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Variability of the educational process when teaching the topics of the section «Topography and cartography» in the 11th form

The purpose of the article is to determine the ways of organizing the educational activities of 11th grade students for the formation of cartographic competence within the framework of the topic «Topography and cartography» in present-day conditions of uncertainty.

Basic material. Students cannot acquire geographic competences qualitatively and efficiently provided there is no cartographic literacy as part of information and digital competence, related to the consideration of the map as a concentrated carrier of information. Not having the opportunity to expand the scope of topographic-cartographic knowledge in the content of school geography, it is necessary to pay attention to the quality of the educational process, forming topographic-cartographic knowledge, abilities and skills under different conditions of conducting educational activities. We propose to take into account the theoretical foundations of the educational process, external and internal conditions, role of topographic-cartographic knowledge in the structure of school geography. Such a model of the training organization will regard the formation of cartographic competence through learning technologies and its results, expressed in cognitive, activity and evaluation-value competences. In modern realities of Ukraine, there is a need to consider five technologies of conducting lessons: traditional face-to-face, mixed, synchronous online, synchronous consultation type without video communication, asynchronous, the modeling possibilities of which we reflected in the publication. All the mentioned technologies have a certain system of available training methods and techniques.

Conclusions and further research. All technologies for conducting classes on cartographic subjects can exist effectively. The analysis of methodical support proved that each learning technology should have its own ones, as well as methods, techniques. The proposed model of the educational process organization determines the relationship between them. The developed models of lessons using 5 technologies have showed that the modeling of educational activities is a permanent feature of a teacher's work, especially in today's changing world. The design of the lessons should allow you to switch quickly from face-to-face lessons to asynchronous lessons, from remote online lessons to remote consultation lessons, etc. The authors have varified the effectiveness of individual lesson models in practice and recommended them for use as an example for modeling lessons on other topics.

Keywords: *educational technologies, teaching methods, modeling of educational activities, cartographic competence, state of emergency, 11th form.*

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Introduction. Education in the modern world is one of the important factors in ensuring economic benefits, social improvement, balanced development of nature, and even security, both personal and state. The last three years have become a test for Ukrainian education, which has shown the ability to quickly adapt to today's challenges, to intensify the search for ways to maintain the quality of education even in the most difficult conditions that society has encountered. Geographical education is basic for understanding the world, for exploring space, and forming a systemic, holistic worldview. All countries of the world have geography as an educational component in school curricula. Institutions of higher education train geographers of various profiles as well as geography teachers. However, students cannot acquire geographical competences qualitatively and effectively in absence of cartographic literacy, underdeveloped cartographic competence.

The role of geographical maps in modern life in the conditions of martial law and unpredictable development of events is extremely important, because knowledge of the landscape can be useful in extreme situations, as well as in everyday life. Maps are the best assistant of the traveler and tourist. Military specialists, drivers, meteorologists, logisticians, scientists, etc., all use maps. Therefore, the base of knowledge, abilities and skills in working with maps, established at school, is useful to everyone. The formation of cartographic competence is of great importance, but school geography itself pays little attention to it. Given the importance of the ability to read a map and work with it in the geography course of the 11th grade correctly and quickly, the section «Topography and cartography» is the first to update and generalize the knowledge. Not having the opportunity to expand the scope of topographic-cartographic knowledge in the content of school geography, it is necessary to pay attention to the quality of the educational process organization for the formation of topographic-cartographic knowledge, abilities and skills in different conditions of conducting educational activities.

Initial prerequisites. The scientific works of V. Bezuglyi [1], O. Braslavska [2], L. Datsenko [3], O. Nepsha [5], and V. Nosachenko [6] are the theoretical basis of the research. Scientific achievements regarding the formation of cartographic competence of future geography teachers have a prominent place among them, while the cartographic competence of students, methodical recommendations for working teachers recede into the background. We can observe this within the framework of professional development courses – there is no cartographic topic in almost all resources that offer professional development services. A similar situation is observed abroad – the programs of improving the qualifications of geography teachers of grades 7-12 cover all geographic topics apart from a separate topic strengthening cartographic competence [9; 10]. Despite the fact that scientific publications have actively raised

the problem of cartographic competence formation for a long time, its formation in practice remains extremely low. Practical works, tasks of cartographic content from EIE (until 2022) are the most difficult, open-form tasks turned out to be failures for most participants. At the Olympiads, the participants most often fail to solve the cartographic tasks. In the past, teachers used maps in geography and history lessons to transfer knowledge about geospace, while today we define cartographic competence as a component of the life competences of each individual, noting the possibility of solving difficult life situations by using a map [2; 6]. Thus, today, the situation with the formation of students' cartographic competence remains extremely difficult.

The purpose of the article is to determine the ways to organize the educational activities of 11th grade students with the aim to form cartographic competence within the framework of the topic «Topography and cartography» in modern conditions of uncertainty.

Presenting main material. State legislation defines the educational process as a system of scientific-methodical and pedagogical measures aimed at the formation and development of the individual through the implementation of the competence approach. Cartographic (spatial) competence is one of the general competences, defined as a component of information and digital competence, which considers a map as a concentrated carrier of information. Looking at the school geography course, we note that cartographic competence begins to form from primary school, from the plan of one's school. Then it gradually moves to more complex results of educational and cognitive activities in grades 6-8, finally generalizing them in grade 11, when studying the topic «Topography and cartography» in the course «Geographic space of the Earth». In addition to topographic-cartographic sections, O. Nepsha [5] believes that cartographic literacy forms in other sections of school geography through the use of cartographic works, descriptions and analyses based on them, with which we agree.

For several years in a row, all classes of basic and comprehensive schools have been studying geography. The program of the 11th grade «Geographic space of the Earth» generalizes the geographical worldview [4]. The natural and socio-economic sections of the program are balanced. However, the section «Topography and cartography» has only five hours, which is unsatisfactory. At the same time, the formation of cartographic competence takes place while studying all program topics, typical for all classes. Thus, a certain disproportion arises. The program itself emphasizes the importance of initial cartographic knowledge, but the basic foundations are extremely limited. The 11th grade geography program, as well as the entire school course, does not focus on certain topics related to the concept of space photographs, comparison of map images of different types of terrain (for example, distortion of areas, angles, shapes by comparing the outlines of

known objects), the concept of aerial photographs and their decoding, the cartographic method of research at least at the level of descriptions [3]. Most importantly, topographical and cartographic topics in school geography courses of different grades are separated from the main geographical material and, thus, the student does not get a general idea of the practical use of cartographic works.

Analysis of foreign publications [7; 8] shows similar problems, in particular, in Czech Republic, the USA, focusing on the lack of allocated time for mastering geographical and cartographic skills, the lack of teachers' preparation to work in modern digital conditions, in particular with GIS, and the obsolescence of technical equipment in schools [8]. Most American students did not work with a map in class and did not see it even when studying geography. Currently, in order to overcome these challenges, the USA launched updated versions of the school geography curriculum «Future 3», «Geography for Life».

We modeled the process of organizing education regarding the formation of cartographic competence through learning technologies and their results, expressed in cognitive competencies, activity and evaluation-value type (Fig. 1). The authors considered theoretical foundations of the educational process, external and internal conditions of its organization, directed on formation of cartographic competence and the role of topographical and cartographic knowledge in the structure of school geography. Such a model will help determine the choice of learning technology and the sequence of steps in the organization of the educational process for the formation of cartographic competence.

Implementation of extreme legal regimes has a particularly strong influence on the conditions of the educational process organization, in particular, geography in general secondary education institutions (Fig. 2). Thus, according to the traditional «pre-COVID» conditions of the educational process organization, attendance at the educational institution was stable. The schools provided the entire set of printed textbooks, the possibility to use a computer classroom, projectors, and multimedia boards. Pupils had an educational space organized in accordance with all the rules and regulations of safety technology with an area for study, food, recreation, etc. Students and teachers could freely communicate with each other, which created a favorable psycho-emotional effect.

Since 2020, the state has implemented various restrictions due to the pandemic, state of emergency and martial law. With each subsequent stage, the restrictions grew both in number and significance. Thus, during the quarantine restrictions, there was a ban on visiting educational institutions for a short period of time, which affected the formation of the team and communication in classes. With the introduction of martial law, psycho-emotional tension, worry for the safety of one's own and that of the family, both among teachers and students,

added to this. But the main thing is that in these conditions, the inequality of students from different regions in terms of education and preparation for NMT is growing. Pupils of schools in the central and western regions of Ukraine have the opportunity to study, using mixed technology with a predominance of face-to-face format. Thus, it is possible for them to conduct excursions, «live» communication, receive explanations from the teacher directly on the spot. At the same time, in the regions located in the combat zone, classes are possible only by remote technology in a hybrid format. Constant air alarms cause psycho-emotional tension and anxiety among students and teachers, interrupt lessons in a synchronous format. In such conditions, the educational process itself and preparation for the NMT require considerable self-organization from the students and a display of mastery from the teacher.

Such present-day living conditions of the Ukrainians force us to consider four technologies for conducting lessons: remote online, remote asynchronous, face-to-face (which, at present, is not available in its full format for schoolchildren in Ukraine, as it is interrupted by air alarms and is forced to switch to mixed in this case), mixed education (which in this school year is not available for students of regions close to the line of hostilities, in particular Kharkiv region). All the mentioned technologies have a certain system of available training methods and techniques.

The main method and technique of studying topographic-cartographic topics is working with a map. Among the types of work, we highlight description of the area, determination of coordinates, distances, areas, establishment of spatial relationships between objects, etc. The use of thematic maps of different scales diversify methods of work which allows you to look at the cartographic image in a new way. Work with GIS is sometimes included in the school geography program only in the 11th grade. Moreover, this type of work is the only one today that will help implement the skill of compiling cartographic works. Any class can include work with GPS in its program. Modern technologies of augmented reality, virtual travel, the use of animated images or video films make it possible to visualize the teaching of topographical and cartographic topics and make them more understandable. Game methods play a significant role in modern conditions. First, it is necessary to distract children from psychological stress, and game technologies greatly contribute to this. Secondly, what is done with one's own hands is better remembered, so the percentage of the material assimilation increases significantly. For this, you can use puzzles, geographical quizzes with cartographic content, baskets of knowledge, etc.

The implementation of extreme conditions for the educational process organization which the Ukrainian school already has experienced for the fifth (!) academic year, usually affects the peculiarities of methodical support. Geography is no exception. As conditions

changed, so did access to certain organizational conditions. Thus, the vast majority of methodological support elements have undergone significant changes (Fig.3).

Accordingly, each lesson needs simulation. During special legal regimes, this activity, among other things, has uncertain results. For example, a teacher plans a remote online lesson to explain a complex topic. An air alert at this time can affect the conduct of this lesson in

several different ways. Anxiety can interrupt a lesson at any moment, make it impossible to start or fully conduct it, affect the emotional state (especially when the cause of anxiety was somewhere nearby), so that the teacher will not be able to conduct them even a few lessons later or the students will not be able to join for the same reason. Therefore, the teacher should anticipate various scenarios in this designs and be ready to continue his activities in different situations. In such conditions, we

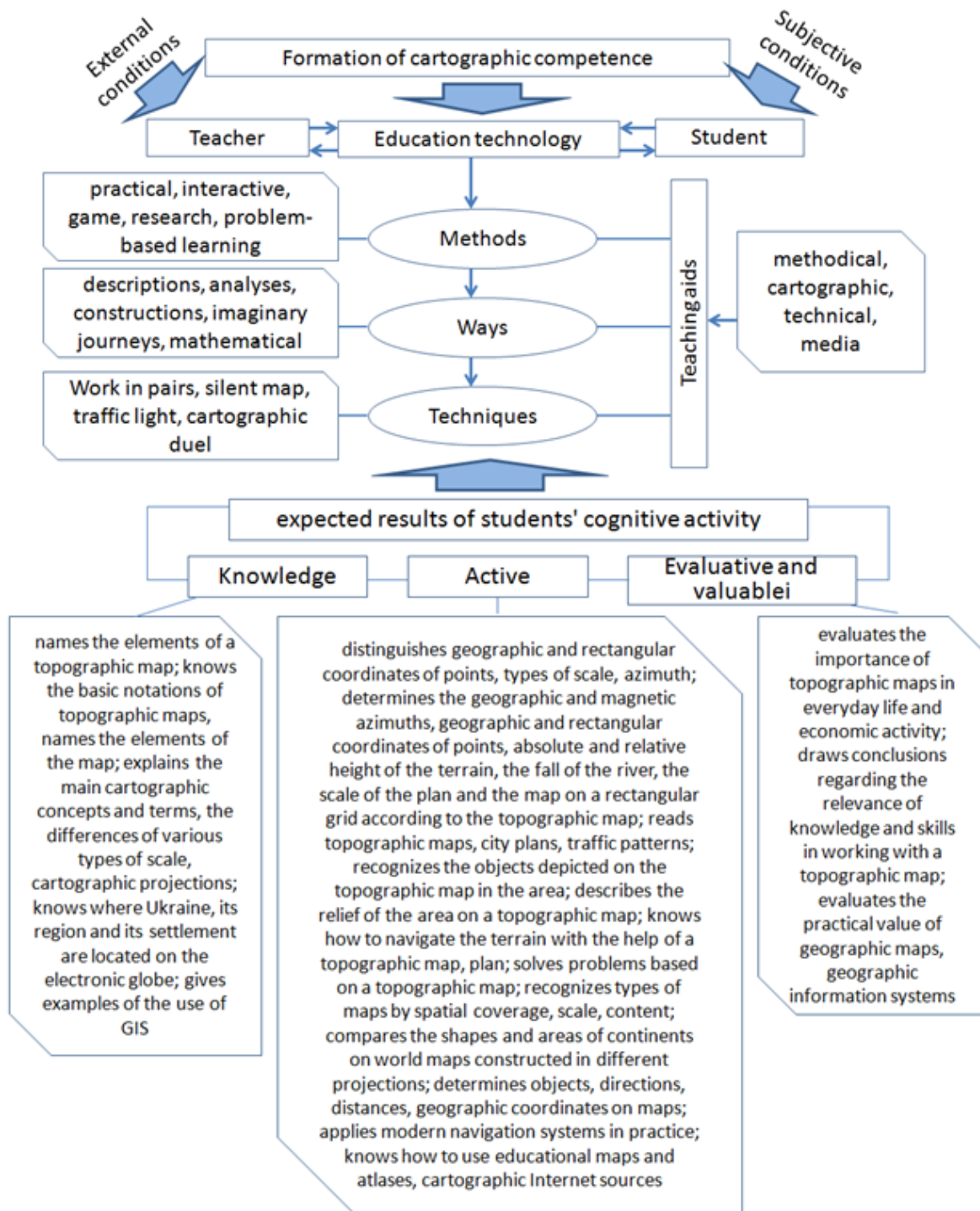


Fig.1. Model of the educational process organization in the 11th grade for the formation of cartographic competence (within Chapter1 «Topography and Cartography»), taking into account the UNESCO recommendations

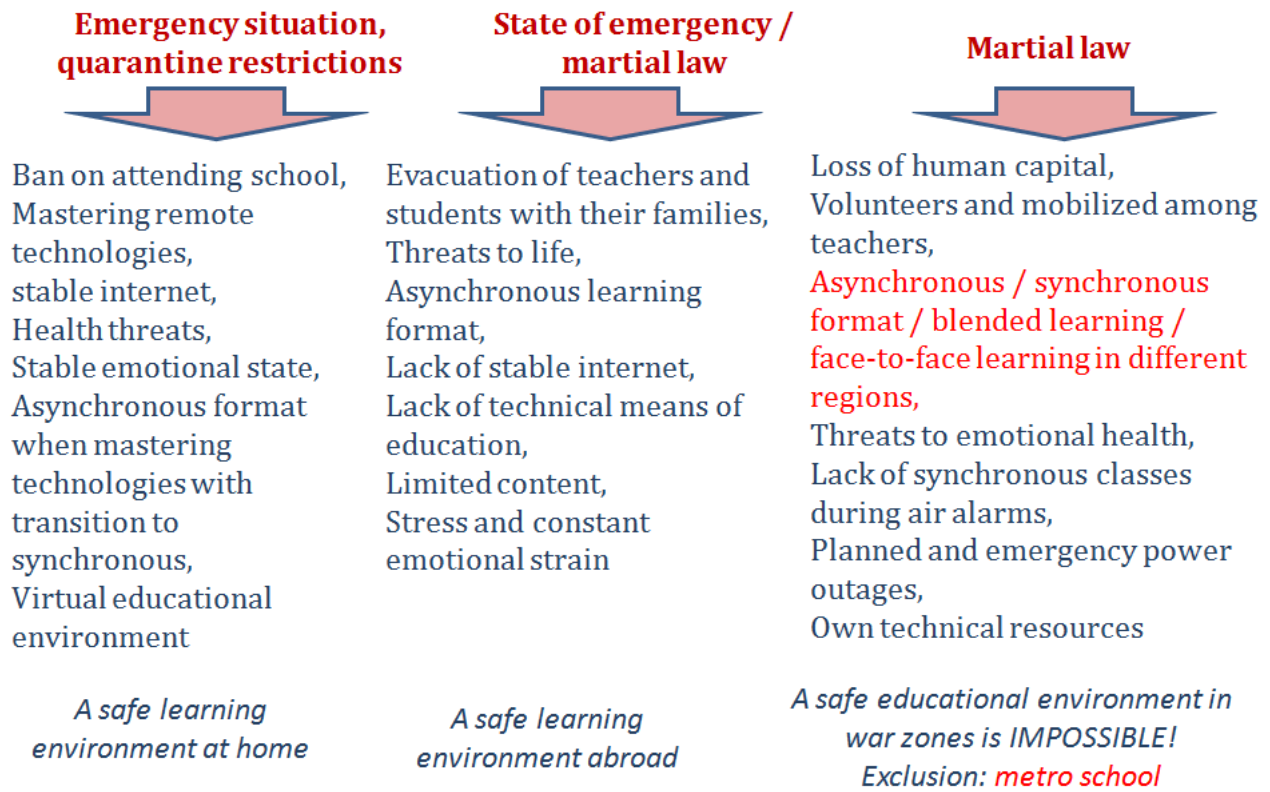


Fig.2. External conditions for the organization of the educational process in various extreme conditions

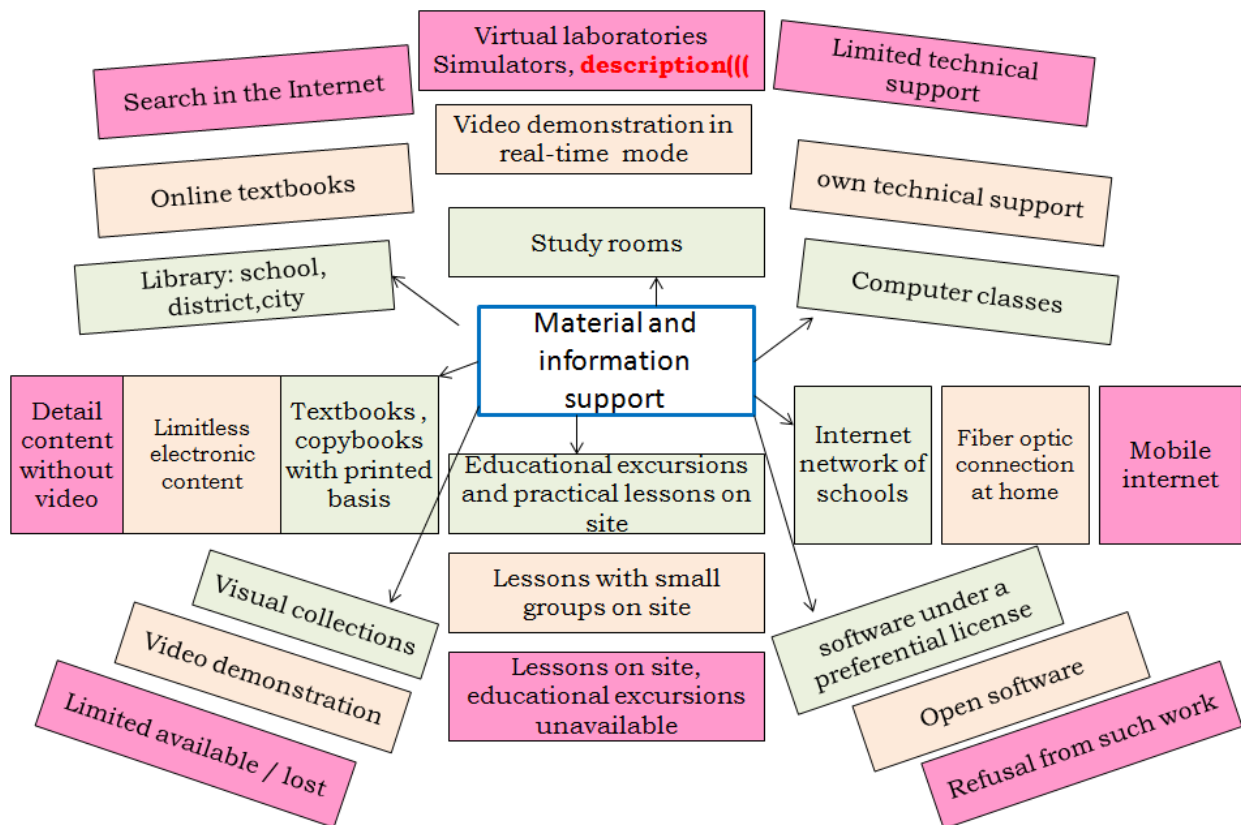


Fig.3. Change in the conditions of the educational process organization in geography with regard to material and information support (pre-war times - post-war times - wartime)

should mention one more thing in this situation - the loss of motivation to work and to study, which requires the implementation of special psychological trainings. Thus, the traditional principles of choosing teaching methods do not work in such conditions. It is necessary to look for models of conducting lessons that will adapt to new realities as much as possible.

In our work, we show the possibilities of lesson modeling depending on specific circumstances and technology. The structure of the lesson is the same: modules of introductory instruction with actualization of knowledge and motivation, study of new material, practice, diagnosis, homework, but the types of work differ significantly depending on specific conditions and the selected training system.

According to the traditional full-time education system, the lesson has a classic structure with the recommendation to include a YES/NO survey, use printed sets of topographic maps, atlases, contour maps, implement feedback technologies, interactive methods (six hats, cartographic chain, associative bush), means of reflection. Moreover, students should solve practice-oriented problems in class, while an additional task that requires the use of an innovative, extraordinary approach should be offered as homework for creative students.

It is difficult to conduct a lesson in a mixed system, when only some students have the opportunity to attend an educational institution. In this case, first, you need to pay attention to the arrangement of the educational space itself, dividing time into offline and online components, multifaceted homework. For students who attend the lesson in the online format, we provide independent work according to methodical recommendations posted in advance by the teacher.

In case of using synchronous online technology, the importance of the module of motivation and psychological mood increases, when we recommend to use trigger techniques, and the module of psychological support or physical training minutes. The possibility of using electronic resources to update knowledge expands with the simultaneous explanation of the material by the teacher. Among the tools are Google forms, <https://learningapps.org>, <https://www.purposegames.com>, built-in test builders, filling out syncways, etc. The module for learning new material is based on the teacher's story with a demonstration of the presentation (required). Other material can be videos (short stories, because otherwise the benefit of a synchronous online lesson disappears), virtual trips, elements of gamification with a simultaneous explanation by the teacher. The teachers actively work with an atlas and an online board. We do not provide feedback questions for this technology during the lesson. They are all assigned to asynchronous work or independent work in synchronous mode with the teacher providing advice to individual students. We also suggest using test technologies in the diagnostics module. The online

technology does not provide for additional tasks, even project tasks for students participating in tournaments and Olympiads. In case you plan a complex topic for the next lesson, you can offer students an anticipatory task using the flipped classroom technology.

A lesson using the synchronous technology of the consultation type without video communication involves the synchronous independent work of students with the amount of information provided by the teacher. Please note, that the material must be strictly limited to the program and content of the topic. It is necessary to pay attention to the portioning of the material so that the students have time to master it independently during the lesson. If it is a video, you should use one piece, if - presentation, then it must be as clear as possible, without additional questions and distractions. You can combine these two methods to give the information, if the total amount of time to master them does not exceed 20 minutes. We do not suggest diversifying the practical component, but giving the same task for everyone. At the same time, according to the necessity, need and desire of the students, the teacher consults them during the lesson in a written form (answers in the messenger or on the educational portal through comments), recording voice messages with subsequent sending in the messenger or adding to the lesson outline, or through video consultations for individual students. This allows you to apply a person-oriented approach and provide help to those who need it, and during the online lesson, due to certain psychological and personal issues, they will not receive it.

With asynchronous technology, the student does not have the opportunity to receive instant feedback from the teacher, but can master the material at a time convenient for him, especially taking into account the possible forced movement abroad. Students independently master the material with the amount of information provided by the teacher. They can send their questions to receive feedback on this technology at any moment of the lesson. Then the teacher answers the received questions during his working day. It is best to organize this work on the educational portal, not in messengers. The total time a student spends on mastering the material and doing homework should not exceed 70 minutes for the 11th grade. The homework module does not differ from the lesson in remote synchronous technology without video communication. There must be feedback from the teacher on completed homework. During a long period of asynchronous lessons, homework should be as simplified as possible, multi-level and alternative, in order to give students the opportunity to master the topic and show the results of their activities in any conditions. During wartime, it is recommended not to limit the deadline for completing tasks, but to set time X, while not closing access to tasks. Another option for homework can be to fill out a compatible Google document with the presented

descriptions for individual questions. Then the students trying to complete the task will have a sample and try to do their part.

The level of professional training of geography teachers is an important indicator in the formation of geographical literacy of students and, through them, the entire population of the country. Indicators of low interest of students in geographic subjects, the decline of classical geographic education in universities indicate that the level of professional ability of geography teachers is also low. The majority of teachers are not interested in the best success of their students, they do not show a desire to spend their own additional energy on self-improvement and motivation. As a result, the vast majority of school graduates do not understand the importance of geographic education for their development and formation.

Based on the content of the 11th grade geography course, we have formulated a block of partial competencies that collectively form a complex cartographic competency, and together can provide high-quality training of geography teachers on this subject. Orientation to the solution of pedagogical tasks in working with maps – to understand, know and read – performs an integrative function in substantiating the content of the topographical and cartographic training of future teachers. Accordingly, complex cartographic competence includes knowledge of the mathematical basis and a system of conventional signs of topographic maps; the ability to receive and competently use quantitative and qualitative information presented on topographic and thematic maps; comprehensive ability to read a topographic map; skills of using topographic maps and thematic cartographic works in everyday life

and when solving professional issues. Only the formation of complex cartographic competence is the key to the successful professional activity of a geography teacher.

Conclusions and prospects for further research.

Present-day complexities of the uncertainty conditions for the organization of educational activities, associated with the implementation of special legal regimes, have shown that all technologies for conducting classes on cartographic topics can exist effectively. The advantages of a face-to-face geography lesson are the available necessary equipment for practical work, communication between the teacher and children, as well as the teacher's control of the work stages. At the same time, the distance lesson allows you to use interactive technologies, various tools for working in an online environment, visual familiarization with electronic geodata. However, the same technologies have a number of disadvantages, which rational design of lessons can overcome. The analysis of methodical support has proved that each learning technology should have its own technologies, methods, techniques. The proposed model of the educational process organization determined the relationship between them. The model lessons on the topic «Topographic map: projection, graphing and conventional signs» for 5 different simulated technologies of conducting lessons have proved that the modeling of educational activity is a permanent feature of the teacher's work, especially in today's changing world. The lesson designs should allow you to switch quickly from face-to-face lessons to asynchronous lessons, from remote online lessons to remote consultation lessons, etc. The authors have varified the effectiveness of individual lesson models in practice and recommended them for use as an example for modeling lessons on other topics.

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ВАРІАТИВНІСТЬ ОСВІТНЬОГО ПРОЦЕСУ ПРИ ВИКЛАДАННІ ТЕМ РОЗДІЛУ «ТОПОГРАФІЯ ТА КАРТОГРАФІЯ» В 11 КЛАСІ

Мета статті полягає у визначенні шляхів організації освітньої діяльності учнів 11 класу для формування картографічної компетентності у межах теми «Топографія та картографія» за сучасних умов невизначеності.

Основний матеріал. Набуття географічних компетентностей учнями не може якісно і ефективно відбуватися за умови відсутності картографічної грамотності як частини інформаційно-цифрової компетентності, що пов'язано з розглядом карти як концентрованого носія інформації. Не маючи можливостей розширення обсягу топографо-картографічних знань у змісті шкільної географії, потрібно звернути увагу на якість організації освітнього процесу з формування топографо-картографічних знань, умінь і навичок за різних умов провадження освітньої діяльності. Ураховуючи теоретичні засади організації освітнього процесу, зовнішні і внутрішні умови, роль топографо-картографічних знань у структурі шкільної географії, запропоновано модель організації навчання щодо формування картографічної компетентності через технології навчання і його результати, виражені у компетентностях знаннєвого, діяльнісного та оцінно-ціннісного виду. У сучасних реаліях українців є необхідність розглядати п'ять технологій проведення уроків: традиційну очну, змішану, синхронну онлайн, синхронну консультаційного типу без відеозв'язку, асинхронну, можливості моделювання за якими відображена у публікації. Усі названі технології володіють певною системою доступних методів і прийомів навчання.

Висновки і подальші дослідження. Усі технології проведення занять з картографічної тематики можуть ефективно існувати. Аналіз методичного супроводу довів, що для кожної технології навчання мають бути свої технології, методи, прийоми. Запропонована модель організації освітнього процесу визначила взаємозв'язок між ними. Розроблені моделі уроків за 5 технологіями показали, що моделювання освітньої діяльності є перманентною рисою роботи вчителя, особливо у сучасному мінливому світі. Розробки уроків мають дозволяти переключитися швидко з очного уроку на асинхронний, з дистанційного онлайн уроку на дистанційний консультаційний тощо. Ефективність окремих моделей уроків перевірена авторами на практиці і рекомендується до використання як приклад для моделювання уроків з інших тем.

Ключові слова: освітні технології, методи навчання, моделювання освітньої діяльності, картографічна компетентність, надзвичайний стан, 11 клас.

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