# Use of Information and Computer-based Distance Learning Technologies during COVID-19 Active Restrictions

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*Abstract*—Despite the reduction of restrictive measures imposed due to the COVID-19 pandemic, the problem of organizing distance learning continues to be topical. Distance learning imposes a much greater responsibility on teachers, giving them more of a workload as learning technologies change rapidly and teachers have to actively adapt to innovations, devoting a lot of time to preparing appropriate materials to ensure the best learning outcomes. The aim of the study is to detect the use of the most effective means of organizing distance learning by teachers. The study is based on a survey of university professors who were teaching in the distance mode during 2020-2021 active administrative restrictions. Opportunities for the use of various services in the organization of distance learning are analyzed and the drawbacks and advantages of the distance learning system are highlighted. The study reveals previously unapparent issues that arose in the course of distance work in quarantine. These include, first and foremost, the high physical workload of teachers, the many technical problems that arose in the transition to distance learning, the lack of teachers' competencies, which needs to be urgently addressed, and the complicated coordination of the learning process. Despite the problems identified, the authors argue that the system of distance learning can and must be adopted and further developed as an additional supporting direction in the organization of the learning process, which will allow educational institutions to promptly shift to distance learning as needed.

*Keywords—Distance learning; teachers; electronic service; online class*

## I. INTRODUCTION

The COVID-19 pandemic forced universities to shift to the mode of distance learning (DL), which required them to use all the powers of the infrastructure, employ specialized software, expand the functionality of the existing educational platforms, and work on the development of databases and teachers' competence [1], [2]. In essence, it was a complex systemic task that covered virtually all parts of the educational process.

Contemporary ICT and web technologies are moving to ever more advanced levels of operation, and DL is becoming more than just an online session or webinar as it incorporates many more student activities, such as data collection, data processing, communication, and interaction with the interface and the external environment [3]–[5].

Research on the peculiarities of using the DL system by teachers of information and computer technologies acquired particular significance when all educational institutions faced the need to fully shift to DL due to the introduced quarantine measures caused by the COVID-19 pandemic. In this light, of special interest are the issues of the use of various means of organizing DL by teachers and practical recommendations on the implementation of DL that could be used by universities during the period of restrictions caused by the COVID-19 pandemic [6].

## II. LITERATURE REVIEW

In the course of the quarantine, there appeared a considerable amount of papers with practical advice and recommendations on the introduction of DL. For instance, one study [7] reveals that the teachers who most easily rearranged their style of work and got more enjoyment from the introduction of the DL work at the institutions that had clear systemic communications and algorithms for action formed prior to the pandemic and implemented and maintained at the level of the management of the individual educational institution.

Scientific research actively discusses new approaches to the organization of DL, which requires substantiation of such provisions as the motivational, technological, and process support for the education system as an integral pedagogical system that accounts for the individual interests, abilities, and aptitudes of students and the newest teaching strategies [8]. At present, the most acute are the issues of using electronic services and platforms to successfully employ DL in the educational process [9], [10].

In the present study, we define DL as a part of web-oriented education – a type of education that fundamentally relies on the use of ICT and in which the participants of the learning process primarily engage in individualized educational communication [11].

In accordance with the research problem, researchers consider cases of DL implementation during the COVID-19 pandemic at various universities around the world [7, 8, 9] and in various areas of study [10, 11, 12]. Researchers analyze the factors that facilitate and hinder the implementation of distance

education during the COVID-19 pandemic [13], study the perception of distance learning by students during the pandemic [14], the satisfaction of teachers and students of distance education and their understanding of the opportunities and problems of distance learning during the period of quarantine restrictions [15] ; determine the existing educational and technological barriers to distance education [16] and the relationship between digital transformation, satisfaction and the intention of students to continue learning online [17] during quarantine restrictions; prove the advantages of organizing DL in order to prevent the spread of a pandemic [18]; justify the benefits of distance learning during the crisis, which are the use of technology, improving the communication skills of students and saving time on teaching and learning [19]; determine the priorities of learning after the removal of restrictions to find a balance between distance learning and full-time education [20].

Nevertheless, a full picture of the realities of DL cannot be painted without considering the position and feedback of teachers as those who put the system into operation.

In view of the above, the goal of the present study is to detect the use of the most effective means of organizing DL by teachers during the period of active restrictions caused by the COVID-19 pandemic.

Research objectives are:

*1)* To analyze the opportunities to use various services in the organization of DL during quarantine measures.

*2)* To define the advantages and drawbacks of the DL system.

*3)* To identify previously unapparent problems in the process of distance work during quarantine.

Further, the article describes the methodology of the study, presents the results of the study and analyzes their significance. In conclusion, the conclusions of the work carried out are drawn.

## III. METHODS

The established research goal entails the following approximate list of theoretical and empirical research methods: the theoretical methods of analysis, synthesis, comparison, and summarization used in the study of scientific literature on the organization of DL during the period of quarantine restrictions caused by the pandemic. The theoretical base of the study was grouped depending on the type of documents. The first group of information sources consisted of studies devoted to the problem of the possibility of introducing distance learning into the educational process. The second group of information sources was devoted to the consideration of the specifics of the use of DL during the period of active restrictions caused by the COVID-19 pandemic. The considered sources of information were 30 articles from scientific peer-reviewed journals Scopus and Web of Science for the last 3 years; the empirical method of a survey employed to analyze the existing peculiarities and problems of organizing DL.

The primary method of research was an expert survey, the sample of which consisted of 100 teachers sampled by the method of criterion-based selection. The survey method was the most appropriate for the purpose of the study, since determining the use by teachers of the most effective means of organizing distance learning during the period of active restrictions caused by the COVID-19 pandemic was most accurately feasible when analyzing the opinions of the teachers themselves, as direct participants in this process. The survey included the following questions:

"What services do you use to post educational and methodological support materials during the organization of DL?" (multiple choice possible), followed by a discussion of the experience;

"What services do you use for hosting video conferences?" (multiple choice possible);

"In your opinion, what are the main disadvantages of DL?" (multiple choice possible);

"In your opinion, what are the main advantages of DL?" (multiple choice possible);

"In your opinion, what are the major problems in the process of DL during quarantine that were not apparent beforehand?" (multiple choice possible).

Thus, the surveyed teachers were asked to identify the main resources they had used to post educational and methodological materials for students to access and the services most often used for communication with students and hosting online conferences. The survey also enabled the teachers to describe the advantages and disadvantages they see in the DL system and to identify major problems in the DL process during quarantine that were not evident beforehand. In addition, the teachers were able to give their opinions on opportunities for improvement.

Further on, the opinions of teachers about the services preferred for posting educational and methodological materials and hosting video conferences, the main drawbacks of DL, and the problems discovered in the course of distance work were ranked by popularity. The consistency of teachers' opinions was assessed by the concordance coefficient:

$$w = \frac{12S}{n^2(m^3 - m)}$$

where S is the sum of the squared deviations of all rank estimates of each evaluated object from the mean value; n – the number of respondents; m – the number of assessment objects.

Statistical processing of the survey results and calculation of descriptive statistics (percentage of expert mentions) and the concordance coefficient were performed using the SPSS software product.

## IV. RESULTS

The conducted survey reveals that in posting educational and methodological materials as part of DL, the respondents give preference to Moodle (45%) and Google Classroom (44%) due to their convenient subdivision of topics and classes and easy access for students (Table I).

TABLE I.    SERVICES FOR POSTING EDUCATIONAL AND METHODOLOGICAL SUPPORT MATERIALS

| № | Service | Response rate*, % | Rank |
|---|---------|-------------------|------|
| 1 | Moodle | 45% | 1 |
| 2 | Google Classroom | 44% | 2 |
| 3 | Google Drive | 31% | 3 |
| 4 | Microsoft Teams | 8% | 4 |
| 5 | Other | 29% | |

multiple choice possible

An object-oriented DL environment Moodle relies on contemporary information and computer technology. The service can also be used by students to receive feedback, as they can post their completed laboratory assignments and other documents to be checked by the professor.

Google Drive as a platform for storing materials with an opportunity to share access to them ranks third in the respondents' choice (31% of the respondents choose this option). Microsoft Teams is used by only 8% of those surveyed. Meanwhile, 29% of the professors do not use any of the mentioned services.

The concordance coefficient for the question is W = 0.78 (p < 0.01), indicating strong consistency of the teachers' responses to the question.

Subsequent additional questions focus on teachers' experiences with the most popular services (Tables II and III).

TABLE II.    EXPERIENCE WITH MOODLE

| № | Teachers' judgment | Response rate, % |
|---|--------------------|------------------|
| 1 | Use a lot | 39% |
| 2 | Use little | 13% |
| 3 | Not use at all | 36% |
| 4 | Consider it convenient to use | 43% |
| 5 | Consider it inconvenient to use | 7% |
| 6 | Recommended for use | 43% |
| 7 | Not recommended for use | 7% |

TABLE III.    EXPERIENCE WITH GOOGLE CLASSROOM

| № | Teachers' judgment | Response rate, % |
|---|--------------------|------------------|
| 1 | Use a lot | 24% |
| 2 | Use little | 23% |
| 3 | Not use at all | 36% |
| 4 | Consider it convenient to use | 26% |
| 5 | Consider it inconvenient to use | 3% |
| 6 | Recommended for use | 37% |
| 7 | Not recommended for use | 26% |

Considering the above services from the point of convenience, 43% of the surveyed teachers consider Moodle to be quite usable and recommend it for use in the educational process (Table II). However, commenting on their experience using Moodle, 7% of the respondents do not recommend using

it as the main system for organizing DL in educational organizations (Table II), explaining their position by the fact that teachers and students voice many complaints about its operation.

The Google Classroom service is used in working with educational and methodological materials by 24% of teachers and recommended for use by only 26% (Table III). Moreover, 36% do not use Moodle and Google Classroom in the learning process at all and consider them inconvenient.

In the organization of DL, of importance are video conferencing platforms, which allow students to attend lectures in real time and actively discuss the materials presented while physically being in different places. This model approximates online learning to study in a real classroom as much as possible.

The responses of teachers to the question "What services do you use for hosting video conferences?" are presented in Table IV.

TABLE IV.    SERVICES FOR HOSTING VIDEO CONFERENCES

| № | Service | Response rate*, % | Rank |
|---|---------|-------------------|------|
| 1 | TrueConfServer | 55% | 1 |
| 2 | VideoMost | 34% | 2 |
| 3 | Google Meet | 17% | 3 |
| 4 | Google Hangouts | 10% | 4 |
| 5 | Microsoft Teams | 8% | 5 |
| 6 | Cisco Webex Meetings | 3% | 6-7 |
| 7 | Big Blue Button | 3% | 6-7 |
| 8 | Skype | 2% | 8 |
| 9 | Discord | 1% | 9 |

multiple choice possible

The survey results show that the most popular video conferencing service is TrueConfServer, which gained popularity after Russian universities ceased cooperation with Zoom, with the selection rate of 55% (Table IV). Another Russian product, VideoMost, has 34% of the vote.

Free video chat services Google Meet and Google Hangouts are used by 17% and 10% of respondents, respectively. The Microsoft Teams service is approved by 8% of university professors; such a low rate may be explained by a fairly high subscription fee charged for most Microsoft services. Among other video conferencing resources mentioned by the teachers are Cisco Webex Meetings (3%), Skype (2%), and Discord (2%).

It should be noted that conferencing directly in Moodle is not a typical solution. Only 3% of the respondents use the Big Blue Button service, which integrates with Moodle, although the previous question reveals that 39% of the respondents use Moodle to post educational and methodological materials (Table II).

The value of the concordance coefficient W = 0.76 (p < 0.01) indicates a high coherence of the teachers' opinions on this issue.

The main disadvantages of DL as viewed by teachers are presented in Table V.

TABLE V. PRIMARY DISADVANTAGES OF DL

| № | Primary disadvantages of DL | Response rate*, % | Rank |
|---|---|---|---|
| 1 | round-the-clock load | 65% | 1 |
| 2 | lack of a unified platform | 37% | 2 |
| 3 | lack of unified standards and requirements, as well as unified software | 35% | 3 |
| 4 | unequal access to high-speed Internet | 19% | 4 |
| 5 | difficulties in objectively assessing knowledge | 16% | 5 |

multiple choice possible

The value of the concordance coefficient W = 0.82 (p < 0.01), which suggests a strong consistency of opinion on the issue.

Additionally, the survey of teachers during the DL process while in quarantine revealed problems that were not apparent beforehand (Table VI).

TABLE VI. PROBLEMS DETECTED WHILE WORKING IN THE DISTANCE MODE

| № | Problem | Response rate*, % | Rank |
|---|---|---|---|
| 1 | teachers' technical competence | 68% | 1 |
| 2 | optimization of class schedules and workload in the distance mode | 44% | 2 |
| 3 | multitasking | 37% | 3 |
| 4 | content structuring of information flows | 24% | 4 |
| 5 | electronic deanery | 20% | 5 |

multiple choice possible

For this item, the concordance coefficient is W = 0.75 (p < 0.01), indicating a strong concordance of the teachers' views on the matter.

## V. DISCUSSION

According to the survey results, the main drawback of DL for teachers is a round-the-clock load caused by the need to adjust educational and methodological materials for online classes, post them online, hold consultations and video conferences, maintain contact with students and their parents (special attention should be paid to the professor's actions in the case of prolonged absence of students who do not attend classes and do not contact them), as well as to conduct control and assessment of the level of students' knowledge, which is consistent with previous research [13]. A particular factor in the higher workload of teachers is the increased amount of reporting documents required in the course of DL.

Among the key disadvantages of the organization of DL, the teachers also note the lack of a unified platform, lack of uniform standards, requirements, and unified software, lack of student motivation, unequal access to high-speed Internet, plagiarism, and difficulties in assessing students' knowledge objectively.

Further on, the study reveals an ambiguity in the teachers' perspectives on the advantages of DL over classroom teaching, or, conversely, classroom over DL. Those advocating for the advantages of DL justify their position by the following arguments: DL provides an opportunity to learn for those unable to attend classes for objective reasons, allows saving time and money for transportation, results in more comfortable working conditions, and gives an opportunity to train the self-discipline and self-organization of students, as well as to develop their skills of independent information search and processing and self-learning.

Discussing the problems detected in the course of remote work, the teachers prioritize in the organization of DL the need for teachers to acquire specific competence, which includes: 1) knowledge of the opportunities and available resources to conduct DL: learning platforms, software, techniques, and instruments; 2) mastery of the methodology of adjusting traditional courses for the electronic format; 3) mastery of the technology of digitizing learning tasks. What can become a solution to the above problem, researchers suggest, is the organization of training and masterclasses as part of professional development programs [20], [21].

The need for content structuring of information flows owes to the fact that the transition to an exclusively distance form of work in the quarantine majorly increased the flow of information from various sources and university departments [22]. The lack of the competence and culture of online communication has resulted in too much noise and spam in professional correspondence, which made coordination and timely access to the necessary documents difficult. To resolve this issue, researchers suggest [16], [23], it is enough to develop a system of labeling documents by content according to an agreed-upon standard in order to structure them and move them to appropriate databases and to provide guidelines for professional online communication for university staff, faculty, and students.

The problem of optimization of class schedules and workload in the distance format consists in the fact that in DL, the number of students in a group does not depend on the size of the classroom and the number of seats. This gives an opportunity to optimize the schedule by merging the student groups studying in the same program. Educational platforms allow one to simultaneously engage all students in different types of tasks during the class. This measure ensures the high quality of the educational process, but also considerably increases the intensity of the teachers' work and the time required to prepare for distance classes and check students; assignments on the platform. Scholars believe that in order to alleviate these issues, it is appropriate to optimize the schedule without reducing the number of classes for students by assigning the courses of one specialty to a single professor [14], [24], [25]. Reducing the teacher's workload by merging student groups can enhance the quality of DL classes by freeing up the professor's time to prepare and check assignments on the platform.

The problem of multitasking consists in the fact that while holding classes in the form of webinars, aside from their regular function of transmitting and controlling the assimilation

of knowledge, teachers also acquire the functions of: an organizer of communication who informs and invites the group to a webinar; a webinar moderator who manages communication in a DL environment; a technical assistant who provides technical support for the process. Simultaneous performance of all these functions, which in traditional teaching are split between the professor, dean's office, and laboratory assistants and require the professional skills of a moderator, significantly increases the load and stress on one faculty member and leads to exhaustion [19].

The problem of multitasking can be solved by means of a specially developed methodology for organizing and holding webinars for systematic DL. This requires, first, to define the specific goals and functions of the participants and those responsible for the organization and support of the process; second, to automate the processes when needed and possible; third, to account for the increased workload of teachers in the remote format [14].

Finally, management of the learning process in DL necessitates the creation of an electronic deanery, which would serve the functions of information support, feedback, learning process organization, control, collection, and analysis of statistical data, sharing the experience gained, and more.

## VI. CONCLUSION

In general, in the context of active restrictions caused by COVID-19, the most effective way to organize the educational process is to switch to an emergency distance learning mode. However, for both teachers and students, long-term training in this mode raises a number of problems, the solution of which requires continued research in this area. In the context of our study, we identified, first of all, the problems of the lack of a single platform, common standards and requirements, as well as unified software.

The issue of relevant organization of DL needs to be studied further since there is a need to reconsider and reorganize the entire learning process, renew the content of educational programs, and develop new integral programs for DL to support the mobile vector of learning, strengthen students' interest, and eliminate the factors of disorganization, distraction from the learning process, and loss of interest.

It is advisable to continue using DL periodically to collect teachers' feedback and recommendations to improve DL since teachers are the key objects and subjects of educational activities who experience the development of DL first-hand at its initial and early stages.

Most universities' learning systems are more oriented toward developing the organization of the in-classroom learning process rather than the DL system. Meanwhile, a system of prompt transition to DL cannot be developed without repeated practice and specialized software. The current state and prospects for the development of technology and remote work, as well as the epidemiological situation, bring to light the need for methodological support for programs, as well as technical and human resource capacity, to ensure self-sufficient DL.

The prospect of further research may be the development of recommendations for teachers on the practical solution of problems arising from the use of educational services and technologies caused by the need to switch to emergency distance learning.

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