

Improving the training of employees of logging enterprises in the field of labor protection

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Abstract. The improvement of the traditional training system is currently relevant due to the complexity of technology and production processes, especially logging. Improving the effectiveness of training is possible due to the widespread use of digitalization of training. The purpose of the work is to determine the directions of application of new digital technologies to improve the effectiveness of training in the field of labor protection at logging enterprises. The use of electronic courses and multimedia technologies along with traditional training makes the learning process more informative, the use of electronic simulators and simulators allows you to work out practical working skills. The most modern teaching methods include the use of augmented and virtual reality technologies, artificial intelligence, which can significantly increase interest in learning and its effectiveness.

1 Introduction

Logging production is quite dangerous, therefore, the task of ensuring labor protection is an important task, on the solution of which depends not only the efficiency of the enterprise, but also the life and health of employees. However, the approach to solving labor protection problems is carried out by various methods and not always with the desired effect.

We live at a time when there is a transition to digitalization of all areas of human life: industry [1, 2], communications, banking, transport [3], healthcare [4], education and many others [5, 6, 7]. At the same time, there is a fundamental change in the concept of data acquisition, analysis, decision-making and use due to the introduction of Big data and Smart data technologies, the use of artificial intelligence and digital counterparts of products and processes [8, 9].

Slowly, but inevitably, digital technologies have come to forestry enterprises, from the simple use of digital maps, there is a transition to the integrated digitalization of all technological processes related to forestry [10], the widespread use of databases [11], as well as the computerization of logging machines - harvesters, forwarders, primarily the queue of

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the world's leading companies, such as PONSSE, KOMATSU, JOHN DEER, managing their maintenance and repair [12].

As the analysis of the works showed [13, 14, 15, 16, 17], the logging process continues to be a dangerous production, this is typical for both European countries and all others. Conducting routine training is becoming insufficient to exclude cases of occupational injury, a search for new training methods is needed.

The purpose of the work is to determine the directions of application of new digital technologies to improve the effectiveness of training in the field of labor protection at logging enterprises.

2 Materials and methods

The article considers the main trends in the field of digitalization of training in the field of labor protection at a logging enterprise, associated with an increase in the efficiency of the training process. A number of works of Russian and foreign researchers concerning the issues of improving the effectiveness of training, including the use of new digital technologies on the example of a forest complex, are analyzed.

3 Results and discussion

The process of acquiring knowledge and skills requires attention and high motivation from trainees, therefore, a constant search is being conducted for new techniques and learning tools that will increase interest in obtaining knowledge, as well as diversify the learning process, making it more interesting and realistic, which is achieved by using digital technologies (Figure 1).

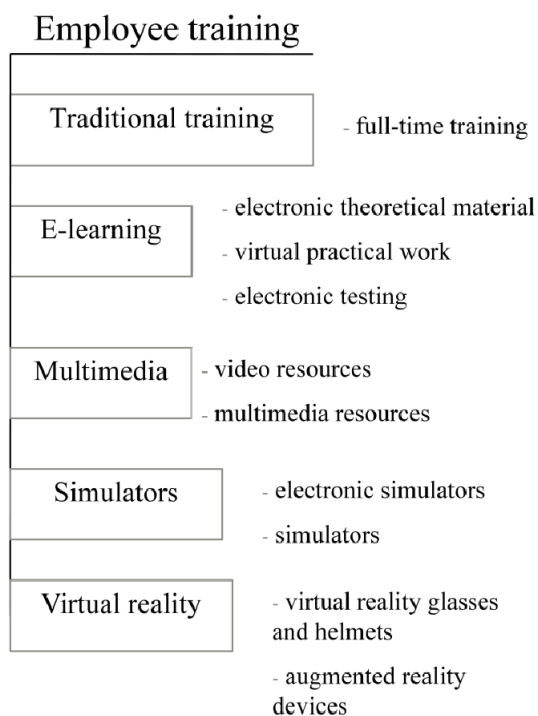


Fig. 1. Application of information technologies in the field of education.

The use of information technologies, along with or in addition to traditional (full-time) training, allows you to diversify the learning process, making it more interesting and memorable.

The use of e-courses allows you to organize access not only to theoretical educational materials in the on-line mode and then control the studied material through electronic testing, for example in the Moodle distance learning system [18, 19], but also to organize the performance of virtual practical and laboratory work.

It is known that a person receives the greatest amount of information through vision, therefore, multimedia presentations and videos can be used to visually represent the studied material. The most famous and largest repository of video information is the service [youtube.com](https://www.youtube.com) [20], which allows you to organize the download of the author's video material and access to it.

However, using only theoretical material and video is not enough, it is necessary to acquire skills related to practical work on equipment. However, when training on complex equipment, for example, a harvester or forwarder, it is expensive and quite dangerous. To obtain initial work skills, it is advisable to use various electronic simulators and simulators. For example, leading manufacturers of logging equipment, such as JOHNDEERE, POUNCE, KOMATSU use their own simulators for training [21], and electronic game simulators have also been developed (Figure 2). The use of electronic simulators and simulators allows you to learn the basic techniques of effective and safe work, reduce the time spent on real training, so they are used in different fields of activity.



Fig. 2. Logging equipment simulator: a – 3D simulator; b - personal computer simulator.

The combination of ordinary and virtual reality makes it possible to operate all human senses (Figure 3), to achieve the highest efficiency of learning [22], without being exposed to real danger. Thus, the research results of a number of authors [14, 15, 16] indicate that during logging there is a fairly large number of accidents associated, as a rule, with violations of the rules of safe operation due to both neglect of safety regulations and ordinary forgetfulness, this is especially characteristic during logging with gasoline-powered saws. The use of virtual reality technologies allows both to gain safe work skills and to quickly restore them after a long break [23, 24].

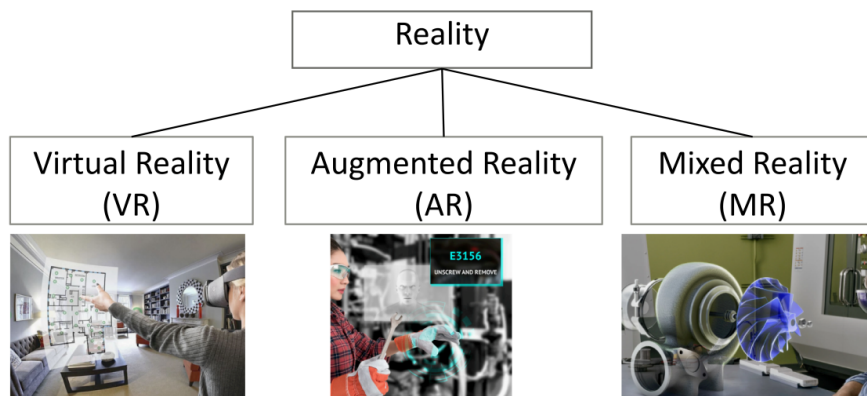


Fig. 3. Types of virtual reality technologies.

Considering the main types of virtual reality technologies, it should be noted that the easiest way for learning purposes can be implemented through VR glasses that allow the learner to be completely transferred to the virtual world, disconnected from reality.

The use of augmented reality (AR) technology allows you to impose a projection or hologram on the real world, for example, but there is no possibility to interact with everything that happens in reality.

The most advanced technology that allows you to combine real and virtual objects into a single whole is the technology of mixed reality (MR), for example, when assembling complex glasses, they will be able to design missing parts and show where to put them according to the type of instructions, which dramatically reduces the possibility of incorrect installation of the product.

It should be noted that work on the creation of virtual reality systems is actively developing in many countries, including the Russian Federation. For example, the INLINE GROUP company is developing a domestic augmented reality software platform "IKSAR" in combination with AR-glasses for use at timber enterprises (Figure 4). The employees used a standard helmet with monocular and binocular AR-glasses attached to it with the loaded IKSAR software and configured processes, thanks to which the employee saw step-by-step operations on the screen of AR-glasses in accordance with the company's work regulations.



Fig. 4. Testing of the Russian augmented reality software platform "IKSAR" with AR-glasses.

The use of artificial intelligence to control the skills of safe and effective work of an employee will help to achieve high productivity in the absence of occupational injuries.

4 Conclusion

Digitalization is one of the main directions of development, including in the field of improving the training of employees of forestry enterprises. Electronic courses that duplicate traditional training or expand the possibilities of traditional training, allow you to quickly test the theoretical knowledge of employees of enterprises. The use of multimedia technologies makes it possible to make the learning process more spectacular and memorable. The use of various electronic simulators and simulators allows you to speed up the learning process and acquire the necessary practical skills. The use of augmented and virtual reality technology for teaching allows you to bring the learning process to a new, more advanced.

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