Compendium as a means of teaching mathematics in the context of distance learning

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Abstract. The article discusses one of the problems of higher educational institutions associated with the allocation of a small number of classroom hours for the study of the discipline "Mathematics". One of the ways to solve this problem is to use the experience of teachers of the Department of Mathematics of one of the universities, who have developed a compendium to help students of engineering specialties. The sections of mathematics for which the compendium was created are presented, as well as the composition of the compendium. Attention is drawn to the introduction of new information technologies in the learning process in the form of an educational and information complex, which includes an electronic textbook, virtual interactive sites for individual sections and a testing system. It is proposed to use the section of personal monitoring "Tester", designed to assess the quality of the knowledge gained on the topic studied.

Keywords: compendium, mathematics, typical calculation, educational information complex, electronic textbook, interactive website, tester, bank of tests.

Introduction

At present, in higher educational institutions of Russia, the classroom load in the disciplines of the compulsory part, in particular, the natural sciences, is allocated an extremely small number of hours, while the share of independent work of students has significantly increased [2]. In this regard, the teachers of the Department of Mathematics of the St. Petersburg State Marine Technical University (SPbSMTU) have developed a compendium on the discipline "Mathematics", addressed to students of all areas of training of engineering specialties.

Purpose of the study - to show the benefits of the correct organization and systematization of the material, taking into account the specifications of the higher educational institution on the example of creating a compendium on the discipline "Mathematics".

Materials and methods

The compendium was developed on the basis of a course of lectures delivered at the SPbSMTU by teachers of the Department of Mathematics. Compared to a course of lectures focused on a certain number of hours, the compendium is distinguished by a more detailed presentation of the material and a large number of analyzed typical problems. This makes it accessible for independent study and contributes to a deeper mastering of mathematics by students.

The compendium includes the development of electronic lecture notes for all sections of the course "Mathematics":

1) elements of linear algebra;

2) vector algebra;

3) analytical geometry;

4) theory of limits;

5) differential calculus of functions of one variable;

6) integral calculus of functions of one variable;

7) differential calculus of functions of several variables;

8) rows, Fourier series;

9) differential equations;

10) multiple, curvilinear and surface integrals;

11) field theory;

12) theory of functions of a complex variable;

13) operational calculation;

14) probability theory and mathematical statistics.

Each section of the compendium is issued in the form of a separate brochure, which contains a thematic plan of the corresponding semester, extracts from the calendar of lectures and practical classes on this topic, a theoretical section, which is essentially a textbook, control questions on the studied topic and a list of questions included in the examination material. tickets. For self-control of the knowledge gained in the compendium there is a training test based on the materials of the studied topic, consisting of questions with multiple answers. At the end of the brochure is a list of recommended reading for the Engineering Mathematics Curriculum, as well as the answers to the test.

The theoretical part of the manual is presented in the form of definitions, theorems with proofs and necessary remarks. The clarity of the theoretical material is provided by a large number of illustrations and practical tasks, which are presented with a detailed analysis.

Test tasks are formulated in such a way that the choice of an answer must be made from several suggested ones. In this case, some of the tasks refer to control questions on theoretical material, the purpose of which is to check the correct understanding of the theoretical foundations of the topic being studied. Another part of the test tasks requires the ability to apply the knowledge gained to solve practical problems. The wrong answers were chosen by the test authors not by chance, but taking into account the most probable mistakes of students.

In addition, standard calculations (individual tasks) have been developed for all the above sections of the course. Workbooks have been developed to aid in performing these sample

calculations as supplementary literature. At the beginning of the workbook, a zero version of a typical calculation is given, and then a detailed solution of each task included in this typical calculation is given. In addition, before solving each example in the workbook, a short theoretical material on this topic is offered, which, of course, helps in the solution process and speeds up the process of finding the necessary theoretical material. At the end of each workbook, 30 options for typical calculations are given. This number of options is quite enough to ensure that there is no overlap of options in each group of students, since the average number of students in a group is on average 25 people.

In addition, new information technologies of education have been introduced into the educational process. For the organization of independent work of students in the discipline "Mathematics" in SPbSMTU developed an educational and information complex, which includes an electronic textbook, virtual interactive sites for separate sections and a testing system.

The electronic textbook contains all sections of the mathematics course 1, 2 and 3 semesters of the curriculum. It contains a theoretical part, presented in lectures, as well as a large number of tasks that illustrate the material presented and demonstrate its application in practice.

The menu system, additional menus, as well as various bookmarks and hyperlinks reflects the structure of the electronic textbook and makes it possible to study the discipline along various routes, starting with the section corresponding to the basic level of the user.

Analysis of typical problems can be carried out interactively, that is, the user first makes an attempt to solve the problem on his own and looks at the correct answer. If in this case difficulties arise, then he can view the solution by opening the corresponding window. The textbook is supplemented with an editor, which allows, if necessary, to make corrections or make additions.

On the basis of the developed electronic textbook for some of its sections, educational interactive sites have been made, which contain theoretical material in a brief form and are intended mainly for teaching the solution of typical problems in an interactive mode. Sites are provided with animation pictures and tips in pop-up windows. The training on the chosen topic in the educational environment "teacher - student - computer" ends with a control test.

The student's independent work with the electronic textbook is supplemented by the "Tester" section of personal monitoring, designed to assess the quality of the knowledge gained on the studied topic and to make the necessary adjustments in a timely manner, as well as to predict the results of subsequent control tests.

"Tester" is a software product that processes client requests and provides information to him using JAVA - SCRIPT technologies in HTML environment. The monitoring section is supplemented by a bank of tests for all sections of the course "Mathematics" [3].

Contacting the "Tester" is possible through the local network of the University, as well as through the Internet.

To monitor the quality of the knowledge gained for a group of students or for several groups, a shell has been developed for testing in a classroom equipped with computers. The shell includes:

• test base of tasks for the discipline "Mathematics", structured by sections of the course being studied and by the level of complexity;

• editor written on the basis of flash - technologies for editing and replenishing the test base;

• "Banker" software module for quick formation of the required test based on a client request from the database;

• "Statistics" software module, which performs statistical processing of test results.

Results and discussion

When teaching using an electronic textbook, students can independently determine the time and place of training, select sections of the curriculum of the educational material and the sequence of their study, as well as repeatedly study sections or topics from different sources until they fully assimilate this knowledge [1].

This development became especially relevant during a pandemic, when the learning process turned into a remote form. All the developed materials were immediately posted in the information system of the university and, thus, the teachers of the Department of Mathematics were able to continue the learning process without any problems in the new format.

All materials became available to students on the website of the Department of Mathematics, as well as in the Information Management System of the University (IMSU) of SPbSMTU.

Based on the order of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation dated September 20, 2021 No. 982 "IMSU" is included in the register of domestic software. IMSU is the authoring development of a team of employees of the information technology department SPbSMTU.

The platform digitizes scientific, educational and business processes - its modules contain information on the main activities of the university.

Conclusion

The developed compendium is addressed to both teachers of the Department of Mathematics to prepare for classes, and students for home independent work. This material can be considered in the form of additional literature used to study the discipline and perform individual tasks with its help, as well as to prepare for control tests of various types.

Due to the fall in the educational level of applicants and the inconsistency of their knowledge with the requirements of the university, the developed compendium designed to give deeper knowledge of the discipline of mathematics can be supplemented with material for repeating the school mathematics course in the volume in which knowledge is needed for further study of the mathematics course at the university. The systematization of the material must be carried out taking into account the specifications of the university.

Today, one of the most promising areas of education development is a combination of traditional and e-learning in the form of blended learning, defined as a purposeful process of transferring and assimilating knowledge, skills, skills and methods of cognitive activity, based on a combination of traditional, computer and distance learning technologies. Blended learning involves the rational use of study time, the adaptation of the educational process to the individual needs of each student, the diversification of knowledge sources, the use of flexible tools for diagnosing and monitoring educational achievements, organizing feedback and, as a result, increasing the productivity of students' educational activities. Blended learning as an innovative form of educational activity is a complex and dynamic learning that takes place under the influence of the conditions of the external and internal environment and the effectiveness of its functioning directly depends on the initial conditions. Compliance with these conditions allows you to determine the direction of development of blended learning and ensure its success [1].

References

1. Denisova D.A., Levanova N.G., Evgrafova I.V., Verkhovod A.S. Formation of cognitive activity of technical university students using elements of blended learning in the study of quantum physics. Revista Tempos e Espacos em Educacao, v. 14, n. 33, Universidade Federal de Sergipe, Brazil, 2021.
2. Evgrafova I.V. Interdisciplinary communications for engineering students. Proceedings of the International Conference. «Process Management and Scientific Developments». – United Kingdom, Melbourne, 2021, pp. 71-76.
3. Vasilyeva N.V., Grigoriev-Golubev V.V., Evgrafova I.V. On increasing the efficiency of software for electronic (E-learing) and mobile (M-learing) learning. Magazine: "Marine Intelligent Technologies". No. 2-1 (36). - SPb .: Publishing house. SEC MORINTECH LLC, 2017. pp. 75-80.