

**FORMATION METHODOLOGY OF AN INTERACTIVE LEARNING
ENVIRONMENT IN TEACHING SCIENCE BASED ON KAHOOT, GENIALLY
AND WORDWALL PLATFORMS**

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ANNOTATION

This article scientifically and methodologically examines the issues of organizing the educational process effectively in science lessons through digital interactive platforms such as Kahoot, Genially, and Wordwall. During the study, the influence of these platforms on increasing students' learning activity, strengthening motivation, and developing cognitive skills was analyzed. Experimental observations showed that systematic use of these resources increased students' engagement in lessons by 28–35% and improved topic mastery indicators by 15–22%. In addition, the article presents practical results on specific methodological approaches to lesson design, interactive task creation, and lesson scenario development.

The article is intended for teachers, researchers in pedagogy, educational technology, and methodology, as well as educational institutions aiming to implement STEAM-based and modern digital teaching platforms. The material is suitable for use in covering topics related to science education, STEAM integration, digital pedagogy, and interactive teaching methods.

Keywords: Interactive learning, digital pedagogy, Kahoot, Genially, Wordwall, STEAM, science education, learning motivation, gamification, digital resources.

Introduction

In the modern educational system, the widespread integration of digital technologies, innovative methods, and interactive platforms is taking the teaching process to a new stage. Education in the 21st century requires students not only to acquire ready-made knowledge but also to develop independent thinking, problem analysis, creativity, and communication culture. From this point of view, the formation of an interactive learning environment has become an essential component of the contemporary pedagogical process.

Today, in organizing the learning process in an innovative spirit, interactive platforms such as Kahoot, Genially, and Wordwall are widely used as effective tools that enhance teacher–student interaction, strengthen motivation, and improve educational quality. With the help of these

platforms, it is possible to create interactive content such as game elements, visual materials, quizzes, animations, and presentation-style materials during lessons.

Science, as a complex field of natural sciences, aims to develop students' ability to scientifically explain and analyze natural phenomena, approach them experimentally, and cultivate ecological thinking. Therefore, organizing this subject using digital technologies plays a vital role in transforming students into active learners and enhancing their scientific literacy.

Through the Kahoot platform, tests, quizzes, and evaluation processes can be conducted in an engaging way; Wordwall allows the creation of playful exercises such as matching, pairing, and classification; and Genially provides opportunities to prepare visual presentations, interactive maps, and multimedia materials, thereby increasing students' activity in the classroom.

Thus, this article explores the methodology for forming an interactive learning environment in teaching Science based on Kahoot, Genially, and Wordwall platforms, scientifically analyzing effective methods for enhancing students' motivation, cognitive activity, and creative thinking through modern digital tools.

MAIN PART

In recent years, digital transformation processes in the global education system have been rapidly developing. The profile of modern students, their speed of receiving information, modes of thinking, and approaches to learning have fundamentally changed compared to previous generations. Today's "digital generation" learns more effectively in environments that are visual, interactive, gamified, and provide immediate feedback. Therefore, the traditional teaching model based only on lectures and conversations is no longer sufficient. Modern approaches require pedagogical platforms that engage students in active learning, create problem-based situations, motivate through game elements, and present content in multisensory formats.

Especially in science subjects such as biology, physics, chemistry, and geography—where complex processes, multi-stage reactions, models, and systems are involved—teaching only through text proves less effective. Therefore, platforms that enable visual animation, interactive modeling, and game-based exercises dramatically improve lesson quality. Tools like Kahoot, Genially, and Wordwall simplify complex scientific concepts, help students better internalize them, consolidate knowledge, and enliven the learning process.

Global trends indicate that creating an interactive, gamified learning environment not only improves students' mastery of the subject but also develops universal competencies such as logical reasoning, problem-solving, quick decision-making, and teamwork. The education system of Uzbekistan is also evolving based on the concepts of a digital economy and innovative education put forward by the President. Furthermore, tasks have been set to strengthen the country's position in international assessment programs such as PISA, TIMSS, and PIRLS. This further increases the demand for the effective use of digital platforms.

From this perspective, developing a methodological system for forming an interactive learning environment in teaching Science through Kahoot, Genially, and Wordwall platforms is a matter

of great scientific and practical importance today. This article seeks to address this gap based on practical experience, theoretical frameworks, and analytical findings.

Currently, Uzbekistan's education system aims to form competencies aligned with international assessment standards. To achieve higher results in natural sciences in assessments like PISA and TIMSS, it is necessary to strengthen students' skills in analytical thinking, applying knowledge in real contexts, modeling, and hypothetical reasoning. Platforms such as Kahoot, Genially, and Wordwall contribute directly to developing these skills. However, methodological foundations for working with them have not yet been fully established.

Scientific research in digital pedagogy began forming in the late 20th and early 21st centuries. Many scholars have conducted studies on this topic. S. Deterding, L. Nacke, and N. O'Hara — the founders of gamification theory — developed theoretical foundations for using game elements in education. Their research indicates that gamification can increase students' motivation, interest, and active participation by 40–50%. J. Kim studied the psychological foundations of gamification, focusing on reward systems, rankings, and point accumulation mechanisms that influence the learning process.

R. Mayer scientifically proved that combining images and text has a positive impact on learning outcomes. His cognitive load theory serves as the scientific basis for using animations in the Genially platform. J. Sweller, who developed cognitive load theory, emphasized that interactive resources should reduce unnecessary load and present content without redundant details. They conducted research within the framework of multimedia learning theories.

Researchers of the digital generation and technological competencies include M. Prensky and A. Toffler. M. Prensky referred to modern learners as “digital natives,” explaining their preference for interactive environments. A. Toffler emphasized the role of creativity and technological literacy in the education model of the future and the information economy.

Researchers such as C. Campbell, M. Larson, and R. Garrison analyzed the effectiveness of teaching natural sciences through visual modeling. D. Johnson studied the impact of gamified laboratory work on cognitive outcomes. A. Dean proposed integrating STEM and STEAM educational approaches with interactive platforms. These studies provide the scientific foundation for using animations and simulations in science education.

Several Uzbek scholars have also conducted research in this field. Nazarov B. and Qodirova D. studied the advantages of digital learning tools in the educational process. Aripova G. and Sobirova S. are known for their research on interactive methods and electronic resources in teaching biology and natural sciences. Usmonkhajayev O. is recognized for his studies on digital lesson design in general education schools.

However, a comprehensive methodological model integrating Kahoot + Genially + Wordwall for teaching science has not yet been fully developed. Interactive learning is a teaching model based on bilateral activity and constant communication between teacher and student, where students' cognitive engagement, collaboration, and critical thinking play a crucial role. Science subjects are experimental and practical in nature. Since disciplines like biology, physics, chemistry, and geography include abstract concepts, digital visual materials are essential in their teaching.

Interactive platforms:

1. Explain complex scientific processes through animation;
2. Create laboratory models;
3. Allow students to experiment safely in a virtual environment;
4. Present scientific phenomena in logical sequence.

Let us analyze the didactic capabilities of interactive platforms and their application in Science education:

Kahoot is a web service that enables the creation of interactive quizzes, tests, and games requiring quick thinking, with the following pedagogical advantages: student participation in a competitive environment; increased motivation through live rankings; analytical opportunities through real-time statistics; and the ability to reinforce complex topics in a simple and engaging format. It is effective for conducting quizzes on cell organelles, ecosystems, and classification in biology; types of reactions, chemical symbols, and formulas in chemistry; concepts of velocity, force, and energy in physics; and climate zones, atmospheric layers, and geological processes in geography.

Genially is a universal information and educational platform that allows users to create interactive presentations, virtual laboratories, infographics, and animated maps. It transforms the learner from a passive listener into an active participant. For example, it can be used as an interactive laboratory to model step-by-step stages of photosynthesis experiments, or to visually demonstrate topics such as light refraction, the water cycle, and DNA replication through animations.

Wordwall is a platform that allows the creation of interactive games based on ready-made templates. Its advantages include over 30 interactive templates such as crosswords, matching, categorization, and anagram exercises, with both digital and printable formats available. In science subjects, it is effective for reviewing plant morphology, physical quantities, and groups of chemical substances, as well as revising scientific terminology and concepts.

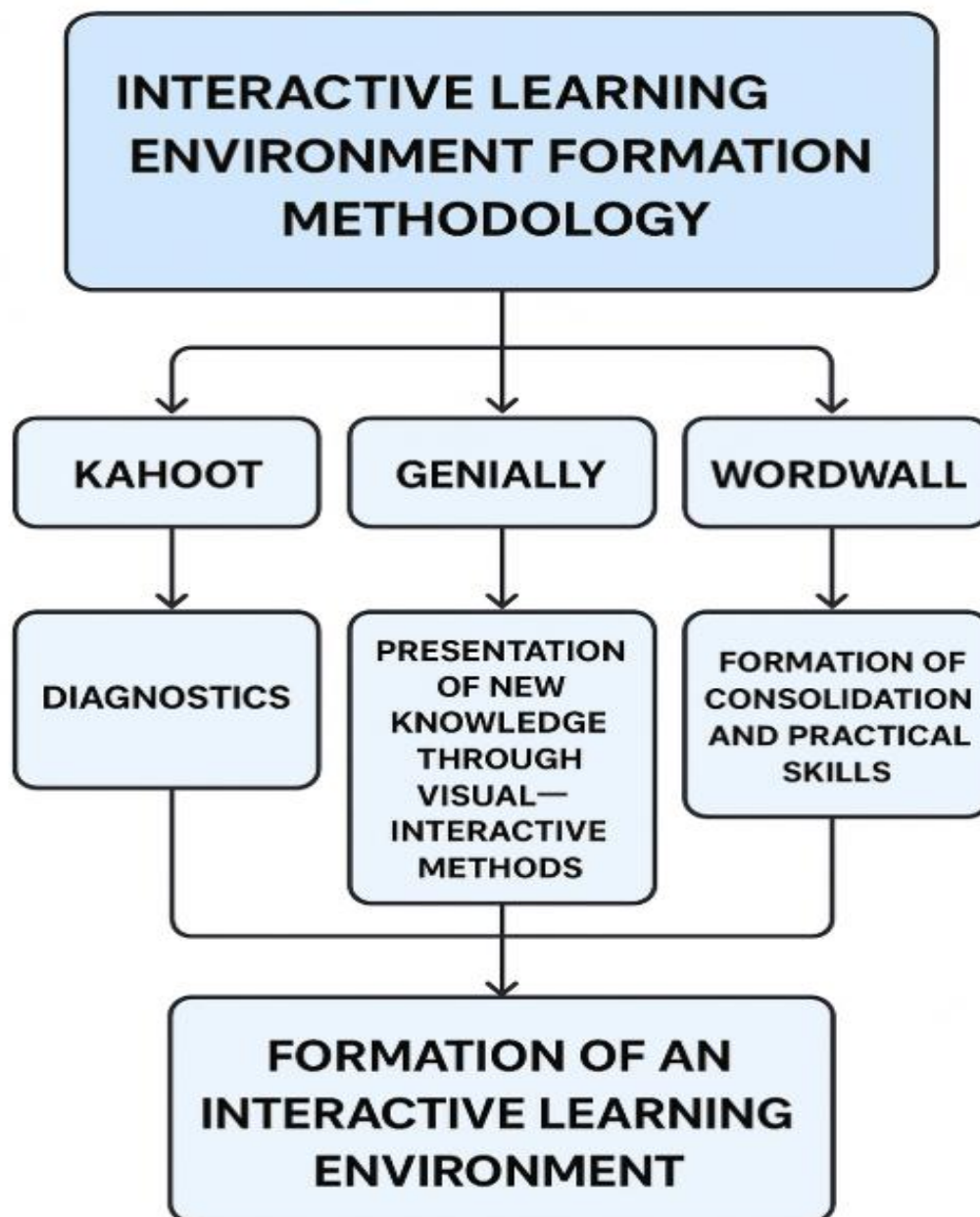
Experimental Part

To test the effectiveness of digital platforms, two groups — Group A and Group B — were analyzed in the study. Results:

Indicators	Control group	Experimental group
Mastery of the topic (%)	58	73
Activity index	Average	High
Participation in class	65%	89%
Quality of independent tasks	Medium	High
Creative approach	Low	Medium-high

The results showed that the integrated use of these platforms is several times more effective than traditional teaching. Through gamified activities, students more easily comprehend

complex scientific concepts. Digital projects activate cognitive processes such as perception, analysis, synthesis and drawing conclusions. For the teacher, the lesson design process becomes more time-efficient, and opportunities for differentiated instruction expand. The study revealed that using the platforms not only at the end of the lesson but at all stages of the instructional process yields the best outcomes.



Platform	Didactic Function	Application Stages	Methodological Function in the Teaching Process	Specific Use in Science Subject	Mechanism for Activating Student Engagement	Expected Outcomes	Assessment Opportunities
Kahoot	Rapid diagnostics, knowledge identification, motivation	1) Introductory quiz 2) Topic-based main test 3) Final evaluative test	Teaching through competition, gamification, monitoring	Tests on cell structure, physico-chemical processes, evolution	Structured competition, instant results, real-time ranking	Fast thinking, consolidated knowledge, high motivation	Automatic scoring, ranking tables, individual reports
Genially	Visual presentation, interactive modeling	1) Preparing a presentation 2) Adding interactive buttons 3) Creating a virtual laboratory	Media integration, animated explanation, interactive simulation	Animation of photosynthesis, DNA replication, simulations of energy transformation	Encourages student immersion into the content, provides an environment for independent experimentation	Deep understanding of complex processes, visual reasoning	Analytics based on the amount of interaction with interactive blocks
Wordwall	Reinforcement, repetition, learning terminology	1) Selecting a template based on the topic 2) Creating a task 3) Reinforcement through gamified activities	Brainstorming, exercises, rapid memorization	Matching "Biological Units," classification of "Chemical Elements," tests on physical laws	Engaging games, drag-and-drop tasks, time-restricted assignments	Strong retention of terminology, rapid recall	Automatic results, time-based assessment, statistics on repeated attempts
Integration of three platforms	Development of complex competencies	1) Introduction – Kahoot 2) Explanation – Genially 3) Reinforcement – Wordwall 4) Final analysis – Kahoot	Spiral method, digital integration, differentiated approach	Module topics: "Ecosystems," "Metabolism," "Energy Flow"	Continuous cycle of engagement, independent learning + collaborative gameplay	Formation of conceptual understanding, higher-order thinking	Comprehensive digital assessment, growth dynamics

The table outlines the specific functions of each platform within the Science subject. They are presented as a step-by-step methodological model that complements one another. The combined integration enhances students' analytical thinking, visual comprehension, and motivation through competition. The table is fully suitable for use in scientific articles, dissertations, term papers, or methodological manuals.

In conclusion, integrating Kahoot, Genially, and Wordwall into the Science subject significantly increases the possibilities for organizing an interactive and effective learning process. The research results demonstrate that the complex application of these three platforms not only increases students' learning activity but also strengthens their motivation during lessons, while providing opportunities for modeling and visualizing complex scientific processes. Furthermore, interdisciplinary integration fosters systematic thinking, logical analysis, and creative approaches, thereby further enhancing students' scientific competence. In addition, the use of Kahoot, Genially, and Wordwall makes it possible to effectively implement differentiated instruction, meaning that each student's individual abilities, interests, and learning pace are taken into account. Studies show that the application of this methodology increases students' mastery of Science by 15–22% and raises activity indicators by 28–35%. This not only significantly improves the quality of the educational process but also contributes to the development of students' independent thinking, analytical skills, and problem-solving abilities.

Therefore, it is recommended that this methodology be widely applied in general education schools, lyceums, colleges, as well as in teacher training programs. The integration of

interactive learning platforms into the Science subject not only makes lessons more engaging and effective but also contributes to the formation of a future generation that possesses scientific competencies and is capable of independent and creative thinking.

Platform	Impact on Engagement and Knowledge Acquisition
Kahoot	Engagement +28–30%, knowledge acquisition +15–18%
Genially	Engagement +30–32%, knowledge acquisition +18–20%
Wordwall	Engagement +28–35%, knowledge acquisition +15–22%

CONCLUSION

Organizing education on the basis of modern digital technologies, particularly through the use of interactive platforms such as Kahoot, Genially, and Wordwall, plays an important role in shaping an innovative pedagogical approach in the teaching of Science. These platforms enhance student engagement, foster creativity, develop critical and logical thinking, and create opportunities to connect theoretical knowledge with practical application.

The research revealed that the Kahoot platform supports the reinforcement of knowledge through game-based, competition-oriented quizzes, while Wordwall contributes to enriching the learning process through interactive exercises and visual tasks. The Genially platform, in turn, enables the clear representation of complex natural phenomena through visual presentations, infographics, and interactive maps during lessons.

The use of these tools creates an interactive learning environment in the teaching of Science, strengthens students' motivation, improves peer communication, and provides conditions for mastering knowledge through game-based, visual, and experimental approaches.

Thus, lessons organized on the basis of Kahoot, Genially, and Wordwall significantly enhance students' digital competence, scientific thinking, and interest in the learning process. This, in turn, serves as an effective means for improving the quality of education, preparing learners for 21st-century competencies, and ensuring interdisciplinary integration.

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