PRACTICAL WAYS TO IMPROVE THE QUALITY OF DISTANCE EDUCATION OF METROLOGY SPECIALISTS

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Abstract

The work aims to study the areas of improving the quality of distance learning of metrology specialists. The main measures for assessing the quality of education at the Odessa State Academy of Technical Regulation and Quality are shown. There is also a review of the work of scientists in the field of improving distance education. The results of research on the quality of training of students in the field of metrology by distance form are presented. Ways to improve the quality of mastering theoretical material for metrologists are shown. The types of virtual laboratory works that are appropriate for the acquisition of practical skills in conducting distance learning are highlighted. The use of virtual laboratory works based on the case method is substantiated. Generalized practical ways to improve the quality of education in the distance form of training of metrology specialists are presented.

Keywords*: distance learning, quality of education, online classes, practical training, virtual laboratory work, case method*.

JEL Classification: D83, M53, P36, P46 Z29, Y80

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1. Introduction

Given the intensive development of distance education in Ukraine and around the world, the issue of quality assurance training has become particularly important. Solving the problem of the quality of higher education is an important priority of any state and an object of scientific research. In the absence of the possibility to conduct courses, ensuring the quality of education through online courses requires the search for additional opportunities and new ways of conducting online courses. In this regard, the search for new and effective ways to provide practical training in distance learning is becoming particularly important.

The degree of scientific approach and its reflection in the literature. Studies of innovation in education, including new advances in online learning, show that the search for new approaches to modern learning has been studied by many researchers. This is evidenced by the intensity of research in this

direction. Their level of training and demand on the labor market is an indicator of the effectiveness and quality of education, so the study of this issue is of considerable scientific interest. Researchers around the world are involved in research to improve the quality of distance education. Thus, one of the outstanding foreign scientists in distance education were Moore M., Clark A, Delling R, Keegan D. Well-known Ukrainian scientists involved in research in this field are A. Zabolotsky, A. Khutorsky, O. Andreev, I Kozubovska and others. One of the most important indicators of the company, as well as the potential development in the future is to ensure the quality of manufactured products. The main direction of product quality assurance is metrological control at all stages of the product life cycle - from design to disposal.

Thus, due to the significant impact of metrological control on product quality, it is necessary to train metrologists who perform technical control, use in their professional activities information and measurement techniques, familiar with control methods and familiar with the legal framework in the field of production. However, there is no research on the distance learning methods of metrology specialists, especially their practical training.

2. Data sources and methods used

The development of practical training methods for metrology specialists is of great methodological importance due to the need for daily use in educational activities and maintaining in competitive market conditions the quality of education at the appropriate level, in accordance with DSTU ISO 9001: 2015 [1] and Standards and recommendations on quality assurance in the European Higher Education Area (ESG) [2].

Among the methods of assessing the quality of training is an analytical method that allows you to operate on the data of observation and experiment. The development of practical training methods for metrology specialists has an important methodological significance associated with the need to further develop the quality of education. The training of high-level specialists is also important in distance learning. If the company hires a specialist who does not meet the company's requirements, with an unsatisfactory state of theoretical and basic practical training, it is primarily the responsibility of the higher education institution. Therefore, an important element of the quality of education is the timely identification of ways to improve the quality of distance education.

3. The statement of the problem and the results obtained

The evaluation of the practical training is done first of all by the analytical method. The Odessa State Academy for Regulation and Technical Quality (ODATRYA) regularly conducts quality control of higher education students through the current, final and rector's control over residual knowledge, as well as state certification of students [3]. The current control is performed periodically, in accordance with the work programs of the academic disciplines. The final control takes place once a semester. Rector's control of residual knowledge is carried out once a school year, including as necessary. State certification of higher education applicants is carried out once in accordance with the curriculum. The result of the inspection is the compliance of the obtained indicators with the normative activity indicators in percentage form.

The quality control of the independent work of the students, the quality of the practical and laboratory hours in ODATRYA is performed 2-3 times per semester. The results of the control are discussed at departmental meetings. The control over the students' internships is performed twice a year, and the results are taken into account at the meeting of the Academic Council. Once a semester, an analysis of students' participation in competitions, Olympics and research projects is performed.

It is important to provide education at the appropriate level to survey employers at the level of academy graduates, which takes place in ODATRYA once a year after graduation. The analysis of the satisfaction of the consumers of educational services is performed once a year based on 50% of the graduates surveyed from the total number. Also, once a year, an analysis of the results of the employment of graduates is performed.

Distance learning has not spread to the market of educational services in Ukraine. This is due to the lack of computerization, the low information ability of adult teachers, the lack of the internet and so on.

Distance learning platforms, video communications and messengers have become the main means of safe and effective communication with students. In [4] it is indicated that in the process of evolution of distance learning using cloud technologies, four models of cloud services have been formulated (Table 1).

Types of cloud services

Table 1

Types of differences	Differences
(Private cloud)	To serve an independent institution
(Community cloud)	For various organizations that adhere to the same principles of IT infrastructure
(Public cloud)	Public and created for large groups and different categories of users
(Hybrid cloud)	A combination of three previous models

Types of cloud differences

Private cloud - To serve an individual organization

Community cloud - For several organizations that adhere to the same principles of IT infrastructure

Public cloud - Public and created for large groups and different categories of users

Hybrid cloud - A combination of three previous models

In the paper [5], the author considers distance learning as a «basis for providing the student with free access to knowledge» and suggests choosing appropriate materials, changing the format of the content and clearly setting objectives and requirements.

In paper [6] the advantages of distance learning are determined, which are based on the analysis of the comparison, first of all, with classical education:

- advanced educational technologies;
- availability of information sources;
- individualization of training;
- convenient counseling system;
- democratic relations between student and teacher;
- convenient schedule and workplace.

The study [7] showed that the development of laboratory workshops leads to the replacement of analog information measuring devices with virtual measuring devices, the use of which is available via the Internet. The devices are created in the LabVIEW environment with the possibility to simulate virtual modeling and measurements. The study [8] presents the advantages of using virtual standards and the reference base in educational activity via the Internet. The authors' research [9] has shown that free digital e-textbooks are an important component of modern learning.

In the authors' research [10], it was established that distance learning requires the implementation of the educational and educational portal of the

educational institution. The main component of these portals should be the applied software products, databases, virtual library and other methodological materials that ensure the learning process.

The study [11, 12] shows that an effective educational tool for distance education is a personal website of the teacher, which is used as a basis for free access to educational, scientific and methodological materials. Studies [13] have shown that approximately 1 million students in distance education programs in the United States today; 32% of Americans prefer the Internet instead of full-time and part-time education, and 39% generally believe that the Internet will make the public useless. Research by the author of this paper has shown that 80% of metrology students consider a convenient distance learning system on the Moodle platform. It is located on the academy's website, has all the necessary teaching materials and means of communication. To perform practical work, 100% of students use guidelines and applications. Difficulties arise when it is necessary to conduct laboratory courses, which require the actual participation of the student in the work. It is important for a metrologist to be able to use control and measurement devices to perform measurements and perform calibration of measuring equipment (FTA). Currently, only a database of virtual standards is created for the possibility of FTA verification via the Internet. Expanding the base of virtual measuring instruments will allow future metrology specialists to acquire the ability to perform virtual calibrations and verifications.

As an example of productive laboratory courses in terms of the efficiency of acquiring theoretical knowledge on the subject of the lesson is the use in the educational process of virtual laboratory work, which is complemented by the ability to view videos about laboratory work.

In terms of acquiring practical skills, virtual lab work will be useful with the use of virtual measuring tools, which allows you to gain skills in making measurements and processing measurement results. Increasing the efficiency of basic practical training to meet employers' requirements will be a laboratory work based on the case method. This paper differs in that the future metrology specialist is in a specific situation simulated by the teacher. The student's task is to determine the correct solution to the production situation, to measure or calibrate according to the correct method and to obtain a positive result. Such courses bring the training as close as possible and adapt it to production needs. Among the indicators that characterize the ability of a graduate specialist in metrology to meet the requirements of the employer, the main one is the ability to learn. The main way to meet this requirement is the independent work of the student. The authors' research showed that 85% of students are able to study the lecture material independently, which

is allocated for independent study. This is due to the fact that the main source of information for young people is the internet. The teacher's task is to instill skills in finding materials from the profile of the future specialty during online courses through video links. The results of the survey showed that 90% of students consider the Zoom platform to be convenient for courses, which offers ample opportunities for interactive communication. As a result of the author's research on improving the online presentation of lecture material, it was found that in order to maintain the public's attention, it is necessary to conduct a survey every 3 minutes on the material presented during this period. There may be one or two questions in the «yes» or «no» format. The Zoom platform allows you to conduct such surveys. It will also be appropriate to use the Google form, the Viber questionnaire, etc. 4.20 Significant help in conducting online courses is provided by lesson videos. Visual inspection promotes better assimilation of the material. The survey showed that 95% of students are positive about completing the material with videos. It's a good idea to watch, for example, the «How It's Arranged» movie series created by Discovery. In particular, series such as «Thermometer», «Car scales», etc. are suitable for future metrologists. As training material you can use the «Chip and Dip» program series, especially «Units of measurement of the SI system in electronics», «Multimeters Mastech M830 series», «Multimeters arrows», «Measurement of microwave radiation» power «,» Measurements with multimeter «etc. The video materials of measuring instrument manufacturers and companies providing metrological services will be useful. 4.22 Among the areas that improve the quality of distance education should be those that meet the requirements: - employers to a modern specialist; - program - based on virtual measuring instruments, - available for perception, - have access to any gadget, - adapted for use in the production activities of the company 5. Conclusions 5.1 The task of a teacher in the field of metrology is to train a specialist whose knowledge and skills meet the modern requirements of the employer. to improve the quality of distance learning of metrology specialists are: the method of viewing the theoretical material, the use of the case method in setting tasks, the use of online questionnaires for lectures, virtual laboratory work, the study of calibration and verification techniques using virtual technology measuring instruments and virtual standards.

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