European Journal of Interdisciplinary Research and Development
Volume- 45 November- 2025
Website: www.ejird.journalspark.org ISSN (E): 2720-5746

METHODOLOGICAL STEPS AND BASIC PRINCIPLES THAT ENSURE EFFECTIVE PROBLEM-SOLVING AND PRACTICAL EXERCISE PERFORMANCE FOR YOUNG TEACHERS

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Abstact
This article discusses the main principles and methodological recommendations for teaching future biology teachers effective and simple methods of solving practical exercises and problems.

Keywords: Biology, young teachers, problem-solving, development, modernity, complex task, problematic situation.

Introduction

Nowadays, the attention given to the education system has reached the level of state policy, which is especially evident in school education. The requirements for young specialists being hired as teachers (where previously only a diploma was needed) have significantly increased. For example, an English language teacher is now required to have at least a B2-level national or international certificate — clear evidence of this change. Similarly, the expectations for young biology teachers have also risen considerably, and one of the key requirements is their ability to effectively solve practical exercises and problems in biology[1]. In this article, we discuss the effective methods for young teachers to perform practical exercises and solve problems, as well as the methodological steps and fundamental principles for developing these skills[2].

Literature review

Based on the information presented in the methodology books for teaching biology written by scholars such as I.N. Ponomareva, O.G. Rogovaya, V.P. Solomin, Judit Orgoványi-Gajdos, and Özçakır Sümen, we can identify the following key stages that young teachers need to master in order to effectively solve practical exercises and problems in biology, as well as to easily and correctly find solutions to problematic situations encountered in their pedagogical practice:[3]

[1] Arbuzova, E. N. — Methodology of Teaching Biology: A Textbook for Bachelor's and Master's Programs, 2nd edition, Moscow, Yurayt, 2019.
[2] Andreeva, N. D., Azizova, I. Yu., Malinovskaya, N. V. — Methodology of Teaching Biology in Modern Schools: Textbook and Practicum for Bachelor's and Master's Programs, 2nd edition, Yurayt, 2019.
[3] Ponomareva, I. N., Rogovaya, O. G., Solomin, V. P. — Methodology of Teaching Biology: Textbook for Students of Higher Professional Education, Akademiya Publishing, 2012.

Starting with strengthening theoretical preparation: every exercise or problem is based on a solid theoretical foundation. A young teacher must first have a strong grasp of the fundamental laws, concepts, and formulas of the subject. For example, to solve genetic hybridization problems, it is essential to have a thorough understanding of Mendel's laws, since comprehension of the problem's core meaning begins with this theoretical aspect. Classifying problems by categories makes the process easier and more systematic. Problems should be solved gradually, from simple to complex, so that students can clearly understand how the solution is reached and develop logical thinking skills. The next step is to form a solution algorithm. A young teacher should follow a clear sequence of steps in problem-solving: carefully read and understand the problem conditions, distinguish what is known and what is unknown, identify the theoretical basis (law, rule, or formula), select and apply the solution method. At the end of the process, it is important to analyze the obtained result and relate it to a real-life example.

To reinforce understanding, it is advisable to use experience and context. Linking each practical exercise or problem to real-life examples enhances its effectiveness. For instance, explaining the "process of osmosis" not only theoretically but also by demonstrating it—such as soaking pea seeds in water, illustrating the stages of germination through pictures, and showing observable results—helps students grasp the concept more deeply.

For newly acquired knowledge and mastered information to be retained in students' minds for a long time, it is essential to create a problem-based situation during the reinforcement stage of the lesson. This encourages students to think independently and to apply the acquired knowledge in relevant contexts. To achieve this, a young teacher should avoid giving ready-made answers. Instead, they should engage students in the process of discovery through asking questions, initiating discussions, and comparing different viewpoints. Such an approach ensures more effective and lasting learning outcomes. It is also important to analyze and reflect on the obtained results. After finding a solution, it should not merely be evaluated as "right or wrong"; rather, an explanation of *why* it turned out that way is required. This practice helps both the young teacher and students develop deeper analytical and reflective thinking. [4] Once a certain goal has been achieved, continuous practice must follow. Exercises and problem-solving activities should be incorporated into every lesson. After each topic, solving at least one practical task or problem should become a habit — otherwise, knowledge is quickly forgotten, and skills and competencies fail to form properly.

To ensure that the acquired knowledge, skills, and abilities become well-developed, students should be encouraged toward creativity. A young teacher should not limit themselves to ready-made problems found in textbooks. Instead, they should strive to design new exercises and problems inspired by real life, nature, and daily experiences — this significantly enhances students' learning effectiveness and motivation. [5]

[4] Jeronen, J., Palmberg, I., Yli-Panula, E. — Teaching Methods in Biology Education and Sustainability Education Including Outdoor Education for Promoting Sustainability: A Literature Review.
[5] Oliveira, H., et al. — Practical Work in Science Education: A Systematic Literature Review.

Research Methodology

Based on a set of precise methods of cognition, scientific analyses were conducted using the techniques of analysis and synthesis, induction and deduction, a systematic approach, logical methods of examination, and scientific methods of studying results. Research works by contemporary foreign scholars on analytical and critical thinking were also reviewed, and their scientific conclusions and recommendations were summarized. Some of the key findings from these studies will be discussed in the following section.

Analysis and result

In Judit Orgoványi-Gajdos's book[6], a new scientific concept is proposed -"Problem-Solving as a Pathway to Teacher Professional Growth**"**— which introduces the following innovations to the field of education: a teacher does not merely solve problems but uses them as an opportunity to conduct a reflective analysis of their pedagogical experience. Through this process, teachers develop metacognitive thinking, innovative approaches, and professional autonomy.

The scientific conclusion of the book is that the problem-solving methodology is not only a learning strategy taught to students but also a tool for teachers to develop themselves professionally. The process of professional growth is viewed as a system integrating problem-solving, reflection, and creativity.

This concept was further refined in 2023 by Özçakır Sümen[7]. The new model developed by the author consists of five stages:

Problem Identification – Understanding the problem
Strategy Planning – Planning a course of action
Problem Solving – Implementing the solution
Reflective Thinking – Analyzing one's own thinking
Evaluation & Improvement – Assessing and improving the process

Within this process, "Reflective Thinking**"** is the central stage, where individuals observe and understand their own thought processes. The main innovation of the article is that Reflective Thinking is not merely an auxiliary part of the problem-based teaching and problem-solving model, but its core function. In other words, reflection is not just a post-solution analysis; it operates as a cognitive mechanism at every stage of the problem-solving process. This new approach facilitates a shift from "automatic thinking" to "conscious, analytical thinking," allowing teachers and students to understand and learn from every decision they make.

Reflective thinking is the central part of problem-based thinking. Rather than merely focusing on the solution itself, it emphasizes analyzing how one arrived at that solution. This process develops the ability to "observe one's own thinking." Reflective thinking is an effective method

[6] Judit Orgoványi-Gajdos (ed.) — Teachers' Professional Development on Problem Solving: Theory and Practice for Teachers and Teacher Educators, 2016. This book examines both theoretical and practical aspects of developing teachers' problem-solving skills. link.springer.com

[7] Özçakır Sümen — Reflective Thinking in the Problem Solving Process: A Model Proposal, 2023. This work explores the role of reflective thinking in the problem-solving process. dergipark.org.tr

for enhancing teacher competence: by analyzing the problems encountered in their lessons and reevaluating their pedagogical decisions, teachers achieve professional growth. This process strengthens the concept of the "reflective practitioner".

Methods for developing reflection in education include asking problem-based questions, explaining logical and critical thinking processes, and encouraging students to think through "why?" and "how?" questions. This can be supported by activities such as keeping reflective journals, conducting group discussions, and using reflective questionnaires.

Enhancing educational effectiveness: When a reflective approach is integrated into the learning process, both students and teachers develop metacognitive awareness — the ability to "think about one's own thinking." This, in turn, allows for faster and more creative problem-solving, improving both understanding and performance in the educational process.

Methodological Guidelines:[8]

Based on the results of the conducted research, the following recommendations are proposed for young teachers to effectively solve practical exercises and problems in biology: First of all, thoroughly master the fundamental laws, concepts, and theories of biology, and explain the theoretical foundation of each exercise or problem to students using simple and clear examples. Next, classify and apply exercises and problems step by step as follows:

Repetitive and Reinforcing Type — Simple Exercises
Problem-Based Tasks Requiring Analysis
Creative Problems that Encourage the Search for Multiple Solutions
Research-Oriented Problems Based on Experimentation and Observation

At the next stage, bring exercises and problems closer to real-life situations. For example: asking *"What would happen to human health and nature if the ozone layer disappeared?"* connects theory with real-world context. Use laboratory experiments to reinforce understanding — for instance, demonstrating osmosis in an onion cell or determining a person's blood type are considered effective methods. Similarly, posing inquiry-based questions such as *"Why is an athlete's heart rate slower than that of an average person?"* encourages students to investigate and think critically. [9]

[10]A problem's solution should not be limited to a number or result; students must be required to explain and interpret their answers by identifying causes and effects. This approach develops deep thinking skills and increases the effectiveness of learning. To elevate acquired knowledge and skills to the level of professional competence, make it a habit to solve at least one practical exercise or problem at the end of each topic. Engage students actively in the problem-solving process — use group work, peer evaluation, and collaborative discussion techniques. Avoid relying solely on ready-made textbook problems. Instead, create new, relevant problems

[8] Approaches to Biology Teaching and Learning, CBE—Life Sciences Education.
[9] Izhoykina, Petkevich — Methodology of Teaching Biology: Textbook.
[10] Ministry of Public Education of the Republic of Uzbekistan — Methodological guidelines for teachers and students on developing critical/analytical thinking.

inspired by real life, nature, and modern scientific achievements. For instance: *"Which characteristics of an organism can be altered through genetic engineering?"* [11]

Conclusion / Recommendations

Scientific research shows that the process of problem-based thinking is not only about finding solutions but also about understanding and improving one's own thinking. Reflective thinking and analytical reasoning can transform every educational problem into an opportunity for personal and professional growth.

For young teachers, the ability to effectively solve practical exercises and problems is crucial. This is because modern school textbooks are written in accordance with the requirements of the global education system and the standards of textbooks from developed countries. To understand, explain, and convey this knowledge to students comprehensively, teachers must be able to solve practical exercises and problems proficiently.[12]

The ability to solve complex problems easily and to find correct solutions in problematic situations is an essential life skill for people of any age. This skill plays a significant role in helping individuals overcome obstacles they may encounter throughout their lives and in addressing problems effectively.

To achieve this, students must: thoroughly master theoretical knowledge, study problems in categorized groups, apply algorithmic approaches, use context and experience, create problem-based situations, practice regularly, and approach tasks creatively. In doing so, a teacher not only becomes a highly competent educator but also fosters independent thinking, analytical skills, and creative problem-solving abilities in their students.

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[11] Khan Academy — Sections on Logical Reasoning and Problem Solving.
[12] Ministry of Public Education of the Republic of Uzbekistan — Methodological guidelines for teachers and students on developing critical/analytical thinking.
[12] Thinker's Guide Library — www.criticalthinking.org

7. Özçakır Sümen — Reflective Thinking in the Problem Solving Process: A Model Proposal, 2023. This work explores the role of reflective thinking in the problem-solving process. dergipark.org.tr
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