Improving The Quality of Learning Through Virtual Laboratory Work Use as Element

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ABSTRACT

The main objectives of laboratory classes are experimental verification of theoretical knowledge; the formation of practical skills and abilities when working with real physical objects and equipment; consolidate the skills of experimental research and processing of the results. To date, the preference is given to the use of traditional forms of laboratory practice using desktop laboratory work in higher education institutions, since they are usually simple and straightforward. The main feature of technical education is the organization and conduct of laboratory practice using real research equipment. Training of specialists of various profiles is impossible without organizing and conducting laboratory classes in basic (basic) subjects of vocational training. The importance of this type of education is confirmed by the current state educational standards.

| Keywords: | laboratory classes, educational standards, skills of experimental, |

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It is well known that traditional education is the most widespread and at the same time the most conservative education. Therefore, it must be recognized that the use of only laboratory (bench) work in training is outdated. Stand-up labs are the most financially expensive type of training, and it has been proven that its cost can

account for up to 80% of all training costs. In addition, technology change and the creation of electronic components is a very fast process, in which the renewal of the laboratory facilities is usually left behind.

The study of telecommunications devices and systems on real physical models requires expensive laboratory equipment and measuring instruments. Practice shows that the assembly of electrical circuits and the connection of measuring instruments takes 30% of the time allotted for laboratory work. However, when conducting this laboratory work, the following specific difficulties arise: a) laboratory work requires a large set of expensive equipment and modern measuring instruments; b) the results of the study are affected by incorrect connections, wire breaks, unreliability of measuring instruments, etc. c) the danger of overloading and failure of power supplies, measuring instruments; d) the impossibility of implementing emergency modes on equipment (stands).

Based on the foregoing, we provide information about the designers of virtual laboratories. Examples of virtual laboratories.

1. STAR virtual laboratory. STAR (Software Tools for Academics and Researchers) is the development program for virtual labs for research and teaching at the Massachusetts Institute of Technology. The program aims to develop curricula and research programs in general biology, biochemistry, genetics, hydrology. The main applications are implemented in java or html. Official website of the program: http://star.mit.edu.

- StarBiochem - 3D visualizer of protein molecules. Flexible and detailed configuration URL: http://star.mit.edu/biochem/index.html.

- StarGenetics is a simulation of hybridization processes that allows you to study the patterns of transmission of monogenic traits from generation to generation (Mendel's laws in genetics). URL: http://star.mit.edu/genetics/index.html

-StarORF. - Open Reading Frames English - ORF - Open Reading Frame - DNA or RNA strand units that can encode a protein URL: http://star.mit.edu/orf/index.html.

- StarMolSim is a series of developments that simulate the processes of molecular dynamics. Each development has a wide range of inputs and a wide range of outputs for similar analysis and exploration. URL: http://star.mit.edu/molsim/index.html

- StarBiogene - Collection of developments in the field of genetics. URL: http://star.mit.edu/biogene/index.html

- StarHydro - a model for modeling hydrological processes. (failed to start!). URL: http://star.mit.edu/hydro/index.html

- StarCluster - a set of tools for creating, configuring and managing clusters of virtual machines in the Amazon EC2 cloud web service URL: http://star.mit.edu/cluster/index.html.

Only specialists in the relevant field can evaluate these virtual laboratories, but we can say with confidence that they are distinguished by their fundamental nature, a wide range of tasks in a particular area, and rich development tools.

2. VirtuLab virtual laboratories. VirtuLab is a project to develop virtual laboratory works for students studying physics, chemistry, biology and ecology. Virtual laboratory work is performed using Flash technology. They are designed for a narrow specialization, often differ in the simplicity of the experiment (the sequence of experimental actions and results is predetermined). VirtualLab products are useful in the field of education and solve the problem of laboratory work in the absence of the necessary equipment. VirtuLab project website: http://www.virtulab.net/

3. Algodoo is a program designed for physical 2D modeling.

The program can simulate not only mechanical processes, but also optical processes, and using the Thyme scripting language, it creates an object with an original physical property, function performed by it, effects and events. You can also upload various drawings: the image becomes a simulation object and you can load the desired physical properties into it. The program is free. Official site http://www.algodoo.com/

4. PhET is a project developed by the University of Colorado. The project includes many virtual laboratories displaying various phenomena in physics, biology, chemistry, mathematics and geosciences. The experiments have a high educational value and are very interesting.

5. Wolfram demo project.

The purpose of the Wolfram Demo Project is to demonstrate modern concepts of science and technology.

6. The ChemCollective project is dedicated to the study of chemistry.

Virtual Lab: http://www.chemcollective.org/vlab/vlab.php. The peculiarity of the laboratory is that it does not have any functions, the user is given freedom of movement. Other products of the project are laboratory projects on some topics related to the departments of chemistry, such as stoichiometry, thermochemistry, theory of acids and bases, analytical chemistry.

7. The project of virtual laboratories Teachmen.ru was developed by specialists of the Chelyabinsk State University of the Russian Federation and is completely devoted to physics. In this project, in addition to laboratory work, you can also find lectures enriched with visual interactive elements.

8. Late Nite Labs is a series of paid virtual labs for chemistry, biology and microbiology. The usage fee is $50 per student from the start of the semester. Virtual laboratories are designed in 3D. Address: https://latenitelabs.com

9. ChemLab software for simulation of laboratory work.

Remote laboratories http://www.tstu.ru/science/seminar/ingobr/pdf/malygin.pdf

Labshare Institute (LBI) project address: http://www.labshare.edu.au

Labshare is a consortium formed at the initiative of 5 technical universities under the Australian Department of Education, Employment and Labor Relations. The goal of the project is to create a national network of remote laboratories.

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