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The role of computer modeling in training specialists of the food direction

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Abstract. Methods and tools, as well as platforms on which information technologies are implemented in the educational process, are now quite diverse. Their choice is closely related to the solving problems. Information technologies, realized in the form of virtual laboratory works, are indispensable tools for modeling situations in the absence of the possibility of their real reconstruction. Their use in the educational process develops creative thinking, raises the motivation to study the subject and forms the research culture of students. They are ideal for providing research work in universities. The use of virtual works solves not only the financial problems of the educational institution for the acquisition of the instrument base and reagents, but also ensures the safety of experiments with potentially dangerous objects. All the developments are oriented at the individual work of students and contain methodological materials that enable them to be used in a real educational process. Virtual laboratory works are used in most educational institutions in Russia, and their versions in other languages are the leading electronic resources abroad.

1. Introduction

The need for the use of information technologies in the educational process in the different spheres is unquestionable today. At the same time, it is obvious that the training of specialists in humanitarian specialties and technical specialists requires their own specifics. Yes, and there is hardly anyone who wants to visit a dentist who has virtually completed all practical classes in a remote mode.

Studies of the problems mentioned are being conducted in many educational institutions, both in our country and abroad. Certain difficulties are caused by the directions of training specialists who have enough time in the curriculum for traditional computer science. The authors devoted more than 10 years to the development and implementation of virtual laboratories in the educational process. Since January 2008, when the Coordination Center for the creation, implementation and dissemination of virtual laboratory works and virtual stands was established in accordance with the decision of the Governing Council of Interuniversity Complex Works "Innovative technologies of education" at the Ministry of Education and Science of the Russian Federation, a spring and autumn school for the exchange of experiences is held every year And conducting master classes in this area. Currently, they conducted on the basis of the MegaFaculty of Biotechnology Low Temperature Systems of the St. Petersburg National Research University of Information Technologies, Mechanics and Optics [1-3].
2. Carried out research and discussion of results
Within the framework of such cooperation, terminals with remote access have been implemented for Kaliningrad http://www.labrabru.narod.ru/kfbvmi/, Povolzhsky branch of MIIT, http://www.labrab.ru/pfmiiit/, Belgorod http://www.labrab.ru/bgsha/, Kamchatka State Technical University http://www.labrab.ru/KamchatGTU/ and other educational institutions [4-8].

The development of our team is based on the application package Adobe Flash CS3-5.

The accumulated experience in the development and operation of virtual workshops allows us to draw some conclusions when they can be used or not [4, 7, 9].

In the first courses take place so-called "leveling" of knowledge, the systematization of the information obtained in the school with the strengthening of certain accents characteristic for the subject area chosen by the particular university. Here virtual workshops are necessary, because with their help the teacher has the opportunity to create within the group or stream the platform necessary for him and his colleagues to transfer knowledge to students in the field of general professional disciplines. As a rule, applied mechanics and physics become courses for the use of virtual workshops [10, 11].

Below on Figure 1 and Figure 2 the possible options for such work are presented.

![Figure 1. Stretching of the steel sample](image1.png)

![Figure 2. Measurement of the level difference in communicating vessels](image2.png)

The processing of repeatedly performed experiments with the definition of mathematical expectation and dispersion fixes the student's basic concepts about the physical characteristics of solid
and liquid media and the laws of their variation. In the context of studying general professional disciplines, it is also appropriate to use virtual workshops at the stage of transferring information about objects to them in future, but in more specific conditions. For example, the loads which values are close to the operational.

An example of one of these workshops is shown on Figure 3. It shows the peculiarities of the behavior of the usual gaseous structures under specific conditions of their displacement.

![Figure 3. Gas flow through the Laval nozzle](image)

Figure 3. Gas flow through the Laval nozzle

![Figure 4. Investigation of the fluidization regime of drying coffee](image)

Figure 4. Investigation of the fluidization regime of drying coffee
Figure 4 shows a frame of a virtual workshop of another type. Despite the fact that it is intended to study the processes of heat and mass transfer in fairly common conditions of contact of a solid body with a gaseous structurest, in studying so-called fluidized, boiling or flowing layer, it can be hardly recommended for studying some fundamental positions without the availability of a teacher Real installation realizing this effect.

Assumptions or disregarding of some boundary conditions, or the corresponding analytical statements of individual specific problems, can lead to significant discrepancies in the theoretical and experimental results, and the student forming a false simplified scheme of really occurring processes. A compromise can be found when a student passes his production practice using one of such facilities [12].

In addition, we can distinguish two characteristic trends, which are followed by the processes of informatization of the educational process.

The first of these trends can be conditionally called "global informatization". Its main idea is that an initiative group of teachers using one of the platforms, implements in it, for example, certain test and measurement material as a means of training students before the exam or test.

Initially it performed for one of the specific disciplines. Convinced of the pedagogical effectiveness of the completed research, the same group (on its own initiative, at the request of colleagues or on contract terms) continues its activities for the same discipline, but for another educational program and, maybe, another university. With the passage of time information development and other purposes may get into the sphere of interest of this group: computer textbooks, virtual laboratory workshops, etc. The advantage of this approach is the comparative constancy of the members of the group and their profound possession of the subject which ensures high quality of electronic content [13, 14].

At the same time, from the point of view of distance learning, which, like all other forms of education, is structured as a whole set of educational disciplines, such an approach is hardly acceptable, since it makes it impossible to implement any of the educational programs completely remotely. In addition, implementing different disciplines on different platforms (if there are different groups of developers), the student also has to master different interfaces, which may not be part of his professional orientation within the chosen educational program.

It is advisable to test the second of tendencies of informatization of the educational process, which can be provisionally called "local informatization". The initiative group of one of the graduating departments, which must necessarily include a professional programmer, selects as a platform for computer modeling a certain package and makes an attempt to develop a series of virtual workshops on all courses of direction. In this case, it becomes possible to talk about a complete transition to a distance learning form, leaving the topic of block, semester or annual protection of the knowledge gained so far open [14, 15].

Summarizing the accumulated experience, it is possible to recommend the following sequence of performing virtual laboratory work in the disciplines on which a decision was made on their methodological expediency.

The virtual laboratory works can be performed according to the general scheme shown on Figure 5. You should first enter into the theoretical and methodological section of the page to learn the basics of the theory of this experiment, a schematic arrangement of a pilot plant, in a row of this lab, methods of preparation and measurement of experimental data and their subsequent processing – of settlements and construction of the necessary schedules. Only after examining of all questions of this section in detail, you can proceed to the next stage performance.

Its main goal is a virtual testing and, based on its positive results, obtaining an admission to the direct execution of virtual laboratory work. In the course of testing should be discussed not only the substantive issues of the topic, but also issues relating to rules of working on the facility.

As well as you give the correct answers for all five control questions from the random sample on this topic and collect the necessary 25 points the button "Continue to work performance" appears in
the lower right part of the testing field. For example, Figure 6 shows the testing program for laboratory work #1 in a state when the correct answers were given to all five questions.

![Diagram of virtual laboratory work](image)

**Figure 5.** Approximate order of virtual laboratory work

![Testing program for laboratory work 1](image)

**Figure 6.** A successfully completed testing program for laboratory work 1.

Otherwise, you will have to pass the test again by clicking the appeared button: "Repeat?"

Next, after clicking the button "Continue to work performance?" and finishing of loading of its figure, the initial picture of a virtual laboratory work appears on the monitor. In the upper left corner of the work there is the emblem of the University, at the bottom – the number and subject of this virtual laboratory work. When you hover over the word "Experience 1", you will see an information field with a detailed description of the theme and content of the work. After pressing and holding the left mouse button, a second information field with a brief instruction for using the virtual version of the lab work will appear.
In addition, in the field of each virtual laboratory work there is an oval reset button on the right below. By pressing this button, you can at any time bringing the laboratory work to its original state. But it will be impossible to restore its previous state.

The established procedure of switching to perform laboratory work through testing, the ability to output two information fields when the mouse pointer is placed on the word "Experience", and the ability to use the "reset" button at any time is common for all virtual laboratory work.

At the present time external studies and distance learning can be considered as successfully used to achieve the objectives of education using forms of virtual laboratory training [4].

The use of such forms involves the search for interactive teaching methods compensate for the lack of contact between the instructor and the learner, is successfully carried out using the statements described above.

The relevance of the search for such tools for higher education is also conditioned by the fact that in the bachelor's training programs, along with lecture and practical classes, an interactive workshop is necessarily included as a tool for the formation of professional competences [6].

If we consider laboratory practice as such an interactive kind of practice, then a number of difficulties arise. The performance of laboratory work is associated with the need for bachelors to attend a university. Since for bachelors who study in a distance form, as a rule, an individual schedule of the educational process is assigned, then the laboratory practical work has to be repeated several times, as the bachelors of the university attend. Increasing the creativity of the trainee and forming the necessary competences for him, therefore, connected with the search for funds that provide for the implementation of laboratory workshops at the place of residence of bachelors trained in distance form [7].

Within the framework of the described problems certain steps are being taken at the ITMO University to develop tools to provide the educational process in a remote form.

The concept and design principles are being improved, and a complete electronic educational resource of the distance learning system (DLS) is being developed, which includes both electronic textbooks and virtual laboratory work. This allows developing the existing network infrastructure and WEB-technologies of collective and individual work of students. The main result of the work is presented by the distance learning system (DLS) of master's programs in the direction 15.03.02 – Technological machines and equipment [8].

The realized principles of designing an electronic resource through a dedicated server provide extensive functionality and tools for integrating DLS into the system of other university educational portals. In the future the tools used by the server, in particular, the application pack-age CS-5, will allow to control the educational process in such a way that its quality indicators will meet the certification standards and standards developed on the basis of direct application of international ISO standards, technical specifications STU 115.005-2001, as well as the industry standard OST 9.2-98 "Educational technology for educational institutions. Systems of automated laboratory practice ». Special didactic properties of the electronic educational resource, which are expected to be implemented, will contribute to the improvement of interactive methods and forms of distance learning, increasing the creativity of trainees. At the present time most of the universities that implement the Master's programs of the direction of 15.04.02 – Technological machines and equipment, components of the electronic educational resource and their types for different types of training classes: theoretical course, practical and laboratory studies, as well as course and diploma design are heterogeneous and shared. In the process of working with some of these resources, for example, with virtual laboratory work and (or) lecture material, the generated data streams exchanged between the subjects of the client-server architecture dynamically.

In the resource the data itself separated from their representation and processing logic. Therefore, as an object of management the educational process is rather complicated. This object has been poorly studied from the standpoint of modern management theory and up to the present time there are no models of it aimed at solving situational management problems. The described concept determines the choice of principles for the optimal organization of SDS resource management in the class of multi-
user systems. At the same time, a number of tasks are supposed to be solved, such as the improving of general professional and special competencies. Especially valuable interactive electronic content is provided by the student's independent work, including various distance learning forms. The solution process can be concentrated in a dedicated server equipped with the functions of the control device of the SDS management system, for which a simulation model and computer implementation using original technologies is offered, as well as installing test and measurement aids on any remote PC. The specialized server is built as a modular structure, which makes it easy to expand its functions.

The cardinal difference between the development system and the known analogs is that it will allow creating mobile electronic content of the block autonomous structure with independent blocks that solve individual didactic tasks of 30-40 Kbytes in size. The management of the educational process is based on the results of the student's interactive impact on the electronic resource as an object of management, taking into account its features.

At the present time in our country great attention is given to the development of distance learning systems, on the one hand, by the Ministry of Science and Education, and on the other – by a number of leading educational institutions of the Russian Federation.

In the process of developing a system of training specialists in the above areas, ITMO conducted research on the specifics of the development of the educational space in the universities of Russia. A model and concept of training bachelors in these areas, as well as requirements for the material and technical basis of the training system and, in particular, the infrastructure of communication and computer networks of the department of general professional disciplines, the main link in general engineering training, have been formed. A concept for the development of network infrastructure and Internet technologies, including a distance learning system, has been developed in different areas of training. An experimental version of the electronic educational information resource has been developed, which is successfully used by a number of Russian universities of related profiles.

3. Conclusion
The generalized and analyzed experience of application of information technologies in university courses of general technical and special training indicates that it is advisable to introduce a large number of application packages into working plans for training non-programmers. Attempts to independently study the various packages of such programs, as a rule, are on the shoulder only for about half of the students who are subsequently employed for a job in the specialty that does not require knowledge of these programs.

At the same time, the study of a single object-oriented package of programs is simply necessary for a modern university graduate. And it's not that it can significantly help him in mastering the subject of future activity. Even ideas about the possibilities of programming in areas that seemingly far from mathematics, such as advertising and building websites will give him more extensive ideas about the possibilities of information technology in the digital economy. This is all the more important today because most of the graduates of schools already have certain knowledge in this field, and they are already necessary means of communication in modern society.

The authors are far from thinking that they solved the problem of rational use of information technologies in the educational process, but consider it necessary to recommend colleagues to analyze the effectiveness of applying modern pedagogical approaches within their courses.

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