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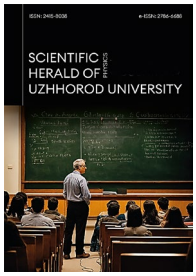

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Teaching the processes of mountain formation in physical geography using multimedia technologies (Kazakhstan)

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Abstract
Relevance. Physical geographical education plays an important role in the system of geographical education. Without mastering physical and geographical knowledge, it is impossible to form knowledge about the process of mountain formation. Teachers can clearly present the dynamic development of the process of mountain formation using multimedia technology in class rooms. However, electronic textbooks, which present an effective method of teaching through multimedia technologies, are not enough. Today, the importance of multimedia applications has increased with the mass distance learning of schoolchildren during the pandemic.

Purpose. The study aims at developing an effective methodological basis for teaching the mountain-forming process in school geography.

Methodology. Despite the works of scientists who have theoretically studied multimedia technologies, the methodology is not sufficiently studied for introducing new technologies into the learning process. This, in turn, requires a thorough study of the pedagogical aspects of multimedia technologies in geography.

Results. This paper analyses the features of teaching geography in Kazakhstan focusing on the analysis of the important role of physical geography in the system of geographical education. This article considers the problem of teaching mountain-forming processes in physical geography. A broad theoretical analysis of folded, wrinkled, folded-axillary mountains was carried out with the classification of mountains by formation, age and height. These data were taken as the theoretical basis of the methodology of teaching the process of mountain formation.

Conclusions. The article defines how multimedia technologies can be used in teaching geography in schools of Kazakhstan. The authors proposed a methodology for teaching the process of mountain formation using a multimedia textbook.

Keywords: physical geography; the process of mountain formation; multimedia technologies; geographical methods of teaching; classification of mountains.

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Introduction

Today, there is a need for informatisation and the content of education due to the rapid development of the digitalisation process in society. Currently, multimedia technologies are one of the new information technologies that implement innovative methods in the learning process using electronic textbooks, computer training programs, audio and video educational materials. Multimedia is the use of computers to display information which is a combination of text, graphics, audio and video so that users can navigate, interact, create and communicate with computers. Computers can manage what will be seen and heard, and what will interact with its users [1].

Currently, the education system has a diverse set of interactive tools for teaching geography. Visibility plays an important role in the assimilation of geographical knowledge. Studying geography without visual aids leads to the fact that words are remembered only mechanically in the minds of students, therefore, since no image is formed in the student's mind, knowledge is quickly lost [2]. If a teacher only narrates factually and unimaginatively following the knowledge in the textbook, the teaching efficiency will be heavily discounted [3]. They just obtain the knowledge based on the rigid memory, and they lose the enthusiasm and initiative of study with the lapse of time, which exerts direct impacts on the teaching effects with the loss of the meanings of teaching [4]. As multimedia technology develops, multimedia technology exerts increasingly obvious impacts on the physical and mental changes of young people. It is difficult to stimulate the learning interests of students just depending on the existing teaching materials, teachers' language, or a small amount of geographic pictures. It not only saves teachers plenty of time to write and draw on the blackboard, but also extends the time and space ranges which are not on the textbook. It makes up for the hysteresis quality of textbook and improves students' learning interests, which can cultivate the geographic literacy of students [3]. Analyzing how to integrate modern information technologies in education, Ioan Cerghit said that "multimedia systems focus on creating a complete and efficient learning environment." [5].

Information technologies began to replace some visual teaching aids as a universal means of collecting, storing, processing, exchanging and presenting information [6]. With the help of information technologies, it is possible to create the necessary programs and images, analyze and synthesize the components of the content of geographical knowledge with the help of creativity [2]. Currently, much attention is paid to the study of multimedia tools and programs. Computer geography improves information innovative methods in geographical education, dealing with issues of distance learning using electronic textbooks (geomultimedia of natural processes and phenomena; talking maps; audio and video tutorials on geographical disciplines of general educational institutions, etc.) [7]. Currently, geography uses various methods of computer animation to demonstrate the development of natural processes using programming or multimedia software. This technique is called geographical multimedia, which combines audio recordings, photos of geographical objects and animated video recordings of various processes. This technology allows fully describing natural processes [7]. Multimedia technologies are a modern, optimal and mobile visual aid that allows significantly expanding this information environment, systematising it, selecting the necessary specific information, seeing the dynamics of the development of processes, objects and phenomena, and also hearing, along with video information, their sound and melody [2]. Multimedia tools allow placing scientific and artistic texts, sound fragments, high-quality images, videos and episodes of television programs in one window.

Audio-Visual teaching tools and their present modern video versions, T.V's, multimedia devices, slide demonstrators and digital cameras have been an important source and interests for the geography teachers since the first day they were discovered [8]. Visuals include charts and graphs, maps, illustrations, pictures, computer graphics (where a real photo is difficult to obtain or e.g. cross sections are needed), movies an computer animations [9]. Multimedia is a combination of text, art, sound, animation, and video that uses computers or other electronic or digital means. The sensation is richly presented. When giving interactive control of the process, it can be fascinated [10]. Using computers, electronic maps, electronic textbooks, satellite images gives students cognitive opportunities, forms important cartographic skills by presenting various methods of working with geographical maps during geography lessons [11]. During the school programme, it was noted that only traditional methods can not be effective for both the teacher and the student when teaching the process. The importance has especially increased of using electronic textbooks in teaching natural processes in geography. To understand the essence of mountain formation processes, teachers can use multimedia learning models during lessons. Nevertheless, multimedia applications are not enough that present the methodology of teaching the process of mountain formation. These prerequisites served as the basis for considering the research work on the example of the mountain-forming process. Implementing the results obtained in the course of scientific research into the content of school geography education, teaching physical geography using new multimedia technologies determine the relevance of research work in geographical education.

Geographic literacy is essential for living and functioning in a world that is rapidly changing due to technology and the digital tools of our era [12]. Geography is a key to understanding and acting effectively in our world [13]. More than any other subject, geography enables people to comprehend the Earth and its environment, and to appreciate the delicate balance between human and physicalelements [14; 15]. Studying geography and earth science in the digital age now requires a sophisticated and complex integration of concepts that include spatial and temporal aspects [16]. Geography must be taught in a way that is congruent with the most recent developments in scientific research and technologies. Teachers are expected to bring new technologies to their classes. Geographic information technologies are considerably suited for active learning processes. Geography must be adapted to technological environments which have changing teaching methods [17; 18].

Materials and Methods

We are faced with the following research tasks: analysis of the content and structure of physical and geographical knowledge in school geography; analysis of methods of teaching the process of mountain formation using a multimedia textbook; differentiation of advantages and contradictions in teaching the process of mountain formation using multimedia programs; to determine the methodological principles and pedagogical conditions for the use of multimedia technologies in physical and geographical education.

Comparative geographical and complex methods of analysis are predominant in this paper. The study also used methods of analysis of cartographic and pedagogical literature, research, generalisation of pedagogical experience and modelling. In teaching physical geography at the level of basic secondary education, an effective method is considered of forming students' skills of working with maps, diagrams, tables, diagrams when processing the collected material from various geographical sources. Text data, drawings, schematic diagrams and tables, maps, questions and tasks presented in the research work will help to reveal the content of concepts related to mountain formation, to identify the main characteristics of the mountain-forming process.

Within the framework of updating the content of education in Kazakhstan, the subject "Geography" is studied in grades 7-9 at the level of basic secondary education and in grades 10-11 at the level of general secondary education. Although this subject is studied from the 7th grade, the initial idea of geography is formed by students of grades 5-6 in the process of studying the subject "Natural Sciences". The content of the discipline "Natural Sciences" consists of 7 chapters, of which 3 Chapters: "The universe. Earth. Man", "Processes in living and dead nature", "Ecology and sustainable development". The subsection " The universe. Earth. Man", which is called "The Earth's crust and its components", offers insight into the lithosphere. In the subsection "Processes in living and dead nature" of the section "Processes in dead nature", a characteristic of the processes of mountain formation is given. According to the standard curriculum, the volume of the academic load is 2 hours per week of the subject "Geography" in grades 7-9, 68 hours per academic year; 4 hours per week in grades 10-11, 136 hours per academic year. The content of the Geography curriculum is organised using sections of training. The content of the discipline "Geography" within the framework of updating the content of education includes 6 sections at the level of basic secondary education and 7 sections at the level of general secondary education (Table 1) [19].

Table 1. Sections contenting the subject "Geography"

Section	Grade 7-9 (basic secondary education)	Grade 10-11 (general secondary education)
1	Methods of geographical research	Methods of geographical research
2	Cartography and geographical databases	Cartography and geoinformatics
3	Physical geography	Environmental management and geoecology
4	Social geography	Geoeconomics
5	Economic geography	Geopolitics
6	Fundamentals of country studies and political geography	Country studies
7		Global problems of humanity

As can be seen from the table, the section "physical geography" is studied in grades 7-9 within the framework of the updated content of education. In grades 7-9, the content of the section "Physical Geography" consists of 5 subsections: "Lithosphere", "Atmosphere", "Hydrosphere", "Biosphere" and "Natural territorial complexes". The topics covered by the "Lithosphere" subsection by class in the content of the "Physical Geography" section are shown in Table 2, respectively [20].

Table 2. Topics of the "Lithosphere" subsection

Topic	7th grade	8th grade	9th grade
1	Structure and material composition of the lithosphere	Patterns of formation and distribution of relief	Geological history and tectonic structure of Kazakhstan
2	Tectonic structure of the Earth	Terrain classification	Main orographic objects of Kazakhstan
3	Tectonic movements of the lithosphere	Large orographic objects of continents and oceans	Kazakh oronyms
4	Lithospheric cataclysms	Classification of rocks and minerals	Patterns of distribution of mineral resources in Kazakhstan
5		Distribution of minerals depending on the formation of rocks and minerals	Extraction and processing centres of mineral resources
6		Properties of rocks and minerals	Assessment of mineral resources of Kazakhstan

The topic "Patterns of formation and distribution of relief forms" is widely studied in the "Formation of mountains" section in the content of the educational subject "Geography" of the 8th grade in the subsection "Lithosphere". The main purpose of this lesson is to study the patterns of formation and distribution of types of relief. To achieve this goal, students should know that mountains are a structural element of the earth's crust; classify

mountains into several types by formation, age and height. Before starting a conversation about mountains in the lesson, teachers will define the concept of "Structural elements of the Earth's crust" and tell students what platforms, geosynclines and mountains belong to them. The vast majority of mountains on earth are formed under the influence of the internal forces of the Earth. Since mountains are formed in orogenic-geosynclinal zones of the Earth's crust, that is, in geosynclinal belts lying inside and on the periphery of continents, schoolchildren, first of all, become more familiar with the concepts of "geosyncline" and "platforms". Class may be asked the following questions: "How do geosynclinal zones arise in the Earth's crust? What stages of development do they have?" Revealing the content of these questions, we will talk, develop and deepen knowledge about the geosyncline. During the conversation, the teacher notes that there are three stages in the development of the geosyncline that differ from each other, and gives an individual characteristic of each stage.

"The formation of a deep depression under the influence of internal processes and filling it with thick, sedimentary layers" is the first stage of the geosyncline development. As a result of the slow sinking of the Earth's crust, a long depression is formed, filled with water, that is, a sea basin, into which stratified rocks settle due to detrital materials and dead marine organisms coming from the adjacent land. Geosynclinaldyn hosted a festival of disabled youth with an audit process, volcanoes are underwater. As a result, volcanic rocks penetrate the depths of thick sedimentary layers and settle. At this time, a chain of islands is formed, and the layer of sedimentary rocks settling in the sea basin thickens to several thousand meters. This process lasts for tens of millions of years. The temperature and pressure increase inside the sedimentary rock layer as the ever-increasing bottom of the depression is lowered. Its lower layers reach the deep bowels of the Earth's crust and mantle, the pressure and temperature of which are very strong [21].

Folded mountains are formed at the second stage of the development of the geosyncline. Under pressure directed from the bottom up in conditions of a stronger temperature inside the layer of accumulated sedimentary rocks, and pressure compressing this side in the area of adjacent solid sections of the Earth's crust, the rock layer begins to contract and rise upwards. Also, layered mountains form very long. At the same time, volcanism occurs on the Earth's surface, numerous volcanoes are formed that do not actively fade, thick sedimentary layers burst and magma passes through these cracks in them. When the magma cools slowly, igneous rocks are formed. Under the influence of pressure, high temperatures, hot solutions and gases, sedimentary and igneous rocks are metamorphosed. In this way, metamorphosed rocks are formed. In the process of gradual cooling of magma and metamorphosis of rocks, ore minerals are formed. At the second stage of geosynclinal development, a thin furrowed valley (the so-called foothill deflection zone) filled with seawater remains between the highly elevated mountain folds and the periphery of the solid part of the Earth's crust. Over millions of years, a lot of lumpy material, plant and animal remains (organic waste) came from the destroyed mountain ranges, from which combustible minerals were formed here: coal, oil and natural gas, as well as salt [21].

The gradual destruction of the system of mountains is the third stage of geosyncline development. Folded mountains formed under the influence of internal processes of the Earth are gradually destroyed. At this stage, the processes caused by the actions of external forces prevail: various types of washing, washing out and moving the destroyed material from place to place. The mountains are gradually eroded, the mountain folds are destroyed, deeply frozen magmatic masses, often rich in ore minerals, come out on the open surface. This stage ends with the almost destruction of mountain ranges, in place of which, as a rule, a belt plain is formed with separate low-lying mountain suffixes. The Earth's crust solidifies in geosynclinal zones as a result of multiple sheeting, the development of layered mountain systems and their destruction. After that, it contracts and cannot curl up. Thus, the crystal foundation of the platform is formed.

Such areas of the Earth's crust are bent under the influence of impending internal processes of the earth, filling them with water from all or partially shallow seas. Layers of sedimentary rocks are deposited: clay, sand, limestone, etc. at their bottom, which is the surface of disturbed layered mountain systems As a rule, the layers are flat in such cases, due to the lack of processes in which folds are formed. On these platforms, the Earth's crust moves mostly slowly, covering a large area. For millions of years, the construction of such an area of the Earth's crust has a characteristic shape-a crystalline foundation (lower tier) covered with a layer of layered sedimentary rocks (upper tier), the surface of which lies smoothly.

This lesson deepens the idea that "the platform is one of the territories of the Earth's crust, it is developed on the site of the geosynclinal zone, but differs from it in structure and quality." As a result, the idea is born in the minds of schoolchildren that the development of the earth's crust is a continuous process, during which the mobile and solid areas of the earth's crust are not only inextricably linked, but also cause the formation of mountains [21]. Thus, students understand that at the second stage of the geosyncline development, folded mountains are formed under the influence of internal processes of the Earth, and at the third stage of the geosyncline development, folded mountains are gradually destroyed. Teachers must note that the elevated parts of the earth's surface are called mountains, rising in isolation from the nearby plains. In this lesson, students get acquainted with such terms as "mountain slopes", "foothills", "mountain peaks", "mountain ranges", "mountain valleys", "mountain ranges", "mountain nodes", which are morphological elements of the mountain. The scheme given in the textbook in the form of a glossary (Figure 1) will help teachers to explain the meaning of these terms [22].

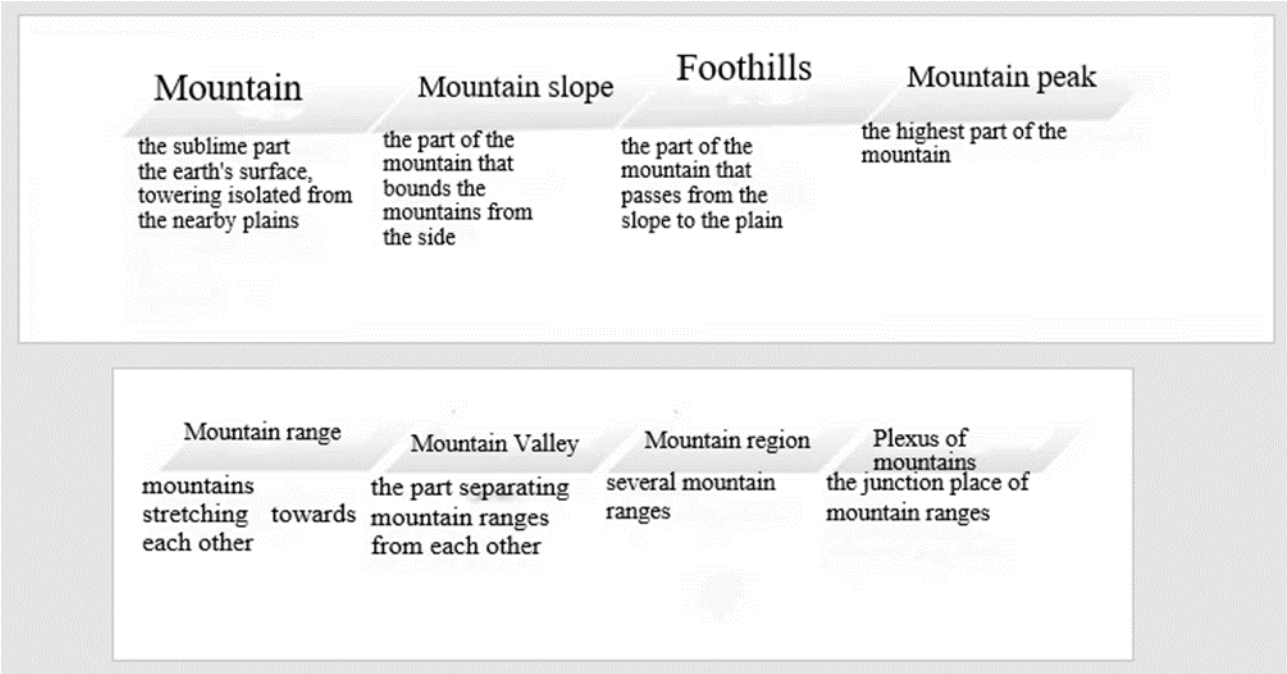


Figure 1. Morphological elements of a mountain

In the lesson, you can give tasks that are performed based on the studied material of students and maps on the topic. So, in the task presented in the form of a geographical dictation, you can check how well new concepts and terms are mastered by writing the word or phrase you need on the space bar: 1. 2. the notch separating the mountain ranges is called_____. 3. mountain ranges consist of_____. 4. the place of the junction of mountain ranges is called_____. 5. the highest part of the mountain is called_____. 6. volcanic mountains are formed as a result of an eruption.

Results and Discussion

In the lesson, the teacher classifies mountains as tectonic, volcanic, erosive (denudation) and describes each type. Tectonic mountains are formed as a result of the collision of lithospheric plates. Tectonic mountains, in turn, are divided into folded, folded-block and block mountains. We have already said that over a long geological time, sedimentary rocks accumulate from the collision of moving parts of the Earth's crust - lithospheric plates-and folds are formed under the action of opposite lateral pressure. As a result of the development of geosynclines and the formation of folded structures, the process of mountain formation occurred in various geological periods, including the Precambrian storage period. Modern mountains formed by layered structures are relatively young, corresponding to the Cenozoic folding.

The main feature of layered mountains is the stretching of high mountain ranges in the form of a chain over a distance of hundreds, thousands of kilometres. Folded mountains are located in zones that differ in the plasticity and mobility of rocks. Currently, the folded mountains have been preserved in their original state only in the part of the Himalayas formed in the Alpine folding. Layered mountains include such mountains as the Himalayas, the Caucasus, the Pamirs, the Alps, the Cordillera, the Hindu Kush. The mountain formation ends not only with folding. It is difficult to find a country in which folded mountains were also common in the process of mountain formation, where there are only mountains without a hump. Boulders are also widespread, as are mountains formed in the young Cenozoic folding. During the interaction of rocks forming layered mountains with air, water, as well as under the influence of glaciers, cracks are formed. Thus, dense mountains are formed due to the uplift of the earth's crust, separated by tectonic cracks. From the stepwise breakthrough of rocks along the cracks, a fault ridge and a fault trough are formed. Horsts (fault ridges) are elevated parts of the earth's crust, fault troughs (landslides) are lowered areas of the earth's crust. The slopes of these mountains are stepped, the peaks are smooth. Examples are the Dragon Mountain in Africa, the Western and Eastern Ghats in India, the Sayano-Altai Ridge, the mountains of Central Europe.

With repeated movement of the Earth's crust under the influence of tectonic forces, the folds break up into large blocks, rise or fall down. Thus, folded-folded mountains are formed. The peaks of this type of mountain are flat, the rocks are steep. Old mountains are characteristic: the Tarbagatai, the Zhetysu Alatau, the Tien Shan Mountains, the Altai, the Urals, Eastern Australia (the Great Dividing Range). These mountains were formed in the Baikal and Caledonian folds and were again subjected to the movement of the Earth's crust in the Hercynian and Mesozoic epochs. Finally, in the Alpine folding, the composite mountains were restored [22]. According to the structure and species character of the folded, maxillofacial and folded-jaw mountains, it is difficult to distinguish. In particular, he does not understand the ways of formation of folded mountains and rocky mountains. "How can you see the inner structure of the mountain? How do the mountain layers relate? What is called a mountain range?" The scientific question about the structure of these mountain folds is not clear to all schoolchildren. To understand the formation of folded mountains in students, the teacher must analyse together with the students the reason for the formation of folds in the form of experience in simple

language. To do this, the teacher uses strips of paper or thick woollen fabric. In short, you need a soft material for bending. If you hold the paper in one such joint with your hand from the side, then a bulge will appear in the upper part of the fold (Figure 2) [23].

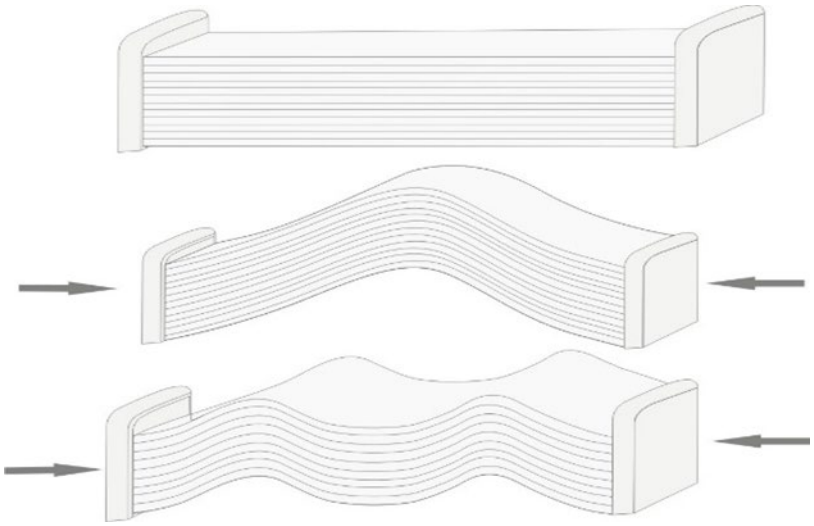


Figure 2. Forming a fold

If you press the paper in the middle in one package, you will get 2 folds. The longer the strip of paper, the more folds form. The rational point of this experience is that students clearly see in which direction the force acts created by the fold. The favourable side of the practice is that every student sitting in the classroom can repeat it in the same place. At the end of the practice, students understand that in no case can they make such folds, except for lateral pressure. From the created experience, the conclusion follows: folds arise as a result of lateral compression or lateral compression. The conclusion of the experiment in the form of a diagram is written on the board and the direction of pressure is indicated (Figure 3).

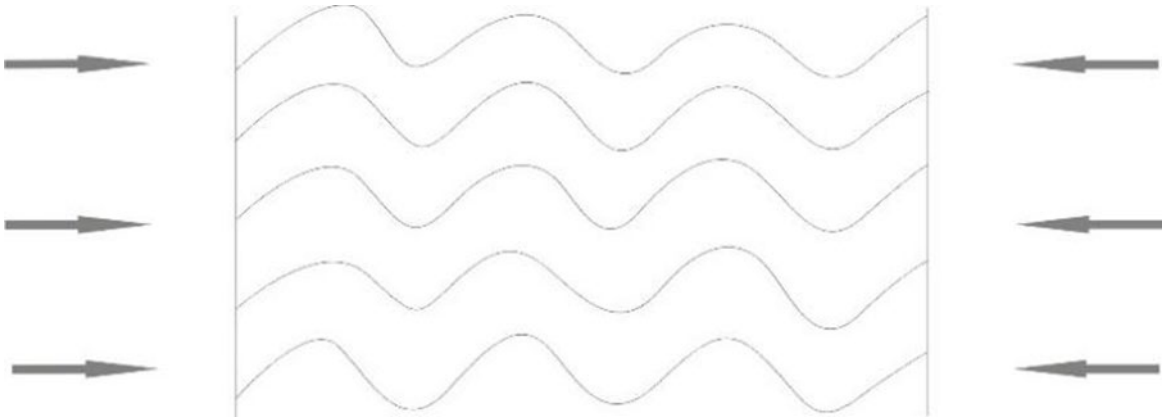


Figure 3. The scheme of the experiment

It will be quite acceptable to explain the origin of the mountains with the use of experience. To do this, three plates of plasticine are taken from various clays (soot mixed, chalk mixed, just clay), which are stacked on top of each other, and make one thick clay chest. Now you need to take a piece of wood, put it under one jaw of plasticine and press on it (Figure 4). If the clay is not very viscous, the experiment will be done very well. Even better, if the clay dries up a little.

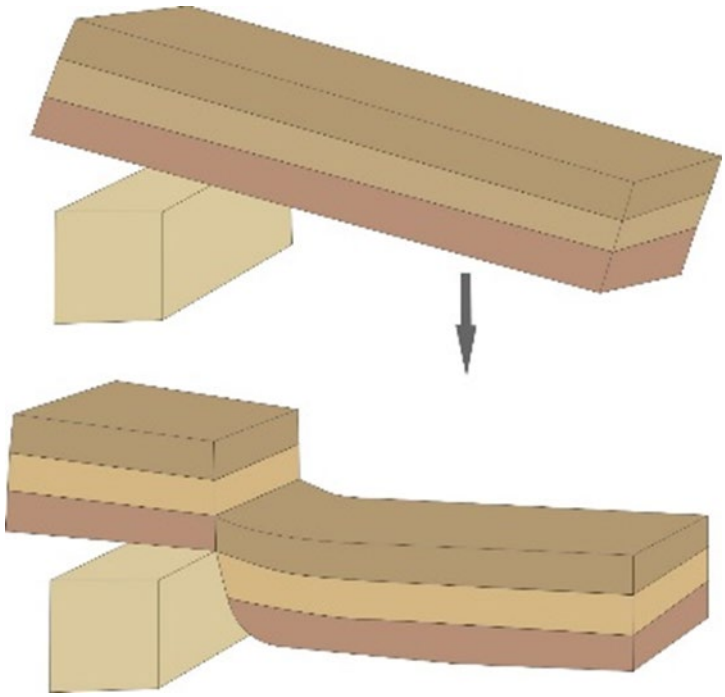


Figure 4. Scheme of ointment formation

In conclusion, it is necessary to say a few words about the causes of the formation of blocky mountains. We called the transition of the earth's crust down the light horst. For the ointment to appear, you must first have a crack in the ground. Thus, the surface of the Earth will not be formed evenly, students should understand this from experience. The thickness of the Earth's crust varies, and most importantly, it is heterogeneous in composition. With lateral compression, soft (buckling) sections of the earth's crust are being folded. And those that are louder do not add up, but crack and disintegrate. The teacher offers students an image of folded, folded-block and block mountains and can use them as a task (Figure 5) [23]. In this task, students, based on the knowledge acquired in the text, determine which type of mountains correspond to the folds of mountains and the nature of the occurrence of rocks in a given figure.

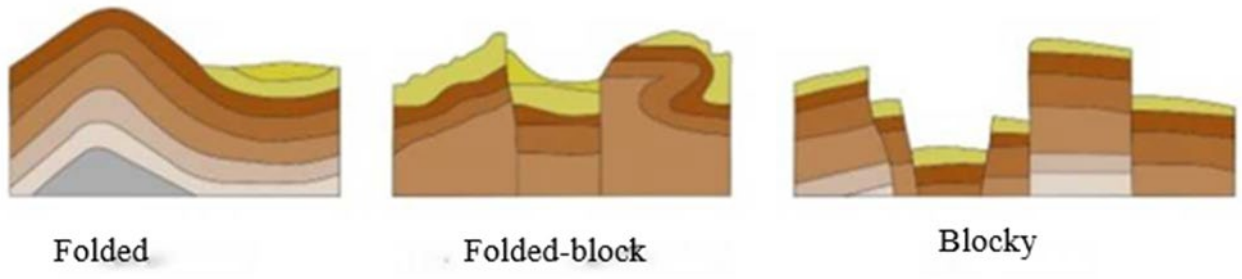


Figure 5. Types of mountains

Volcanic mountains were formed as a result of volcanic eruptions. As a rule, they are located along the explosive lines of the earth's crust or in the lithospheric layers. This type of mountain includes the volcanoes Fuji, Mayon (Philippines), Popocatepetl (Mexico), Misty (Peru), Shasta (California), Fujiyama (Japan), Kalimanjaro (Africa), Aconcagua (Argentina). Erosive (denudation) mountains were formed as a result of intensive distribution of wastewater over plains and plateaus. Many mountains of this type are distinguished by their four-mountain shape and the presence of canyon-like valleys among them. The modern relief of the erosion mountains was formed mainly under the influence of sewage. Examples of erosive (denudation) mountains are the second and third ridges of the Crimean Mountains, the Rocky Ridge of the Caucasus and the mountains of Central Siberia (Vilyu, Tunguska, Ilim, etc.) [22]. Students in this lesson understand that mountains are divided into young mountains and old mountains with age. Usually young mountains are considered to be mountains formed over the last 50-60 million years. In these mountain systems, internal processes are still actively taking place, accompanied by earthquakes, and sometimes volcanic eruptions. Therefore, the relief of the young mountains is strongly dissected, the peaks of the ridges are sharp, the slopes are steep and high, the gorges are deep and narrow. The youngest mountains on earth are located in the mainland and island parts of the Pacific Ocean. The young mountains include the Himalayas, the Alps, the Caucasus, the Carpathians, the Pamir and Kamchatka mountains.

The age of ancient mountains is usually several hundred million years. The old mountains were formed mainly due to the reduction of the mountains to the level of average height or lowlands as a result of the processes

of dying under the influence of external forces (sun and wind, precipitation, erosion of streams), formed before the Alpine folding. These mountains include the mountains of the Tien Shan, Altai, the Urals, and Scandinavia. Many modern plains once had ancient mountains.

As a result of the destruction of the peaks of the old mountains, the lower layers of rocks rich in deposits and minerals are opened. Mineral substances are concentrated in hollows, valleys and river terraces due to the mass accumulation of loose rocks. Therefore, old mountains are more suitable for ore mining compared to young or reconstructed ones [24].

When studying the classification of mountains, it is important to use a comparison method. Comparison is an effective way of knowing the phenomena of nature and its essence. In this lesson, in a schematic form, you can compare young mountains and old mountains in shape, type of appearance, peaks, valleys, terrain, according to the conditions of endogenous and exogenous processes there (Figure 6). According to this drawing, students can determine the specific features of the relief of young and old mountains.

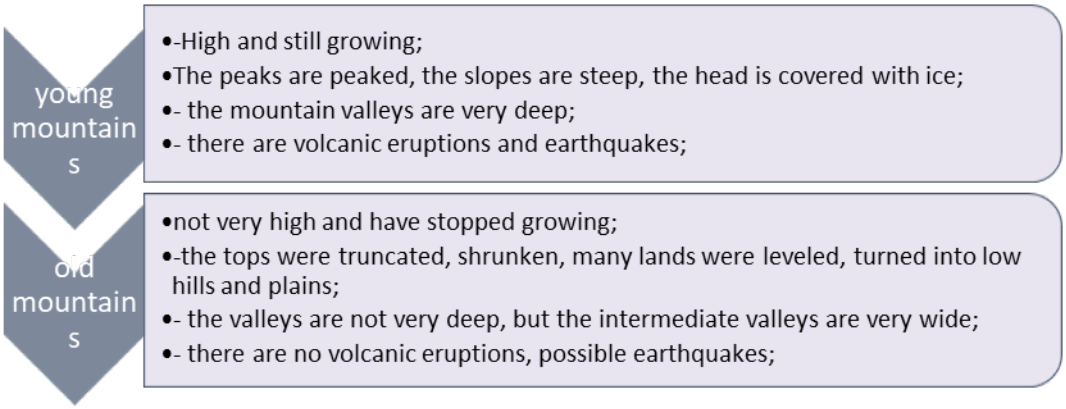


Figure 6. Features of young mountains and old mountains

Mountains are divided into low, medium and high-altitude mountains. Mountains up to 1000 m high belong to the low mountains. These mountains include the small hills of Saryarka in the central part of Kazakhstan, the mountains of Mugalzhar and Mangistau. To the middle mountains we refer mountains up to 1000-2000 meters high. For example, Crimea, the Carpathians, the Urals, the Appalachian Mountains. And mountains with a height of more than 2000 m are called high mountains. These mountains include Altai, Tien Shan, Zhetysu Alatau, Tarbagatai and Pamir, Caucasus, Andes, Himalayas, Alpine Mountains (Figure 7) [22; 25].

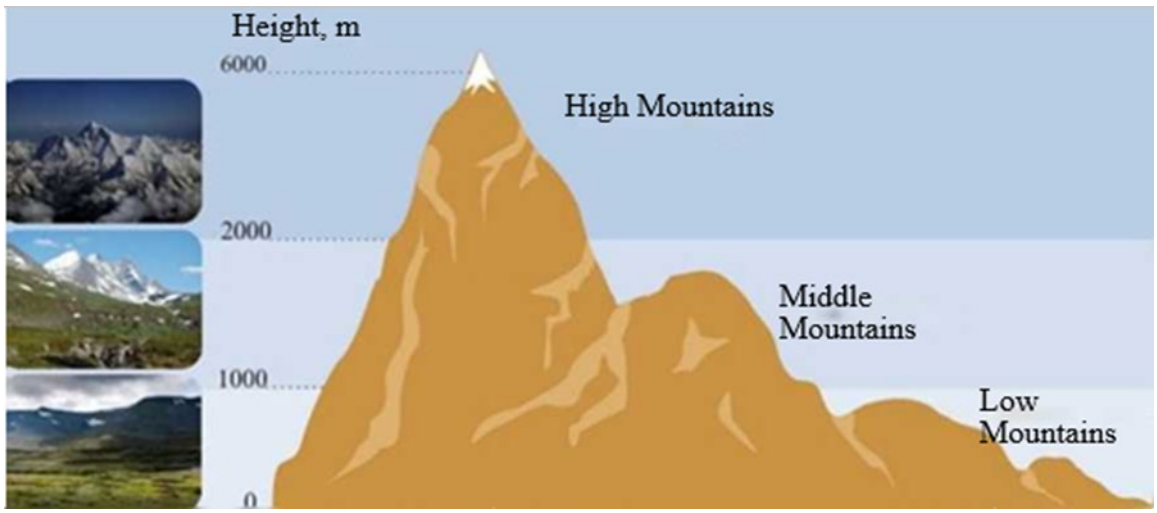
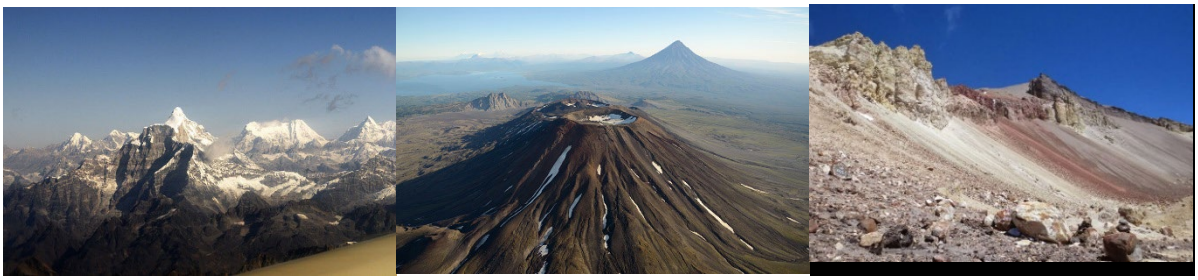


Figure 7. Classification of mountains by height

Photos in the lesson make up important visual effects. It is necessary to encourage students to see the photo quickly, not only superficially, but also to see a new source of information in it again. These images not only give an idea of the diversity of mountains, but also help to identify new concepts related to the types of mountains [21]. For example, it is possible to determine which of these concepts "tectonic mountains", "volcanic mountains", "erosive mountains" belong to (Figure 8).



a) b) c)

Figure 8. Classification of mountains by their formation (a – tectonic mountains, b – volcanic mountains, c – erosive mountains)

Students are asked questions that teach critical thinking, the answers to which can be checked by students themselves: 1. What influences the formation of tectonic mountains? Name tectonic mountains. 2. How to distinguish young and old mountains by their appearance? 3. What kind of mountain is formed as a result of the intensive distribution of wastewater across plains and plateaus? 4. In what kind of mountain are endogenous processes still actively occurring with age? 5. What type of mountains by origin do you refer to the Altai Mountains, Tarbagatai, Zhetysu Alatau, Tien Shan? 6. Is a mountain formed by the rise of the earth's crust, bounded by tectonic cracks, a folded mountain or a flat one? 7. Which mountains in the country are low-lying? Schematic drawings, graphs and graphic schemes help to reveal the content of concepts, to identify the main characteristics of the mountain-forming process. In the schematic drawing "classification of mountains" mountains are grouped by height, education, age. Each type of group is defined and examples are given (Figure 9).

<table>
<tr><td colspan="4">Mountains (mountain countries) are vast, highly elevated above the surrounding terrain, strongly and deeply dissected areas of the earth's crust with a folded or folded-block structure.</td></tr>
<tr><td rowspan="5">The mountains are divided by:</td><td colspan="2" rowspan="3">absolute height</td><td>Low (low mountains) – up to 1000 m (Tien Shan, Middle Urals)</td></tr>
<tr><td>Medium-altitude – up to 2000 m (Khibiny, Carpathians).</td></tr>
<tr><td>High (highlands) – more than 2000 m (Pamir, Himalayas,</td></tr>
<tr><td rowspan="2">origin</td><td>Tectonic</td><td>Folded: "young", formed during the Alpine folding (separate areas in the Himalayas) – "primary". Folded-block: with repeated tectonic movements on the site of destroyed mountains – "reborn" (Tien Shan, Altai, Transbaikalia). Block-folded: the latest tectonic movements – “rejuvenated”, again raise mountains not destroyed by Mesozoic folding (the Rocky Mountains, highlands of Tibet, the Verkhoyansky</td></tr>
<tr><td>Volcanic</td><td>Formed at fault lines or the boundaries of lithospheric plates, composed of products of volcanic eruptions (Klyuchevskaya</td></tr>
</table>

Figure 9. Mountain classification scheme

This scheme will help students summarize the knowledge gained during the lesson, formulate their thoughts, and keep in mind the main classifications. Reading with filling in the table assumes the ability to extract words from the text that he does not need, but the existing knowledge and ability to work with the map. In the task below, students put these names of mountains in the appropriate column (Table 3). Names of mountains: Alps, Tunguska, Ural, Sayano-Altai, Himalayas, Kalimanjaro, Altai, Pamir, Vilyu, Fujiyama, Caucasus, Tien Shan, Ilim, Tarbagatai, Shasta.

Table 3. Classification of mountains by formation (template)

Folded Mountains	Blocky Mountains	Folded-block mountains	Volcanic	Erosive

Geography cannot exist without maps, they are the second language of geography and an independent source of knowledge [21]. In this lesson, you can create the desired object with numbers and create a task by finding it on the map. Problems, students find on the map page the name of the black mountains instead of the geographical location of the surrounded number (Figure 10).

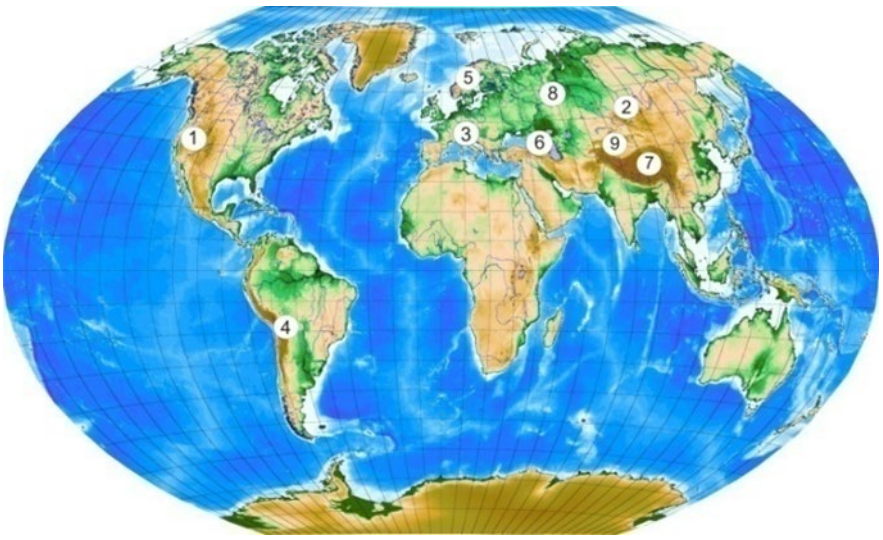


Figure 10. Physical map of the world

When checking the student's work, it is especially important to pay attention to the careful and thorough execution of the work with the map and diagrams. Yazıcı and Demirkaya [26] stated that teaching technologies have an important role in the teaching and learning of geography and they claimed that the use of technology increases the quality of geography teaching and it helps better detection of geographic information and process in the mind. The features of multimedia tools for the formation of physical and geographical knowledge include openness and flexibility (the ability to change and supplement the content of training, the ability to choose a learning strategy); the ability to offer an individual and differentiated approach to learning (can be formed within a personality-oriented model, taking into account individual rates of acquisition of knowledge and skills by students, level of training and interests); the main distinguishing feature of multimedia is interactivity (the process of presenting information in response to user requests). Interactivity allows you to control the presentation of information, adjust the pace and number of repetitions of the material [27-29]. Recently, animation modelling has been widely used in the compilation of multimedia textbooks. The introduction of multimedia into the educational process has opened up a new opportunity to create and use cartographic material: in the lesson, the map can be directly modelled [6]. Educationally speaking, virtual globes and world maps can be defined as “the most powerful and useful visualization tools ever created” [30]. These virtual journeys make it possible to acquire new important geographical information and encourage inter-disciplinary discussions [31-33].

The creation of special multimedia programs based on school textbooks significantly expands the possibilities of teaching geography. Since the educational material can be presented in various forms using multimedia, such information is interesting and well stored in memory [11; 34; 35]. Using the database, the teacher can prepare a handout, create a multimedia presentation. Multimedia presentation can perform the function of clarity when explaining the topic by the teacher: through the use of colour images, geographical maps, fragments of educational videos and TV shows in the lesson, a clear idea of the subject of geographical research is formed [6]. It is very convenient to use the materials of a multimedia textbook in introductory classes to form an image of the object of study and the territory, phenomenon, as well as at the stage of summing up the lesson or topic, offering students practical tasks or test tasks of various levels, in which video clips are integrated [2]. Full assimilation of the material from the multimedia textbook in the lesson is not a prerequisite, therefore, part of the material can be used in a geographical circle, intellectual games circles, elective courses and geographical evenings [11].

The results of the research work can be summarized by the following conclusions:

The use of multimedia technologies accelerates the transfer of information, visually complements the material, increases the educational motivation and emotional activity of students, forms the skills and abilities of research, information orientation and the ability to process it [11; 36; 37].

It not only saves teachers plenty of time to write and draw on the blackboard, but also extends the time and space ranges which are not on the textbook. It makes up for the hysteresis quality of textbook and improves students' learning interests, which can cultivate the geographic literacy of students [3; 38-40].

In geography lessons, students can develop cartographic skills by offering various methods of working with electronic geographical maps.

The study of geography should include, right from the start, the constant use of maps, to activate students’ visual memory and facilitate the memorisation of, and ability to locate, various objects [41-43]. The information presented by photographs, informational materials, video presentations, animations contributes to the formation of a geographical picture of the world by viewing an animated picture of objects and phenomena [6]. These animations depict phenomena, much like a simulation would do, or allow the student to take a closer look at tools, objects and entities discussed in the lesson [9]. Therefore, we considered geographical education using multimedia as an effective form of mastering the content of the subject by students.

However, when using multimedia (information) learning tools, special attention should be paid to the following obstacles: the student himself can assimilate

false or scientifically unproven information in the learning process; uneven levels of computer skills among students; the transmission of presented information in various forms (image, sound, video recording, animation) can negatively affect the perception of basic information by students; individualisation of learning negatively affects the dialogical communication of the teacher and student with each other; the inability to create an experience with their own hands when working with information learning tools requires supplementing the learning process with traditional practical work and laboratory classes; excessive use of multimedia negatively affects the health of students [44-47].

These contradictions indicate that the introduction of multimedia resources into the learning process should be based on the principle of consistency.

The teacher using educational media in class must keep away from excessive use of it not to be beyond the purpose of the course and the extremely poor and inadequate use of it [48]. Meanwhile, traditional teaching also has irreplaceable advantages. Multimedia technology is just a kind of teaching means, and it will never replace the classroom teaching experience and wisdom [49]. As such, teachers should make full use of the advantages of multimedia technology in teaching scientifically and rationally [3; 50; 51].

The theoretical significance of the research: the analytical materials of the work can be used by foreign researchers and applicants of educational fields in determining the role of physical geography in the education system of Kazakhstan and in studying the methodology of teaching geography in schools of Kazakhstan. Applied (practical) significance of the study: the results of the study can be recommended to teachers as a methodological guide when studying the subject "Physical Geography of Kazakhstan" in secondary schools of Kazakhstan. Also, the methods used in teaching with the help of multimedia technologies in research can be used in the development of an electronic textbook. There is a multitude of visual aids, technologies, software packages and tools that can be integrated into traditional educational practices. The lag time and weak link in the chain are that educators must familiarize themselves with new computer software packages, learn new technical skill sets and rework existing lesson plans to incorporate the new capabilities and spatial products [52]. Need to add experience about multimedia, can develop learning, and choose learning content as needed and ability [53]. One of the most important methodological principles of using multimedia is the compatibility of information technologies with traditional forms of education [11]. Student reactions to teaching with traditional approaches that include computer-based components in the form of CD-ROMs, reading textbooks and completing various tasks compared to the use of laboratory components of geographic information systems to create digital descriptions of landscapes shows students get very valuable benefits [54]

Conclusions

In the course of the study, we propose the following methodological principles of teaching mountain building at school:

1. At the lesson, it is advisable to give various oral and written tasks for the development of the logic of geographical thinking of students, teaching them practical skills and skills.

2. When checking written exercises performed by students, it is important to pay special attention to the exact use of terms reflecting scientific concepts. To begin with, when forming the concept of "mountain" and revealing the content of the process of "mountain formation", students need to learn the definition of scientific terms related to the mountain.

3. The teacher uses special cards in the lesson, students learn to read the conditional signs of the card, take measurements on them, deeply understand the content of various cards, compare the phenomena depicted on the cards and draw logical conclusions about them. For a better understanding of the process of mountain formation, the student should be able to represent the geographical position of mountains on the map and represent the orographic structure of mountain systems.

4. Systematically compose questions and electronic test tasks that instil critical thinking skills in students to work out this material on the topic and check how deeply and thoroughly it has been learned. When properly constructed, questions can become an effective teaching tool, support student learning and increase the level of knowledge.

During the research, we noticed that the use of multimedia does not violate the traditional method of teaching, but, on the contrary, can become an important component of the lesson. The lesson will be rational if the teacher plans to use multimedia technologies at what stage of the lesson and for what time, depending on the content and structure of the lesson and taking into account the age characteristics and abilities of students. Every innovative teacher will be able to effectively use various multimedia technologies in the educational process, which will undoubtedly improve the quality of the lesson.

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None.

Conflict of Interest

None.

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Викладання процесів горотворення у фізичній географії з використанням мультимедійних технологій (Казахстан)

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Анотація

Актуальність. Фізико-географічна освіта відіграє важливу роль у системі географічної освіти. Без оволодіння фізико-географічними знаннями неможливо сформувати знання про процес горотворення. Вчителі можуть наочно представити динамічний розвиток процесу горотворення, використовуючи мультимедійні технології на уроках. Однак електронних підручників, які представляють ефективну методику викладання за допомогою мультимедійних технологій, недостатньо. Сьогодні важливість мультимедійних додатків зросла у зв'язку з масовим дистанційним навчанням школярів під час пандемії.

Мета. Метою дослідження є розробка ефективної методичної основи викладання горотворчого процесу в шкільній географії.

Методологія. Незважаючи на праці науковців, які теоретично досліджували мультимедійні технології, недостатньо вивченою залишається методика впровадження нових технологій у навчальний процес. Це, у свою чергу, вимагає ґрунтовного дослідження педагогічних аспектів використання мультимедійних технологій у географії.

Результати. У статті проаналізовано особливості викладання географії в Казахстані з акцентом на аналізі важливої ролі фізичної географії в системі географічної освіти. Розглянуто проблему викладання горотворчих процесів у фізичній географії. Проведено широкий теоретичний аналіз складчастих, зморшкуватих, складчасто-пасмових гір з класифікацією гір за формацією, віком і висотою. Ці дані були взяті за теоретичну основу методики викладання процесу горотворення.

Висновки. У статті визначено, як мультимедійні технології можуть бути використані у викладанні географії в школах Казахстану. Запропоновано методику викладання процесу горотворення з використанням мультимедійного підручника.

Ключові слова: фізична географія; процес горотворення; мультимедійні технології; географічні методи навчання; класифікація гір.