Prospects For The Development Of Distance Educational Learning Technologies During The Training Of Students Of Higher Education

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Summary

This article identifies the problems and substantiates the directions for the development of distance learning technologies in the training of personnel. An example of using digital media to create a remote access laboratory is given. The article is devoted to the definition of the main aspects of the organization of distance education. Rapid digitization, economic, political and social changes taking place in Ukraine necessitate the reform of the education system. First of all, it concerns meeting the educational needs of citizens throughout their lives, providing access to educational and professional training for all who have the necessary abilities and adequate training. The most effective solution to the above-mentioned problems is facilitated by distance learning. The article analyzes the essence and methods of distance learning organization, reveals the features of the use of electronic platforms for the organization of this form of education in different countries of the world. The positive characteristics of distance learning are identified, namely: extraterritoriality; savings on transport costs; the interest of modern youth in the use of information tools in everyday life; increase in the number of students; simplicity and accessibility of training; convenient consultation system; democratic relations between the student and the teacher; convenience for organizations in training their employees without interrupting their regular work; low level of payment for distance education compared to traditional education; individual learning pace; new teacher status. Among the negative features of online education, the author refers to the following problems: authentication of users during knowledge verification, calculation of the teacher's methodological load and copyright of educational materials; the high labor intensity of developing high-quality educational content and the high cost of distance learning equipment; the need to provide users with a personal computer and access to the Internet; the need to find and use effective motivation mechanisms for education seekers.

Keywords:
technologies, professional competence, higher education, teaching technology

1. Introduction

The current stage of development of our country requires the creation of conditions for achieving a new quality of vocational education in accordance with the current and future needs of the individual, society and the state based on the modernization of the educational process in universities.

The development of the education system, the popularity and actualization of higher education impose increased requirements on the quality of training graduates. A modern higher education institution is required to introduce advanced learning technologies that, along with its fundamental nature, ensure the development of communicative, creative and professional competencies, the need for self-education based on the potential multivariance of content.

Initially opened as one of the additional forms of education to guarantee social equality of rights to education of various sectors of society, correspondence the form of education in its development acquired the status of an equal in rights with the full-time form and was formed as an independent educational system. Further scientific study of the formation and development of pedagogical technologies in the system of correspondence education in order to develop this form of organization of the educational process in universities as a powerful resource for the development of a system of vocational education, training and retraining of highly qualified personnel.

To date, a contradiction has arisen between the established forms and methods of distance learning and the

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insufficient development of pedagogical technologies of the higher correspondence school [3].
Distance learning based on the use of distance learning technologies via the Internet, being an innovation in relation to modern education, is becoming a logical development of modern distance learning, which is traditionally mainly carried out in classrooms and laboratories. Distance education, in our opinion, has an essential significant superiority over traditional distance education, as it solves the main problem of distance education - the problem of the lack of distance learning other forms of conducting classes in the full scope of the curriculum. Education using distance technologies can fill this gap by conducting classes of various forms through information and telecommunication networks [5].

This article identifies the problems and substantiates the directions for the development of distance learning technologies in the training of personnel. An example of using digital media to create a remote access laboratory is given.

2. Theoretical Consideration

In the context of global informatization, the tasks of training, education and certification of personnel acquire new features and opportunities.
The goal of improving education today is the widespread use of information and telecommunication technologies that allow achieve comprehensive openness, flexibility, individualization and continuity of education [2]. In such a system, the educational process is based on development of individual curricula and programs with a free choice of time, pace and place of study.

Fundamental difficulties in the implementation of open education most often arise in the system of natural science and technical education, since here full-fledged training of specialists is impossible without practical training of students in educational laboratories, and at the final stages of training - without involvement in scientific research. It is known that laboratory workshops are the most expensive type of educational process, requiring about 80% of all costs for the training of engineers for their implementation. The accelerating change of technology and the rapid development of technology inevitably lead to equally rapid obsolescence material and technical base for the educational process. The lack of laboratory equipment and limited access to it do not allow for the preparation training of highly qualified personnel at the modern level.
This circumstance is also connected with the fact that the funds allocated in the 80s ... 90s of the 20th century for the development of the material and technical base of universities turned out to be clearly insufficient. These funds were not enough not only to equip the laboratories with modern instruments and equipment, but also to maintain the technical stands that were already in the material and technical base providing the educational process.

The introduction of computerized and telecommunication technologies makes it possible to switch to distance learning (DL), which is a promising form of an open engineering education system. It is based on the use of modern information technologies, while it is necessary to use only those technologies that are most effective in teaching. When conducting distance learning, information technologies should provide:
- delivery to trainees of the main volume of the studied material;
- interactive interaction between students and teachers in the learning process;
- providing students with the opportunity of independent work on the assimilation of the studied material;
- assessment of the knowledge and skills of students obtained in the learning process.
However, there are at least three problems:
– the effectiveness of distance education (due to the territorial distribution of students and tutors);
– information and technological security of part-time students and information security of educational institutions of distance education (due to the fact that educational information and teaching methods, as a rule, are of a confidential, original and commercial nature);
- the quality of educational and methodological materials, and especially for engineering education as the most science-intensive and "equipment-intensive".
The quality (value) of educational information is understood as a set of internal and external properties of information that characterize the degree of its compliance with the needs (goals and values) of users (trainees, tutors, etc.)

The main issue in the development of educational and methodological materials should be considered the choice of criteria that they must meet in order to achieve the goal - without the participation of a teacher, to develop the student's level of mastering the content of the discipline to the level determined by the state educational standard of higher education [6].
The biggest problem for high-quality DL in engineering disciplines is the performance of laboratory work, since the development of a theoretical course of disciplines is accompanied by their obligatory passage, which allows [3]:
– develop the skills of independent work (fix the connection between theory and practice in the mind, contribute to a deep disclosure of the physical essence of theory issues and their assimilation);
- provide confirmation and illustration of the theory in experiments.

and sufficient to study the discipline and, as a rule, more than students perform in examination sessions with traditional distance learning technologies.
When performing laboratory work, students must:
- get acquainted with the working schemes of the installations;
- to study the design of machines and devices;
- get acquainted with the methods of testing and research, with the technique of experimentation;
- to learn how to work with devices;
– to analyze the received data;
- draw the necessary conclusions.

Virtual laboratory in the DL system. The use of virtual laboratories in the DL system partially removes the above problem [4]. When using virtual laboratories, the student sees on the screen various instruments, instrument arrows, controls, and even an image of the system under study, obtained using a web camera. However, can the image on a computer display be considered "real equipment" and how is it different from an imitation?
This dilemma raises the question: “Is it important for engineering education to experiment with real equipment, or are well-modeled systems sufficient”?
Moreover, sometimes the model provides much more opportunities for maneuvering the system parameters than real equipment, which is important for a comprehensive study of the system.
It is important to note that when performing virtual laboratory work, the student does not influence the object of study on his own assignment, does not make mistakes, does not learns from his own mistakes. He is only a passive observer of someone else's, professional, verified, error-free actions [8].

To date, the issue of large-scale introduction of virtual laboratories into the educational process, which are fully implemented by means of computer simulation instead of performing laboratory work on real physical stands, is being actively discussed. Most often, such a statement takes place in the study of fairly simple objects for which mathematical models adequately describe the processes under study. The absence of a mathematical model dictates the need for setting up an educational experimental study, which is mandatory in the training of a future technician, engineer, researcher-scientist. In the ideal formulation of the educational process in order to increase the efficiency of assimilation, it is obligatory order, each object of study within the academic discipline must be supplied with all the necessary components of theoretical, practical, model and experimental study. If the most important in this chain - the experiment - is absent, then a specialist will be released who can only model, but cannot measuring, working with equipment - a specialist who does not have practical skills in working with tools and equipment, i.e. not possessing metrological skills.

Remote access laboratory in the DL system. In connection with the intensive development of methods for using distance learning technologies in the educational process, the remote access laboratory is becoming increasingly important.
The subsequent use of remote access laboratories in the educational process in order to increase the level of practical training of students is very relevant for most universities. The use of such laboratories with the help of the Internet establishes communication channels between computers on real physical equipment for the conditions of the experiment and students' computers.
As a result, remote access to the object under study began to be used in pedagogical practice in the form of laboratories with remote access for engineering education. Today, the stand under study can be located within the walls of an educational institution, and a student can fully perform experimental tasks with the help of pens, levers and indicators on a personal computer screen. Performing laboratory work in this form allegedly excludes the direct physical contact of the student with the equipment of the stand and the impossibility of obtaining practical skills.
However, in this case, the student has the opportunity to conduct experiments on such stands and according to such methods that were previously inaccessible to him, and most importantly, to independently compose a scenario and set the experimental modes. In case of non-compliance with the methodology or making a mistake, he will receive information about this when his own experimental program will be subject to feasibility testing at a remote stand, which in real conditions can lead to equipment failure [5].
At the end of the experiment, the results are displayed to the remote user either in tabular or graphical form. After exiting monopoly mode control, the student can save them on his computer.

Therefore, learners should be able to access unique installations and laboratory resources of the university from any geographical point in multi-user mode and in real time. The need to create a of such laboratories is due to the fact that engineering education involves consolidating the material covered in the preparation of practitioners and researchers - scientists who have the skills to work with devices.
Remote access labs include a personal computer and a real lab setup. Laboratory work is carried out in the usual (full-time) way, and all changes that occur in the process of doing work with a real installation are set and displayed on the student's computer.
To implement this form of training, the use of special technical means is required, both for automating the experimental stand and for connecting the control computer with a remote user; development of specialized software, methodological support of the laboratory workshop [9]:
– remote users;
– main server;

– remote automated educational laboratories;
- computer centers and computer classes of universities.
Thus, the transition of teaching with the use of distance technologies to engineering disciplines is possible provided that remote real measurements and control of a physical experiment.
When creating a remote access laboratory, two main stages can be considered that allow you to organize the educational process in the most optimal way.

First stage. The creation of an automated information measuring and control system for an installation, stand or laboratory layout is a necessary condition for local automation of a remote access laboratory. This requires the use of special technical means - a control computer (laboratory server) connected to the stand through an interface device with the object [7, 10], various sensors and actuators, conversion and matching modules, etc.
The basis of the remote laboratory is a laboratory server, the connection of laboratory units to which is carried out by means of input / output devices installed either on its motherboards or connected via the corresponding ports (COM, USB).

The main requirements for any measuring device are the provision of input / output of information, data analysis and visualization of results. The main difference between virtual and traditional instruments is the flexibility in the construction of measuring systems, which are provided by the user depending on the requirements of the problem being solved, the computer platform used, the need saturation of the system.

Second phase. Providing remote access to the installation to a researcher or student. To do this, the local automated installation system is interfaced with the setevy and telecommunication resources (local, mobile, global networks).
The functioning of the remote access laboratory is carried out according to the client-server principle. Access of remote users (students or teachers) to laborator resources (LR) is carried out through the global network Internet.
Thus, to implement a remote access laboratory, it is necessary to ensure the transfer of data between remote users and the LR, as well as the management distributed LR. To manage the educational process within the framework of the remote access laboratory, it is necessary to integrate the system with the corporate educational process management system of the university.
The transmission must be provided in two sections:
– global network Internet (remote user – the main server of the system);
– the local computer network of the university (the main server of the university of the system is a laboratory resource).

The software (software) for the functioning of the remote access laboratory should, on the one hand, serve in an interactive mode the dialogue of the remote user with the main server when setting the conditions of the experiment, and on the other hand, implement the specified mode on the stand and broadcast the results of its execution on remote computer. In addition, the specialized software developed for the remote access laboratory should also provide methodological support for the laboratory.
ny works, i.e. description of the laboratory stand, measurement technique, various reference materials, etc. Obviously, most of the software is original, written in high-level languages specifically for this workshop; when creating it, for example, graphical programming tools can be used [8].
In the program algorithm, two large blocks can be distinguished:
– a block to support the work of the main server of the workshop;
– a block for providing communication between the main server of the workshop and the stand, performing the experiment according to the scenarios of remote users and broadcasting the results [7].
The telecommunications subsystem is implemented on the main server, and work with a remote user is carried out in the Internet/Internet network. The main server is connected to the laboratory server by a local network. Network support on the laboratory computer is carried out by the operating system, and all exchange operations with the stand through the interface device with the object occur through the resident program. This communication technology is much more flexible and efficient, and makes the main control and measurement operations virtually independent of the main server load and the number of users [12].

This eliminates the influence of random factors, for example, in the event of a break or disruption in the connection of the remote client with the main server, the laboratory server will continue to run the experiment according to the conditions specified by the user, and the bench operation mode will not be disturbed.

Conclusions

Thus, based on our research, we can identify the main conditions necessary for the implementation of the information and educational environment in parts of the implementation of distance learning technologies [3]:
1. Developed material and technical and information and methodological base. This includes the availability of software and a single server for distance learning of an educational institution, which hosts electronic educational and methodological complexes, which, in turn, includes a study schedule for a semester, a working curriculum for each of the disciplines, educational and methodological

materials for each discipline of the semester. It is also supposed to provide the means of such a server with the possibility of holding webinars, the availability of virtual laboratories for the needs of certain areas, specialties, etc.
2. Qualified teaching staff.
3. Regulatory and organizational base.
On the part of the student, respectively, it is necessary to have access to a personal computer with a set of necessary software and access to the Internet. To perform laboratory work in a remote access laboratory, you must have an Internet connection channel with a sufficiently high bandwidth.
It is necessary to highlight the main advantages of learning using distance learning technologies that were discovered in the course of our analysis:
1. They stimulate the cognitive activity of the student himself, which, in turn, correlates with the competency-based approach [13-17].
2. Allow to be trained outside of professional activities the student, thus giving him the opportunity to receive education in another specialty or to improve the level of his professional qualifications.
3. Solve the problem of the lack of distance learning full-time forms of conducting classes, allowing you to organize remotely various forms of conducting classes, including interactive ones.

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