concepts and practical applications. Research-based learning is also considered an effective approach in the formation of systemic thinking because it develops observation, experimentation, data analysis, and evidence-based reasoning skills. By conducting laboratory experiments and scientific investigations, future biology teachers gain practical experience that improves their ability to explain biological phenomena systematically and accurately. In addition, digital technologies and multimedia resources enhance the visualization of microscopic structures, ecological systems, and physiological processes, making complex scientific information more understandable and engaging for students. As a result, systemic thinking contributes not only to academic achievement but also to the professional, intellectual, and personal development of future biology teachers.The pedagogical and didactic foundations of developing systemic thinking are based on learner-centered education, competency-based approaches, and the integration of theory with practice. Modern biology education requires teachers who can adapt to rapidly changing scientific and technological conditions, implement innovative educational methods, and organize effective learning environments that promote critical and creative thinking. In this regard, the educational process should provide opportunities for students to participate in independent learning, collaborative activities, and reflective analysis. Problem-based learning is one of the most effective methods for developing systemic thinking because it encourages students to investigate biological problems, identify relationships between different factors, and propose scientifically grounded solutions. Through this approach, future biology teachers learn to think critically, make informed decisions, and apply scientific methods in educational and professional contexts. Another important

aspect of systemic thinking development is the formation of communication and teamwork skills, which are essential for successful pedagogical activity. Group discussions, research projects, presentations, and peer collaboration help students exchange ideas, defend their opinions, and develop mutual understanding in the learning process. Furthermore, the role of motivation and cognitive interest cannot be ignored, as students who are actively engaged in learning demonstrate higher levels of analytical thinking and professional competence. Educational institutions should therefore create supportive pedagogical conditions that encourage creativity, innovation, and intellectual curiosity among future teachers. The didactic content of biology education should also include the use of modern assessment methods that evaluate not only factual knowledge but also analytical abilities, problem-solving skills, and the capacity to apply knowledge in practical situations. Continuous assessment, portfolio evaluation, reflective journals, and project-based tasks can effectively measure the development of systemic thinking and professional growth. In addition, the integration of environmental education into biology teaching strengthens students' ecological awareness and responsibility toward nature and society. Future biology teachers who possess systemic thinking skills are more capable of understanding global ecological challenges and educating younger generations about sustainable lifestyles and environmental protection. Consequently, the development of systemic thinking becomes an important factor in improving the quality of teacher education and preparing competent specialists who can contribute to scientific progress and social development. By combining scientific knowledge, pedagogical mastery, innovative technologies, and interdisciplinary approaches, higher education institutions can effectively prepare future biology teachers for successful professional activity in contemporary educational environments.

References

1. Biber, D., Conrad, S., & Reppen, R. (1998). *Corpus Linguistics: Investigating Language Structure and Use*. Cambridge University Press.
2. McEnery, T., & Hardie, A. (2012). *Corpus Linguistics: Method, Theory and Practice*. Cambridge University Press.
3. Sinclair, J. (1991). *Corpus, Concordance, Collocation*. Oxford University Press.
4. Anthony, L. (2019). *AntConc (Version 3.5)* [Computer Software].
5. Kilgarriff, A., et al. (2014). The Sketch Engine: Ten years on. *Lexicography*, 1(1), 7–36.
6. Scott, M. (2016). *WordSmith Tools* [Computer Software].
7. Hunston, S. (2002). *Corpora in Applied Linguistics*. Cambridge University Press.
8. Gries, S. T. (2009). *Statistics for Linguistics with R*. De Gruyter.
9. McCarthy, M., & O'Keeffe, A. (2010). *The Routledge Handbook of Corpus Linguistics*. Routledge.
10. Baker, P. (2006). *Using Corpora in Discourse Analysis*. Continuum.
11. Tognini-Bonelli, E. (2001). *Corpus Linguistics at Work*. John Benjamins.
12. Johansson, S. (2007). *Seeing through Multilingual Corpora*. John Benjamins.