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ELEKTROMAGNITEZM BO‘LIMINI O’QITISHDA EKOLOGIK KOMPETENSIYANI SHAKLLANTIRISHNING INNOVATSION MODELI VA SUN’IY INTELLEKTNING DIDAKTIK ROLI

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Annotatsiya: Mazkur maqolada umumta’lim maktablari va ixtisoslashtirilgan ta’lim muassasalarida elektrodinamika mavzularini ekologik kompetensiya bilan integratsiyalash asosida o‘qitishning didaktik imkoniyatlari yoritiladi. Maqolada elektr toki, elektr maydon, magnit maydon, elektromagnit induksiya, elektr energiyasini ishlab chiqarish va uzatish, turli muhitlarda elektr toki, yuqori kuchlanishli liniyalar, ionlanish, elektroliz va elektromagnit to‘lqinlarning ekologik jihatlari tahlil qilingan. Sun’iy intellekt vositalaridan foydalanish orqali elektrodinamik jarayonlarni vizuallashtirish, ekologik muammolarni modellashtirish, o‘quvchilarning mustaqil izlanish faoliyatini tashkil etish, interaktiv topshiriqlar, ekologik keyslar va raqamli baholash tizimlarini yaratish imkoniyatlari ochib berilgan

Kalit so‘zlar: elektrodinamika, ekologik kompetensiya, sun’iy intellekt, ekologik xavfsizlik, raqamli ta’lim, integrativ yondashuv, STEAM ta’lim.

ИННОВАЦИОННАЯ МОДЕЛЬ ФОРМИРОВАНИЯ ЭКОЛОГИЧЕСКОЙ КОМПЕТЕНЦИИ ПРИ ИЗУЧЕНИИ РАЗДЕЛА ЭЛЕКТРОМАГНЕТИЗМА И ДИДАКТИЧЕСКАЯ РОЛЬ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

Аннотация: В данной статье освещаются дидактические возможности обучения темам электродинамики в общеобразовательных школах и специализированных образовательных учреждениях на основе интеграции с экологической компетенцией. В статье проанализированы экологические аспекты электрического тока, электрического поля, магнитного поля, электромагнитной индукции, производства и передачи электроэнергии, электрического тока в различных средах, линий высокого напряжения, ионизации, электролиза и электромагнитных волн. Раскрыты возможности визуализации электродинамических процессов, моделирования экологических проблем, организации самостоятельной исследовательской деятельности учащихся, создания интерактивных заданий, экологических кейсов и цифровых систем оценки с использованием инструментов искусственного интеллекта.

Ключевые слова: электродинамика, экологическая компетенция, искусственный интеллект, экологическая безопасность, цифровое образование, интегративный подход, STEAM-образование.

INNOVATIVE MODEL FOR FORMING ECOLOGICAL COMPETENCE IN TEACHING THE SECTION OF ELECTROMAGNETISM AND THE DIDACTIC ROLE OF ARTIFICIAL INTELLIGENCE

Abstract: This article highlights the didactic possibilities of teaching electrodynamics topics in general education schools and specialized educational institutions based on integration with ecological competence. The article analyzes the ecological aspects of electric current, electric field, magnetic field, electromagnetic induction, production and transmission of electricity, electric current in various media, high-voltage lines, ionization, electrolysis, and electromagnetic waves. The possibilities of visualizing electrodynamic processes, modeling environmental problems, organizing independent research activities of students, creating

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interactive assignments, environmental cases, and digital assessment systems using artificial intelligence tools are revealed.

Keywords: electrodynamics, ecological competence, artificial intelligence, environmental safety, digital education, integrative approach, STEAM education.

Introduction

One of the most important tasks facing humanity in today's global development process is ensuring environmental sustainability, rational use of natural resources, and reducing the negative impact of man-made processes on the environment. Issues such as climate change, air pollution, depletion of energy resources, increase in greenhouse gas emissions, pollution of water basins, and loss of biodiversity have become pressing concerns not only for environmental science but for all natural sciences, including physics education. Physics is one of the fundamental sciences that reveals the scientific basis of natural phenomena and technical processes [1]. The section on electrodynamics, in particular, is closely related to modern energy, industry, transport, information and communication technologies, and daily life. The generation, transmission, and consumption of electric energy, the propagation of electromagnetic fields, the operation of electrical devices, high-voltage lines, semiconductor devices, sources of electromagnetic radiation, and processes associated with electric current all require in-depth analysis from an environmental perspective.

Another important aspect of using artificial intelligence in integrating electrodynamics topics with environmental competence is that it enhances students' independent research activities. The student is not limited to memorizing ready-made information but identifies problems, analyzes data, creates graphs and tables, assesses environmental risk factors, and draws scientifically based conclusions. This aligns with the competency-based approach, STEAM integration, and digital education principles required in modern education [2].

Thus, enriching electrodynamics topics with environmental content and teaching them through artificial intelligence tools increases students' interest in physics, develops their environmental culture, and teaches them to apply theoretical knowledge in real-life situations. This enhances not only the educational but also the pedagogical, practical, and social significance of physics education.

Research Methodology

In this study, the main methodological direction was defined as integrating electrodynamics topics with environmental competence and identifying the didactic possibilities of using artificial intelligence technologies in this process. The theoretical basis of the research consists of competency-based, integrative, activity-oriented, STEAM, and digital-didactic approaches. These approaches allow the study of the electrodynamics section not only as a system of physical laws but also as an interdisciplinary educational field related to environmental safety, technological progress, energy efficiency, and digital modeling [3].

The following methods were deemed appropriate for use in the research methodology: analysis of scientific and methodological literature, examination of environmental content in physics textbooks and curricula, identification of environmental opportunities in electrodynamics topics, diagnosis of students' environmental competence levels, development of tasks based on AI tools, pedagogical observation, interviews, tests, practical assignments, and statistical analysis of results.

Results

Developing students' environmental competences during the teaching of electrodynamics topics can be effectively applied specifically while covering topics related to the electrodynamics section. This is because topics such as electric current, electric field, magnetic field, electromagnetic induction, electric current in different media, generation and transmission of

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electric energy, and electromagnetic waves are directly related to technology, energy, production, daily life, and the environment.

The following methodological directions are important in developing environmental competences through electrodynamics topics. First, the environmental content of each physical phenomenon is highlighted. Second, students are asked problem-based questions grounded in real-life situations. Third, physical laws are linked to environmental safety, energy efficiency, and the impact of technical processes on the environment. Fourth, independent analysis, comparison, modeling, and conclusion-drawing activities are organized for students using artificial intelligence tools. Artificial intelligence is used as an auxiliary didactic tool in this process. It allows for visual explanation of electrodynamic processes, creation of cases on environmental situations, analysis of calculations regarding electric energy consumption, compilation of comparative tables, and formation of project assignments on alternative energy sources. In this context, the information provided by AI is regarded not as a ready-made answer, but as a source of information to be verified, analyzed, and interpreted by the student based on physical laws [4].

The development of environmental competences in teaching electrodynamics topics can be organized based on the following table.

Electrodynamics topic	**Content of developing environmental competence**	**Opportunity to use artificial intelligence**
Electric current and resistance	Explaining energy saving, energy waste, and environmental consequences	Performing calculations on electricity consumption and developing energy efficiency recommendations
Electric field	Understanding high-voltage devices and safety issues	Visually modelling electric field lines
Magnetic field	Analysing power transmission lines, transformers, and the electromagnetic environment	Classifying sources of electromagnetic fields
Electric current in various media	Explaining the environmental significance of electrolysis, ionisation, gas discharge, and electrostatic filters	Creating environmental case studies on electrolysis and electrostatic filters
Electromagnetic induction	Studying generators, power plants, and alternative energy sources	Creating a comparative table of traditional and alternative energy sources
Electromagnetic waves	Scientifically explaining radio communication, Wi-Fi, mobile communication, and electromagnetic safety	Preparing a digital presentation on sources of electromagnetic waves

The development of environmental competences should be seen not as an external addition to the electrodynamics section, but as an internal didactic capability of that section. This approach enriches students' physics knowledge with real-life practical content, fostering energy efficiency, technical safety, environmental responsibility, and digital literacy in them. As a result, electrodynamics topics become not just a set of formulas for the student, but a source of integrative knowledge that serves to understand nature, society, technology, and environmental safety [5].

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The electrodynamics section inherently offers broad opportunities for forming environmental competence, because topics such as electric field, magnetic field, electric current, electromagnetic induction, electromagnetic waves, generation and transmission of electric energy are directly related to modern technology, energy, industry, transport, communication systems, and daily life. Each of these processes affects the environment to varying degrees. Therefore, when teaching electrodynamics topics, it is necessary not only to explain the physical law but also to demonstrate the real-life, environmental, and technological consequences of that law.

This approach can be implemented through the following methodological mechanism [6]:

First stage — defining the physical concept. The student masters the theoretical foundations of the electrodynamics topic. For example, concepts such as electric field, current strength, resistance, magnetic induction, electromagnetic induction, or electromagnetic waves are explained in a physical context.

Second stage — revealing the environmental content. The aspects of this physical phenomenon related to the environment, human health, energy, technology, and natural resources are identified. For instance, high consumption of electric energy is linked to increased fuel use and atmospheric emissions.

Third stage — creating a problem situation. Students are given an environmental-physical problem close to real life. For example: "How can the environmental load be reduced by decreasing electric energy consumption in a school building?" or "If a residential area is planned near high-voltage power lines, what safety factors should be considered?"

Fourth stage — analysis based on artificial intelligence. Using AI, students search for data, create tables, draw graphs, make comparisons, and develop possible solutions to the problem. In this process, they do not copy ready-made answers, but verify the information provided by AI based on physical laws and reliable sources.

Fifth stage — drawing conclusions and making environmental decisions. Students formulate environmental conclusions regarding the studied physical phenomenon. For example, they develop recommendations on saving electric energy, using renewable energy sources, observing electromagnetic safety rules, or rationally using technical devices.

Artificial intelligence performs several important didactic tasks in integrating electrodynamics topics with environmental competence. First of all, it helps to visualise physical processes that are difficult to observe directly, in a visual, understandable, and interactive form. Processes such as electric and magnetic field lines, movement of charged particles, propagation of electromagnetic waves, transmission of electric energy, or energy losses become clearer in the student's mind through digital models.

The second capability of AI is organising an individual learning trajectory. Each student has a different level of preparation, interest, and pace of understanding. AI tools can offer appropriate questions, simplified explanations, more complex tasks, tests, and independent projects to the student. This helps the teacher to effectively organise differentiated instruction [7].

The third capability — creating environmental case studies. For example, using AI, cases such as "Comparison of the environmental impact of a thermal power plant and a solar power plant", "Advantages and disadvantages of electric vehicles", "Electromagnetic environment around high-voltage power lines", "Energy efficiency in the use of household appliances" can be developed. Such tasks teach students to analyse real-world problems.

The fourth capability — developing research skills. The student collects and compares data using AI, presents results in graphs and tables, and provides scientific explanations. This process strengthens the student's independent thinking, critical analysis, and evidence-based conclusion-drawing skills.

The fifth capability — improving the assessment process. Using artificial intelligence, students' answers, project work, environmental analyses, and test results can be quickly analysed. The assessment is not limited to determining right or wrong answers, but also takes into account

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the student's reasoning path, use of evidence, ability to draw environmental conclusions, and the level of applying physical laws to practical situations [8].

When teaching electrodynamics topics in connection with environmental competence, the system of tasks is of particular importance. The tasks should not consist solely of theoretical questions, but be oriented towards observation, analysis, comparison, modelling, and drawing environmental conclusions.

Below is a sample system of such tasks.

Task 1. Saving electric energy and environmental impact

Electric energy consumption at school increased over the course of a month. Identify the causes and environmental consequences. Propose ways to save electric energy. In this task, students analyse electric energy consumption from a physical and environmental perspective. They link physical quantities such as electric power, energy, time, and consumption volume with environmental responsibility. Using AI, they can compile a list of energy-saving measures and create an "energy audit" table for the school.

Task 2. High-voltage power lines and the electromagnetic environment

An electromagnetic field exists around high-voltage power lines. What factors are considered to ensure environmental and sanitary-hygienic safety in such areas? Through this task, students master concepts such as magnetic field, electric field, distance, voltage, safety zone. Using AI, they can illustrate the relationship between high-voltage lines, transformer substations, and residential areas in schematic form.

Task 3. Electrolysis and environmental safety

Electrolysis is widely used in industry. Identify its benefits and environmental risk factors. Analyse the issues of waste, energy consumption, and environmental impact during electrolysis. In this task, students link the physical nature of electrolysis with environmental content. In the main article, the environmental issues of electrolysis are also highlighted as an important knowledge element in the topic "Electric current in different media".

Task 4. Electric current in gases and air purification technologies

What is the environmental significance of electric current in gases, ionisation, and electrostatic filters? Through this task, students learn concepts such as gas discharge, ionisation, electrostatic filter, and capture of dust particles. Using AI, they present the working principle of an electrostatic filter in the form of a simple diagram, table, or a short explanatory project.

Assessment is carried out based on the following criteria:

Criteria	Content
Physical knowledge	Understanding the content of electric current, electric field, magnetic field, electromagnetic induction, and electromagnetic waves
Environmental awareness (or ecological understanding)	Being able to explain the relationship of physical processes with the environment, human health, and natural resources
Analytical thinking	Analysing an environmental-physical problem based on cause-and-effect relationships
Digital literacy	Using AI, simulations, tables, graphs, and digital resources wisely
Practical conclusion	Developing a proposal on energy efficiency, environmental safety, or an alternative solution

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According to the results of the main pedagogical experiment, it was noted that enriching the content of electrodynamics with an environmental direction increased students' environmental competence by an average of 16% in the experimental classes. Furthermore, the percentage of correct answers in the section "Electric Current in Various Media" was higher in the experimental classes compared to the control classes. This indicates that enriching electrodynamics topics with environmental content positively affects students' knowledge, skills, and competences.

Discussion

Based on the content of the research, the following resultant directions are identified in forming environmental competence within the framework of the electrodynamics section:

First, students develop the skill of explaining physical concepts in an environmental context. For example, through the topic of electric current, issues such as energy consumption, saving electric energy, heat losses, and energy efficiency are revealed. In the topic of magnetic field, concepts of high-voltage power lines, transformer stations, and electromagnetic safety are discussed. In the topic of electromagnetic waves, a scientific understanding is formed about mobile communication, Wi-Fi, radio communication, microwave technologies, and their biological and environmental safety [9].

Second, students' ability to analyse environmental problems based on physical laws is strengthened. For example, they compare different methods of generating electricity from physical and environmental perspectives: they evaluate fuel consumption and exhaust gas emissions in thermal power plants, the impact of hydroelectric power plants on water basins, as well as the advantages and technical limitations of solar and wind energy. In this process, physical knowledge becomes a tool for making environmental decisions.

Third, artificial intelligence tools enhance students' independent research activities. Using AI, students formulate questions about electrodynamic processes, analyse environmental case studies, create comparative tables, perform calculations of electric energy consumption, classify sources of electromagnetic fields, and draw evidence-based conclusions about alternative energy sources. This turns them not into memorisers of ready-made information, but into active subjects oriented towards analysis and research.

Fourth, the components of environmental competence are consistently developed through electrodynamics topics. In particular, the cognitive component is developed through physical and environmental knowledge; the practical-activity component through experiments, projects, calculations, and observations; the motivational component through a responsible attitude towards nature and the idea of energy efficiency; and the reflexive component through the student's assessment of their own behaviour and culture of using technical devices.

During the main pedagogical experiment, it was noted that introducing an environmental component into the content of electrodynamics significantly increased students' environmental knowledge and competence. In particular, in the section "Electric Current in Various Media", results concerning the environmental content of electrolysis, ionisation, electric current in gases, high-voltage power lines, and electrostatic filters were higher in the experimental classes compared to the control classes. This indicates that targeted inclusion of an environmental component into physics content helps students understand the topic more deeply [10].

This result can be further enhanced using artificial intelligence. For example, it is advisable to give students the following types of AI-based tasks:

Electrodynamics topic	Environmental content	AI-based task
Electric current	Energy consumption and energy efficiency	Develop a digital plan for saving electric energy at school
Magnetic field	High-voltage lines and	Analyse safety factors

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Electrodynamics topic	Environmental content	AI-based task
	electromagnetic safety	around the power transmission network
Electric current in various media	Electrolysis, ionisation, electrostatic filters	Compare the beneficial and environmentally hazardous aspects of electrolysis in a table
Electromagnetic induction	Generators and electric energy generation	Prepare a project explaining the physical basis of alternative energy sources
Electromagnetic waves	Electromagnetic pollution and biological effects	Scientifically classify sources of Wi-Fi, mobile communication, and radio communication

These tasks develop students' ability to learn physics, ecology, and digital technologies in an interconnected manner. In particular, the use of artificial intelligence enhances students' culture of searching, sorting, analysing information, and drawing scientific conclusions. However, the use of AI tools in this process must not be uncontrolled. Each AI response should be analysed under teacher guidance and compared with physical laws and reliable sources.

Based on the analyses, the following scientific and methodological conclusions can be drawn:

1. The electrodynamics section is one of the most suitable physics sections for forming environmental competence, because its topics are directly related to energy, industry, technology, communication, and everyday life.
2. Electrodynamics lessons enriched with environmental content develop students' interdisciplinary thinking – that is, they learn to evaluate physical phenomena from biological, technological, ecological, and social perspectives.
3. Artificial intelligence tools make it possible to teach electric and magnetic fields, electromagnetic waves, energy generation, energy transmission, and environmental safety in a visual, interactive, and analytical manner.
4. AI-based tasks develop students' competences in independent research, critical thinking, digital literacy, and drawing evidence-based conclusions.
5. Integrating electrodynamics topics with environmental competence serves to teach natural sciences in a life-applied direction, strengthen the STEAM approach, and develop ecological culture in Uzbekistan's education system.

Thus, the analyses show that enriching electrodynamics topics with environmental content and teaching them using artificial intelligence tools harmoniously develops students' physics knowledge, environmental responsibility, digital literacy, and practical decision-making skills. This strengthens not only the knowledge-giving function of modern physics education but also the task of educating individuals to be environmentally and technologically responsible.

When applying this methodology in the context of Uzbek education, national curricula, existing textbooks, schools' technical capabilities, and teachers' digital competence must be taken into account. For example, not all schools may have sophisticated laboratory equipment, but electrodynamics topics can be taught with environmental content using simple digital tools, AI chatbots, online simulations, video clips, graph-making software, and presentation tools. This expands the feasibility of implementing the methodology in practice. Furthermore, this integrative approach broadens the educational potential of physics education. Because the student understands electric current, magnetic field, or electromagnetic waves not just as physical concepts from a textbook, but as processes in real life connected to human health, the

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environment, energy resources, and technological progress. This serves to shape a modern civic position, environmental responsibility, and a scientific worldview in the student.

Consequently, integrating electrodynamics topics with environmental competence and using AI capabilities in this process yields a threefold result in physics education: first, students' physics knowledge deepens; second, their environmental competence develops; third, a culture of conscious and critical use of digital technologies is formed. This fully aligns with the competency-based, integrative, and digital-didactic requirements of modern education.

Discussions show that the following methodological conditions are important in integrating electrodynamics topics with environmental competence:

1. Highlighting the environmental content in each electrodynamics topic;
2. Linking physical laws to real technical and environmental situations;
3. Activating students through problem questions, environmental case studies, and project assignments;
4. Using artificial intelligence only as an auxiliary, analytical, and modelling tool;
5. Verifying AI responses on the basis of scientific sources, experiments, and physical laws;
6. Forming in students a culture of environmental responsibility, energy efficiency, and technological safety.

Conclusion And Recommendations

The scientific and methodological analyses carried out show that integrating electrodynamics topics with environmental competence is one of the pressing directions of modern physics education. Because topics studied in the electrodynamics section – such as electric current, electric field, magnetic field, electromagnetic induction, electric current in different media, generation and transmission of electric energy, and electromagnetic waves – are directly related to energy, industry, transport, communication systems, everyday technology, and the environment. Therefore, it is important to teach these topics not only within the framework of theoretical physical concepts but also in harmony with the ideas of environmental safety, energy efficiency, technological responsibility, and sustainable development.

The analyses have revealed that strengthening environmental content in physics education forms students' scientific attitude towards natural phenomena. Through the electrodynamics section, students gain an understanding of the culture of using electric energy, safety around high-voltage power lines, environmental aspects of electromagnetic fields, the impact of industrial electrical equipment on the environment, and the practical-environmental meaning of electrolysis and ionisation processes. This enriches their environmental competence not only with theoretical knowledge but also with practical activity, analytical thinking, and responsible decision-making skills.

The use of artificial intelligence tools creates new didactic opportunities for integrating electrodynamics topics with environmental competence. With the help of AI, students can model invisible electric and magnetic fields, explain the propagation of electromagnetic waves, compare the environmental advantages and disadvantages of energy sources, calculate electric energy consumption, identify environmental risk factors, and draw scientific conclusions about problematic situations. This process develops students' competences in independent research, critical thinking, digital literacy, and environmental responsibility.

Based on the research results, the following recommendations are put forward:

1. It is advisable to enrich electrodynamics topics with environmental content in the physics course of general secondary education and academic lyceums.
2. It is necessary to develop a system of practical tasks on environmental safety, energy efficiency, and technogenic impact for the topics "Electric Current", "Magnetic Field", "Electric Current in Various Media", "Electromagnetic Induction", and "Electromagnetic Waves".

3. To develop students' environmental competence, problem questions, project work, environmental case studies, comparative tables, digital modelling, and observation tasks should be used.

4. Artificial intelligence tools can be used in teaching electrodynamics topics as a means of visualisation, creating individual tasks, analysing data, modelling environmental problems, and assessing student activity.

5. When using AI tools, students should be taught the culture of critically evaluating information, comparing sources, drawing conclusions based on physical laws, and not copying ready-made answers.

6. It is advisable to develop a methodological guide or a short professional development module for physics teachers on "Using Artificial Intelligence in Integrating Electrodynamics Topics with Environmental Competence".

7. It is recommended to systematically introduce into the process of teaching electrodynamics topics in schools and academic lyceums environmental problem questions, AI-based analytical tasks, and practical exercises on energy efficiency.

Overall, integrating electrodynamics topics with environmental competence and teaching them using artificial intelligence tools enriches the content of physics education in a life-applied, interdisciplinary, and modern digital direction. Such an approach forms in students the skills of deeply mastering physics knowledge, taking responsibility for environmental problems, rationally using energy resources, and scientifically assessing the impact of technological progress on the environment. Therefore, this methodology fully meets the competency-based, integrative, and digital-didactic requirements of modern education.

REFERENCES

1. Rakhmetova M.T., Abykanova B.T.,
2. Choruh Ali. Opportunities to Improve the Ecological Competence of Students in the Secondary School Physics Course // Iasaýı Ýnıversıtetiniń Habarshysy. – 2023. – №3(129). – P. 295–307. DOI: 10.47526/2023-3/2664-0686.22.
3. Dustkabilovich R. O. Innovative technologies in teaching directors and specialists of industrial enterprises on labor protection //O ‘zbekiston Respublikasi Favqulodda vaziyatlar vazirligi Akademiyasi axborotnomasi. – 2021. – с. 108.
4. Rakhmetova M., Imashev G. The development of ecological knowledge and skills in teaching physics courses: Monograph. – Atyrau: “Raz project” centre, 2020. – 132 p.
5. Рахимов О. Электрон таълим ресурсларини яратиш талаблари ва технологияси //Современное образование (Узбекистан). – 2016. – №. 2. – С. 45-50.
6. Childebayev D. O‘quvchilarning ekologik bilim mazmunining ilmiy-pedagogik asoslari: ped. fan. nomz. ... diss. – Almaty, 2006. – 145 b.
7. Beysenova A.S. Ekologiya – el taqdiri: ekolog mutaxassislar uchun o‘quv qo‘llanma. – Almaty: Mektep, 2006. – 208 b.
8. Рахимов О. Д. Инновацион педагогик технологиялар: лойиҳалар услуби таълим сифатини оширувчи технология сифатида //Қарши, ТАТУ Қарши филиали. – 2013. – Т. 80.
9. Sarybekov M.N. Teoriya i praktika ekologicheskoy podgotovki budushchikh uchiteley: diss. ... dokt. ped. nauk. – Taraz, 1998. – 312 s.
10. Roczen N. Environmental competence: the interplay between connection with nature and environmental knowledge in promoting ecological behavior: PhD Thesis. – Eindhoven University of Technology, 2011. – 118 p.
11. Rakhimov O. D. et al. Unused opportunities: distance education in Uzbekistan //Scientific journal. – 2021. – №. 3. – С. 58.