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CHARACTERISTIC OF VIRTUAL LABORATORIES USED IN THE EDUCATIONAL PROCESS

***Abstract:** The article describes the types of virtual laboratories in which teaching and research equipment is replaced by means of mathematical modeling. In the educational process, it is important to use virtual laboratories for imitating the performance of laboratory work, modeling of physical processes, visual demonstration of the principles of operation of devices, testing the skills of controlling various equipment.*

***Key words:** virtual laboratory, simulation, educational process, virtual education space.*

***Аннотация:** В статье рассмотрены типы виртуальных лабораторий, в которых учебно-исследовательское оборудование заменено средствами математического моделирования. В учебно-образовательном процессе большое преимущество дает использование виртуальных лабораторий для имитационного выполнения лабораторных работ, моделирования физических процессов, для наглядной демонстрации принципов работы устройств и отработки навыков управления различным оборудованием.*

***Ключевые слова:** виртуальная лаборатория, симуляция, образовательный процесс, виртуальное образовательное пространство.*

Nowadays, it is established that the modern educational process is becoming more effective by using interactive, multimedia-rich educational resources that provide active teaching methods. In the best way, these requirements are met by educational resources and virtual reality systems. Examples of such electronic resources are virtual laboratories that can model the behavior of real-world objects in a computer-based learning environment and help students master new knowledge and skills in scientific and natural disciplines such as chemistry, physics, mathematics, computer science, and biology.

One of the goals of creating virtual laboratories is to strive for comprehensive visualization of the studied processes, and one of the main tasks is to provide the possibility of preparing the trainee for the fullest perception and understanding of their essence. Virtual laboratories contribute increasing the visibility, interactivity, as well as the formation of cognitive and creative activity of students.

Virtual laboratories allow to model objects and processes of the surrounding world, to organize access to real laboratory equipment.

The problems of using computer information technologies in the educational process are highlighted in the works of J. Fischer, R. Mitchell, etc., scientists were

involved in the creation and use of virtual laboratories: M. Kubo, R. Tori, C. Kirner, and many others.

When creating a virtual laboratory, you have to understand the issue of its definition. Analysis of various sources made it possible to identify the following concept: "The virtual laboratory is a complex set of tasks of any subject area, providing the student with virtual tools for creating and formalizing the condition of the task, the means of solving it and controlling the actions of students" [1, p.3].

The theoretical review of the creation of virtual laboratories has made it possible to single out a number of uses of virtual laboratories for remote access in education:

1. **Virtual laboratory "Transfusion"**, is specialized for solving problems that are based on the model of transfusion (or spillage) of the contents between vessels of a certain capacity. During the solution of problems, a "source" of liquid and "drain" are also permissible—that is, vessels of unlimited capacity, from which the contents of the "working" capacity can be filled or poured. The construction of the model includes the selection of the vessels needed for the solution, an indication of their capacitance, and a record of the short condition for solving the problem [2, p.210].

2. **Virtual laboratory "Crossings"**. In this virtual laboratory, the moments of ferrying of several characters on one ferry are modeled, within the framework of which some current restrictions are included. It is used in studying the topic: "Algorithms and their implementers of the form of recording algorithms, block diagrams."

3. **Virtual laboratory "Siding"**. In this laboratory, the main purpose of the work is essentially the sequence of transportation, which provides the sequence needed on the other side.

4. **Virtual laboratory "Black boxes"**. This laboratory is designed to solve problems to identify mathematical operations performed on numbers. Models inherent in the concept of "black box" - a device that has several inputs and one

output, and the formula for the work is unknown. To build a solution model, you need to select from the set of "black boxes" one that has the number of inputs (one, two or three) that is necessary, by the condition of the task. After that, in the "initial state" field, you must enter the values of the input variables. Inputs are defined by the letters of the Latin alphabet. Numbers corresponding to the values of variables are entered via comma. The "final state" field is filled in the same way.

The tasks of the virtual computer laboratory are:

- Mastering complex corporate and other software, performing its cycle of tasks for creating virtual servers: deploying and configuring software, and also using it on problem-oriented practical examples, which allow to form professional competencies and develop constructive, analytical and systemic thinking of students;
- Organization of research projects, involving the potential of leading IT companies;
- Introduction of the IBM open source products and information technologies in the educational process of the university, provided to the school / university within the framework of the academic initiative program for profile subjects / specialties and directions of graduates' preparation;
- Implementation of practical tasks within the framework of seminars;
- Providing the possibility of remote use of corporate software and other software used in the learning process, for self-training;
- Conducting training sessions;
- Preparation of schoolchildren, students and graduate students to participate in speeches at conferences and competitions at various levels with the publication of research results.

The use of virtual laboratories allows:

- Initiate a sufficiently large interest among schoolchildren, along with accessibility for them;

- Help to improve the effectiveness of conducting training sessions, the assimilation of teaching materials, as well as the effectiveness of training in general;

- Reduce the time spent preparing for lessons;
- Demonstrate during the lesson experiments that can not be put in real life;
- Organize an individual approach to the trainees [3, p.432].

A virtual experiment can be organized as follows:

- On the basis of the mathematical model of the under study process. During the experiment there is an imitation of the work of real laboratory equipment. The trainee has the impression that he works with real instruments and equipment (or their mock-ups).

- On the basis of real or industrial equipment with the possibility of remote access (for example, via Internet channels) to the object under study. In this case, the experiment is carried out in real time on a laboratory installation. The trainee is given the opportunity to set different mode characteristics, enable / disable the appropriate mechanisms, take data from the monitored devices and store them on his computer for the next processing [4, p.401].

A virtual laboratory can be organized for local use or a network option. One of the most important issues in the development of a virtual laboratory is the creation of a navigation system that is convenient for the learner. It should provide three main indicators:

First, the student's orientation within the given laboratory with a unique identification of the place where he got.

The second, a special reflection of those places of the laboratory, in which the student has already visited. For this, in general, it is used to highlight the visited links in a different color.

The third, providing the possibility for the student to visit those places of the laboratory, where he was not previously. In order to ensure this indicator of

navigation the most important is a clear and adequate representation of the overall structure of the entire virtual laboratory.

The most common three navigation strategies are: in width (displaying the upper levels of the structure), in depth displaying the full path to this page by the structure of the laboratory) and mixed.

The organization of good navigation can be provided only with a clear information architecture of the virtual laboratory. As a rule, it has a hierarchical character. In the development of information architecture, the problem of ensuring the information comfort of the learner when working in a given virtual laboratory should play a decisive role.

Such a service as "search" greatly simplifies the navigation of the learner while trying to find the necessary information. The search function should clearly define the area in which the information is searched, and be easily accessible on any page of the laboratory. It should be possible to expand the search for other similar laboratories, sites or known information retrieval systems.

The analysis allowed us to identify a number of reasons for the need to use virtual laboratories in the field of informatics:

- Virtual laboratories can be demonstrated in the classroom during training sessions, as additional material for study;
- The use of virtual laboratories increases the interest of students in the study of discipline;
- Increases the effectiveness of training in general, provides for both a group and individual approach to the student.

Use of the Virtual Laboratory in the educational process:

- Increases and stimulates students' interest in acquiring new knowledge, activates thought activity, thanks to interactivity, allows to effectively assimilate learning material.
- Students are given the opportunity to model and visualize processes that are difficult to demonstrate in reality, to conduct independently researching

materials published on the Internet for the preparation of reports and abstracts, thereby developing student self-esteem, self-assessment skills.

- There is attraction and training of students to search creative activity, imagination and model vision develops. Any computer training program is actually a model that reflects reality in the virtual world. The learner learns reality using a computer through conditional concepts and images.

- The use of electronic works contributes to the formation of information competence among students, they learn to interpret, systematize, critically evaluate and analyze the information received from the position of the task to be solved, draw reasoned conclusions, use the information obtained in planning and implementing their activities in a given situation, information, to present it in various forms and on various carriers adequate to their requests.

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