Types and Structures of Educational and Methodological Materials with Information Communicative Technology

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Annotation: The article describes the types and structures of innovative teaching materials with computer support, a class of practical training tools, as well as the functions and significance of virtual laboratories.

Keywords: Innovation, information, virtual laboratory, educational and methodical material, learning tools, multimedia.

Introduction

The creation of a virtual laboratory of innovative computer didactics required the consideration of both existing educational and methodological materials and the justification of new models of innovative didactic objects. Recently, in connection with the rapid development of information technology, a large number of innovative educational materials have been developed. A.I. Bashmakov [1] classify computer educational materials by the nature of the discipline, by the pedagogical tasks to be solved, by the breadth of coverage of the educational material, by the use of telecommunication technologies, by the forms of information presentation, by the nature of the model of the object or process under study, by the type of user interface, by the implementation intellectual functions.

The Main Part

Let us dwell in more detail on the division of computer training materials according to pedagogical tasks, according to which they are classified into means of theoretical, technological, practical training, as well as auxiliary and complex means.

The first class includes:

1. Computer textbook - a computer training tool for basic training in a specific course.
2. A computer-based learning system is used for basic training in one or more sections.
3. A computerized knowledge control system is used to determine the level of knowledge of a student in a given discipline, course, section, topic or fragment of the subject area and to assess it taking into account the established qualification requirements.

The class of means of practical training includes:

1) A computer problem book is used to develop skills and abilities for solving typical practical problems in a given subject area, as well as developing related abilities.

2) A computer simulator is used to develop the skills and abilities of a certain activity, as well as the development of related abilities.

The third class of aids includes computer educational and methodological materials that contribute to the solution of certain problems, but are insufficient to achieve the corresponding goals. These include:

- computer laboratory practice - is used to support automated laboratory work, in which the studied objects, processes and means of activity are investigated using experiments with their models;
- computer reference - a computer learning tool containing a reference information base on a particular discipline, course, topic or a fragment of the subject area and providing the possibility of its use in the educational process;
- Multimedia training session - a computer training tool, the main content of which is a multimedia recording of a real training session. The class of complex means includes:
- computer training course - used to prepare for a specific course, which integrates functions or tools for solving the main tasks of theoretical, technological and practical training;
- a computer-based recovery course is used to restore knowledge and skills within a specific course, in which functions or tools are integrated that support different stages of the professional development process.

Analysis of the Literature on the Subject

T.L. Shaposhnikova [2] distinguishes the following types of software products for educational purposes: training programs, complex computer training materials, testing systems, multimedia lecture demonstrations, electronic textbooks, multimedia textbooks, virtual laboratories, and presentation systems, computer educational and methodological complexes. An analysis of these types of computer learning tools is given in the works of D.V. Iusa and E.I. Zhuzha [3].

Thematic tutorials are applied in streaming mode. In this mode, the transition from a simple component to a complex one is carried out, but at the same time, each component can be used independently of the previous one. These are multi-level training programs in which, depending on the training of the contingent of trainees, the level of information presentation varies. The authors come to the conclusion that the main ways of presenting information in computer training programs are textual and graphic. At the same time, color carries a certain information load, since the color scheme is used to highlight both textual and graphic information. In these software pedagogical products, the most diverse ways of functioning of educational information can be attributed: from a simple static image to animation.

Comprehensive computer training materials are a single set of training programs that are focused on mastering a large section. A software part is added to their structure, which allows you to navigate through the entire educational section [4].

Research Methodology

The pedagogical potential of these computer learning materials is complemented by more active independent work of students, automated access to laboratory work, and the possibility of using distance learning. Forms of presentation of educational • information do not change, and the mode of functioning of the software-pedagogical product is transformed from an autonomous one into a system one. It is characterized by both a meaningful connection of individual portions of information, and methodological, in which the same content is

interpreted in different forms (text, graphics, and educational experiment). Testing systems with interactive control tools are methodically interconnected with the first two types of software and pedagogical products, because they cover a toolkit that allows diagnosing the results of their application. In testing systems, the possibilities of knowledge control are significantly expanded.

Multimedia lecture demonstrations implement illustrative functions and are designed to accompany lectures. In them, illustrations can be shown both in the usual static, and in dynamic and cinematic modes. It is also possible to integrate sound accompaniment to these software pedagogical products. Electronic textbooks are clear and consistent. Ontological structure. At the same time, the software component is responsible for the ability to navigate within the textbook. As a rule, in electronic textbooks a complex structure of cross-references is used. In this case, the illustrative material is presented in a static form. The educational functions in multimedia textbooks are significantly expanding, since a set of multimedia technologies is added to all the structural elements of an electronic textbook. At the same time, it becomes possible to store large amounts of information, change and process it, remote access to other sources of information, and organize interactive communication with the student. As a result, all of the above contributes to the enrichment of their pedagogical functions.

Virtual laboratories are multifunctional computer training systems that include a set of virtual experiments with reference, calculation, testing and training components. With the help of virtual laboratories, students have the opportunity to study modern experimental facilities. Also, with the help of them, it is possible to organize various workshops and use mathematical methods for processing the results of the experiment. This type of training systems develops the skills of experimental work in students, demonstrating the role of practice in the formation of theory, which is the basis for verifying natural science theories and hypotheses. These computer learning materials are instrumentally based on the variety of forms of information presentation, the possibilities for its processing and functioning in the educational process.

Analysis and Results

Presentation systems usually consist of structured slides that reflect the main content and stages of work. Their main purpose is to briefly present the results of educational and research work. They can work in automatic and interactive modes. Computer educational and methodical complexes are multi-component software training tools that integrate many of the above computer educational materials into a single system and form a single semantic structure. The complexes may include multimedia - textbooks, virtual laboratories, training and testing systems, and thanks to this they contribute to bridging the gap between theoretical knowledge and their practical application. They are a universal means of teaching and allow you to organize the educational process, taking into account the psychological characteristics of students and the degree of their learning. Computer educational and methodological complexes use all forms of information presentation (text, graphics, color, sound), as well as all kinds of modes of its functioning.

Virtual Lab is interactive environment-based software for experiment simulation. The laboratory mainly focuses on experiments to demonstrate theoretical concepts. A simulation environment is designed to convey a sense of immersion, as if students were doing an experiment in the real world. The experiment can be implemented on the basis of an autonomous access application or on the basis of a web server and a web browser.

The virtual physics lab can be used in a variety of ways to revitalize the teaching of physics:

- as an animated board;
- as a virtual experiment to obtain typical data measurements;
- as an auxiliary curriculum;
- as a tool for qualitative research;
- as a demonstration of how to conduct an experiment to allow students to control real physical equipment in a laboratory;
- As a tool to expand knowledge about subjects and deepen understanding of students as well as teachers.
- as a reference encyclopedia of interactive experiments;
- as an inexpensive data recording package (using the microphone input of a sound card or mouse as an angle position sensor).

The main goal of developing the concept of a virtual laboratory is to complement a real physical laboratory in training. The main tasks of virtual laboratories are [8]:

- Reduce maintenance costs.
- Remote access to various virtual laboratories.
- Motivate students to conduct experiments in their own interests.

The main goal of the virtual laboratory is that the user can easily increase his knowledge and improve the application of fundamental concepts to practical work.

In addition to remote access, virtual laboratories can also be remotely configured, which allows each individual student to provide the necessary tasks and virtual models, with their settings as needed for specific practical exercises. A virtual laboratory can be designed in various ways depending on the program course for which it is intended. According to the study, in the case of skillful design, the laboratory should have such characteristics as configurability, scalability, cost-effectiveness, reliability, maintainability, and realism.

The laboratory must be very flexible and re-configurable. Different topics and tasks require different models. It is necessary to develop and add new ones.

The laboratory must be scalable and must be able to support many students. Student groups should not be large due to lack of resources.

The cost of installing and maintaining the laboratory should be much less than what is being modeled in the laboratory. For example, physical processes that require a large amount of equipment.

The laboratory should be able to withstand and handle unintentional student errors in actions during improper laboratory work.

According to methodological studies, a virtual laboratory should include:

- a module for simulating a laboratory experiment;
- control module;
- telecommunications module;
- identification module;
- training module;

- testing module;
- transaction accounting module;
- visualization module;
- module for maintaining electronic educational resources;
- Monitoring module.

Conclusion. So, the analysis of approaches to the typology of computer educational materials showed the lack of unity in solving this problem. At the same time, we consider the most optimal choice as the basis for the classification of these didactic objects of pedagogical tasks, the solution of which this or that object is aimed at. We rely on this approach when structuring the virtual laboratory of innovative computer didactics. The second important conclusion for solving the problems of our study is that all computer educational materials are based on the use of four forms of information presentation: textual, graphic, sound and color. At the same time, the modes of functioning of information can also be different - from statistical in a slide show of presentation systems to multimedia using dynamic video files and sound. This conclusion is important for designing interactive versions of the didactic objects of the virtual laboratory of innovative computer didactics.

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