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Electronic course development for future engineers training

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Abstract. Due to the necessity of implementing the requirements of the Federal State Educational Standard, there is a need to use electronic information in educational environment. The article considered creation of an electronic course in the context of blended learning, since this approach seems to be one of the most effective, bringing better results. The educational process in this case is based on integration and blending of traditional and e-learning technologies. Materials were placed in the electronic educational environment Moodle. Objective: to identify features of the development of an electronic course for future engineers. A training scheme how to blend traditional model and e-learning is introduced. The recommendations on the selection of educational material are provided. For the 1st year students whose major is engineering and construction control of the teacher and is extremely important. Thus, an electronic course of «Basics of Geology» was developed to combine blended learning and traditional approach. Special recommendations for creating such a course are developed. A scenario for the development of the training course consisting of several stages is proposed. We have analyzed the implementation of this course into practice.

1 Introduction

Today, there is a tendency in the world to use electronic educational resources, which is caused by the need to increase mobility and independence of students. Electronic information in educational environment in Russia should be used according to the Federal State Educational Standard.

In 2016, the Government of Russia established the Project “Modern Digital Educational Environment in Russia”. Its goal was to create conditions for improving the quality and expanding the possibilities of continuing education for all citizens through the development of the digital educational space. Note that the “National Open Education Platform” is being implemented within the framework of this project.

The implementation of the “Modern Digital Educational Environment in the Russian Federation” shows that the number of training platforms is growing, there are several of them. Online courses are numerous. To choose a suitable course is quite difficult. Therefore, higher educational institutions should pay attention to the development of internal university courses in specific disciplines. With the transition to the federal state educational standards of a new generation, the time of classroom pressure has decreased and the number of independent work of students has increased [1]. This trend may adversely affect students whose first year training requires constant practice and teacher control [2]. We have identified future engineers for whom the e-course will allow implementing the principle of virtual academic mobility by providing high-quality educational content (statistical texts with a large number of illustrations and explanations, video lectures with demonstrations of technical processes in dynamics, files with additional information and buildings, final tests), while there is a necessity to provide teachers as well.

2 Methodology



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We considered the tools of electronic courses and developed special recommendations for its creation. The practice of using the course of the discipline «Fundamentals of Geology» is analyzed.

The developed e-course was tested for students whose major is «Construction». According to the students' achievements who were trained the help of this course, a survey was conducted in which students answered the following questions: «Did the course contribute to better learning?», «Would you like to use this course in further education?» 80% of students answered positively. In addition, final testing showed higher results of than before the introduction of the course. The students noted the advantage of being able to control the level of their achievements at any stage of the study of the course, as well as the positive effect of constant access to necessary materials.

3 Results and discussions

Experts emphasize the use of:

- traditional learning (without using any electronic technologies);
- blended learning (Blended-learning, part of the courses implemented in the network, combined learning) [3];
- full online learning (does not provide for full-time interaction between the teacher and students).

We will consider the creation of an electronic course in the framework of blended learning, where it serves as an auxiliary element [4].

The educational process in this case is based on the integration of traditional and e-learning technologies [5]. E-learning can take up to 80% of the time. With the reduction of classroom activities, they are replaced by the electronic environment [6].

A well-organized electronic training course is not only a place for storing contents, but also a means for interaction between a teacher and a student, as well as a means of accompanying the educational process [7].

Course development should not begin with finding the right content and developing it, but with defining the planned learning outcomes. Next, the teaching strategy is determined scenarios of interaction between students and teachers for maximum involvement of the first ones in the educational process. Selection and structuring of educational content occurs at the last stage [8].

The organization of the course in an electronic environment occurs so that the order of the key components of the educational process becomes different. The traditional teaching model assumes that at the beginning the presentation and explanation of materials in the classroom conditions and the performance of tasks and the consolidation of the material goes to extracurricular work, and verification and control again takes place in the classroom, then using e-learning, the process begins with the problem statement. Then the student independently acquaints himself with the educational material located on the e-learning course and with the materials of open educational resources predetermined by the teacher [9]. The student conducts self-control understanding of the content. Thus, the activity of the student begins with independent work, but takes place in an environment with the participation of the teacher. In the classroom, a teacher helps a student clarify understanding and discuss assignments [10]. Then there is a demand to provide the automated control of learning outcomes [11].

We recommend the following scenario development course. At the first stage the following actions are performed:

- this is the design of learning outcomes. It is necessary to formulate the results of training in the discipline as a whole, and then structure it into separate thematic sections [12];
- development of assessment tools (a system for assessing the achievement of initially planned results by students) [13];
- this is a selection of educational content.

The teacher needs to select educational resources on the Internet that could be used on the course (audio-video materials, graphics, electronic textbooks) [14]. The collected content is best structured into subsections with intermediate control in the form of testing [15]. Note that the time to study the

subsection should be no more than 15 minutes. 45-60 minutes are allocated for mastering disciplinary knowledge [16].

The second stage is devoted to the placement of content according to the requirements for the structure of sections of the electronic course in the electronic educational environment Moodle [17]. We speak about this environment because it has a number of advantages over the others and is most often used by higher educational institutions [18]. The structure of the e-course in Moodle should have the following elements:

- a section where information is reflected throughout the course as a whole, where a glossary, a forum, a brief description of the course can be located;

Figure 1 presents a section on the subject «Fundamentals of Geology» for students in the direction of training «Vocational training», the profile «Construction».

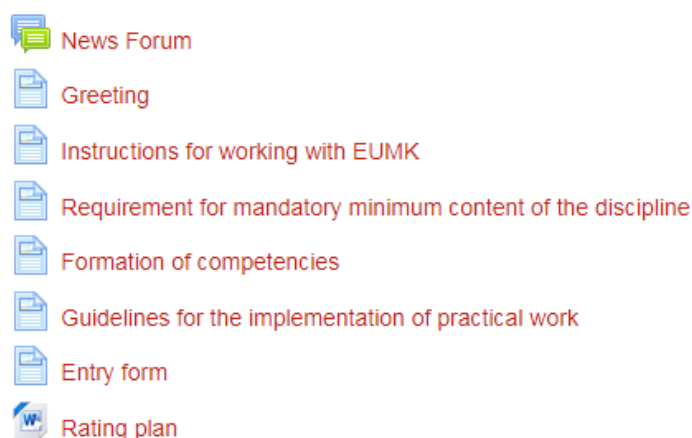


Figure 1. Elements of the electronic course on the discipline «Fundamentals of Geology», located on the platform «Moodle»

The teacher provides information using the tools of the platform at his discretion [19]. The main thing is that the student can understand what this discipline is for and how to approach the performance of tasks. Future engineers, thus, receive full awareness of the discipline and competencies that they can acquire after passing it.

- theme sections (there should also be educational materials on topics) [20];

For the engineering discipline «Fundamentals of Geology» one of these sections is as follows.

Theoretical Foundations of Engineering Geology

This section provides a full theoretical course of discipline, expressed the basic concepts and definitions necessary for the formation of certain knowledge and skills of the student.

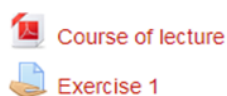


Figure 2. Section on the discipline «Fundamentals of Geology» - section with materials of the final assessment event

Final testing

This section provides tests to test knowledge of this discipline.

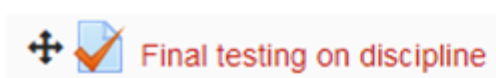


Figure 3. Final testing on the electronic platform Moodle on the discipline «Fundamentals of Geology»

Training material should be selected according to the following criteria:

- ensuring the disclosure of all the themes of the program of the academic discipline while maintaining intra-subject and interdisciplinary communication;

- reliability of materials;

- compliance of materials with the current state of the studied science.

At the same time it is necessary to observe the methodical principles

- output of information for better memorization and assimilation of material by students;

- the sequence of presentation of information (educational material is organized in such a way that when studying new topics briefly repeated previous ones);

- the use of problematic style of presentation in the preparation of tasks;

- the construction of tasks should be made taking into account the future profession of students. In our case of engineers, for example, to establish methods of dealing with the negative influence of geological processes and phenomena on the engineering and geological properties of soils or engineering structures;

- design materials in the same style;

- the use of hypertexts in educational material (hyperlinks can be made to various illustrations, multimedia information - audio recordings and video sequences, additional materials, educational and scientific literature).

For each assignment, guidelines for their implementation are developed and indicators and evaluation criteria are specified [21].

To increase the validity of the assessment of learning outcomes for the assignment, it is recommended to use a certain period of time between attempts [22]. For example, the second attempt may be granted no earlier than 24 hours.

The third stage is approbation. At this stage, various kinds of errors are identified. The course can be tested by colleagues to identify critical comments, as well as by the students themselves [23].

The e-course on the discipline «Fundamentals of Geology» was originally introduced in addition to the traditional teaching of the discipline for a group of engineering-construction students of the 1st course to identify the degree of their learning of the educational material. According to the results of mastering the discipline with the use of this course, a survey was conducted in which students answered the following questions: «Did the course contribute to better learning?», «Would you like to use this course in further education?» 80% of students answered positively. In addition, final testing showed higher results of mastering the discipline than before the introduction of the course. The students themselves point out the advantages of being able to control the level of mastering the material at any stage of the study of the discipline, the positive effect of the ability to constantly update the content and the quick availability of the necessary materials.

4 Conclusions

In the process of work, we highlighted the features of the development of an electronic course for future engineers in the context of blended learning. The presented recommendations will help teachers

to navigate in creating a course. The results of a survey conducted after the students graduated from the course «Basics of Geology» allowed to conclude that there is a necessity to introduce an e-course as an addition to traditional engineering education.

E-courses allow you to make future engineers more mobile, independent, give them the freedom to manifest their creative component and as a result help to form a graduate who is ready to carry out their professional activities.

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