

## Computer Technologies and Teaching Aids for Distance Learning in Educational Institutions Under Quarantine

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**Abstract:** The global spread of coronavirus infection has paralysed the work of many areas of economic, business, and, of course, educational activities of almost all countries on the planet. Unfortunately, Ukraine is no exception and a quarantine regime has been introduced in this country. The way out of the current situation in education in Ukraine was the introduction of distance learning in all educational institutions, which created new challenges for both teachers and students. The purpose of the paper was to study information technologies, tools and methods of learning that can be used for distance learning in educational institutions under quarantine. As a result, authors analysed world practices in ensuring the educational process within the framework of distance learning. The advantages and disadvantages of distance learning technologies for both higher education institutions and higher education seekers were identified. The research algorithm was presented in the form of systemic interrelations between the form of distance learning and information and software resources. The main features of such remote technologies as Moodle, Google Classroom, and video communication systems Zoom and Hangouts Meet were analysed.

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**Keywords:** Distance Learning, Information Technology, Internet Technology, Educational Institutions.

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### 1. Introduction

In connection with the spread of the COVID-19 pandemic, on March 11, 2020, the Cabinet of Ministers of Ukraine decided to impose quarantine for all types of educational institutions. In pursuance of the Resolution of the Cabinet of Ministers of Ukraine No. 211 of 11.03.2020 (On prevention of the spread... 2020), on March 12, 2020, all higher education institutions switched to the distance learning regime, which many higher education institutions seem to have declared in recent years. The new challenge has become an unbearable burden for some and an opportunity for development for others. Teachers of educational institutions, where distance learning technologies existed before, found themselves in better positions as many of them have already tried online courses out. Furthermore, social networks and various messengers were used to communicate with students. In addition, the best teachers have long begun to place their learning resources on the Internet (Tovt and Drozd 2019).

The fundamental criterion for the evaluation and implementation of a particular educational technology (forms, methods) of teaching in the education system is its effectiveness. A comparison of the effectiveness of distance learning with classrooms, conducted in the United States based on a survey of teachers of higher education institutions, showed that 57% of teachers consider the results of distance learning comparable or even superior to traditional classes, and 33% of teachers believe that in the coming years distance learning results will be capable of surpassing those of the classroom learning (Advantages and disadvantages of distance learning... 2020).

The distance learning system has the following features: individual learning, freedom and flexibility of time management, accessibility for all, social equality, creativity, low emotional stress. On the contrary, the conventional education system has other features – live communication between students and teachers, there is stress on exams and seminars, a strongly expressed methodological and ideological orientation of classes (Varha and Martyn 2020).

It is noteworthy that the online mode is well suited for lectures and less so for practical classes, and this format is almost impossible for conducting "classic" laboratory classes. It is not possible to automatically transpose seminars to this format. It is necessary to seriously change the form of work to involve all students. But in general, the university education system, where in recent years there has been a strong emphasis on independent work of students, more or less coped with this load, at least during lectures (Baydiuk 2019; Aizstrauta and Ginters 2013). All this is an important aspect when considering the issue of information and other technologies in distance learning, especially under quarantine restrictions, when distance learning is the only possible form of educational process.

Among the scholars involved in the development of scientific and academic research approaches to the development of distance learning, it is worth noting Yu.V. Sakulina (2018), L. Shahmoradi et al. (2018), V. Donets et al. (2018), P. Khanna (2016), Y.I. Nikolaev (2019), L. Gavrilova and Yu. Katasonova (2017), and others.

The main purpose of the application of information technology (IT) in free economic education should be to provide students and applicants with knowledge, skills, and abilities necessary for effective interaction with modern computer technology and new IT in the educational process and future professional activities (Kyzdarbekova et al. 2014). Considering the future specialty of students and applicants for higher education, in the classes, if possible, it is necessary to link the terms of IT with the concepts of their future subject area (Kravchenko 2018).

Among the technologies used in distance learning, the most widespread are as follows (Boronenko et al. 2018):

- case technology – a form of distance learning based on providing students with informational educational resources in the form of specialised sets of educational and methodological complexes with the use of different types of media (cases);
- Internet technology – a method of remote transmission of information based on the use of global and local computer networks to ensure access of students to information educational resources and to form a set of methodological, organisational, technical, and software tools for implementing and managing the learning process regardless of location of its subjects;
- telecommunication technology – a technology based mainly on the use of satellite data transmission and broadcasting, as well as global and local networks to ensure student interaction with the teacher and with each other and students' access to informational educational resources in the form of digital libraries, video lectures, and other means of teaching.

It is also worth addressing the advantages and disadvantages of distance learning technologies for both higher education institutions and for higher education seekers, i.e. students. This list of advantages and disadvantages is presented in Table 1.

**Table 1:** Advantages and disadvantages of distance learning technologies for both higher education institution and higher education seeker

<b>Advantages of educational technologies</b>	
for higher education institution	for higher education seeker
Ease of communication with students	Opportunity to study at any time
Wider opportunities to work with educational materials	Opportunity to study anywhere
A larger percentage of working time is used to improve the learning process	Opportunity to study at a comfortable pace
	Opportunity to study in a quiet environment
Unification of the learning process in all structures of the higher education institutions	Opportunity to study without leaving the main field of activity
Documentation of the learning process	Access to teachers
Variety of ways of studying the material, individualisation of the learning process, creative approach to learning	
Ability to provide knowledge of higher quality	
Increase in the number of students	
<b>Disadvantages of distance learning technologies</b>	
for higher education institution	for higher education seeker
Lack of control	Insufficient motivation

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Theorisation of learning	Insufficient computer literacy
Dependence of the educational process on information technology	
Not suitable for the development of communication skills and teamwork skills	
Not suitable for the development of practical skills	

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When referring to "distance technology in education", authors mean specific platforms and tools (e.g., Moodle, Google Classroom, Zoom, Skype, Google Suite/Docs, etc.) that allow students and teachers to communicate, perform, and assess tasks, control attendance, organise semester control, certification, etc. Such technologies, depending on the country, university and discipline studied, can be integrated at any stage of the course. Here the initiative of the teacher on introduction of such technologies, readiness of students to use them and technical possibility of both parties to apply these technologies are important (Boronenko et al. 2018, Thistoll and Yates 2016).

Google Suite for Education allows to quickly organise the educational process with Classroom and Hangouts Meet. Google has created a distributed system of support and training for users of its services. Furthermore, close integration of Google services with the LMS Moodle distance learning management system is ensured.

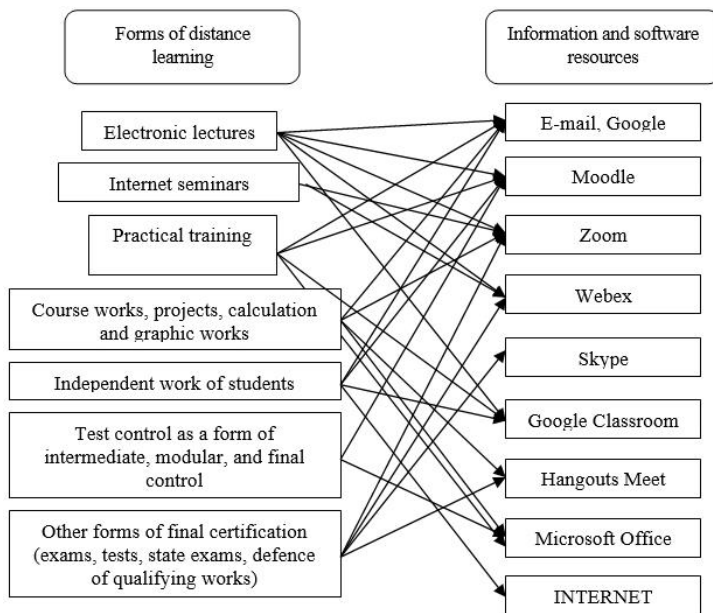
Nowadays, Google Suite for Education offers a full range of available services for free. The list of the most popular includes Google Drive, Calendar, Docs, Sheets, Slides, Mail, Search, YouTube. Full integration of services creates a unique ecosystem and a single repository of documents and files, without restrictions. Moodle functionality allows to organise adaptive learning. It can be used for self-training, for distance learning, certification and retraining of specialists, for the organisation of lifelong learning and during the course the teacher can observe not only the success of students, but also their progress with competences (Al-Rahmi et al. 2018).

Each distance technology has its own features of use, and therefore it is important, especially for the implementation of the educational process in quarantine, to understand the general mechanisms of use of software packages and distance learning technologies. Therefore, the purpose of the paper was to investigate information technology, tools and methods of learning that can be used for distance learning in educational institutions under quarantine.

## 2. Materials and Methods

Authors applied theoretical research methods in the paper, namely the analysis of literary sources where the principles of construction of the remote form of educational process are considered. The methodological framework of the study are the basic ideas of system, technological, and activity approaches. Distance learning technologies are closely related to the most common teaching methods. In terms of distance learning, there are the following: illustrative, reproductive, problem-based, research, and heuristic.

An illustrative method of teaching allows students to acquire knowledge in lectures, from educational and methodical literature, from an on-screen textbook. Perceiving and comprehending the facts, students' conclusions remain within the framework of reproduction of thinking. The reproductive method of teaching contributes to the comprehension of educational material by students according to rules similar to the shown patterns or situations. The method of problem statement in teaching is applied with the use of various sources and tools. Before teaching the material, the teacher formulates a cognitive task, and then, comparing opinions and different approaches, shows how to solve the problem. In this method, students are participants in scientific research.



**Figure 1.** Algorithm of research as a form of system interrelations between the form of conducting a remote lesson and information and software resources

The research method of teaching is used after the analysis of educational material, setting tasks, oral or written instruction of the teacher. This method allows students to independently study the literature, sources and perform search actions. The heuristic method of teaching helps to solve the tasks either under the guidance of the teacher or by the students themselves based on working with electronic textbooks and teaching materials.

The materials of the research were literary and information sources on the ways of using various software packages that are applied in classes in distance form. The algorithm of research can be presented in the form of system interrelations between the form of carrying out remote employment and the information and software resource which is used for its maintenance (Figure 1).

A separate category should include messengers, which are used to communicate with a particular student, and provide an opportunity to communicate with the entire group at once. These are: Viber, Telegram, WhatsApp, etc.

### 3. Results and Discussion

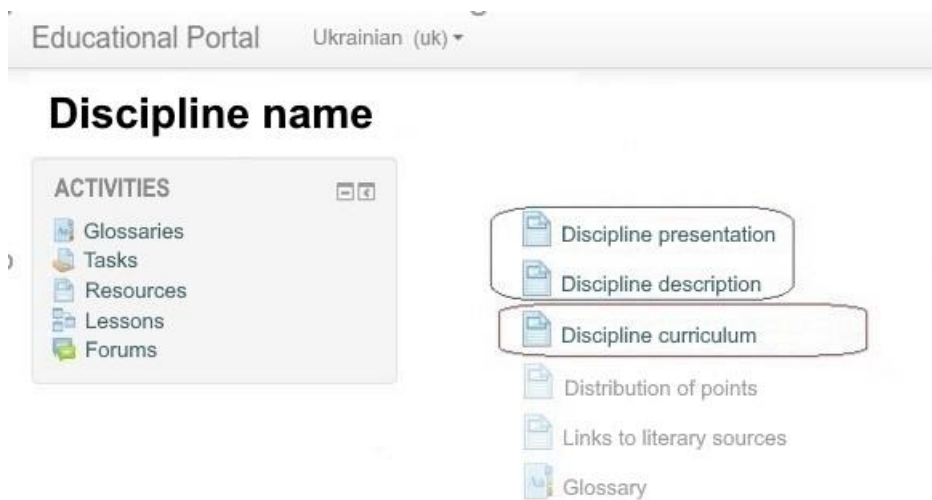
Analysis of Figure 1 suggests that among the information and software resources that allow to conduct distance learning classes, it is possible to identify those with which both the student and the teacher encounter in everyday life. These are primarily the use of e-mail and electronic disks (for example, Google Drive), Skype – video technology, and Microsoft Office, which at present is studied by pupils as early as in elementary school. The Internet does not require additional descriptions and comments, as it is used by almost 95% of the population of countries where it is available from the technical and economic aspects of development. In contrast, Webex is just beginning to conquer the market for video services in Ukraine, and therefore this study will not describe this software.

At the same time, distance learning technologies such as Moodle and Google Classroom are specific technologies for the general public, and video systems such as Zoom and Hangouts Meet, albeit well-known, were almost non-existent prior to the introduction of quarantine restrictions in the educational process. Therefore, further research will cover a more detailed analysis of these 4 information and software resources of distance learning.

The functionality of each of these applications is quite wide, therefore authors will address the main features that will reveal the main technical possibilities of using these information and software resources and for which forms of distance learning classes can be used. Moodle distance learning platform (Modular Object-Oriented Dynamic Learning Environment).

The Moodle distance learning resource is a modular object-oriented dynamic learning environment, also called a learning management system (LMS), a course management system (CMS), a virtual learning environment (VLE), or simply a learning platform that provides teachers, students, and administrators with a very developed set of tools for computer-based learning, including distance learning. Moodle can be used in student education, professional development, business education, both in computer classes of the institution, and for independent work at home (Moodle 2018).

The platform can contain a curriculum of study of the relevant subject, lecture material and material for practical classes, control questions to test knowledge, furthermore, video and audio materials can be placed on the platform, as well as presentations, many interactive materials and detailed 3D-models. The system is filled according to template forms and tools. Figure 2 demonstrates a general presentation of the discipline (subject) on the Moodle platform. The most important information according to the teacher who is engaged in development and filling of system for remote studying of any subject is specified.



**Figure 2.** General presentation of the discipline within the remote platform Moodle with the selection of basic structural elements

The next stage is to fill the system of topics and lecture materials that will be studied by the student within the framework of the discipline learning. As an example, authors provide the discipline "Theory of State and Law". Furthermore, Figure 3 presents the material that is displayed when working on a seminar. In the Moodle distance learning system, it is also possible to use various forms of control to supervise the acquisition of knowledge by students. The Google Classroom cloud-centric platform combines useful Google services organised specifically for learning. The following tasks are possible on its basis:

- Create a separate class (course);
- Organise the enrolment of students in the course;
- Provide students with access to the necessary study material;
- Provide tasks to perform;
- Evaluate tasks;
- Organise communication between all participants.

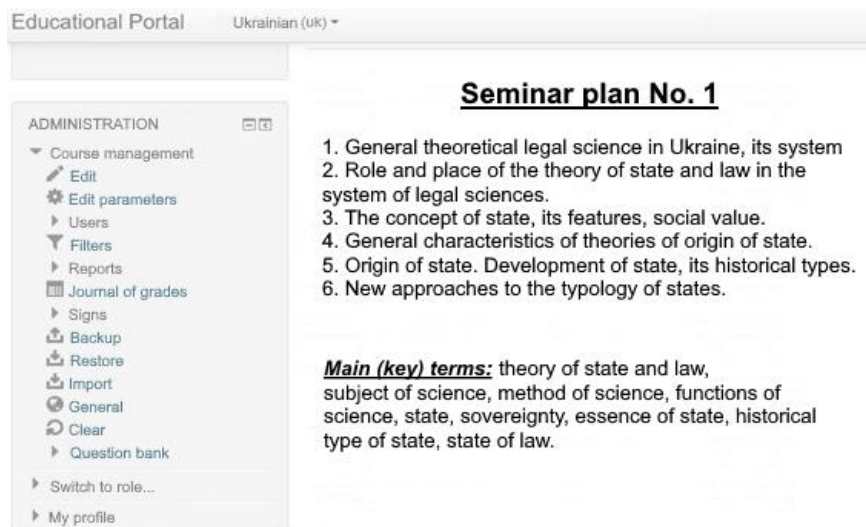


Figure 3. Presentation of seminars in the Moodle system

Next, authors consider the algorithm in Google Classroom in more detail. To get started, one needs to log in to corporate mail. Google Classroom is located in Google applications where it can be selected for further work. After signing up in the application, it will be necessary to select a role – a student or a teacher. Once opened, the user will be taken to Google Classroom where they can start creating their own course. Training courses that have been accessed by other users will also be found. It is possible to join an existing class or create a new one. Authors provide an example of creating a new one. To do this, click on "+" in the upper right corner and select "Create class". Then fill in the form in accordance with the names of the fields.

In the future it is possible to set the frame of the course and create messages for students. When creating and organising the course, the main tabs will be available: Tasks, People, and Grades. The Tasks tab allows to add learning materials to the course and distribute the tasks by topic and in the required sequence. When creating a Task, the user should follow the prompts of the system and carefully fill in all the fields, because the interface is intuitive.

The People tab will list the students who have joined the course. Users who have not yet confirmed the invitation in the system have a pale icon and are inactive. The user can send individual notifications to all authorised users via corporate mail (click on the icon and select the command "Send a letter to the student"). In the Grades tab, the teacher can check the tasks, give grades, comment on the answers. In the Grades tab, 2 modes for work are available:

1. View all works of a specific user (student).
2. Check the works directly in the general window.

If necessary, the teacher has the opportunity to leave comments on the work. Returning to the Tasks tab, statistics are available for each type of work. Furthermore, most of the functionality is for student work, but it is difficult to cover it in great detail within the framework of a scientific article on the basic technologies of distance learning. Summarising the description of the features of work in Google Classroom, it should be stated that this resource is best suited for practical classes and independent work of students in the format of distance learning.

Zoom combines cloud video conferencing, simple Internet conferencing, group chat in conference rooms based on the platform. After registering or logging in, click Organise a conference – the desktop application will be downloaded automatically. Alternatively, a user can click on the download link in the footer <https://zoom.us> or download directly at <https://zoom.us/support/download>. To log in, the user needs to visit <https://zoom.us> and click "Sign in". Google, Facebook, or Zoom accounts are available for logging in.

If a user has no Zoom account, they can click "Sign Up, It's Free" button to create a new Zoom account. Next, the interface of the personal account should be explored and account settings and conference settings need to be adjusted. The Personal Meeting ID (PMI) is automatically assigned to the user as a permanent personal meeting room. The user can run it at any time or schedule it for future use.

The user's PMI is part of the personal meeting URL, for example, <https://zoom.us/j/5551112222>. If the user is on a paid subscription and has a Pro license, it is possible to set a 10-digit PMI, otherwise changes are not possible. Conferences:

1. Start: Click "Start" to start a pre-scheduled conference included in the list of upcoming conferences.
2. Edit: Edit or update the scheduled conference in the "Personal Meeting Room" tab.
3. Delete: Click "Delete" to permanently delete the scheduled conference.

The user must select "Meeting" to view, start, edit, and delete scheduled conferences, conference entries, and personal conference ID. To start creating an meeting, one needs to click on the system button "Schedule a New Meeting". To edit a conference, the user must go to the "Personal Meeting Room" tab, view the meeting details and click on the system button. In addition, this tab can be used to duplicate the meeting in such cloud-oriented applications as Google Calendar, Outlook Calendar, Yahoo Calendar. It is also important to consider the functionality, which is located at the bottom of the video conferencing.

- Mute: Mute or unmute the microphone.
- Start Video: show video from the camera or install a screen saver from the account.
- Invite: view and manage participants (if the user is the organiser).
- Manage Participants: opens a window with a list of users.
- Share Screen: allows to upload photos and images to show to the participants, show the desktop of the user's computer.
- Reaction: allows to add an emotional reaction to the report.
- More: button for selection of additional parameters.

To end the meeting, click on "End Meeting" in the system window and select the method of ending the meeting (only for the user who created the conference or for all participants). During the meeting, users can invite people to join the conference by clicking on the Invite tab.

After clicking the invitation, users can select the option "Invite by e-mail", "Invite in chat", and "Invite by phone" (requires a subscription to the audio conference plan) or invite a number system (requires a subscription for connection to the cloud). Users must select "Copy URL" or "Copy Invitation" to send instant meeting information to another location. Copying the URL will copy the join link, and Copy Invitation will copy the full text of the invitation. It can further be pasted using Ctrl + V on PC, Command + V on Mac, or by right-clicking and selecting Paste.

To invite from the Zoom web portal, users need to go to the Meeting menu in the account and select the meeting to which they want to invite others. Then users need to go to the tab "Personal Meeting Room" and click "Copy the invitation". The meeting invitation will be copied and this information will be available for pasting into an email or other location where users want to send it.

Thus, the main functionality of the information and software resource Zoom, which is created for video conferencing in distance learning, was considered. It remains to consider the latest resource of this study, namely Hangouts Meet. To organise a video lesson via Google Calendar with the use of Hangouts Meet, users need to:

- In the browser window, open the link: <https://gmail.com/>. Enter your corporate email address, click "Next" and add a password.
- Classes should be scheduled in advance for a specific day and time. To do this, sign in to Google Calendar. Then select the specified day and time in the calendar, add the name of the event and click "Other settings".
- Add lecture time and select "Hangouts Meet".

All students are added to the meeting with the help of "Add guests" by typing their names. Then a link to a video call can be selected and shared in other available ways (in the ENC e-learning system, social networks, etc.). After adjusting all the settings, click "Save". The system will ask to send invitations to participants whose addresses the user has specified. The Lecturer, who organises the lecture, has to start the lecture at the appointed time. This can be done with the use of the calendar.

Participants can join by following the link in their e-mail inbox. Pre-invited guests can announce their participation. The page of the remote lecture or seminar will open in a separate tab. After selecting "Join now" the user must wait for other participants. In the video lecture window, the number of those who joined can be seen, also users can open a chat and exchange text messages.

Hangouts Meet allows to ask participants to turn off the microphones when the teacher provides the information; to visualise the lecture, it is possible to present your desktop or a certain window, for example with a presentation; users can choose a convenient version of the presentation in window or full-screen mode by selecting the window and clicking "send".

Students can also share their screen with the completed task, etc. To do this, they must click "Start presentation now". The teacher and all other students will see a screen demonstration. To stop, click "Stop presentation". Or select the "Do not share again" option if you are not in the appointment tab. To end the lecture, click "End call". To create a remote lesson for the same group, simply create a copy of the event and edit it.

#### 4. Conclusions

Thus, in modern conditions of quarantine restrictions, teaching requires the widespread use of various distance learning technologies. It is safe to say that the use of distance learning technologies in the implementation of educational curricula for students on a systematic basis and based on modern international platform Moodle, as well as with the use of technologies such as Google Classroom, and video systems Zoom and Hangouts Meet allow to organise the educational process according to modern requirements, and also to support an appropriate level of quality of forming competences of future experts in the conditions of difficult educational processes under quarantine.

Furthermore, special attention should be paid to retraining of teachers to master modern knowledge of information technology, because distance education will develop after the completion of quarantine restrictions, because, of course, the distance learning technologies are the future of world education. Further development of the study is seen in scientific articles on each separate information and software resource for the educational process within the framework of distance learning.

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