

METHODS OF APPLYING VIRTUAL LABORATORIES IN TEACHING HYDRAULICS AND HEAT TECHNOLOGY

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ABSTRACT

This article systematically analyzes the theoretical foundations for enhancing the training of future teachers in the subject “Technologies”, which are the most important condition for today's educational field. The article explores the didactic opportunities to increase the motivation of students in the subject through the use of virtual laboratories in the educational process. Pedagogically based the development of guidelines for the formation and use of virtual laboratories in the process of teaching the subject “Hydraulics and Heat Engineering”, which is taught in universities in the direction 5112100 - Labor education. Recommended methods of creating a programmed electronic educational and methodical complex, which consists of: introduction, regulatory documents, lecture classes, practical and laboratory classes, virtual laboratories, independent work topics, presentations, animations, programmed control tests, keywords and terms, used literature, as well as information about the authors. Fresh ideas on the solution of current problems of the development of the education system and improving the efficiency of the development of the subject “Hydraulics and Heat Engineering” are presented.

Keywords: Educational system, hydraulics and heat technology, programmed electronic educational- methodical complex, Bernoulli equation, virtual laboratory.

INTRODUCTION

In present time, in the educational system, serious attention is being paid to such important tasks as: modern information technologies, the establishment and application of programmed educational tools, the complete satisfaction of the population's need for information, entry into the global information community, as well as creating favorable conditions for using world information resources.

This article, to a certain extent, serves the fulfillment of the tasks stipulated in the Decrees of the President of the Republic of Uzbekistan “On measures for the further development of the higher education system” from April 20, 2017 No. PP-2909; “On measures to further expand the participation of industries and spheres of the economy in improving the quality of training of specialists with higher education” dated 07.27.2017 for number PP-3151, as well as in the Decree of the President of the Republic of Uzbekistan “On measures to fundamentally improve conditions for the development of the information technology industry in the Republic ”of 30.06.2017 for the number UP-5099 and other regulatory documents relevant to this type of activity.

Effective use of preparatory works in creative activities are important factors that ensure the success of educational reforms in the formation of the competences of teaching future teachers of the subject “Technologies” on the basis of virtual education.

Based on the foregoing, it can be said that increasing the efficiency of the education system with the use of programmed electronic educational-methodical complexes require a number of tasks. Therefore, it is necessary to develop programmed electronic educational and methodological complexes and use them into practice, taking into consideration the choice of the sphere of education and analysis of existing problems.

LITERATURE REVIEW

For the further development of the system of lifelong education, the fulfillment of such tasks as increasing the availability of high-quality educational services to students, the training of qualified personnel is one of the innovative issues of today. The Strategy for Action in the five priority areas of development of Uzbekistan in 2017–2021 provides for continuation of the course for further improving the system of continuing education, increasing the availability of high-quality educational services, training highly qualified personnel, and also drastically improving the quality of general secondary education, deeply study important and required subjects [1].

Creating an e-educational sphere is as important as ensuring the integration of production, education and science.

The Law of the Republic of Uzbekistan “On Education” and the “National Program for Personnel Training” serve as an example of the great attention of the state to the improvement of the educational-up-bringing process [2,3].

From this point of view, based on the requirements of the “National Training Program”, one of the pressing issues is the professional training of future teachers of the subject “Technologies” with the aim of highly qualified training of the younger generation.

By a joint order dated March 7, 2002 No. 71/22/44 of the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan, the Ministry of Public Education of the Republic of Uzbekistan and the State Press Committee, the “Concept of creating a new generation of educational literature for the system of continuing education” provides for the definition of strategic the scale of the development of scientific ideas, ideological, psychological, pedagogical and methodological requirements for the creation of programmed electronic educational and methodological complexes; rational and purposeful use of programmed electronic educational and methodical complexes with the aim of accurate description and forms and types of their creation across the country [4].

Considering the above commenting on important tasks, it is easy to understand that training future teachers of the subject “Technologies” as highly intellectual, professionally mature, competitive, requires free-thinking teachers the creation of programmed electronic educational-methodical complexes [5].

V. Parondjanov in his work entitled “The Textbook of the XXI Century” states such thoughts: “The new generation of today must have modern knowledge and necessary information. We'll have to learn a huge amount of knowledge that is not comparable with the previous standards in the fields of natural, technical and social sciences and humanities. The methods of education, technology and educational literature of today's time do not meet these criteria” [6].

METHODOLOGY

Based on the method of analysis on the research topic, the scientific and methodological literature was systematically analyzed, advanced pedagogical methods were studied, and conclusions were combined. Based on the method of observation, the organization of the discipline “Hydraulics and Heat Engineering” conducted in the direction 5112100-Labor education in higher educational institutions, an observation of the process of conducting training sessions was conducted.

By the method of comparison, the didactic educational opportunities and the methodological foundations of the formation of the electronic educational complex programmed by the educational literature in the discipline “Hydraulics and Heat Engineering” were compared.

On the basis of the experimental method, the normative documents of higher education and the experiences of leading teachers were studied, virtual laboratory experimental works were organized and conducted on the basis of the programmed electronic educational and methodological complex in the discipline “Hydraulics and Heat Engineering” to students of group 4-1 MEH 17, direction 5112100-“Labor education” of Bukhara State University.

STATEMENT OF THE PROBLEM

Today, in the organization of laboratory and practical classes on discipline “Hydraulics and Heat Engineering” there is the problem of forming the material and technical base in the required level (lack of laboratory equipment). Existing teaching and laboratory audiences do not meet innovative requirements and are obsolete. Of course, this negatively affects the quality of education.

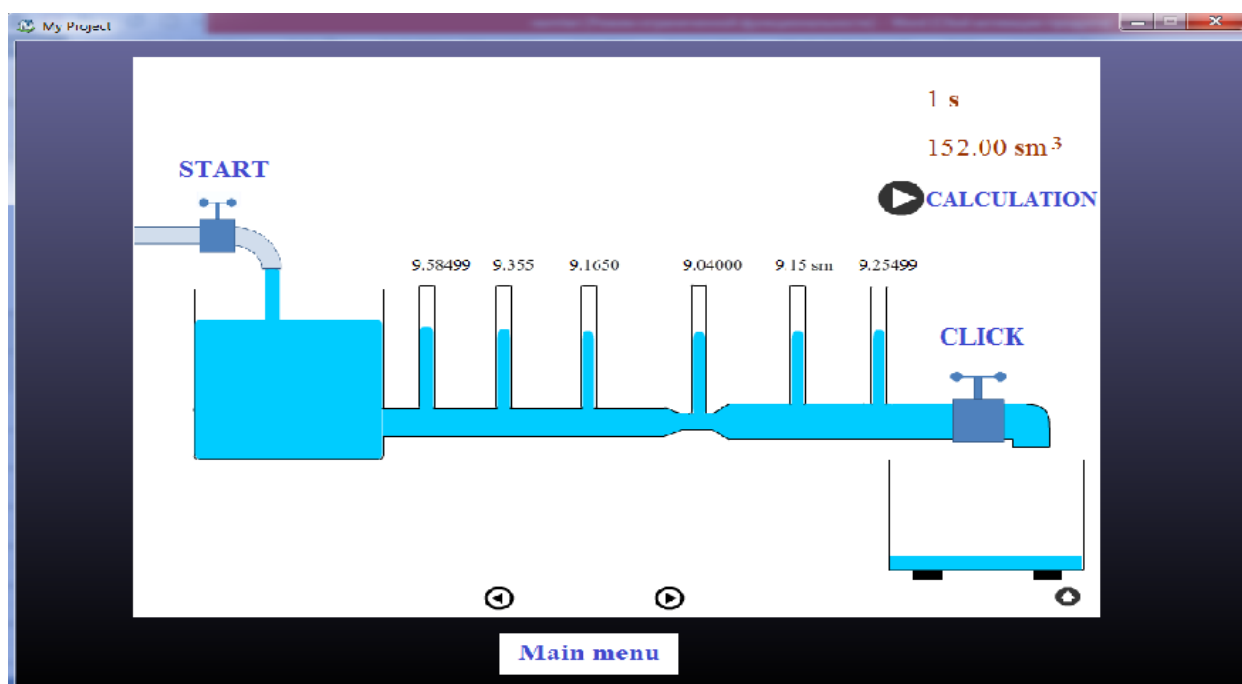
The problem of using virtual laboratories in teaching the subject “Hydraulics and Heat Engineering” is manifested in the fact that methodological bases of such training have not yet been developed, and those that have been developed are not of a mass nature and are not applied in the process of practical training.

RESULTS

This problem can be solved by creating a virtual education system by organically linking slides, training tools designed for teaching the discipline “Hydraulics and Thermal Engineering”, textbooks, tables, video films and others. A virtual database of education is made up of informational materials, which make it possible to illustrate in each topic [7].

The multimedia data catalog is related to precise topics based on the discipline’s curriculum. A teacher can use a single multimedia object to explain various topics [8]. For example: this may provide an opportunity for the exponential educational process of the discipline “Hydraulics and Heat Engineering”, because the content of this subject is related to the state of balance and movement of fluids, technical processes and objects [9].

Below are photos from the virtual-conducted process of laboratory classes (1-pic).



1-pic. Virtual process of studying the Bernoulli equation by conducting experiments.

To observe the process of studying the Bernoulli equation by conducting experiments, click the left mouse button on the “Start” point, after which a liquid flows from the tap into the container.

From the bottom of the tank, a liquid flows through the pipe and the level of the liquid rises in the tubes. Then, the left mouse button is pressed on the “Click” point. If you press once the liquid falls from the piezometric tubes into the cup measuring the level of the liquid. In this process, you can observe the difference of raising or lowering the fluid level. The last stage is pressing the “Calculation” button, this determines the results of virtual laboratory classes (1-2 tables).

1-table: Virtual laboratory tesometry indicators for the Bernoulli equation

Indicators of tesometry						V	t
$\frac{P_1}{\rho_g}$	$\frac{P_2}{\rho_g}$	$\frac{P_3}{\rho_g}$	$\frac{P_4}{\rho_g}$	$\frac{P_5}{\rho_g}$	$\frac{P_6}{\rho_g}$		
sm	sm	sm	sm	sm	sm	sm/s	s
8	7	6.1	5.6	6.1	8	900.00	10

2-table: The results of the virtual laboratory by the Bernoulli equation

№	Calculation amount	Quantity in sectional movement					
		I	II	III	IV	V	VI
1	Diameter of pipe D, sm	1.5 sm	1.5 sm	1.5 sm	1 sm	2.5 sm	2.5 sm
2	Section area ω , sm ²	1.77	1.77	1.77	0.79	4.91	4.91
3	Average speed v, sm /s	50.85	50.85	50.85	113.92	18.33	18.33
4	Specific kinetic energy	131.92	131.92	131.92	662.13	17.14	17.14
5	Specific kinetic energy	41.30	40.30	39.40	38.90	39.40	41.30

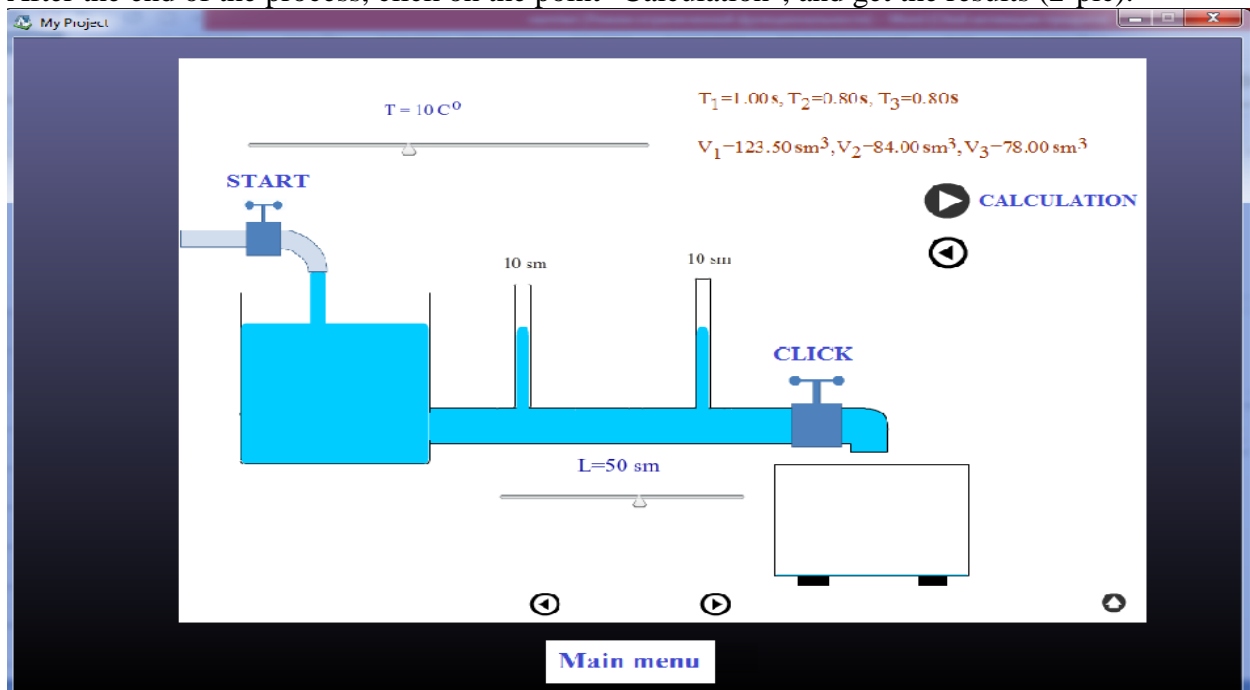
6	Total specific energy	173.8	172.8	171.9	709.5	56.6	58.5
7	Hydraulic losses h_w , sm	115.30					

In order to determine the drag coefficient for hydraulic friction along the length of the pipe, one can follow the virtual process.

This process also begins by clicking on the “Start” point. Everything happens in the manner described in the previous process.

After raising the level of the liquid to the maximum height, click on the point "Click", the liquid flows into the main tank.

After the end of the process, click on the point "Calculation", and get the results (2-pic).



2-pic. The virtual process of determining the drag coefficient for hydraulic friction along the length of the pipe.

Future teachers of the subject “Technologies” through a virtual laboratory can not only study the structure of mechanisms, the principles of their work, but also perform a number of practical work. To increase the efficiency of full awareness of the educational material, it is advisable to use special technological methods for real seeing the object of labor and familiarizing it with small details, in particular, using the flash-animation program [10].

CONCLUSIONS

In the conditions of lack of opportunities to perform laboratory and practical classes on the subject “Hydraulics and Heat Engineering”, applying virtual education, it is necessary to improve the method of forming qualifications, knowledge and skills of students.

Applying virtual education in high schools, teaching the discipline “Hydraulics and Heat Engineering” in the direction of 5112100-Professional Education, it is possible to achieve an increase in the efficiency of mastering the subject.

The content of the developed virtual laboratory “Hydraulics and Heat Engineering” contains a rather large database of files with video animations and multimedia. The teacher in the classroom can achieve a sufficient formation of students and effective organization of the process of the lesson. The use of this method is recommended.

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