

## METHODS OF FORMATION OF ENERGY SAVING CULTURE IN SCHOOL STUDENTS IN PHYSICS LESSONS

*The thesis of the article emphasizes the practical and theoretical significance of the need to form a culture of energy saving of primary school students in physics lessons. The experience of domestic and foreign researchers in forming a culture of energy saving of students is described. The definition of the concept of energy saving culture of primary school students in physics lessons has been clarified and presented. The article describes the structure of the energy saving culture of primary school students in physics lessons, which includes the following four components: motivation-valueable, cognitive, activity and reflexive. The essence of each aspect of the structure of energy saving culture is briefly described. The method of forming the culture of energy saving of primary school students in physics lessons is presented and the integrative connections between the components of the method are schematically shown. The model of the methodology meets three criteria: provides the formation of a culture of energy saving in accordance with the objectives and goals of the educational sector; implements a cross-cutting content line «Environmental safety and sustainable development»; and is created in accordance with the principles of didactic theory. Each of the components contains concepts, judgments, the necessary conditions for the effective functioning of the methodology and forms a single holistic system. According to the presented model, the described principles of teaching influence the content of activity, and the choice of methods and forms of teaching, and is a component that corresponds to modern trends in education. At the same time, the emphasis is placed on the availability of space for the implementation of pedagogical creativity of teachers, examples of effective forms and methods of working with primary school students in physics lessons and extracurricular activities to form a culture of energy saving in students. The method of forming the culture of energy saving of primary school students includes goal setting, structural components; the tasks of forming the culture of energy saving, scientific approaches are described; the stages of implementation and pedagogical conditions are defined. The procedural component contains a list of forms, methods and means of implementing the technique. The reflective component describes the criteria for the level of formation of the culture of energy saving of primary school students in physics lessons.*

**Key words:** *methods, culture, energy saving, primary school students, methods, forms, pedagogical conditions, physical education.*

**Formulation of the problem.** At the beginning of the third millennium, the use of renewable energy sources is one of the most important elements of sustainable development of world powers, and an effective solution in the fight against energy problems today. Today, a significant part of the energy used for human needs comes from such fossils as oil, coal and natural gas. As countries' energy needs increase, the consumption of these fuels continues to grow. It is important to note that the scarcity of non-renewable natural resources and environmental pollution is a key determinant for the development and use of alternative energy sources.

Ukraine does not stay aside and accepts new technological and economic challenges.

The formation of a new energy policy of our state includes the search and development of innovative developments in the field of energy consumption, improving the efficiency of transportation and energy consumption. The main ideas of new solutions in the field of energy saving and energy efficiency and strategic guidelines for the development of the fuel and energy

complex of our country are reflected in the current Energy Strategy of Ukraine «Security, Energy Efficiency, Competitiveness», adopted in 2017 by the Cabinet of Ministers [1].

The document outlines the main priorities and goals of the country's energy development, including the need to build a conscious society in the field of energy conservation, stimulating energy-efficient behavior of citizens and forming energy-efficient consumer consciousness.

In our opinion, the formation of such a society should begin at school, forming a culture of energy saving of primary school students in physics lessons, because physics is a compulsory subject in school and the terminology of the subject is the closest to the terminology of energy saving and energy efficiency.

The formation of energy saving culture in primary school students in physics lessons requires the development of specific methods that will increase the efficiency of this process, bring it into line with the requirements of reforming modern secondary education, theoretically justify the means of implementation in the educational process of secondary school.

The necessity to develop this model and the relevance of its implementation in physics lessons at school are caused by the following processes in modern society: awareness of energy conservation as a key component on the path to European integration and development of our country; rapid aggravation of the environmental situation in the country and abroad; the need to become a society knowledgeable in terms of energy conservation and energy efficiency, the construction of which should begin in a general secondary educational institution.

**Analysis of current research.** In modern scientific literature, the priority areas of education in the field of energy saving in teaching physics at school are reflected in the works by A.M. Andreiev [2], the formation of energy-saving competencies of teachers and students in the system of postgraduate pedagogical education are described by LO Klimenko [3]. In foreign studies, the most of the works of N. Zografakis, A. Menegaki, K. Tsagarakis, H. Elsharkawya, P. Rutherfordb concern the study of energy-efficient behavior of students and their parents, as well as the impact of projects on behavior change to more energy-efficient one [4]. The most of scientific researches on the formation of energy saving culture relates to the formation of energy saving culture and energy saving competence of future skilled workers in specialties related to the use of electricity in production by V. Radkevich [5]. Attention to current trends in energy saving and energy efficiency, contributes to the rapid adaptation of future skilled workers in the complex technological processes, this idea was considered by V. Tatarchuk [6], V.F. Bezyazychny [7], N.V. Zhovtyansky [8], A.V. Prakhovnik and G.R. Trapp in their works [9]. However, in the works we have taken into account, the theoretical aspects of the formation of the culture of energy saving of primary school students in physics lessons are insufficiently covered.

**The purpose of the article.** Having noted the practical and theoretical significance of the necessity to form a culture of energy saving of primary school students in physics lessons one should admit that the question of forming such a culture requires the construction of a theoretical foundation. Therefore, the purpose of this study is to clarify the concept of «energy saving culture of primary school students in physics lessons», to create a methodology for energy saving culture of students and build a model of its formation.

**Presenting main material.** The essence of the concept of «energy saving culture» includes a combination of such concepts as «energy», «culture» and «energy saving», «energy efficiency». From the 7th grade of the school physics course, students learn about the concept of energy as a physical quantity that characterizes the ability of a body or a body system to perform work [10]. In the Great Explanatory Dictionary of the modern Ukrainian language, the term «effective» is defined as the greatest effect. The concept of «efficiency» is considered as the ratio between the result and the resources expended to achieve it [11].

In the current Law of Ukraine «On Energy Conservation» with appropriate changes, the concept of «energy conservation» is considered as an organizational, scientific, practical, informational activity aimed at the rational use of natural energy resources [12].

The definition of culture in the works of domestic and foreign scholars has many different meanings and is defined in different areas of human life. In the scientific pedagogical literature they consider subject, mathematical culture, which includes subject literacy [13]. In philosophical

literature it is considered as a combination of material and spiritual values. According to Kant, culture is defined as the highest degree of the development of a person's mental abilities and his ability to ascend to moral existence. According to the philosopher E. Cassirar, culture is a symbolic circle in which a person carries out his life [14, p.30].

Based on the analysis of the concepts of «energy saving», «culture», «efficiency», we clarified the concept of energy saving culture of primary school students as a level of personal development of the student, which is expressed in a combination of awareness of value and exhaustion of natural resources, and decision-making on energy saving in future activities. The concept of energy saving culture of primary school students includes energy saving competence.

The method of forming a culture of energy saving of primary school students in physics lessons was built on the following principles: acmeological which is based on scientific conclusions about the highest degree of a personality's development, in our opinion the foundation of such development is laid in school. Axiological principle emphasizes the need for a value attitude to the formation of a culture of energy saving culture and the process of its formation. The system approach is aimed at understanding the energy-saving culture as a system that has a clearly defined structure; educational process in physics as a system object, which includes various forms and methods of work of students. The personality-activity approach is focused on the formation of energy saving culture in primary school students in physics lessons, which requires consideration of the peculiarities of mental development of students of this age group and theoretical knowledge of the theory of activity. Schematically, the main components of the methodology and integrative connections are shown in Fig.2.

The proposed technique forms a system of related components. Each component includes basic concepts and describes the conditions for effective operation, integrative connections are a necessary component of combining all components into a single system. In the method of forming a culture of energy saving of primary school students the general principles of teaching are described, including the principle of gnosticism, scientific, systematic, unity of theory and practice, sociocultural and natural conditioning, developmental and educational training ones.

The State Standard of Basic and Complete General Secondary Education in 2011, with appropriate changes, prescribes the tasks of the field of education, including the formation of value orientations for nature conservation, as well as ideas of sustainable development. It is important to note that in the current energy strategy of sustainable development of Ukraine the main priorities are to reform the energy efficiency program in the formation of a society awareness of energy conservation (Decree of the President of Ukraine, 2015). Based on current regulations, we have identified the target component of the methodology, which includes the purpose of the methodology - the formation of a culture of energy conservation of primary school students in physics lessons.

The theoretical and methodological component describing the structure of the energy saving culture of primary school students includes the following elements (Fig. 1):

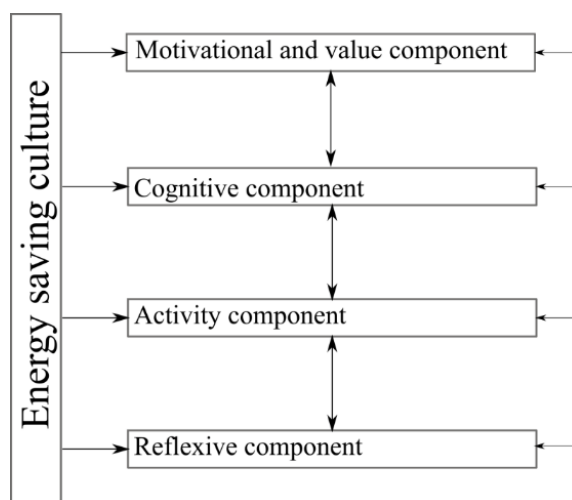
1. Motivational and value, combining values, personal attitude to the ideas of sustainable development, this component involves the ability of students to realize the economic benefits and advantages of energy efficient behavior and the belief in the need to use energy efficiently.

2. The cognitive component includes a set of theoretical knowledge about the efficient use of energy resources, which are based on the fundamental laws of nature and help students understand the patterns of energy processes. Theoretical knowledge is needed to understand the measures associated with energy conservation and efficient use of resources. Knowledge of the basic laws studied in physics lessons in primary school such as the laws of Ohm, Ampere, conservation of mechanical energy, etc., helps to imagine the course of phenomena associated with the conversion of energy in certain processes of the system.

3. The activity component includes energy-efficient behavior, which is expressed in the development of practical skills to use energy resources efficiently both at home and at school, and to develop skills acquired during schooling in further activities.

4. The reflective component provides a quantitative and qualitative analysis of the results of the formation of a culture of energy saving in primary school students. It is important to note that

an important condition for the implementation of this component is the availability and comprehensibility of results not only for teachers and students but also for parents of students, as parents are an integral part of the contemporary educational process.



**Fig. 1. The structure of the culture of energy saving primary school students in physics lessons**

The presented method of forming the culture of energy saving of primary school students outlines the main tasks that we have defined, which are based on the target component: to form a value attitude to natural energy resources; a system of knowledge on energy saving; energy efficient behavior; to bring up responsibility for the organization of vital activity on the basis of energy-efficient behavior; to develop students' ability to self-development, self-improvement.

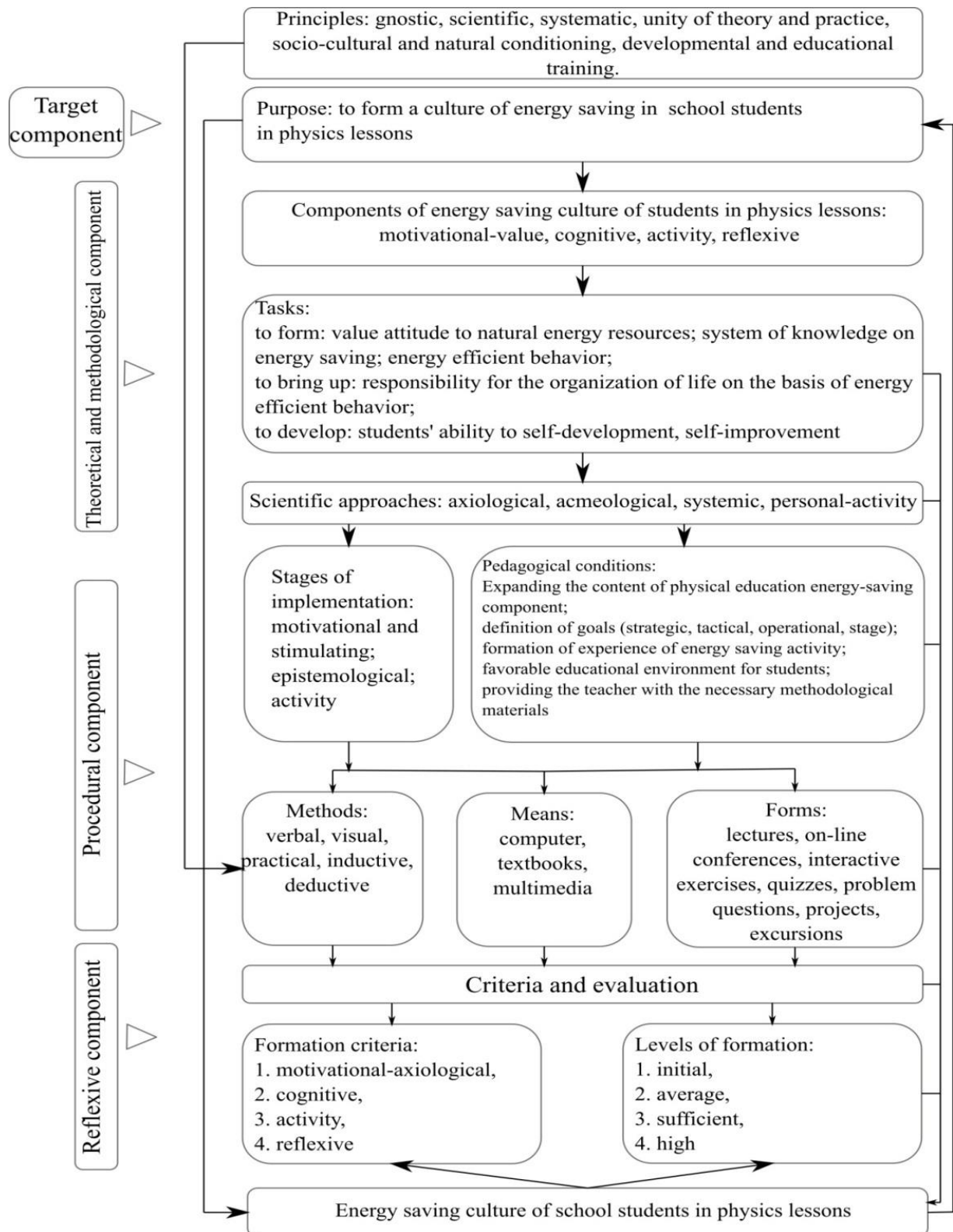
The procedural component defines the content that reveals each aspect of the structure of the methodology in forming a culture of energy saving.

Stages of implementation of the methodology include motivation-stimulating, epistemological and activity ones. The stages mentioned above are implemented under the following pedagogical conditions: the expansion of the content of physical education with the energy-saving component, which is described more precisely in [15]; the defining of the purposes, the formation of experience of energy saving activity in the process of the performance of research exercises, projects on energy saving, excursions, etc.; favorable educational environment for students, which includes teacher support at the school administration level; providing the teacher with the necessary methodological materials and his constant training on this topic due to the fact that energy-saving technologies and approaches are developing rapidly.

An important condition for the implementation of the procedural component of the methodology is the pedagogical creativity of the teacher, his innovative activities, mentioned in [16].

We believe that the most effective methods of forming a culture of energy saving of primary school students are a combination of traditional, non-traditional and active teaching methods. The peculiarity of this combination is the alternation of forms of student activity, the information obtained in the physics lesson should have practical support at home, in practice. While studying the topic «Electricity» when students get acquainted with electrical appliances, it is advisable to use as a homework research exercise: to inquire about electricity tariffs, energy efficiency classes of household appliances and more.

It is expedient to combine the study of thermal phenomena with an excursion to a heat supply company, or to investigate the condition of pipes in a school, to draw conclusions about heat loss, to ask the question «Why is it warmer on the ground floor than on the third one?» Pupils may suggest ideas as to how to reduce heat loss, etc. The combination of such forms and methods will allow to develop the content line of New Ukrainian School (NUS) «Ecological safety and sustainable development» and to realize the importance of energy saving on the scale of school, city, country.



**Fig. 2. Model of methods of forming the culture of energy saving of school students in physics lessons.**

Taking into account the internal structure of energy saving culture, the criteria for its formation are the following: motivational-axiological, an indicator of which is the student's motivation to study the topic of energy saving, which determines the motives of energy saving and the place of energy saving in the system of personal values and personal priorities; cognitive due to the fact that the topic of energy saving requires students to have certain knowledge of physics, defined by the current curriculum; activity due to the fact that the formation of students'

energy saving culture involves the ability to analyze the process of energy saving, see the problems of overuse of energy and the ways to solve them and reflective criterion that involves the implementation of self-analysis of activities and results achieved. In our opinion it is the powerful force of personal development in further activities, both educational and professional. We determined the levels of formation based on the current standard of basic secondary education and methodological recommendations provided in the program of teaching physics, so their number corresponds to the number of levels traditional for the modern educational process such as high, sufficient, medium, low.

**Conclusions and prospects for further scientific research.** Analyzing the theoretical material on the construction of energy saving culture, we came to the conclusion that the components of the methodology are invariant. The formed culture of energy saving of primary school students is a sign of high quality of their educational achievements, high level of public and energy consciousness and understanding of the problems of an inefficient use of energy resources. We will continue to work towards the gradual solution of the problems of forming a culture of energy saving.

A teacher who teaches physics in a general secondary educational institution must be aware of the field of energy saving, and then form a culture of energy saving in students. A promising area of work is the development of guidelines and manuals for teachers of general secondary education, the formation of culture of energy saving in physics lessons for primary school students. The next step in the work is to describe the criteria for assessing the level of formation of the energy saving culture of primary school students in physics lessons.

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**Цапенко М. В. Методика формування культури енергозбереження учнів основної школи на уроках фізики.**

*У статті наголошується на практичній і теоретичній значимості потреби у формуванні культури енергозбереження учнів основної школи на уроках фізики. Описаний досвід вітчизняних та зарубіжних дослідників з формування культури енергозбереження учнів. Уточнене і представлено визначення поняття культура енергозбереження учнів основної школи на уроках фізики. У статті описана структура культури енергозбереження учнів основної школи на уроках фізики, яка включає чотири компоненти, мотиваційно-ціннісний, когнітивний компонент, діяльнісний, рефлексивний. Коротко описана суть кожного з аспектів структури культури енергозбереження. Представлена методика формування культури енергозбереження учнів основної школи на уроках фізики та схематично показані інтегративні зв'язки між компонентами методики. Модель методики відповідає трьом критеріям: забезпечує формування культури енергозбереження відповідно до завдань і мети освітньої галузі; реалізовує наскрізну змістову лінію «Екологічна безпека та сталий розвиток»; створена відповідно до принципів дидактичної теорії. Кожен із компонентів містить поняття, судження, необхідні умови ефективного функціонування методики та утворює єдину цілісну систему. Згідно представленої моделі, описані принципи навчання впливають на зміст діяльності, і на вибір методів і форм навчання, і є компонентою, яка відповідає сучасним тенденціям в освіті. Разом з тим наголошується на наявності простору для реалізації педагогічної творчості учителя, наведені приклади ефективних форм і методів роботи з учнями основної школи на уроках фізики та в позаурочній діяльності з формування культури енергозбереження в учнів. Методика формування культури енергозбереження учнів основної школи включає постановку мети, структурні компоненти, описані завдання формування культури енергозбереження, наукові підходи, визначені етапи реалізації та педагогічні умови. Процесуальна складова містить перелік форм, методів і засобів реалізації методики. Рефлексивна складова описує критерії рівня сформованості культури енергозбереження учнів основної школи на уроках фізики. На етапі рефлексії потрібно здійснити аналіз діяльності, використовуючи описаний критеріальний апарат з метою оцінювання ефективності методики. В залежності від результатів аналізу, зробити висновок про застосування методів та форм роботи. В методиці формування культури енергозбереження учнів основної школи на уроках фізики вчитель має простір для прояву педагогічної творчості, і формувати культуру енергозбереження учнів використовуючи власний педагогічний досвід.*

**Ключові слова:** методика, культура, енергозбереження, учні основної школи, методи, форми, педагогічні умови, фізична освіта.

**Цапенко М. В. Методика формирования культуры энергосбережения у учащихся основной школы на уроках физики.**

*В статье отмечается практическая и теоретическая значимости необходимости формирования культуры энергосбережения учащихся основной школы на уроках физики. Описанный опыт отечественных и зарубежных исследователей по формированию культуры энергосбережения учеников. Представлено определение понятия культура*



енергосбереження учасників основної школи на уроках фізики. В статті описана структура культури енергосбереження учасників основної школи на уроках фізики, яка включає чотири компоненти, мотиваційно-ціннісний, когнітивний компонент, діяльності, рефлексивний. Коротко описано суть кожного з аспектів структури культури енергосбереження. Представлена методика формування культури енергосбереження учасників основної школи на уроках фізики і схематично показано інтегративні зв'язки між компонентами методики. Модель методики відповідає трем критеріям: забезпечує формування культури енергосбереження відповідно до завдань і цілей освіти; реалізує змістову лінію «Екологічна безпека і сталі розвиток»; створена відповідно до принципів дидактичної теорії. Кожен з компонентів містить поняття, судження, необхідні умови ефективного функціонування методики і утворює єдину цілісну систему. Згідно з представленою моделлю, описані принципи навчання впливають на зміст діяльності, і на вибір методів і форм навчання, і є компонентом, який відповідає сучасним тенденціям в освіті. Разом з тим відзначається наявність простору для реалізації педагогічного творчості вчителя, наведено приклади ефективних форм і методів роботи з учасниками основної школи на уроках фізики і в позурочній діяльності по формуванню культури енергосбереження у учасників. Методика формування культури енергосбереження учасників основної школи включає постановку цілей, структурні компоненти, описані завдання формування культури енергосбереження, наукові підходи, визначені етапи реалізації і педагогічні умови. Процесуальна складова містить перелік форм, методів і засобів реалізації методики. Рефлексивна складова описує критерії рівня формування культури енергосбереження учасників основної школи на уроках фізики.

**Ключові слова:** методика, культура, енергосбереження, учасники основної школи, методи, форми, педагогічні умови, фізична освіта.

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## **ПРОБЛЕМИ ТА ВИКЛИКИ ДИСТАНЦІЙНОГО НАВЧАННЯ ХІМІЇ У ЗАКЛАДАХ ЗАГАЛЬНОЇ СЕРЕДНЬОЇ ОСВІТИ**

Останніми роками у всьому світі невпинно зростає інтерес до організації освітнього процесу за допомогою технічних засобів навчання. Особливо гостро постало це питання у зв'язку із переходом закладів освіти до дистанційної форми навчання. У статті розкривається ряд проблем і викликів, що виникли в учнів закладів загальної середньої освіти у зв'язку з незапланованим, швидким і невизначеним за тривалістю переходом до дистанційної форми навчання. До основних недоліків, що заважають ефективній дистанційній освіті, педагоги відносять такі: залежність від технічних пристроїв і Інтернету; проблеми із зосередженням школярів; низький рівень інформаційно-комунікаційної компетентності учасників освітнього процесу; неадекватність