



USE OF INNOVATIVE PEDAGOGICAL TECHNOLOGIES IN TEACHING NATURAL SCIENCES IN PRIMARY GRADES

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Abstract. *This article provides a detailed analysis of the theoretical foundations, methodological possibilities, and didactic advantages of using innovative pedagogical technologies in teaching natural sciences in primary grades. It highlights the effectiveness of digital resources, STEAM approaches, project-based learning, gamification, and other modern methods in developing students’ scientific thinking, observation skills, experimentation abilities, and analytical competence.*

Keywords: *innovative pedagogical technologies, primary education, natural sciences, STEAM, digital learning, gamification, interactive methods, competence, project-based learning.*

Teaching natural sciences in primary grades today requires not only introducing young learners to basic scientific concepts related to natural phenomena but also developing essential academic and practical competences such as observation, comparison, analysis, experimentation, and drawing conclusions. As the modern education system increasingly demands the use of innovative pedagogical technologies, integrating interactivity, digital tools, visual modeling, gamified elements, project-based and inquiry-based approaches into natural science lessons makes the learning process not only engaging but also greatly enhances students’ independent and creative thinking. Innovative pedagogical technologies turn learners into active participants of the learning process, encouraging them to engage deeply with the content—this directly aligns with John Dewey’s principle of “learning through experience.” In primary education, STEAM (Science, Technology, Engineering, Art, Mathematics) approaches have become widely used, as they allow students to understand complex scientific processes through multidisciplinary integration. For example, when studying the “water cycle,” students may create models using technological tools, express the process visually through art, and analyze measurement data using mathematics. Through such STEAM-integrated activities, learners develop multiple competences simultaneously.

Digital technologies have become an essential component of modern education. The use of animations, virtual labs, 3D models, interactive quizzes, and simulations in natural science lessons enables students to grasp complex scientific phenomena in simplified and visually appealing ways. The well-known TPACK model developed by P. Mishra and M. Koehler emphasizes that effective teaching requires the teacher to skillfully integrate technological, pedagogical, and content knowledge. Therefore, the digital literacy of



primary school teachers plays a crucial role in ensuring lesson effectiveness. Gamification is another powerful innovative tool in natural science teaching. Introducing game-based tasks, point collection systems, level-based challenges, and interactive activities increases students' motivation and maintains their interest throughout the learning process. Game technologies are particularly suitable for young learners, as they enable emotionally positive learning experiences, healthy competition, and active participation in lessons. Project-based learning helps learners engage in small-scale research, conduct experiments, organize findings, and present results. For instance, students may conduct experiments on the conditions necessary for plant growth by comparing different levels of light and moisture. Such activities foster independence, responsibility, and scientific inquiry. Interactive teaching methods—cluster mapping, brainstorming, Venn diagrams, group work, peer assessment, role-playing—enhance communication, collaboration, creativity, and shared learning in natural science classes. Assessment systems based on innovative technologies are also becoming increasingly relevant. Formative assessment, rubrics, portfolios, project outcomes, and electronic tests allow educators to assess learners' real competences more accurately. This eliminates the one-sided nature of traditional assessment and helps track students' developmental dynamics. Teachers' methodological readiness, continuous professional development, and ability to effectively use digital resources are also essential for implementing innovative teaching methods.

All these aspects demonstrate that innovative pedagogical technologies enrich the process of teaching natural sciences in primary grades by making lessons more engaging, effective, and modern. The combination of digital technologies, STEAM, gamification, and interactive methods significantly improves the quality of primary education and expands opportunities for learners to develop scientific, creative, and independent thinking skills. When these innovative approaches are applied harmoniously, they contribute to shaping learners' scientific worldview and fostering essential 21st-century skills.

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