

*S. Tsybulnyak,  
Student,  
O. Zymovets,  
Senior Lecturer,  
Zhytomyr Ivan Franko State University*

## **EDUCATIONAL POTENTIAL OF AR TECHNOLOGIES IN FORMING NATURAL SCIENCE AND ENVIRONMENTAL COMPETENCE IN PRESCHOOL CHILDREN**

The modern system of preschool education is undergoing significant transformation due to the digitalization of the educational environment and the need to develop key competencies in children, particularly natural science and environmental competence. In the context of global environmental challenges – such as climate change, biodiversity loss, and environmental degradation – the issue of ecological education for preschool children is becoming increasingly important. It is during the preschool years that initial ideas about nature, environmentally appropriate behavior, and a conscious, emotionally value-based attitude toward the environment are formed.

At the same time, traditional methods of introducing children to natural objects do not always provide sufficient visualization, dynamism, and emotional engagement. Some natural phenomena are difficult to observe directly, while certain objects remain inaccessible for real-life study in preschool settings. Augmented Reality (AR) technologies offer new opportunities to address these limitations, as they enable the “animation” of educational content, the creation of interactive models of plants, animals, and natural processes, and the immersion of children in safe digital ecosystems.

The formation of environmental competence in preschool children has been extensively studied by scholars such as H. Bielienka, N. Horopakha, L. Zahorodnia, K. Krutii, N. Lysenko, O. Shevtsova, and N. Yarysheva, who emphasize the importance of ecological education and outline its theoretical and conceptual foundations. The development of environmental awareness, motivation, and environmentally appropriate behavior, as well as the integration of innovative technologies into this process, has been explored by N. Havrysh, O. Maksymova, N. Myskova, Yu. Nosenko, O. Pometun, O. Sokolovska, and O. Sorochynska, among others.

The aim of this article is to analyze the educational potential of augmented reality (AR) technologies in the formation of natural science and environmental competence in preschool children.

Based on scientific research and the age-specific psychological characteristics of preschoolers, natural science and environmental competence in senior preschool children can be defined as an integrated personal quality manifested in basic scientific knowledge, an emotional and value-based attitude toward the environment, and the ability to behave in an environmentally appropriate manner in everyday situations [1; 2; 3]. It includes understanding relationships in nature, initial research skills, awareness of personal responsibility for the environment, readiness to protect natural objects, and the ability to apply acquired knowledge in practice [5; 6].

AR technologies provide broad educational opportunities for developing this competence by offering innovative tools for educators to foster children's cognitive, emotional, and practical skills. With their help, it becomes possible to "bring to life" natural phenomena and processes that are difficult or impossible to observe directly, such as plant growth, the water cycle, seasonal changes, and animal migration. This helps children understand relationships within ecosystems, form initial concepts of the complexity and integrity of natural processes, and develop research-oriented thinking.

AR technologies also encourage children to search for answers, compare observed phenomena, conduct simple experiments, and draw their own conclusions. Interactive models of plants, animals, water bodies, and forest ecosystems allow children to explore the beauty and uniqueness of nature, fostering an emotional and value-based attitude toward the environment and encouraging environmentally responsible behavior. Additionally, AR supports the integration of knowledge from different educational domains, including natural science, mathematics, art, and technology, making the learning process more holistic and engaging [4].

Importantly, AR technologies provide a safe way to explore complex or distant natural phenomena, such as volcanoes, ocean depths, or Arctic ecosystems, which are typically inaccessible in preschool settings. This significantly expands children's learning experiences, increases their motivation and interest in environmental topics, and fosters sustainable skills of observation, analysis, and responsible interaction with the environment.

Thus, the use of AR technologies in preschool education enhances children's motivation, stimulates cognitive interest, supports the development of research skills, and contributes to the formation of environmentally conscious behavior.

## REFERENCES

1. Атрощенко Т.О., Попович О.М., Коврей Д.Й., Теоретичні підходи до змістової характеристики природничо-екологічної компетентності дітей як ключової компетентності для сучасної дошкільної освіти. *Інноваційна педагогіка. Дошкільна педагогіка*. Випуск 71. Том 2. 2024. С. 140-144.
2. Максимова Олена. Екологічна компетентність та її формування у дітей старшого дошкільного віку / *Ekologia i racjonalne zarządzanie przyrodą: edukacja, nauka i praktyka [Zasób elektroniczny]: materiały z międzynarodowej konferencji naukowo-praktycznej, Łomża – Żytomierz, 15.11.2023 r.* / Pod redakcją naukową Zoia Sharlovych, Janisz Lisowski, Ruslana Romaniuk. Część 2. Wydawnictwo: MANS w Łomży, 2023. S. 59-66.
3. Маланчук О. Формування природничо-екологічної компетентності в дітей старшого дошкільного віку. *Вересень*. 2023. Том 4 № 99. С. 38 – 50.
4. Носенко Ю. Г. Класифікація імерсивних технологій і сервісів для освітнього процесу. *Наукові записки. Серія: Педагогічні науки*. 2024. № 216. С. 237–242.
5. Розгон В., Миськова Н., Курта В. Формування екологічно доцільної поведінки у дітей раннього та дошкільного віку. *Вісник Глухівського національного педагогічного університету імені Олександра Довженка*. 2025. 2(58). С. 230-237.

6. Стаєнна О. Аналізуємо освітній процес: природничо-екологічний напрям. *Вихователь-методист дошкільного закладу*. 2023. № 3. URL : <https://emetodyst.expertus.com.ua/10004961> .