Specificity of Distance Learning Information Flows Using Cloud Services

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Abstract

The organization of distance learning at the present stage is not complete without the use of information educational technologies. In the face of social constraints caused by the pandemic, the development of economic, social, and information processes in the interaction of subjects of distance learning is moving to a new level. The article analyzes the state of the socio-economic system of the organization of distance education and the existing organizational methods of interaction between a teacher and a student using cloud technologies. The results of the analysis of information flow between the components of distance learning, problems arising for teachers due to the lack of feedback from the audience during remote lectures, are presented. It is noted that some of these problems are associated with the imperfection of the technical teaching aids used. The existing restrictions on attracting students to interactive interaction in educational activities are reflected. The peculiarities of conducting practical classes, as well as the presentation of independent student works are separately touched upon. Based on the study, possible ways of developing domestic cloud technologies for the educational sphere are proposed.

Keywords 1

distance learning, distance technologies, information flow, cloud technologies, socio-economic system

1. Introduction

The socio-economic conditions for the organization and development of educational processes in universities are closely related to the need to improve information interaction between academic staff and students.

In the 2012 Russian Federal Law on Education, there is a direct indication of the need to create and use an electronic information learning environment (EILE) for educational institutions. To date, software, technical and technological solutions of EILE, and as a special case, distance educational resources, require large material investments. In many ways, it all depends on the number of students at the university. This causes an increase in attention to the systematization of information flows between participants in educational processes, to the development of the socio-economic system of organizing distance education (SESDE) as a whole.

Such a complex set of tasks of the socio-economic system of organizing distance education can be more briefly called distance learning, which often happens. We will use this term throughout the article.

The situation with restrictions on population movements has caused additional problems in the field of distance learning, both social and economic. As the last year and a half have shown, universities have begun to actively use not only their infrastructure but also use third-party cloud services. Thus, distance

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technologies allow SESDE to go beyond its limits or significantly expand them, including new components, which affects its openness [3,8,9].

Note that this article refers to learning in the field of information technology (IT) and information systems. The authors have many years of experience in learning in the field of IT.

2. Generalities

Distance learning has long found a place in domestic systems of higher education, mainly by correspondence. At the same time, specially developed software tools were used to ensure the acceptance of tests and exams through a specialized portal - the learning management system (LMS). However, the learning process itself took place in a format traditional for distance learning: information (texts of lectures, assignments, tests, topics of essays) was posted on the LMS portal. The work with them was carried out offline, as with regular e-mail, and only the final events were carried out in the online dialogue mode.

Much has been written about the advantages and disadvantages of such distance learning systems in previous years [1,2,5,7]. However, due to the limitations caused by the pandemic, it was necessary to almost completely change the traditional methods of distance learning. This is also because it was necessary to adapt the methods and means used in the LMS for teaching full-time students in "remote mode". For students, the resources of the EILE, and part of its LMS, are cloud services.

The set of elements that make up SESDE is shown in Figure 1. It displays the electronic information learning environment in a generalized form.

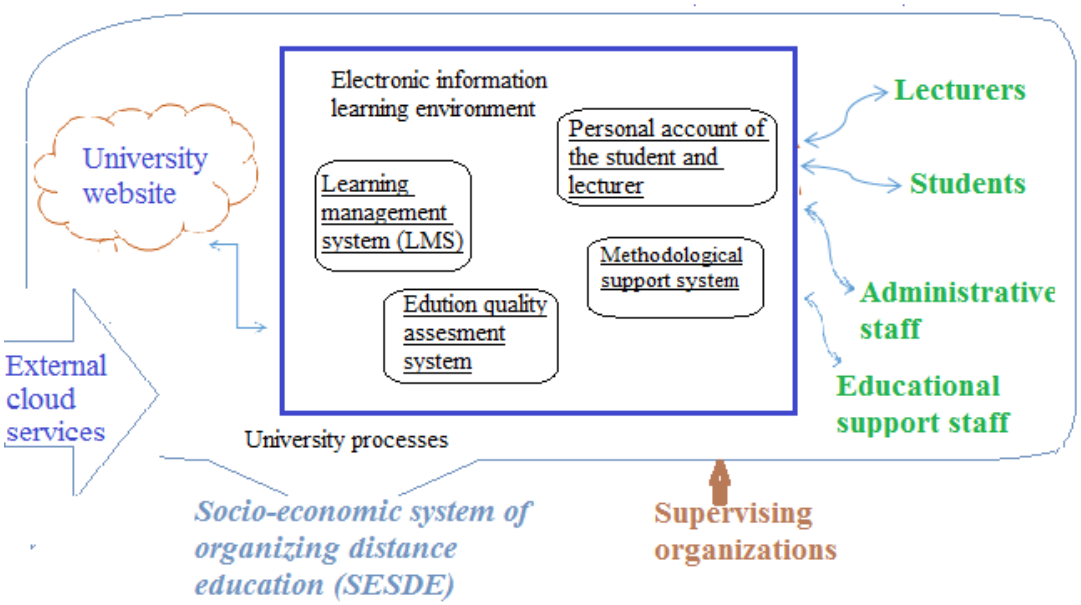

Figure 1: Structure socio-economic system of organizing distance education

Each of these tools is decomposed, so, for example, electronic libraries and reference services belong to the methodological system. Logging in to your account allows you to use the calendar of events, free software, email, career development. The educational portal of distance learning –LMS - allows participants in the educational process to post educational and methodological materials, the results of the implementation of educational tasks, and conduct online events. As a rule, it is connected to the tools of the system for monitoring and evaluating learning outcomes. The most common system in Russian universities is the free software Moodle.

3. Features of Information Flow of Distance Learning

Let us consider the components of the SESDE, which require the provision of simultaneous information interaction between lecturers and students. These are such objects for the implementation

of educational activities as lectures, seminars (practical classes), laboratory and practical work, term papers and projects, tests and exams, final qualification works (FQW). The subjects of constant contact are students, academic and educational support personnel, and administrative workers. Figure 2 shows a generalized view of the flow of information flows between the specified system components during the implementation of distance learning, which was highly deterministic [4,6].

Figure 2: Information flows between objects and subjects in distance learning

Each of these elements has its specific characteristics, some of which we will focus on.

3.1. Online Lectures

Regardless of the software (software) used, as a rule, these are cloud services Zoom, MS Teams, Webinar [11,12,13], there are common problems that we will analyze:

1. Lack of live communication between the student and the lecturer. Most cloud services for telecommuting limit the ability to simultaneously display all participants in the educational process. The lecturer, speaks in front of the camera and microphone, as a rule, in the role of a "talking head", not being able to see the entire audience, react to its emotions, feel a drop in the participants' interest in the process of giving a lecture. In some cases, this can be viewed as an audio version of the lecture notes. All feedback is provided either through “chat” or “question” windows, so the lecturer must be constantly distracted to get a response. In doing so, one should not forget about the various technical aspects. An increase in the number of connected participants leads to a significant overload of communication channels.

Usually, only one student appears on the screen, who at the moment can ask questions or answer the lecturer's questions. Of course, you can limit yourself to questions and answers in the chat, but from experience, we can say that about a quarter of students connect to the webinar from tablets and smartphones, on which it is extremely inconvenient to work with the keyboard. This problem can be partially compensated for at seminars (practical classes) when direct communication between a lecturer and a student is necessary.

From a psychological point of view, lecturing is extremely tedious because not all lecturers can effectively lecture in their subjects without feedback from the audience. There is some analogy here with actors. It is known that the most difficult element for an actor is a solo performance, but even in this case, the reaction of the audience helps (or hinders) him. The lack of an audience raises doubts about the effectiveness of the process.

2. Lack of opportunities for students to communicate with each other. We know from practice that at any lecture, no matter how interesting it is, listeners cannot do without communication. They need to share opinions, ask each other questions, listen to other students' questions to the lecturer, etc. Here we are faced with a situation where a student is invited to listen to a lecturer's lecture along with a minimal opportunity to interact with his fellow students. A survey of students confirms that the lack of horizontal connections causes them some discomfort.

3. It is difficult to assess the degree of assimilation of the material by students. If during the lecture you stopped and asked: - Are there any questions? then the lack of reaction can be interpreted in two ways - either everything is clear, or nothing is clear. Ways to counteract this - the subsequent analysis of the lecture at seminars or return to the covered material in subsequent lectures based on the results of the analysis of questions received from students through electronic services.

4. Storing lectures in data warehouses. A positive element of distance lectures is the fact of fixing and recording a lecture with the possibility of placing it in the LMS storage or on other EILE resources. Students have the opportunity to watch a specific lecture, highlighting individual questions of interest to them, and then formulate their questions and ask them to the lecturer either at a seminar or via available communication channels: LMS services, e-mail, etc. Given the current trends related to the storage of information in "cloud" services, it is necessary to mention one more aspect. Recordings of lectures are stored on sites in their original form without editing. Unfortunately, not all authors have access to resources and the ability to edit media files, and this leads to the need for constant self-control in the style of presentation. In addition, in lectures on technology subjects, some examples may be given, the distribution of which is undesirable for various reasons.

3.2. Practical Classes Online

The features described above can be partially attributed to practical exercises, but there are questions specific to them.

For IT subjects, it is assumed that students should be able to access hardware and software tools used in the design, construction, operation of information software systems. In the case of traditional classes, classical computer classes are used, united in a local computer network, which makes it possible in practice to provide an opportunity to study practical work with software systems, databases, modeling systems, measuring systems, "neural networks". On each computer in the computer class, the same type of general and special software is installed, which is mine to be specific for this direction of study. So, for example, a classroom for an information security course should have different tools (both software and technical) than a class for a course in computer modeling or computer graphics. Considering that a student provides access to a remote practical lesson from the same device, the question arises of how to ensure his work with the necessary tools.

In this mode, the student can no longer use smartphones and simple tablets. He either needs a normal computer or a specialized device (such as a "thin" client) for full access to a "virtual" classroom. Unfortunately, such devices, the main function of which will be to provide interactive access to the network and full-screen display of information, are currently not available in mass production. At the moment, their functions are performed by classic personal computers, subject to all the dangers and threats that exist on the network.

3.3. Distance Presentation of Final Qualifying Works

One more feature of “remote” learning has appeared. If earlier, even traditional correspondence students came to institutes to pass state exams and defend their diploma projects in person, then last summer for the first time on a massive scale these events were held online without the physical presence of students and members of the examination commissions in universities.

This process was somewhat chaotic, which was partly due to the insufficient readiness of lecturers and students (technical, informational, psychological). Let's consider these issues in more detail.

Despite the learning that was carried out for the secretaries and members of the State certification commission (SCC), it was not possible to solve the problems of a high-quality presentation of final qualifying works in a distance mode. If it is possible to get acquainted with the printed version of the document in full-time mode, then in the online mode there is no such possibility. On average, a group of up to 15 people is invited to defend one day. As usual, the members of the commission have time during the student's report to scroll through the work or clarify the questions that arose during the report. In online mode, such a possibility is rather difficult. We can say that all members of the commission can familiarize themselves with the electronic version of the work since the work must be posted on the electronic resources of the university without fail. Ideally, the SCC members should have three

windows open on the screen - a window with a presentation, a window with an image of colleagues in the meeting, and a student, as well as a window with his work.

From the experience of working at SCC, we note that this was very difficult to implement since the participants in the process used completely different technical means: stationary full-screen (FullHD) computers, laptops, netbooks, tablets, and even smartphones - everything was determined by the individual capabilities of the participants in the process. This also includes the problems of the quality of communication, the capabilities of the software used, the workload of the server on which the services used are deployed. All this led to the fact that the assessment of the final qualifying work was carried out based on the student's presentation and report, and influenced the objectivity of its presentation. In such a case, even a very good work with a bad report received only a satisfactory mark.

There are still some questions related to the organizational component. Where and how long is the record of the process of defending the graduation work kept, how the opinion of the SCC members on certain aspects of the defense is recorded, how the participation of the commission members in the defense process is recorded, whether electronic signatures can be used, how archives are formed and stored, and so on. It should also be taken into account that at the beginning of the defense, the student fully identifies himself, showing his passport on the screen, or even personal data. This situation imposes certain restrictions on the subsequent storage of this information in "cloud" data storage. These issues will become even more important in the transition to "paperless" workflow, to the use of "electronic" grade books

The experience gained has revealed quite a few problems that need to be resolved in the future.

4. Conclusions

In the current situation, for the socio-economic system of organizing distance education, as for the traditional educational system, new information flows of interaction between the lecturer and the student will rapidly form to consolidate skills and abilities, and develop independent work of the systematic thinking of students. The EILE used in most universities today are located on their infrastructure, however, an increase in recorded content will require the expansion of existing capacities and the use of cloud services. The research of social aspects of the organization of information environments, specialized electronic educational resources to ensure uninterrupted communication between the lecturer and the student during the introduction of restrictions, revealed several features, for which several proposals were formulated.

1. When recording lectures, restrict access to them and provide for their storage only in domestic data storage. This approach should be extended to all types of stored student work.

In the mode of remote access to educational content, students use not only personal technical means but are also forced to pay for communication services, which have a different cost for each provider. Not everyone can have fixed network access. Many people use mobile communications, which have a higher "unit cost". This requires raising the question of classifying services for providing access to educational content to the category of socially significant services, access to which should be funded by the state.

2. For practical exercises, use specialized devices that work with cloud systems in SaaS, PaaS, IaaS modes. This will standardize and unify the accessibility of students' “virtual” classrooms.

Unfortunately, most universities do not have the opportunity to provide students with specialized remote access tools focused on the educational process, firstly, because of the potential cost of these devices, and secondly, because of their actual absence. As an example, we can recall the promises of some domestic manufacturers about the production of specialized tablets for schoolchildren, but business did not go further than promises. And here again, we need to talk about the need for additional targeted funding for research, design, and development work aimed at achieving a breakthrough in the field of creating technical means focused on the educational process.

3. Another possible direction of providing distance learning can be associated with the provision of RDO mode - remote "desktop access" to existing "real" classrooms.

This mode can be especially effective when conducting practical and laboratory exercises related to the use of specialized technical means connected to remote devices. The disadvantage of this approach

may be increased requirements for the characteristics of communication lines providing remote "desktop access".

4. Identification of a student during control activities by demonstrating his documents, recorded as video content, raises a special need to restrict access to personal data. It is necessary to organize their safe storage when using open cloud services.

Now students must save their course and diploma projects in electronic form, using the data repositories of universities. This raises questions about the "security" of these storages. Even though graduates' diploma projects can be (and should be) classified as the results of intellectual activity, they do not have appropriate protection. In the process of teaching, I repeatedly had to deal with cases when a slightly modified borrowed work was offered as a thesis. Universities use various systems for checking borrowings in the text, such as "Antiplagiat", "Rukontext" and others [14,15,16], mainly in cloud versions. Accordingly, the verification of completed FQWs is carried out within the framework of the selected system and the universities connected to it. The presence of a common database would make it possible to avoid the appearance of "typical theses", which not only have no practical value but also do not allow assessing the level of learning of a graduate student [10].

5. Issues of assessing the quality of education require special attention. In this regard, one can regret the refusal of some universities to conduct state examinations, which made it possible to assess the degree of mastering by students of the basic courses they listened to in the learning process. In addition, these exams made it possible to assess not only the knowledge of graduate students but also to some extent evaluate the lecturers who taught these courses. It is clear that in the context of distance learning it is not so easy to organize the conduct of state exams, however, to improve the quality of education, consideration should be given to returning to this form of the final assessment of graduate students.

6. The time standards for remote and full-time work of lecturers in the past academic years were the same. In the opinion of the authors, they should be divided according to these modes.

Table 1 shows the correspondence of information flows identified for the main objects described above and expanded for Figure 1, taking into account the formulated proposals for the development of the SESDE.

Table 1

The relationship between the system objects and the formulated proposals through information flows

Objects	Information flows	Offers
Lectures	Lecturer - Students - Support staff	1, 6
Practical classes	Lecturer - Students	2, 3, 4
Student self-work	Students - Lecturer	1, 2, 3
Control activities	Lecturers - Students - Administrative staff	4, 5
Final qualifying work	Team Lecturer - students - Administrative staff - Invited specialists	4, 5, 6

Note that all of the above aspects of the SESDE include the processes of organizing secure authentication and identification of the student, which can already use the corresponding government cloud solutions. The use of cloud services in this case is limited by the capabilities of domestic developers. Here, technical requirements for the development of the infrastructure of universities and the expansion of communication channels are also becoming relevant. The proposals made become tasks for the development of distance learning.

The collegiality of the participants in the educational space in solving such problems will ensure the effective use of the allocated contact time and the flexibility of the educational process.

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