

Department of educational process in conditions of implementation of interactive training of future engineers

Departamento de proceso educativo en condiciones de implementación de formación interactiva de futuros ingenieros

Departamento de processo educacional em condições de implementação de treinamento interativo de engenheiros futuros

Recibido: 16 de enero de 2019. Aceptado: 06 de febrero de 2019

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Abstract

Because of the established new socio-economic situation in the country that led to changes in the sphere of education, there is a need for modernization of education based on information technologies. One of the most important in this situation is interactive training. The new model of the student "learner", in contrast to the "learner", requires searching for actual ways of managing the educational process. Both the teacher and the student in the modern educational process should be equal, however, the teacher is assigned a leading role and he must manage the learning process without going beyond the subject-subject relationship.

The purpose of the article is to consider practical experience of managing educational process in conditions of application of interactive technologies in the training of engineers.

The article explores the interactive course, located on the electronic platform Moodle for a more complete study of the management of training of engineering students.

The variant of application of interactive technologies in Nizhny Novgorod State Pedagogical University named after Kozma Minin is offered at an auditor and extracurricular

Resumen

Debido a la nueva situación socioeconómica establecida en el país que llevó a cambios en la esfera de la educación, existe una necesidad de modernización de la educación basada en las tecnologías de la información. Uno de los más importantes en esta situación es la formación interactiva. El nuevo modelo del estudiante "aprendiz", en contraste con el "aprendiz", requiere la búsqueda de formas reales de gestionar el proceso educativo. Tanto el docente como el alumno en el proceso educativo moderno deben ser iguales; sin embargo, se le asigna un papel de liderazgo y debe gestionar el proceso de aprendizaje sin ir más allá de la relación sujeto-sujeto.

El propósito del artículo es considerar la experiencia práctica de administrar el proceso educativo en condiciones de aplicación de tecnologías interactivas en la capacitación de ingenieros.

El artículo explora el curso interactivo, ubicado en la plataforma electrónica Moodle para un estudio más completo de la gestión de la formación de estudiantes de ingeniería.

La variante de la aplicación de tecnologías interactivas en la Universidad Pedagógica Estatal

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independent studying by students of a theoretical material. The results of real pedagogical practice are presented. It is indicated that in the course of work methods such as problem lectures, problem seminars, group discussions on various topics, brainstorming, a round table, case-tasks, simulation exercises, trainings, business games are used.

The article shows the real practice of using Moodle at the university. The tools are shown with the help of which the teacher can manage the activities of the student, adjust his training.

Keywords: Interactive training, graduate, vocational training, student, competence, competence approach, Moodle, engineer.

de Nizhny Novgorod, llamada así por KozmaMinin, se ofrece a un auditor y un estudio extracurricular independiente realizado por estudiantes de un material teórico. Se presentan los resultados de la práctica pedagógica real. Se indica que en el curso de los métodos de trabajo tales como conferencias de problemas, seminarios de problemas, discusiones de grupo sobre diversos temas, lluvia de ideas, una mesa redonda, tareas de casos, ejercicios de simulación, entrenamientos, juegos de negocios se utilizan.

El artículo muestra la práctica real de usar Moodle en la universidad. Las herramientas se muestran con la ayuda de la cual el profesor puede gestionar las actividades del alumno, ajustar su formación.

Palabras claves: entrenamiento interactivo, posgrado, entrenamiento vocacional, estudiante, competencia, enfoque de competencia, Moodle, ingeniero.

Resumo

Devido à nova situação socioeconômica estabelecida no país, que levou a mudanças na esfera da educação, há necessidade de modernização da educação baseada nas tecnologias da informação. Um dos mais importantes nessa situação é o treinamento interativo. O novo modelo de "aprendiz" estudantil, em contraste com o "aprendiz", requer a busca de formas reais de gerenciar o processo educacional. Tanto o professor quanto o aluno no processo educacional moderno devem ser iguais; no entanto, ele é atribuído a um papel de liderança e deve gerenciar o processo de aprendizagem sem ir além da relação sujeito-sujeito.

O objetivo do artigo é considerar a experiência prática de gerenciar o processo educacional em condições de aplicação de tecnologias interativas na formação de engenheiros.

O artigo explora o curso interativo, localizado na plataforma eletrônica do Moodle, para um estudo mais completo do gerenciamento de treinamento de estudantes de engenharia.

A variante da aplicação de tecnologias interativas na Universidade Pedagógica Estado de Nizhny Novgorod, nomeado para KozmaMinin, ofereceu um auditor e um estudo extracurricular independente por estudantes de material teórico. Os resultados da prática pedagógica real são apresentados. É indicado que, no decorrer de métodos de trabalho, tais como conferências de problemas, seminários de problemas, discussões em grupo sobre vários tópicos, brainstorming, uma mesa redonda, tarefas de casos, exercícios de simulação, treinamentos, jogos de negócios são usar.

O artigo mostra a prática real de usar o Moodle na universidade. As ferramentas são mostradas com a ajuda de que o professor pode gerenciar as atividades do aluno, ajustar seu treinamento.

Palavras-chave: treinamento interativo, pós-graduação, formação profissional, estudante, competição, abordagem de competência, Moodle, engenheiro.

Introduction

In the world, engineering personnel are in demand that are capable of independently taking weighted and responsible decisions that can solve problems in an unconventional way, however, the existing training system is not sufficiently focused on the formation of this type

of specialist. Attention is paid to this problem at the state level. Thus, the document "Priorities of state policy in vocational education for the period until 2020 ..." establishes the need to implement educational programs in accordance with the requirements of employers, students and taking

into account economic development (Arkhipova et al, 2017).

Modern educational paradigm is built on a competence approach that requires extensive use of active and interactive methods in the learning process. It should be noted that recently the interactive approach in higher education of the Russian Federation is used quite actively, therefore the management of the educational process acquires a certain specificity.

Consider the experience of managing the educational process with the help of various electronic educational platforms. For starters, it's worth pointing to the Blackboard, a flexible, open electronic system that allows the teacher to organize courses for the remote learning and management of student learning. However, it allows to organize work in the classroom.

WebCT is a whole system of virtual learning systems on the Internet, designed for higher educational institutions (Vaganova et al, 2018).

However, most universities use Moodle, trusting this platform as the most reliable and convenient, which helps to implement interactive teaching methods.

In Nizhny Novgorod State Pedagogical University named after KozmaMinin, interactive methods based on the electronic platform Moodle are successfully used in the process of teaching students. Moodle is a course management system or a virtual learning environment that is a web application with the ability to create sites for online learning.

Methodology

Since physics is one of the fundamental disciplines in engineering education, we have considered the goals that students need to

achieve in studying it and the elements that students need to master for achieving these goals qualitatively. In order for students to be as effective as possible, it is suggested to use interactive teaching technologies that increase the independence of students in the performance of assignments. To this end, detailed curricula have been developed with a list of innovative forms and methods of work aimed at enhancing the independent work of students in both classroom and non-auditoriums. In out-of-class studies, the tasks are solved, preparation for laboratory and practical studies, work with training and controlling electronic resources.

The article shows the development of a map of the application of interactive technologies in the process of studying the material on the discipline "Physics". With the introduction of these methods there is support for the independent work of students.

As some of the results of the educational practice implemented in physics classes, it should be pointed out that despite the students' positive attitude toward the proposed research topics, few students took up their implementation, motivating it with congestion in other disciplines. Therefore, it is advisable to abandon the practice of planning design-research assignments for each discipline separately.

Results

The question of the application of interactive techniques was considered by scientists from different points of view of different approaches. Teachers of building disciplines note the important role of interactive technologies in the development of critical thinking of students. Table I shows the approaches that can be applied in the training of engineering students.

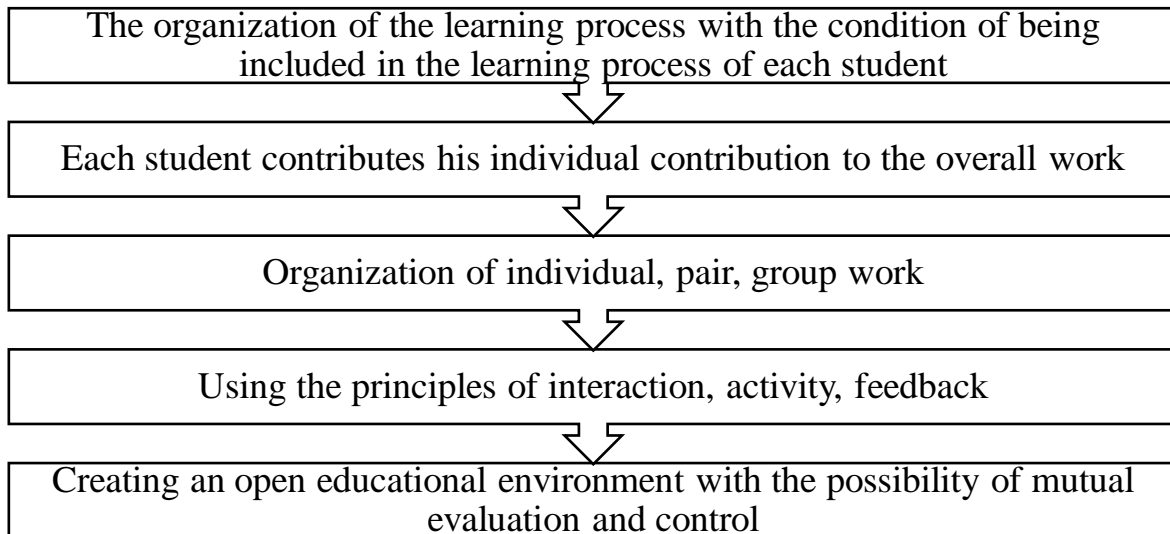
Table I: Features of the application of different approaches to interactive learning (Ilaltdinova et al, 2017)

| Name of the approach | Application features |
|----------------------|---|
| Mathematical | - Increase intellectual activity of students; - activation and development of critical thinking; |

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- Leadership development
 - activation of students' thinking;
 - intensification of the learning process;
 - acquisition by students of practical skills in identifying the problem and working out proposals for its solution
 - regulation of the student's relationship with the team;
- Economic
- emotional response and modification of experiences;
 - acceptance of the feelings and opinions of other people
 - unity of theory and practice;
 - the formation of social experience;
- Psychological
- Self-development, self-realization in the team;
 - Developing their creative abilities to learners;
 - Formation of social experience
 - analysis of specific situations;
- System
- organization of collective work on the project;
 - ability to solve problems constructively
- Situational
-

It is worth considering the stages on which the interactive teaching methodology is based.

Figure 1- Stages serving as the basis for the interactive methodology (Manikandan&Muthumeenakshi, 2018)



With interactive training in classes on engineering graphics, several methods are used:

- methods of demonstration. Here, visual support is used in the form of graphical representations of concepts on a plane. Students perform tasks of a variable nature (drawings) using computer graphics (Markova et al, 2017);
- use of cognitive-reproductive and stimulating-searching binary method. Due to this, the teacher encourages the student to perform mental and objective actions in three-dimensional space (Ilyashenko, 2018).








- After the student fulfills the task, the teacher can check it and correct the shortcomings (Kutepov et al, 2017).

Managing the teaching process of the teacher is much more convenient through an electronic system. We have already mentioned the Moodle system.

In Nizhny Novgorod State Pedagogical University named after KozmaMinin there are materials on the researched electronic platform for students to complete the third year of calculation and graphic works. Here, too, there are the necessary tools for managing student learning.

Figure 2- Moodle tools for managing the training of engineering students

Модуль 1. Основы расчета строительных конструкций

-  Лекция 1
-  Лекция 2
-  Итоговый тест по модулю 1
-  Мини-опрос
-  Индивидуальное задание №1
-  Конструктивные схемы зданий
-  Классификация зданий и сооружений.

As you can see in Figure 2, the teacher gives the material in the form of lectures, after which the student is asked to take a test and a mini-survey, and then it is necessary to perform an individual

task. With the help of such tools the educator can check the executed work with greater speed and react to it, competently and productively managing the process.

In the management of the training process in the training of engineers, these methods are used.

Table 2- Classification of interactive methods (Ajeenkya&Patil, 2014)

| Name | Виды |
|--------------|-------------------------------------|
| Imitational | Problem Lectures |
| | Problem seminars |
| | Group discussions on various topics |
| | Brainstorm |
| Imitation | Round table |
| | Case-quest |
| - not a game | Simulation exercises |
| | Trainings |
| - game | Business games |

A problem lecture is one of the interactive methods that raises the problem, the tense situation that the teacher solves directly in the

process of presenting the topic, involving students in the course of events, thereby activating their cognitive activities.

The problem seminar, in contrast to the problem lecture, assumes an even greater activity of students. Now the teacher only gives the task of a problem nature, however, he retains the role of the manager of the entire process. And with his leading position he speaks with students on equal terms. Students can freely express their views and suggest solutions to the problem.

Group discussions on various topics allow the teacher to understand whether students are able to interact with each other and to express their opinion reasonably.

The influence of the teacher on a group of students using the method of brainstorming is minimal. First, students offer a variety of solutions to the task without any criticism, take into account the most absurd ideas. In the process of work, students themselves are eliminating the wrong viewpoints. The role of the teacher is consulting.

The method of the round table creates a creative and relaxed atmosphere in the classroom. Discussion of topics often takes place with the use of multimedia presentations (Nemova et al, 2016). The teacher when choosing a topic for the holistic, diversified development of students takes into account their interests.

Case studies form the skills of self-management, effective work with information (Ilyashenko et al, 2018). Students learn to plan their actions. Speaking about training, it is worth pointing out that it takes about 20-25 people (this is the optimal number of participants). All students should be involved in active activities throughout the training (Vaganova et al, 2017). Training usually includes three stages: an information block, development of practical skills and summing up (Markova et al, 2017). At the first stage the material is presented as a lecture accompanied by a presentation. Here theoretical knowledge is provided (Bicheva & Filatova, 2017). At the second stage, students can gain some practical experience. We take into account that any knowledge should be combined with practical skills. The third stage is the final stage, where students can be given the opportunity to fill in questionnaires to reveal their attitude to training, its effectiveness (Ilyashenko et al, 2018).

Simulation exercises are characterized by the fact that the teacher knows in advance the best solution to the problem. There is no need for

long-term studies (Ilyashenko et al, 2018). The answers can be individual or collective.

During business games, the teacher immerses the students in a situation that is close to that which can arise in professional conditions. Such a system is monitored and corrected by the teacher, since the procedure for the game is prepared in advance by him (Smirnova et al, 2017). The teacher may not interfere at all in the game relationship, but only observe, while exercising the necessary control to achieve the objectives of the session and preserve the focus of the game (Ilyashenko et al, 2018).

All these methods can be used in the process of training students as engineers as a tool to optimize their activities (Barber et al, 2013). Applying these methods, the teacher manages the learning process according to the current situation that has appeared in education: "The teacher not only transfers a certain amount of knowledge and skills, but acts as a consultant when the students perform their tasks independently"

(AygulZufarovnalbatova&Viktorovnalppolitova, 2018). However, the teacher does not lose the role of the process manager.

Each of the methods has its own characteristics and leads to different results, so it is advisable to use them together (Braine, 2013).

Next, we will consider the course "Physics" as one of the fundamental in engineering education. The methods we have considered can also be used in this course. Consider the possibilities of managing the educational process using the example of physics courses. This includes:

- acquisition by students of the necessary knowledge for the performance of engineering tasks;
- formation of general cultural and professional competences in the students (great attention is paid to the project-implementation activity) (Bulaeva et al, 2017);
- Forming students a holistic natural-scientific worldview with a single approach to the study of phenomena (Vandergrift, 2007).
- To achieve these goals, students in the course of the course need:
- master fundamental concepts, study laws and theories of modern and classical physics (Markova et al, 2017);

- to get skills of conducting a physical experiment;
- use the capabilities of the physical and mathematical apparatus and apply the basic concepts of laws and physical models to solve problems that may arise in the course of professional activity (Smirnova et al, 2017).

In order for students to be as effective as possible, it is suggested to use interactive teaching technologies that increase the independence of students in the performance of assignments. To this end, detailed curricula have

been developed with a list of innovative forms and methods of work aimed at enhancing the independent work of students in both classroom and non-auditoriums. In out-of-class studies, the tasks are solved, preparation for laboratory and practical studies, work with training and controlling electronic resources.

Table 3 shows the development of a map of the application of interactive technologies in the process of studying the material in the discipline "Physics". With the introduction of these methods there is support for the independent work of students.

Table 3 - Fragment of the map of the application of interactive technologies in the process of studying the material on the discipline "Physics"

| A week | Mastery of theoretical material in classroom study | Method of work in the classroom | Theoretical material for extracurricular study | Tasks for independent work of students outside the classroom |
|--------|--|---|---|--|
| 1 | Introduction. Kinematics (lecture) | | Rotational motion | Make a table of the relationship between the characteristics of the translational and rotational motion Creation of a basic synopsis on the theme |
| 2 | Curvilinear motion | Brainstorm | Dynamics of a material point | "Dynamics of a material point" |
| 3 | Dynamics of a material point | Conversation, discussion | Non-inertial reference frames | Independent summary |
| 4 | Individual tasks on dynamics | The method of the analysis of concrete situations | Job. Energy | Prepare a report with a presentation on "Work and Energy" |
| 5 | Job. Energy | Conducting, protecting and discussing presentations | The impact of absolutely elastic and inelastic bodies | Functional summary |
| 6 | Beat absolutely elastic and inelastic bodies. | Individual tasks. The method of the analysis of concrete situations | Dynamics of a rigid body | Independent summary |

| | | | | |
|----|--------------------------------------|--|--|---|
| 7 | Dynamics of a rigid body | Individual tasks. The method of the analysis of concrete situations | Dynamics of a rigid body | Filling a table on the dynamics of a solid body |
| 8 | Dynamics of a rigid body | Individual tasks. The method of the analysis of concrete situations | Elements of the mechanics of liquids | Reading of educational literature |
| 9 | Elements of the mechanics of liquids | The method of the analysis of concrete situations | Deformation of a solid | Identify factors that affect the amount of deformation |
| 10 | Deformation of a solid | Presentation of design and research works on deformation of a rigid body | Fundamentals of the special theory of relativity | Selection of material on the topic: the paradoxes of the special theory of relativity |

Such methods as the solution of individual problems and the analysis of specific situations maximize the development of students' independence, which they can show in the process of carrying out subsequent assignments. In the process of using the method of brainstorming, thematic discussion, the performance of student design and research, the teacher acts as an expert and mentor, manages the learning process.

In the training of engineering students, design and research work is important. The package of project assignments consists of a list of proposed design and research works and a project passport. The passport must be filled by students together with the teacher. The students of the first courses do not have sufficient knowledge about the project activity, therefore, in the organization of the educational process, not so much the design work was done, as much as the design and research work. Bachelor students in the first semester were offered the following sample topics for the assignment:

- study of the motion of a solid body;
- study of the mechanical properties of the material;
- investigation of transport phenomena using the example of thermal conductivity.

As a result, it should be noted that students studying on the developed map became more independent, less addressed to the instructor for step-by-step instruction, more skillfully used the information provided.

Also, despite the students' interest in the proposed research topics, few students took up their implementation, motivating it with congestion in other disciplines. Therefore, it is advisable to abandon the practice of planning design-research assignments for each discipline separately.

Conclusions

We have considered practical experience of managing the educational process in the conditions of application of interactive technologies in the training of engineers. Despite the increase in the proportion of independent work of students, practice shows that the necessary, qualitative educational process is the organizing, directing, analytical participation of the teacher. The management of the educational process using interactive methods can be carried out both in the classroom and outside it, using the electronic platform Moodle. We believe that Moodle, as a tool for managing the educational process, is an extremely important and necessary element. The presented development of the map of the application of interactive technologies in the process of studying the material on the discipline "Physics" allows to optimize the educational process for the formation of independent highly qualified engineers. Interactive technologies allow students to formulate independent decision-making skills, develop their creative component, and become more mobile and active.

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