The Phenomenon of Distance Learning and the Analysis of Modern Technological Possibilities of Its Organization in the Modern World

Mukhabbatkhon Mirzakarimova
Doctoral student of Tashkent State University of Economics Tashkent, Uzbekistan

Abstract: This article discusses a new form of distance learning – multimedia lectures and the information and telecommunication technologies that support them. This topic is relevant especially during the Pandemic. The existing technologies, standards and software complexes, because of which these systems can, built, and the most popular samples of such systems are considered. In the article, the parameters and comparison of distant lecturing systems worked out, revealing the most problematic sides of the development of distant lecturing systems functionality and suggesting the perspective approach to their organization.

Keywords: multimedia lectures, distance learning, information systems, electronic learning tools, online work.

i. INTRODUCTION

Videoconferencing, first demonstrated in 1968 by Douglas Engelbart [1], has now become part of the daily routine of humankind. At the same time every year, we observe its increasing penetration into the most distant from computer technology areas. The widespread use of systems like Skype for personal communication, video meeting room systems and video walls in business, the use of videoconferencing for counseling in complex medical operations and telemedicine systems are just some of the long list of practical uses of videoconferencing technology.

Interest in these modern technologies is also developing in the field of educational services. Videoconferencing is becoming a common and increasingly common tool for retraining and advanced training of specialists, for profile schools, for teaching people with disabilities, and self-education. One of the most promising forms of educational process for the implementation of communication is a distance lecture, which allows a lecture to deliver from the main university to geographically distant branches, organizing highly specialized lectures for a small number of users dispersed geographically, to use saved lectures as additional material, including distance learning.

As early as 2000, a series of thematic seminars with broadcasts on the Internet (videoconferences) “The Use of Internet Technologies in the Teaching of School Subjects” for teachers of full-time distance learning courses of the “Learning and Internet Access” (IATP) Program showed a high efficiency of the use of this technology, provided it is properly prepared and conducted interactively [2;3].

Today more and more universities are experimenting with distance lectures using various video conferencing support systems. So, for example, during the Pandemic in the universities of Uzbekistan several forms of videoconferencing used such as broadcasting, teleconference,

ZOOM, telegram or various platforms (each university has its own). The main educational form of videoconferencing is a lecture – an interactive lecture session with remote audiences. Students who are both in a given classroom and in one or more remote classrooms, for example, in branches and representative offices [4], can attend the lectures.

Educational videoconferencing provides such modes as two-way videoconferencing (point-to-point) for any two subscriber terminals; group (multi-point) videoconferencing with simultaneous participation of up to 100 or more (depending on the organizer of the conference) participants; demonstration of presentations or other computer materials simultaneously with videoconferencing sessions [5].

We can say that videoconferencing technologies have become a source of great expectations and even a revolution in education, which are defined by hopes to solve the biggest problem of distance education – the problem of quality – through the organization of full-fledged interaction between student and teacher, as close as possible to face-to-face communication. At the same time, a distance lecture seen by many as the main form of videoconferencing application in distance education.

The modern development of videoconferencing technologies and software makes it possible to use them for educational purposes in a number of already today. However, the direct use of common videoconferencing systems for educational purposes restricted by the fact that such systems do not take into account the specific educational process hindered by the fact that such systems do not take into account the specific requirements of the educational process. For example, the interaction between the participants of a lecture with the distribution the interaction between lecturers and listeners, with notes on the blackboard, presentations, questions and discussion at the blackboard is quite different from, for example, videoconferencing, private conversation, or remote consultations during medical operations.

Until recently, there were no video conferencing systems that tooks into account the features of educational applications. In the last few years, however, a whole series of developments have emerged that adapt videoconferencing systems A whole series of developments that adapt videoconferencing systems and technologies for the purposes of distance learning in the form of a lecture has emerged in the last few years. Most of these systems Most of these systems based on the possibility of accompanying a videoconferencing session with a synchronized set of demonstrations and tools. As a rule, each such system has the possibility of presenting slides and drawing (sometimes jointly) on the blackboard. In other details, they differ significantly from each other and provide very different sets of functions and tools. Many important aspects of the lecture activity left out of the picture.

This state of affairs is mainly due to the current lack of a common understanding of what a remote multimedia lecture is and what functionality a developed software system for distance lecturing should have.

The present paper is devoted to researching the phenomenon of a distance lecture and analyzing modern technological capabilities of its organization, as well as consideration of possible approaches to the construction of software systems for distance lecturing.

ii. METHODS AND RESULTS

Video conferencing has now reached a level that allows remote communication to almost any modern PC (personal computer) user. So, to carry out a regular interactive video communication (using, for example, Skype or Live Messenger) one needs a computer of average or even below average power, an inexpensive webcam, an Internet connection with a 1 mbps bandwidth (for example, ADSL is available almost everywhere).

A one mbps channel will allow streaming of 320 × 240 video at 15 frames per second in good quality. The video stream coming over the Internet will then be compressed 200 times as much as that coming from a webcam. This level of compression achieved using advanced video compression algorithms developed within the MPEG standards. A compression rate of 200 times gives you video quality close to the original At the same time, compression by a factor of 200 provides video of the same quality as the original video, while compression by a factor of 500 provides video of minimally acceptable quality.

In addition, a means of vector coding of video images of a human figure being actively developed now. The algorithm finds characteristic points on the face and torso and transmits their location through the network channel. At the other end, taking into account these points, the algorithm constructs a three-dimensional human figure and superimposes a special texture on it. Using this technology, video transmission of any quality requires a channel width of about one Kbit [6-8].

There are a number of different protocols for transmitting audio and video data. Audio and video streams require a special approach for transmission over network channels because they, on the one hand, contain very large amounts of data, on the other hand, allow for minor data loss and distortion during transmission. Protocols such as the RTP 6 real-time protocol (Conference XP) and the RTP-based H.323 7 (NetMeeting) and SIP 8 (Windows Messenger).

When sending the same data over the network to multiple users in the usual way if the same data sent over the network to multiple users in the usual way, the server side is redundant (see the figure): instead of one set of data sets sent over the network channel, one data set for each user. As a result, the more recipients, the more traffic on the server. With multicast technology, the server sends one set of data to all end users. Which going through the network in an optimal way and multiplied is just before branch of each user from the overall network segment [8].

Many videoconferencing systems nowadays provide the ability to show slides (MS PowerPoint or Adobe PDF) while lecturing. Thus, technically, a virtual conference has the tools that used in a real conference, which allows a typical conference to hold remotely without sacrificing in formativeness. In addition, modern videoconferencing allows users to collaborate on documents, such as Excel or Word.

Roughly, divide modern videoconferencing support systems into four groups.

1. Complex hardware and software systems. This is usually a hardware and software it is usually a boxed product, connected to the IP network and has all peripherals. Usually a boxed hardware and software product connects to an IP network and comes complete with all peripherals – screen, video camera, microphone, or assumes additional purchase of these devices from a narrow list of devices. Devices from a narrow list of devices, usually from the same manufacturer. This approach saves the user the trouble of searching for and connecting high quality peripheral devices. These systems usually have presentation tools, collaborative work with documents, and drawing on the board. Hardware-software complexes allow simultaneous videoconferencing of large numbers of users and show good quality on narrow channels due to efficient compression and packaging of audio/video data into network packets by powerful hardware.

Such complexes are quite expensive by modern standards for an average university (for example, the systems of Polycom, Tandberg or Hauvey). In addition, such complexes are closed software and do not have the ability to adapt the software for the purposes of the university and even more so for a particular course.

2. Software systems. These are software products designed to installed on the user's

computer. Using standard peripheral devices – screen computer screen, webcam, computer microphone, computer speakers or headphones.

Since a personal computer has no hardware for encoding audio/video streams and does not always have high-performance resources, such systems cannot use resource-intensive efficient data compression algorithms, which adversely affects the quality of communication compared to hardware-software systems.

Video conferencing software systems can be commercial or freely Software videoconferencing systems can be commercial or freely distributed, sometimes even open source. In terms of software functionality, such systems are largely similar to hardware-software videoconferencing systems. Moreover, they often act as a cheaper analog of the hardware product of the same manufacturer (for example, Polycom PVX 8.0.2 application).

Web conferencing, conferencing systems built on web-based platforms and usually not requiring installation of specific software. These systems are usually designed to be displayed in a browser using technologies such as Adobe Flash, Silverlight, Java, ActiveX.

Adapted for the web, such systems often lose some of the properties of video conferencing, due to the lack of interaction between web-oriented platforms and the application programming interface of the operating system (due to the limitations of web content security or technical limitations), as well as due to insufficient performance of such platforms. It becomes impossible to use some hardware capabilities of personal computers, as well as insufficient resources to execute resource-intensive algorithms.

Thus, in general, web conferencing only allows the audio/video transmission of a single conference participant, moreover, often disables the video transmission, leaving only audio communication. Some web conferencing systems however, include voting and polling sessions, which provides some interaction between the audience and the lecturer. Seminars conducted through such systems referred to as webinars. Web conferencing usually has facilities for broadcasting presentation slides, a drawing board, but cannot provide document collaboration.

4. Video telephony software systems, voice and video communication systems focused on video telephony calls, not on business communications. Typically designed to communicate with only two interlocutors at a time and have no additional such as drawing board, presentations and joint work with documents.

However, many video telephony systems have additional features and the functionality of many video telephony systems is close to that of software videoconferencing systems.

.iii. ANALYSIS AND DISCUSSION

Let us now consider several popular software videoconferencing systems. A catalog of available videoconferencing systems and their properties maintained on the Internet.

Microsoft Net meeting. One of the first platforms considered was the Net meeting 3.0 10, because of which there is an application of the same name built into the Windows operating system. NetMeeting allows you to organize audio and video (if you have a video camera) contacts between participants of the conference. In addition, NetMeeting has the following features: file transfer, joint work on a document, chatting, Whiteboard. However, audio and video communication is possible only between two conference participants, which deprives the lecturer of the possibility to have more than one listener. Such a system cannot used for distance lectures.

Windows Messenger. The Windows Messenger 11 platform has similar properties to Net meeting. Windows Messenger allows you to work remotely with documents, provides a Drawing board, chat room, etc. in a similar way. In addition, Windows Messenger allows Windows Messenger also makes it possible to collaborate with your desktop. However, it also designed for two interlocutors. The advantageous difference is that Windows Messenger uses a more modern and correspondingly faster SIP protocol, in contrast to net meeting, which uses the H.323 standard.

Skype. The Skype system, which has recently become extremely popular for personal communication, performs point-to-point video conferencing. Recent versions announce the possibility of multipoint videoconferencing between several participants as an additional option. Although there are known cases of using the system in educational applications, the lack of means of presenting a demonstration series significantly narrows the possibilities of using Skype for education.

MS Conference XP 12 – is a product from the Microsoft Research group of developers, positioned as a tool for distance learning. Conference XP is a set of applications, libraries and services implementing a multilevel distributed video conferencing system in the environment. Net, as well as the open source code of all these components.

An advantage of the Conference XP platform is the use of the RTP protocol for transmitting data over the network (unicast and multicast). Audio and video data transmitted in Windows Media Video format. Using these formats and protocols, data can transmitted with configurable compression and with a latency of about 50 ms, which is more than acceptable for video conferencing. In addition, the Conference XP platform provides recording and replay tools which can be used to save lectures. The open source code allows creating modules based on this platform with non-standard functionality required in a project.

Thus, the existing development of videoconferencing standards and technologies, as well as the modern development of information and communication infrastructure in the country and the world as a whole provide an opportunity to create systems for conducting distant lectures with the necessary technical characteristics.

Let us look at a few of the most popular products currently in use for remote lecturing.

Adobe Acrobat Connect Pro – is a video conferencing system aimed at business conferences and training seminars. Adobe Connect provides the means to demonstrate Slideshow, drawing on the blackboard, displaying the desktop of a Windows user. In addition, the system provides tools for organizing seminars or business meetings. The held conference saved and viewed repeatedly. The disadvantage of the system. The disadvantage of the system is the absence of tools for designing demonstrations in the system: the user needs to for example, you have to install an additional application for designing slideshows like PowerPoint. Adobe Acrobat Connect – a typical example of software systems for running webinars.

MOODLE – is the most popular educational communication system. Although the MOODLE kernel has no videoconferencing capabilities, the openness of the system allows its functionality to expand. One attempt to extend MOODLE into the area of videoconferencing is AmvoNet. Because of the extension, we get a system that has similar functionality to Adobe Acrobat Connect Pro in the area of videoconferencing, but by including the basic functionality of MOODLE, which aimed at the educational process. For example, the system implements class schedules and student accounting, offers an educational forum.

IBM Lotus Sometime – is a system design mainly for business interaction, but in some universities, it used for remote lecturing. As demonstration materials, slides in MS PowerPoint format and the ability to draw over them with a marker are used. The key difference of the system is that it uses an IM (Instant Message) client, an instant messaging application, where users can communicate with each other everywhere. In addition, if this client were as popular as ICQ, QIP or MSN Messenger, the organizational costs of organizing a lecture would be minimal.

MS Conference XP. This system occupies a special place. Unlike previous systems, Conference XP provides developers with program source code and thus, if desired, the system extended as broadly and deeply as desired. System can be extended as broadly and deeply as desired, including making serious architectural changes. However, in its initial version, this system presents all the same tools as the previous systems reviewed.

GWOTS. This system developed at the Leipzig University of Applied Sciences and designed specifically for distance lectures. GWOTS slides are HTML pages located on the Internet, which in itself provides more freedom in presenting the demonstration sequence than the PowerPoint slides discussed so far. However, the lecturer has to take care of creating such pages himself or use existing ones on the Internet. Another problem with the system is the absence of any feedback options – no testing, no video questions, or anything else. The demonstration sequence in the GWOTS system compares favorably to the previous systems reviewed, but it still does not meet the requirements of a distance lecture. For a lecture, the slides must be interactive so that the lecturer, for example, control the viewing angle of a three-dimensional graphic or the position of a video recording of an experiment.

Note that in order to build a successful remote lecturing system, all phases of the learning process taken into account. For this purpose, let us consider a face-to-face lecture. A face-to-face lecture begins with the formation of a schedule on the one hand and the preparation of the lecture material on the other. Then there is the actual process of reading the lecture to the audience, after which students additionally understand the outlined materials of the lecture. Overall, the above-mentioned systems somehow support the lecture-reading phase and sometimes the re-use phase, but the lecture materials preparation phase not provided at all. The lecturer has to worry about purchasing, installation and using any software or hardware for this does not make the lecturer responsible for purchasing, installing, and using any software tools for instructional materials development.

Distance lecture should be an integral part of a comprehensive process of training organization, considered in isolation from its other components, including the lecture should be an integral part of the complex process of organizing training, and considered in isolation from its other components.

Thus, based on the previously identified phases of the learning process, let us define the key information processes of a distance lecture.

1. Lecture preparation phase:

- Creation, filling, management of the demonstration series and generally a number of educational the lecture preparation phase: creation, filling and management of a set of illustrative materials, in general:
- lecture scenario creation;
- organizing the pool of training materials in the database with the possibility of their reuse, including in other formats of educational work;
- Maintenance of schedules, group students.

2. Lecture phase:

- Reading a lecture online;
- Presentation of demonstration materials;
- Answering listeners' questions.

3. Reuse phase:

- Using the lecture in the system;
- Export into an independent means of learning;
- Use of learning materials in other forms of educational work.

Because of the selected information processes and taking into account possible needs of a lecturer, let us formulate the user requirements to a distance lecture organizing system lectures.

Lecture phase. First, the lecturer must be able to control the demonstration row, which should offer rich demonstration possibilities: presentation of formatted texts, mathematical formulas, scientific graphs, multimedia data (images, videos, etc.). Besides, such demonstration series should provide the lecturer with an opportunity to interact interact with dynamic elements of demonstrations – video clips, graphs, images. Since some courses may require additional demonstration means, it should be possible to expand the demonstration range with new types of demonstration elements by the system's application programmer.

Secondly, the system should provide various types of feedback: express testing of the audience, video questioning of the listener, joint work with demonstrations, chat, and forum.

Thirdly, such system should provide the means of video conferencing, the transmission of audio/video and other data over the network should be with economical loading of channels, and the data transmission system itself should be easily replaceable by more advanced analogues.

Lecture preparation phase. All the necessary tools for developing demonstration materials built into the system. In addition, the system should have a full set of elements of the educational process organization: class schedule, attendance log.

Re-use phase. It should be possible to save the lecture in the system, on local media and in Web-format on the Internet. The recorded the lecture must correspond to the functionality of an online lecture, in particular, the user must have an opportunity to take a recorded express-test.

The table shows the results of a comparison of previously considered systems used for remote lecturing, according to the formulated user requirements.

From the table we can see that the considered systems have a number of typical disadvantages: the monotony of demonstration means, the lack of dynamics of demonstrations, and the lack of feedback means. The lack of opportunities for developing educational materials by the built-in means of the system (the need to use a variety of additional (you need to use a variety of additional software products, often for a fee), lack of ability to save the lecture and record a copy on CD-ROM, overloading communication channels.

The reason is that only a small part of the requirements implemented based on video conferencing systems. Some requirements require advanced functionality provided by LMS (Learning Management System) and LCMS (Learning Content Management System) systems, therefore, the system of organization of distance lectures Therefore, the system of distance lectures organization should be based on LCMS + LMS system with integration of videoconferencing facilities.

Thus, we can conclude that the currently existing systems of distance lectures based, as a rule, on video conferencing systems. This does not allow taking into account the specifics of the educational lecture process and properly meet the requirements of the user. More perspective is the approach to development of the systems for organization of distance lecturing because of learning management systems (including management of learning process and learning materials) with integration of video conferencing means.

IV. CONCLUSION

To summarize, let us make the following conclusions.

- Educational technologies based on video communication are becoming an important the educational technologies based on video communications are becoming an important factor in increasing the efficiency and quality of learning at all levels of education. One of the forms of the educational process most promising for the implementation of communication is a distance lecture.
- The existing development of standards and technologies of videoconferencing, as well as the modern development of information and communication infrastructure in the country and the world as a whole provide an opportunity to create systems for distance lectures with the necessary technical characteristics.
- Distance lecture as such is an integral part of the complex process of training organization and considered in isolation from its other constituent including the stage of preparation of learning materials and the stage of reuse of the results of the lecture activity.
- Currently existing systems of remote lecturing based, as a rule, on videoconferencing systems. Which does not allow taking into account the specifics of educational lecturing process and meet the requirements of the user fully. A more perspective approach to building systems for organizing lections based on the learning management systems (including the management of Learning management systems (including the management of the learning process and study materials) with the integration of videoconferencing facilities into them is a more promising approach.

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