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Особливості створення вебквесту та його використання на уроках біології

FEATURES OF DESIGNING A WEB QUEST AND ITS IMPLEMENTATION IN BIOLOGY CLASSES

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Анотація. *Стрімкий розвиток інформаційно-комунікаційних технологій зумовлює потребу впровадження інноваційних форм навчання, які сприяють активізації пізнавальної діяльності учнів. Однією з ефективних таких форм є квест, що поєднує ігрові елементи з пошуковою та дослідницькою діяльністю. У наукових джерелах це поняття розглядають як інтерактивний процес самостійного набуття знань, що включає елементи пригодницької або рольової гри. Вебквест, як правило, функціонує у форматі вебсайту чи електронної платформи, присвяченої певній тематиці та побудованої як система послідовних завдань, об'єднаних спільною*

сюжетною лінією. Автори методу наголошували на його дослідницькому характері та вагомій ролі у розвитку мислення високого рівня, зокрема аналізу, синтезу й оцінювання. Незважаючи на зростання зацікавленості ігровими технологіями, квести й надалі залишаються відносно новою формою навчальної діяльності, яка ще не має достатнього методичного опрацювання. Лише останніми роками їх почали активно використовувати вчителі різних навчальних дисциплін – біології, історії, інформатики, іноземних мов. Застосування таких технологій сприяє розвитку пізнавального інтересу учнів і є важливим елементом професійної підготовки. У освітньому процесі вебквест виконує низку важливих функцій, зокрема мотиваційну, навчальну та розвивальну. Працюючи над квестом, учні поглиблюють свої знання, розширюють кругозір, розвивають логічне мислення й толерантність, а також набувають умінь самостійної навчальної діяльності. На уроках біології використання вебквестів є особливо результативним, оскільки цей предмет передбачає активне пізнання, аналіз природних об'єктів і явищ, виконання дослідів та розв'язання проблемних завдань. Вони активізують екологічне мислення, розвивають навички командної взаємодії, створюють умови для творчого пошуку, самостійного вибору та нестандартного підходу до розв'язання завдань. Окрім цього, вебквести сприяють комплексному досягненню освітніх, виховних і розвивальних цілей навчання. У статті подано методичну розробку вебквесту «Таємниці клітини».
Ключові слова: *вебквест, структура, послідовні етапи, пізнавальна діяльність, уроки біології.*

Summary. *The rapid development of information and communication technologies necessitates the implementation of innovative teaching methods that enhance students' cognitive activity. One of the most effective forms is the quest, which combines game-based elements with search and research activities. In academic sources, this concept is interpreted as an interactive process of independent knowledge acquisition that includes elements of an adventure or role-playing game. A web quest typically functions as a website or an online platform devoted to a specific topic and structured as a series of sequential tasks united by a common storyline. The authors of the method emphasized its research-oriented nature and its significant role in developing higher-order thinking skills, particularly analysis, synthesis, and evaluation. Despite the growing interest in game-based learning technologies, quests still remain a relatively new form of educational activity that has not yet been sufficiently developed from a methodological perspective. Only in recent years have they been actively implemented by teachers of various school subjects, including biology, history, computer science, and foreign languages. The use of such technologies contributes to the development of students' cognitive interest and serves as an important component of professional training. In the educational process, a web quest performs a number of essential functions, including motivational, instructional, and developmental ones. While working on a quest, students deepen their knowledge, broaden their horizons, develop logical thinking and tolerance, and also acquire skills of independent learning. The use of web quests in biology classes is particularly effective, as this subject involves active exploration, analysis of natural objects and phenomena, conducting experiments, and solving problem-based tasks. They stimulate ecological thinking, develop teamwork skills, and create opportunities for creative inquiry, independent decision-making, and unconventional approaches to problem-solving. In addition, web quests contribute to the comprehensive achievement of educational, developmental, and instructional goals. The article presents a methodological development of the web quest «Secrets of the Cell».*
Key words: *web quest, structure, sequential stages, cognitive activity, biology lessons.*

Introduction. The rapid development of information and communication technologies necessitates the implementation of new innovative forms of learning that can stimulate students' cognitive activity. An important place among pedagogical technologies is occupied by quests, which teach schoolchildren to find the necessary information, analyze it, systematize it, and solve the assigned tasks. Quests combine game-based, search, and research methods of learning.

Despite the growing interest in game-based technologies, quests still remain a relatively new and methodologically underdeveloped form of work. Only in recent years have they been actively

implemented by teachers of various subjects, including biology, history, computer science, and foreign languages. Such technologies contribute to the development of students' cognitive interest and are important for the professional training of future specialists.

In biology lessons, quests are particularly effective because this subject involves active cognitive activity, analysis of natural objects and phenomena, conducting experiments, and solving problem-based tasks. Biology quests make it possible to organize practice-oriented learning, combine theoretical knowledge with real observations, stimulate ecological thinking, develop teamwork skills, and create situations that encourage creativity, choice, and non-standard thinking. In addition, they contribute to the comprehensive implementation of educational, upbringing, and developmental goals.

In the educational process, a WebQuest performs several important functions: motivational, instructional, and developmental. While working on a quest, students broaden their worldview, develop logical thinking and tolerance, and form skills of independent work.

In the scientific literature, the concept is interpreted as an interactive process of independent knowledge acquisition with elements of an adventure or role-playing game.

Analysis of recent research. The features of creating and using quests in the educational process have been studied by both Ukrainian and foreign researchers. In particular, it is emphasized that a quest can be regarded as a new learning technology, which has its own specific methods, forms, and tools, and can be optimally combined with traditional teaching technologies. A quest is based on an intellectual competition with elements of role-playing. This technology promotes the growth of students' positive motivation for learning, the development of their methodological, communicative, and informational competencies, as well as the enhancement of creativity [9, p. 49].

O. Tymchenko considers a quest as a game-based technology with clearly defined didactic tasks and rules, analyzes its origin, types, and criteria for effectiveness, and also provides practical WebQuest designs for various academic subjects [4, p.79]. According to V. Schmidt, a WebQuest is a mini-project aimed at searching for and organizing information from the Internet, which contributes to the development of critical thinking, creativity, and informational competence. The author emphasizes that the game as a learning method enhances attention, observation, resourcefulness, and increases cognitive activity [8, p. 174].

The educational manual by K. Rozhko serves as a practical guide for biology teachers, as it is dedicated to creating WebQuests using free cloud-based tools. The author notes that a WebQuest is an Internet-oriented project-based method that develops critical thinking, teamwork, and student motivation through role-based tasks. The work emphasizes the advantages of a WebQuest: increased interest in biology, integration of ICT, and the development of 21st-century skills. It also highlights the necessity of teacher digital literacy and access to the Internet [6].

The article by R. Melnychenko examines quest technologies as a means of developing creativity in students-future teachers. The author analyzes the theoretical foundations, presenting a quest as a game-based model of knowledge acquisition that combines elements of project-based learning, role-playing games, and digital technologies, with reference to classical models. The author concludes that quests increase motivation, develop research skills, and prepare young educators for innovative teaching in schools [5, p. 148].

In the article by T. Zubeikhina, the WebQuest is examined as a component of e-learning in higher pedagogical education. The author notes that WebQuests are effective for developing competencies in biology, especially in the context of distance learning [3, p. 249].

A WebQuest is a type of quest in which the key tools are Internet resources and digital technologies. The idea of a WebQuest was first proposed in 1995 by American researchers B. Dodge and T. March, who viewed it as a problem-based task whose completion relies on the use of Internet resources [1, p.133].

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A WebQuest usually takes the form of a website or electronic platform dedicated to a specific topic and structured as a series of sequential tasks linked by a common storyline. The founders of the method emphasized its research-oriented nature and its significant impact on the development of higher-order thinking skills, such as analysis, synthesis, and evaluation.

The aim of our work was to examine the features of the step-by-step creation of a WebQuest and the possibilities of its use in biology lessons.

Presentation of the main material. A quest, as a method of organizing research activities, has a clear structure, rules, and defined objectives. There are various classifications of quests. In particular, quests can be classified as follows: • by format: computer-based, WebQuests, media quests, QR quests, natural science quests, and combined; • by mode: real, virtual, and hybrid; • by duration: short-term and long-term; • by organization of work: group or individual; • by content: subject-specific or interdisciplinary; • by storyline: linear, non-linear, or circular; • by information environment: traditional, educational, or virtual; • by platform: forums, wiki pages, Google Groups, websites; • by type of task: retelling, planning, self-reflection, puzzle, detective, evaluation, journalistic investigation, scientific research; • by type of activity: informational, search-based, research, role-playing, creative, and others [2, p. 162].

The effectiveness of a biology quest as an innovative form of organizing learning activities depends on adhering to a set of methodological conditions that ensure its productivity, pedagogical appropriateness, and alignment with educational objectives. A quest should not only be an engaging game-based activity but also a didactically motivated tool aimed at developing subject-specific and life competencies [7, p. 294].

The first key condition for the success of quests is the clear definition of a goal that is understandable to students. Cognitive interest is activated when students recognize the practical significance of the knowledge gained, feel emotionally engaged, and perceive a logical sense in the tasks assigned. A motivational atmosphere is created through elements of intrigue, the quest's storyline, fair assessment, and support from the teacher. The teacher should purposefully explain the goal, stimulate students' activity, and encourage their willingness to overcome challenges.

A student-centered approach constitutes the second condition for the effective implementation of a quest. It involves taking into account individual characteristics, preparedness levels, and learning styles of each student. Important aspects include the opportunity to choose roles and tasks, as well as support for intellectual initiative and independence. The teacher should tactfully allocate responsibilities, help less confident students experience a sense of success, and allow stronger students to exercise their leadership abilities. This approach ensures psychological comfort and the active involvement of every student in collaborative activities.

The third condition is the use of a set of diverse tasks that stimulate thinking, attention, imagination, and various types of intellectual engagement. Combining educational, exploratory, creative, and role-based tasks makes the quest multifaceted, prevents monotony, and maintains students' interest [8, p. 174].

An important condition is also active collaboration between the teacher and students. A democratic communication style, mutual support, and trust create an atmosphere in which students are willing to show initiative and take responsibility. Such interactions promote the development of independence and foster a positive attitude toward learning.

The success of a quest largely depends on the quality of its organization, including a clear scenario, a well-planned route, logical task progression, time management, and the availability of instructions, information cards, hints, materials, and assessment criteria. Equally important is discussing the game rules, ensuring safety, and, if possible, involving assistants to monitor specific stages. It is

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also essential to ensure technical readiness, especially when using QR codes, mobile devices, or online resources. The teacher needs to set an optimal level of difficulty, avoiding overload and an excessive number of stages. An important aspect is motivational support: incorporating elements of competition, rewards, and role-based interaction, which foster emotional engagement and enhance students' intrinsic motivation [8, p. 175].

The preparation of a WebQuest takes place in several stages. During the design stage, the teacher determines the topic, didactic goal, type of quest, number of tasks, duration of the activity, and selects available resources. At the technological stage, the electronic structure is created: pages are designed, materials and instructions are added, and roles and reporting formats are defined. The final preparatory stage includes checking the technical functionality of all links, resources, and device capabilities.

To create a WebQuest, platforms such as WordPress, Blogger, LiveJournal, Wix, Jimdo, Google Sites, uKit, A5, and other website builders can be used. These platforms allow the use of ready-made templates and do not require any special programming skills [7, p. 295].

As a modern interactive technology, a WebQuest has a clearly defined structure, content, and sequence of stages that ensure the effectiveness of cognitive activity. Its essential components include [8, p. 176]:

1. Introduction – It includes the topic, goal, duration of the quest, a brief storyline, a description of the task, participant roles, and the overall scenario. It serves a motivational function and ensures student engagement in the activity.

2. Quest Task – The central problem or puzzle is formulated, which requires a solution and defines the direction of the teams' work. Tasks should be relevant, correspond to the lesson topic, and match the students' level of preparedness.

3. Resource Instruction Card – Contains teacher-selected informational materials, including hyperlinks, text and multimedia resources, videos, images, tables, diagrams, as well as templates for presenting the results.

4. Participant Guidelines – Describe the rules of interaction, the task execution algorithm, tips for effective information search, and instructions for working with the chosen platform.

5. Assessment – Involves evaluating the completed task for accuracy, reliability of information, creativity, and the quality of result presentation.

6. Conclusion – Provides a summary of the knowledge gained, competencies developed, challenges overcome by the students, and general conclusions.

Conducting a WebQuest involves the sequential completion of several stages. In the preparatory stage, students become familiar with the rules, roles, and assessment criteria, discuss the problem situation, and develop a strategy for its solution. The research stage involves completing individual and group tasks according to the assigned roles, as well as searching for and analyzing information. The teacher acts as a consultant, guiding students through challenging issues. In the final stage, the team compiles a joint report and presents the results.

The assessment system for a WebQuest depends on the lesson's objectives and the nature of the tasks. General criteria include students' understanding of the problem, quality of task completion, accuracy and logical presentation of information, ability to analyze and organize material, and level of teamwork.

According to the structural components, students demonstrate the following outcomes: motivational, cognitive, operational, and reflective. These are manifested in increased interest in learning, acquisition of new knowledge and skills, the ability to work with information and in a team, as well as the capacity to evaluate their own activities and draw reasoned conclusions [6].

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Methodical materials for implementing the web quest «Secrets of the cell»

Target Audience: Students in grades 7–9 of general secondary education institutions

Place in the Educational Process: Lesson for summarizing and systematizing knowledge

Interdisciplinary Connections: Biology, Computer Science, Natural Science, Ukrainian Language, Chemistry, Visual Arts, Health Education

Equipment: Cell diagrams, illustrations of organelles, QR codes linking to digital resources, gadgets, materials for creating a poster or mini-presentation

Objective of the Quest: To summarize, reinforce, and assess students' knowledge of the cell as the basic unit of life, including its structure and the functions of main organelles. To develop teamwork skills, stimulate cognitive activity through game-based and research tasks, analyze information, draw conclusions, and apply knowledge in non-standard learning situations.

Tasks:

1. Systematize and consolidate knowledge about cell structure, organelle functions, and their interrelationships.
2. Develop the ability to identify organelles and distinguish between plant and animal cells.
3. Enhance skills in working with informational sources and analyzing biological data.
4. Promote teamwork skills, including role distribution and collective decision-making.
5. Stimulate cognitive interest in studying biology through game-based and research activities.

Expected Outcomes: Participants will consolidate their knowledge of the structure and functions of the cell, develop logical thinking and the ability to compare information, master relevant terminology, and improve teamwork skills as well as responsibility for collective results.

The WebQuest «Secrets of the Cell» was created on the Blogger.com platform (https://secret-softhecell7thgrade.blogspot.com/) as part of the biology course, specifically for the topic «The Cell – Structural and Functional Unit of Organisms. Prokaryotes». The tasks were developed using digital tools: exercises in the LearningApps app, puzzles generated in JigsawPlanet, and final tests in Kahoot, Google Forms, and Classtime. The WebQuest includes a series of interactive pages that allow students to work through the material sequentially and develop independent information-searching skills (Fig. 1).

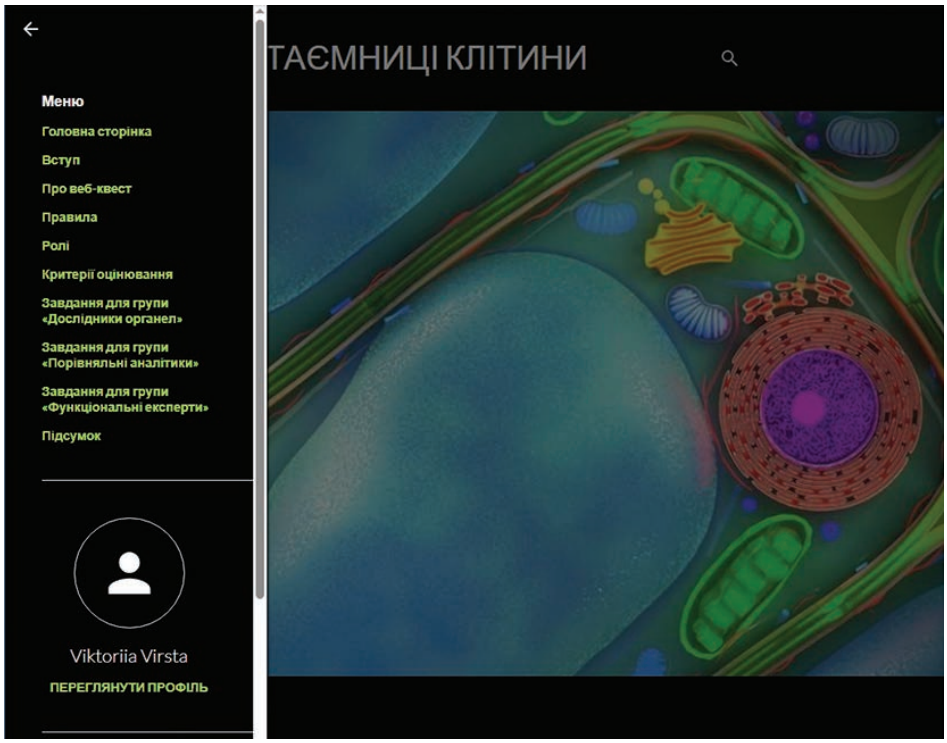

Figure 1. WebQuest Menu

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The main page serves motivational and orientation functions. It features a welcome message for participants and a brief introductory survey aimed at activating prior knowledge about the history of cell study. The test includes an active link (https://learningapps.org/watch?v=p0cwp23xa25), which ensures the rapid engagement of students in cognitive activities.

The introduction provides information about the goal, tasks, and duration of the activity. The «About the WebQuest» page presents the definition of a WebQuest and specifies that the work is conducted in small groups, with tasks completed according to assigned roles. The next page familiarizes participants with the rules for completing the WebQuest.

Rules for Participants:

1. Carefully review the topic, goal, and tasks of the WebQuest.
2. Follow the instructions provided at each stage of the activity.
3. Work actively, completing tasks step by step, according to your assigned role or as part of a team.
4. Use the suggested informational resources (texts, images, videos, interactive exercises), and, if necessary, consult additional reliable sources.
5. Adhere to the principles of academic integrity.
6. Work in a friendly atmosphere, respect the opinions of other participants, and help one another.
7. Present your work in the specified format (presentation, interactive task, diagram, brief report, etc.).
8. After completing the WebQuest, participate in the discussion of results and reflect on your own activities.

The next page is dedicated to roles. Here, students are divided into three groups, each with its own research focus, but all working toward a common goal. This division ensures active interaction among participants and helps develop a comprehensive understanding of the topic.

First Group: «Organelle Researchers» – Participants in this group focus on studying the internal structure of the cell. Their task is to investigate the main cellular organelles, determine their structure, and understand their significance for the cell's vital functions. Students work with educational resources, diagrams, and illustrations, establish relationships between organelles, and present the results in the form of a summary table, diagram, or brief presentation. After reviewing the provided Internet sources, students are expected to complete the following tasks:

1. Using the LearningApps app, complete the crossword «Guess the Organelle» (https://learningapps.org/watch?v=powira78325).
2. Assemble the puzzle «Cell Organelle» in the Jigsaw Planet app (https://www.jigsawplanet.com/?rc=play&pid=0b0fc8a17c42).
3. Take the final test in Google Forms via the provided link: https://docs.google.com/forms/d/e/1FAIpQLSdV0ZFUoX6AF2724PXeRDkiEwBOtQ1_gJUmI6jcEanJ8yIj4Q/viewform?usp=header

Second Group: «Comparative Analysts» – The activity of this group is focused on analyzing the similarities and differences between plant and animal cells. Students compare their structure, the presence and functions of organelles, and specific features of cellular activity. During the activity, students learn to identify key characteristics, synthesize information, and draw well-reasoned conclusions. Initially, participants are provided with recommended informational sources, followed by specific tasks to complete:

1. Using the LearningApps app, complete the exercise «Statements about Cells» (https://learningapps.org/watch?v=pqi2phrqk25).
2. Assemble the puzzle «Plant and Animal Cells» in the Jigsaw Planet app (https://www.jigsawplanet.com/?rc=play&pid=3af49d3548d6).

3. Take the final test in the Classtime app via the provided link: https://www.classtime.com/code/ZPHD9Y/Wb6RmZKIAtcpGx4cp00zgA:AQ

Third Group: «Functional Experts» – The task of this group is to determine the functional role of the cell as the structural and functional unit of living organisms. Participants analyze how the coordinated work of organelles ensures vital processes and explain the significance of the cell for the organism as a whole. After reviewing the online resources, they complete the assigned exercises.

1. In the LearningApps app (https://learningapps.org/watch?v=pqrtr3rx525), complete the exercise «Matching: Organelle ↔ Function».

2. Assemble the puzzle «Cell Functions» using Jigsaw Planet (https://www.jigsawplanet.com/?rc=play&pid=044488d8067d).

3. Take the final test in Kahoot via the provided link: https://kahoot.it/challenge/03612685?challenge-id=348ffb91-1fbf-48d4-a534-f396983fe2bc_1765746363346.

Additionally, each team must present their results in the form of a poster, interactive material, or another format that clearly demonstrates the tasks they have completed.

The «Assessment Criteria» page was created to familiarize students with the requirements for completing WebQuest tasks and to allow them to anticipate the expected outcomes of their work. Assessment is conducted by the teacher and participants from other groups. The maximum score is 12 points. The evaluation takes into account: the accuracy and completeness of task completion, the logical order and coherence of the presented material, originality and creative approach, appropriate use of digital resources and online services, the level of team collaboration, and the final outcome achieved.

The «Conclusion» section contains further instructions for the activity: discussion of each group's results, self-assessment and peer-assessment, as well as reflection on the knowledge gained and experiences from completing the WebQuest through an anonymous survey using the AnswerGarden online service. Participants answer the following questions: what new information they learned about cell structure (https://answergarden.ch/4981702), which fact about the cell surprised them the most (https://answergarden.ch/4982378), and what are the similarities and differences between plant and animal cells (https://answergarden.ch/4982381).

The proposed WebQuest can be used for thematic assessments, extracurricular activities, as well as in remote or blended learning formats. The use of interactive digital resources and group-based activities promotes increased learning motivation, the development of key and subject-specific competencies, teamwork skills, and responsibility for collective outcomes.

Conclusions. A WebQuest is a modern, innovative tool for stimulating students' cognitive activity. It also serves as an interactive technology in the study of biology, combining research-based activities, group collaboration, and the use of Internet resources. A clear structure and well-organized work stages contribute to the development of research and communication skills, the formation of digital and informational competencies, and teamwork abilities, which are key competencies of the New Ukrainian School. The methodological conditions for the effective implementation of a biology WebQuest include: the motivational significance of the activity, consideration of individual and age-specific characteristics, diversity and integrative nature of tasks, high-quality organizational and technical preparation, and collaborative interaction. Adhering to these conditions ensures a high level of student engagement, stimulates their cognitive activity, and fosters a positive attitude toward learning biology.

Biology WebQuests can be considered an effective and innovative tool for stimulating cognitive activity and are recommended for use both during classes and in extracurricular activities.

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