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Ways of improving distance teaching of mathematics under the conditions of martial law in Ukrainian educational institutions

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**Ways of improving distance teaching of mathematics under the
conditions of martial law in Ukrainian educational institutions.**

*From February 24, 2022, the course of our country's history has changed
dramatically and the life of Ukrainian students has shifted to a new
format. Even though the issues of personal safety, adequate emotional
and psychological state, provision of heat and electricity, nutrition
and essential goods became the priority, education did not diminish its*

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importance in the new conditions yet. Knowledge is the main weapon, with which a student will move into the future. Educated people will help to reconstruct our state after the war. Distance education via Internet is one of the modern forms of educational process, which has gained special importance and development in new conditions. The modern educational platforms used for distance teaching as well as the pros and cons of this type of educational process are being considered in this article. Additionally, there are made a number of suggestions that can help in preparing to and managing an online class.

Keywords: distance learning, platform, conference, webinar, chat classes, Google.classroom, Zoom, Skype, martial law, mathematics.

1. Formulation of the problem

Distance education has developed rapidly in Ukraine since 2019, during the COVID-19 coronavirus epidemic. Since 2022 it has become an integral form of education in schools, special secondary and higher educational institutions in those settlements: 1) where there is a real threat of attack with bombs, shells, or other missiles; 2) where sirens often sound, after which people should immediately interrupt classes and go to shelter; 3) which are directly in the line of fire; 4) which are under temporary occupation.

Distance learning (or online learning) is a form of learning in which all or most of the course is taught to students or students (students) using modern technologies and in an interactive mode, while teachers and students can be located in different countries and even on different continents. The great advantage of such an education is that there is no urgent need to visit an educational school, spend time on the way to it, visit a school at a defined time, listen to lectures, and learn the material from the courses in a short time and a certain order. However, such teaching is not suitable for all disciplines. It should be noted that some students continue their studies in this way, even being at the front, in the breaks of hostilities. Particularly, such students are among the students of the University of Customs and Finance yet. The advantages and disadvantages of this type of learning and some proposals to overcome them are formulated in the paper.

2. Analysis of the latest research

A detailed analysis of the trends and prospects for the development of distance education was performed by N. Kentnor (2015), E. Banas

(1998), W. Emory (1998), K. Harting (2005), M. Erthal (2005). A line of Ukrainian scientists paid considerable attention to the development of conceptual provisions for distance learning including O. Andreev, N. Andrusenko [1], V. Bykov, D. Vasylieva [4], M. Burda [3], D. Ivanchenko, T. Godovanyuk [6] V. Kukhareenko, N. Morse, E. Polat, E. Smirnova-Trybulska, V. Lapinskyi, Yu. Bogachkov, P. Stefanenko, A. Khutorskyi and others. In recent years, a huge number of articles and studies, as well as books, collections [3] and scientific conferences [2], [7], [8] have been devoted to the problem of distance learning. Most authors mainly pay attention to specifying the advantages and disadvantages of distance learning [1], [12], determining the general trends in the development of these forms and their connection with world forms of distance learning [2], [8], the history of the concept of distance learning in the world [7], [8], features of the organization of distance learning in certain disciplines [7, p. 23-27], disadvantages of distance learning in Ukrainian universities [7, p. 37-30] etc. Appeared, there are few studies on the features of distance learning in mathematics [3], [4], [5], [6]. In addition, we did not find any specific propositions for improving the forms of such teaching in mathematical science, which became the aim of the current research. There is also a lack of research on the peculiarities of distance learning in universities of Ukraine under martial law. In the current article, we will try to determine the features of the use of distance learning for teaching mathematical disciplines during military operations and offer a line of recommendations for its improvement.

3. Presentation of the main material

First, we will analyze the pros and cons of this type of distance teaching, taking into account our own experience and the feedback of the students.

The advantages include the following:

- saving time – you don't have to spend precious hours standing in traffic jams or travelling from afar. People who do not live in cities also save a lot of money, which should have been spent on travel;
- coverage of a larger number of listeners, as residents of not only large cities, but also the most remote towns and villages, and even countries, have the opportunity to study. And this is extremely important, since, as we know, a large number of residents with children and students (mainly girls) left abroad as a result of Russian aggression;

- convenience of teaching, since all necessary materials for classes are always at hand (both the teacher and students);
- the ability to control the attention of each listener that is difficult to do at the time of offline classes;
- saving correspondence with students, their answers and the entire class in the files allowing at any time to return to the studied material;
- this format of teaching is extremely convenient for people with limited physical abilities;
- the active usage of images, text, sound and video during online classes significantly increases the quality of assimilation of new information.

Other advantages noted by various researchers are not so significant on our opinion [1, p. 8-9], [2, p. 10-11], [7, p. 28].

Disadvantages of distance learning include the following:

- quality of Internet or communication services connection may not be always sufficient;
- forced termination of the class due to power outages (scheduled or emergency, which Ukraine has been suffering from in recent months);
- lack of communication with teachers in real-time, because online classes can't provide face-to-face communication between teacher and students;
- lack of full-fledged pedagogical control by the teacher, which is a stimulating factor for effective learning;
- resource consumption and labour intensity on the part of the higher education institution (HEI) and the teacher. In addition to the necessary technical equipment of the educational institution, the teacher is required to create a distance course [7, p. 29];
- a large amount of information in a fairly short time, etc.

It is very important to choose a platform that is most convenient for a given case and a given subject for conducting distance learning from a specific course. There are quite a few developed platforms for distance learning. Let's consider some of them:

- Chat classes using chat technologies. They are held synchronously, that is, all participants have simultaneous access to the chat. Many remote educational institutions operate a chat school, in which the activities of remote teachers and students are organized with the help of chat rooms.

- Web classes – distance classes, conferences, seminars, business games, laboratory works, workshops and other forms of educational classes, which are conducted with the help of telecommunications and other possibilities of the World Wide Web. For online classes, specialized educational web forums are used – a form of user work on a certain topic or problem with the help of records that remain on one of the sites with the corresponding program installed on it. Web forums differ from chat classes in the possibility of longer (multi-day) work and the asynchronous nature of interaction between students and teachers.
- Teleconferencing – usually based on mailing lists using e-mail. Educational teleconferences are characterized by the formation of educational tasks. There are also forms of distance learning, in which educational materials are sent by mail to the regions. The basis of such a system is a teaching method called «Natural learning process» (English natural learning manner). The listener, constantly performing practical tasks, acquires stable automated skills. Theoretical knowledge is learned without additional effort, organically interwoven into training exercises. Formation of theoretical and practical skills is achieved in the process of systematic study of materials and listening and repetition of exercises on audio and video media (if available).
- Telepresence. For example, the remote presence using the R.Bot 100 robot.

Some platforms have been developed for distance learning in the first and second types (chat classes and web classes):

Skype – provides text, voice and video communication over the Internet between computers, optionally using peering network technologies);

Zoom – provides a video telephony service that allows you to connect up to 100 devices simultaneously for free, with a 40-minute limit for free accounts (during the war, this limit is removed);

Google Meet – on this service, it is very convenient to conduct secure video conferences in which up to 500 internal or external participants can participate, as well as conduct live broadcasts for up to 100,000 viewers in the domain;

Moodle is a free, highly customizable platform, also known as a learning management system or virtual environment. It is an

abbreviation of the English words Modular Object-Oriented Dynamic Learning Environment. Is a free web application that allows you to create sites for online learning;

Ilias is a free platform with the ability to create forums and personal blogs. The system is widespread in universities, primarily in German ones. Based on Apache, PHP, MySQL, XML. Meets the SCORM standard;

Spring Learn – a platform for remote training of employees, online testing and webinars;

WebTutor is a talent management system that offers tools for recruitment, training, competency assessment, career planning, and knowledge management;

Teachbase is a platform for organizing distance learning, creating courses, tests, and conducting webinars;

Spring Market is a software platform for creating and selling online courses;

Memberluxe – a service for creating courses based on WordPress;

Microsoft Teams is a corporate platform that combines chat, meetings, notes and attachments in the workspace;

EdApp – the virtual class works harmoniously with Zoom and Microsoft Teams video conference platforms;

Google Classroom is a free web service for educational institutions designed to simplify the creation, distribution and assessment of assignments in a paperless way. Through this product, remote testing and exams are conducted.

Ukrainian educational institutions mainly use Zoom platforms based on Google Classroom, Skype, Moodle, Google Meet. At the same time, there are several types (forms) of distance learning:

- 1) correspondence education, when students receive educational materials, tests or exam questions by e-mail or by attaching them to a file in Google Class and work, receiving some help from the teacher via mail, phone or chat;
- 2) e-learning through a computer, Google Drive, CDs or DVDs, and certain computer programs;
- 3) online learning in the format of dialogue is its own interactive learning [6, c. 142-143].

Usually, all three forms are used.

Distance learning of mathematical disciplines, in particular, has its own peculiarities and difficulties, because it is necessary not only to pronounce the text and communicate with the listeners, but also to write

formulas, draw graphs, and write down proofs of theorems. This can be done in one of three ways:

the first method is using a tablet or an online whiteboard with a mouse, but you need to get used to it, and it is sometimes quite difficult if there are too many formulas and graphs;

the second way is to direct the webcam not at the teacher, but at his desk so that the listeners can see what he writes on the sheets of paper. At the same time, if you can use a regular pen when working in Skype, then you have to use markers when working in the Zoom platform because the video quality is lower in Zoom. The speed of teaching in this way is slightly higher than in the first (even if the teacher has an online blackboard). Its advantage also lies in the fact that the sheets with the recorded lesson are saved and can be reused in the future;

the third way is to gradually teach pre-prepared presentation materials during the lesson: text, formulas, graphics and drawings. But this is static information, and «live» interactive communication with the audience, the dynamics of showing material, and answering questions is lost.

It is clear that distance education will spread in the world, and especially in Ukraine due to its current military situation, and new platforms and services will be developed. However, based on our own experience, we want to put forward proposals for the improvement of already existing platforms to adapt them for more convenient teaching of mathematical disciplines and those related to them. In particular, the google.classroom platform, which is used for testing and exams, needs such improvements.

1. Google.classroom forms are intended more for humanities. However, teachers of exact sciences also have to use them: mathematical disciplines (algebra and geometry, probability theory and mathematical statistics, discrete mathematics, mathematical analysis, numerical methods, etc.), physics, chemistry, economics, etc. Many formulas and graphs need to be entered in the tests and tasks of these subjects, but in google.classroom «forms» there is no possibility to directly enter a formula or graph. It is necessary to first convert them into a picture format with the extension jpg or jpeg, and then convert them into a form through a file (see Fig. 1), which is very inconvenient and time-consuming.

Probability theory and mathematical statistics

Questions Answers 35 Settings In total: 50

Enter the correct equality: *

☐ Version 1

$P_n = A_n^n * C_n^n$

☐ Version 2

$C_n^n = A_n^n * P_n$

☐ Version 3

$C_n^n = A_n^n * P_n$

Fig. 1. The method of entering formulas into the google.classroom «form» is not convenient enough

In addition, a figure (both in the text of the task and in the answer options) can be inserted only once, but in the text of the task, there can be several formulas (translated into figures). In this case, a teacher has to convert the entire text of the task into a jpg or jpeg picture format. Therefore, it would be appropriate to avoid this shortcoming and allow teachers to simply insert the formulas in the «Option» or «Task text» lines, and not as a figure located below these lines.

2. It would be great to make it possible to type superscript and subscript indexes that are not available yet. To transfer such indexes, it is also necessary to convert them into a picture format. It is also welcome to provide an ability to enter directly other symbols and letters in the «Option» or «Task text» lines.

3. The same applies to entering pictures into the «form» - it is more convenient to enter them directly in the text of the task itself, and not by inserting it through a file with the extension jpg or jpeg (see Fig. 2) that takes extra time (a picture has to be first translated into graphic format either jpg or jpeg, and then add it to the «form» using a paste special).

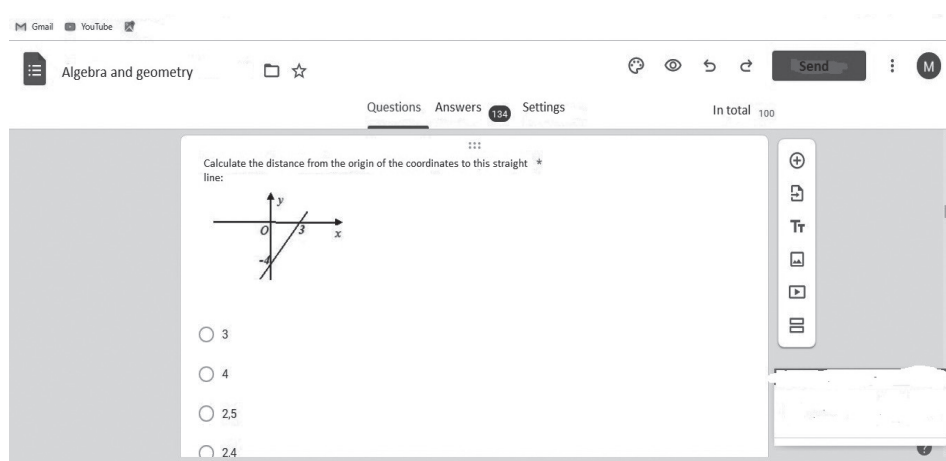


Fig. 2. Entering the «form» of the drawings takes a lot of time

4. Conclusions

The distance learning platforms widely used in Ukraine (Zoom, Google Class, Moodle, Google Meet) for teaching mathematical science still have several shortcomings. There are some proposals in the article on how to overcome some of these flaws. Next, in our opinion, some exemptions should be made for those students who are mobilized and are at the front or in military units and intend to continue their studies, avoiding just sending these students on academic leave. And taking into account frequent power outages, which, moreover, occur at different times for different cities and even districts of the same city, it is necessary to switch to distance learning in the format of dialogue to a rolling schedule of classes, and those who could not participate in the class should send (preferably in automatic mode) an electronic or paper copy of the lesson. It would also be good to purchase online boards for students so that communication with the teacher is continuous, flexible and fast.

References:

1. Андрусенко Н. В. Дистанційне навчання в Україні / Н. В. Андрусенко // Дистанційне навчання як сучасна освітня технологія: матеріали міжвузівського вебінару 31 березня 2017 року. – Вінниця: ВТЕІ КНТЕУ, 2017. – С. 7-9.

2. Блажко О. Сучасні тенденції розвитку дистанційного навчання студентів у ВНЗ / О. Блажко // Дистанційне навчання як сучасна освітня технологія: матеріали міжвузівського вебінару 31 березня 2017 року. – Вінниця: ВТЕІ КНТЕУ, 2017. – С. 10-11.
3. Бурда М., Васильєва Д. Особливості навчання математики в умовах воєнного стану (методичні рекомендації) / М. Бурда, Д. Васильєва // Математика в рідній школі. – 2022. – № 4 – 5. – С. 6-15.
4. Васильєва Д. Стан дистанційного навчання математики під час війни в Україні // Український педагогічний журнал. – 2022. – № 2. – С. 38-42.
5. Глазова В., Весела К. Елементи дистанційного навчання при вивченні математики в школі, В. Глазова, К. Весела // Збірник наукових праць фізико-математичного факультету ДДПУ, 2015. – С. 91-96 [Електронний ресурс]. – Режим доступу: <https://www.academia.edu/35877116> (дата звернення: 4.02.2023).
6. Годованюк Т. Дистанційний курс навчання методики математики / Т. Годованюк // Науковий часопис НПУ імені М. П. Драгоманова. Серія 3. Фізика і математика у вищій і середній школі. – 2016. – С. 54-59.
7. Дистанційне навчання в глобалізованому світі: Міжвузівський науково-методичний семінар. Тези доповідей. – Київ: Київський нац. торг.-екон. ун-т, 2021. – 101 с.
8. Інноваційний розвиток вищої освіти: глобальний, європейський та національний виміри змін: матеріали VII Міжнародної науково-практичної конференції (20-21 квітня 2021 року, м. Суми). – Суми: СумДПУ ім. А. С. Макаренка, 2021. – 304 с.
9. Концепція розвитку дистанційної освіти в Україні (затверджено Постановою МОН України В. Г. Кременем 20 грудня 2000 р.).
10. Мала І. Дистанційне навчання як дієвий інструмент управлінської освіти / І. Мала // Вчені записки Університету «КРОК». – 2022. – № 2(66). – С. 132-150.
11. Романовський О. Г., Квасник О. В., Мороз В. М., Підбуцька Н. В., Резнік С. М., Черкашин А. І., Шаповалова В. В. Фактори розвитку та напрями вдосконалення дистанційної освіти навчання в системі вищої освіти України / О. Г. Романовський [та ін.] // Інформаційні технології та засоби навчання. – 2019. – Т. 74. – № 6. – С. 20-35.
12. Ткачова Н. М., Казанська О. О. Дистанційне навчання як дієвий інструмент державного управління в сфері освіти / Н. М. Ткачова, О. О. Казанська // Зб. наукових праць міжнародної науково-практичної конференції «Les tendances actuelles de la mondialisation de la science mondiale collection de papiers scientifiques «ΛΟΓΟΣ», 03 квітня 2020 р. – Монако, МСО, 2020. – Т. 1. – С. 68-71.

Transliteration of References:

1. Andrusenko N. V. Dystantsiine navchannia v Ukraini / N. V. Andrusenko // Dystantsiine navchannia yak suchasna osvittia tekhnolohiia: materialy mizhvuzivskoho vebinaru 31 bereznia 2017 roku. – Vinnytsia: VTEI KNTEU, 2017. – S. 7-9. [in Ukraine].
2. Blazhko O. Suchasni tendentsii rozvytku dystantsiinoho navchannia studentiv u VNZ / O. Blazhko // Dystantsiine navchannia yak suchasna osvittia tekhnolohiia: materialy mizhvuzivskoho vebinaru 31 bereznia 2017 roku. – Vinnytsia: VTEI KNTEU, 2017. – S. 10-11. [in Ukraine].
3. Burda M., Vasylieva D. Osoblyvosti navchannia matematyky v umovakh voiennoho stanu (metodychni rekomendatsii) / M. Burda, D. Vasylieva // Matematika v ridnii shkoli. – 2022. – № 4 – 5. – S. 6-15. [in Ukraine].
4. Vasylieva D. Stan dystantsiinoho navchannia matematyky pid chas viiny v Ukraini // Ukrainskyi pedahohichnyi zhurnal. – 2022. – № 2. – S. 38-42. [in Ukraine].
5. Hlazova V., Vesela K. Elementy dystantsiinoho navchannia pry vyvchenni matematyky v shkoli, V. Hlazova, K. Vesela // Zbirnyk naukovykh prats fizyko-matematichnoho fakultetu DDPU, 2015. – S. 91-96 [Elektronnyi resurs]. – Rezhym dostupu: <https://www.academia.edu/35877116> (data zvernennia: 4.02.2023). [in Ukraine].
6. Hodovaniuk T. Dystantsiinyi kurs navchannia metodyky matematyky / T. Hodovaniuk // Naukovyi chasopys NPU imeni M. P. Drahomanova. Serii 3. Fizyka i matematika u vyshchii i serednii shkoli. – 2016. – S. 54-59. [in Ukraine].
7. Dystantsiine navchannia v hlobalizovanomu sviti: Mizhvuzivskyi naukovometodychnyi seminar. Tezy dopovidei. – Kyiv: Kyivskyi nats. torh.-ekon. un-t, 2021. – 101 s. [in Ukraine].
8. Innovatsiinyi rozvytok vyshchoi osvity: hlobalnyi, yevropeyskyi ta natsionalnyi vymiry zmin: materialy VII Mizhnarodnoi naukovopraktychnoi konferentsii (20-21 kvitnia 2021 roku, m. Sumy). – Sumy: SumDPU im. A. S. Makarenka, 2021. – 304 s. [in Ukraine].
9. Kontseptsiiia rozvytku dystantsiinoi osvity v Ukraini (zatverdzheno Postanovoiu MON Ukrainy V. H. Kremenem 20 hrudnia 2000 r.). [in Ukraine].
10. Mala I. Dystantsiine navchannia yak diievyi instrument upravlinskoi osvity / I. Mala // Vcheni zapysky Universytetu «KROK». – 2022. – № 2(66). – S. 132-150. [in Ukraine].
11. Romanovskiy O. H., Kvasnyk O. V., Moroz V. M., Pidbutska N. V., Reznik S. M., Cherkashyn A. I., Shapovalova V. V. Faktory rozvytku ta napriamy vdoskonalennia dystantsiinoi osvity navchannia v systemi vyshchoi osvity Ukrainy / O. H. Romanovskiy [ta in.] // Informatsiini tekhnolohii ta zasoby navchannia. – 2019. – T. 74. – № 6. – S. 20-35. [in Ukraine].
12. Tkachova N. M., Kazanska O. O. Dystantsiine navchannia yak diievyi instrument derzhavnogo upravlinnia v sferi osvity / N. M. Tkachova, O. O. Kazanska //

Zb. naukovykh prats mizhnarodnoi naukovo-praktychnoi konferentsii «Les tendances actuelles de la mondialisation de la science mondiale collection de papiers scientifiques «ΛΟΗΟΣ», 03 kvitnia 2020 r. – Monako, MCO, 2020. – T. 1. – S. 68-71. [in Ukraine].

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Abstract

МИКОЛА МОРМУЛЬ, ДМИТРО ЩИТОВ, ОЛЕКСАНДР ЩИТОВ, ЛЮБОВ РОМАНЧУК, ТЕТЯНА ЧУПІЛКО. **Шляхи вдосконалення дистанційного навчання математики в умовах воєнного стану в навчальних закладах України.** Після 24 лютого 2022 року хід історії нашої країни різко змінився, а життя українського студентства перейшло в новий формат. Але, хоча у пріоритеті стали питання власної безпеки, адекватного емоційно-психологічного стану, забезпечення теплом та електроенергією, продуктами харчування й товарами першої необхідності, тим не менш навчання не зменшило свого значення і в нових умовах. Знання – це основна зброя, з якою студент піде в майбутнє. Освічені люди допоможуть відбудовувати нашу державу після війни. Дистанційне навчання із використанням інформаційних технологій – одна з сучасних форм навчання – набуло особливого значення та розвитку за цих умов. У статті розглянуто сучасні платформи, які призначені для такого навчання, переваги та недоліки дистанційної форми навчання, а також внесено низку пропозицій, які зможуть удосконалити процес підготовки та проведення заняття у дистанційній формі.

Ключові слова: дистанційне навчання, платформа, конференція, вебінар, чат-заняття, Google.classroom, Zoom, Skype, воєнний стан, математика.

MYKOŁA MORMUL, DMYTRO SZCZYTOW, OLEKSANDR SZCHYTOW, LJUBOW ROMANCZUK, TETYANA CZUPILKO. **Sposoby usprawnienia zdalnego nauczania matematyki w warunkach stanu wojennego w ukraińskich placówkach oświatowych.** Po 24 lutego 2022 roku bieg historii naszego kraju zmienił się diametralnie, a życie ukraińskich studentów nabrało nowego formatu. Ale choć kwestie bezpieczeństwa osobistego, odpowiedniego stanu emocjonalnego i psychicznego, zaopatrzenia w żywność i artykuły pierwszej potrzeby stały się priorytetem, to edukacja nie straciła na znaczeniu w nowych warunkach. Wiedza jest główną bronią, z którą uczeń pójdzie w przyszłość. Wykształceni ludzie pomogą odbudować nasze państwo po wojnie. Kształcenie na odległość przez Internet – jedna z nowoczesnych form uczenia się – nabrało w tych warunkach szczególnego

znaczenia i rozwoju. W artykule przeanalizowano nowoczesne platformy przeznaczone do takiego szkolenia, zalety i wady tej formy szkolenia, a także przedstawiono szereg propozycji, które mogą usprawnić proces tworzenia i prowadzenia klasa w formie zdalnej.

Słowa kluczowe: kształcenie na odległość, platforma, konferencja, webinar, zajęcia na czacie, Google.classroom, Zoom, Skype, stan wojenny, matematyka.