USE OF COMPUTER MODELING IN THE PROCESS OF TEACHING THE GENERAL PROFESSIONAL AND SPECIAL DISCIPLINES IN HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

In this article information about analysis of existing curricula, possibilities and results of usage of the author's own experience CO2 extraction module in the subject "Modeling of Technological Systems and Processes" based on the analysis of research on the educational reforms, new educational paradigms, modern program facilities, especially in teaching the computer science specialties related to modeling subjects in technical higher education institutions is given. At the same time, the specific pedagogical method was used, and along with the analysis of the results obtained, the correlation-regression analysis of the results was performed.

Keywords: Modeling, modernization of education, the application of modeling programs, the training of special disciplines, computer programs, the extraction process, statistics, data analysis, teaching methods.

INTRODUCTION

The current social-economic reforms being carried out in Uzbekistan pose the task to the education system to train highly qualified specialists with creative abilities, which can make decisions independently, able to firmly assimilate technique and technology, and quickly adapt to innovations.

For the modernization of education, due to modern trends in the development of engineering and technology, traditionally relevant is the need to ensure meaningful and methodological continuity in the study of general professional and disciplines of a technical higher institution.

Analysis of the educational process in a technical higher institution reveals insufficient use of the fundamental basis of technological processes when they are considered in the applied aspect of special disciplines. The formalized presentation of the educational material and the algorithmization of educational research activities of students, which are characteristic both for the course of general professional disciplines and for special disciplines that develop its position, lead to the fact that understanding the essence of the subject gives way to the assimilation of ready-made knowledge and the acquisition of a limited number of skills.

At the same time, modern trends in the development of technical education are aimed at developing students' ability to think outside the box, to use intellectual and communicative abilities for the successful organization of professional and social activities in continuously changing multi-factor situations [1].

Maintaining and improving the quality of technical higher education in the context of the redistribution of classroom hours between general professional subjects and special disciplines, increasing the share of independent work in the total hours of discipline, developing distance and open teaching requires the development, justification and use of new teaching methods, including methods based on modern computer technology.

Computer modeling, which is an integral part and a tool of computer training, contains the potential for increasing the effectiveness of studying general professional and special disciplines of a technical institution. These features include:

- increasing the visibility, variability, interactivity and information capacity of the provided educational material, compensation, and through this, reducing the number of hours of classroom lessons;
- modernization of full-scale laboratory research through the use of computer models for the visual representation of technological processes of production;
- creating conditions for the implementation of a personality-oriented approach to the training of special disciplines;
- increasing the effectiveness of independent work of students through the provision of the opportunity to choose and implement an individual route of independent learning, corresponding to the level of knowledge, temperament and characteristics of students' thinking;
- the development of students' independent work skills with the most important form of information presentation - the model, the development of skills to use the mathematical model in the planning, formulation and interpretation of the results of a field experiment, the ability to assess the scope of the model;
- carrying out experimental activities – difficult, impossible or unsafe – in the conditions of a training laboratory, ensuring the multiplicity and variability of experiments;
- rationalization the work of the student and teacher through the transfer of routine functions of calculation and verification and focusing on the creative aspect of educational research.

LITERATURE REVIEW

Therefore, we have studied and analyzed the research done in this field in foreign institutions in scientific work of N.F.Neusa, M.M.Elizete Lucia “The Art of Involving Students in Sciences' Learning Using Educational Software Programs” have been saying following: “Currently, teachers are confronted with several technological tools which can help them on daily teaching activities, and besides the vast majority of software can be considered educational. But what are the criteria for particular software to be considered educational? How can the use of software involve students in their learning? They present a survey of known educational software, aiming to analyze its applicability in the educational process in science education, specifically in Chemistry. The software was developed by teachers who use themes from everyday life and can be applied to high school students. Along with the research results, we will emphasize the concern in the careful choice of software, pointing it as a great pedagogical ally in the art of involving the learner in the process of teaching and learning” [13].

And Woratat Makasiranondh, S. Paul Maj & David Veal give an information in “Within the field of network technology, practical hands-on skills are highly regarded by potential employers. However, dedicated network teaching laboratories are expensive. In addition to the purchase cost, there is ongoing technical support and maintenance. An alternative approach is

to provide students with a network simulator. While simulators cannot provide students with important practical skills, such as cabling and physical connectivity, they represent a useful, cost-effective adjunct to teaching programmes. This study is a preliminary analysis of two of the main network simulators currently in use"[14]. Besides, Francisco Arias, Julián Moreno, and Demetrio Ovalle in "Integration Model of E-Learning based on Pedagogical Software Agents and Collaborative.

Learning Environments" say about web based education systems are becoming more and more attractive; however, most of them are nothing more than a network of pages with static content. To improve these applications, more adaptability and interactivity should be provided, enabling the educational content to adapt to the users' characteristics and further facilitate the use of collaborative tools that enhance their knowledge. Therefore, the aim of this paper is to present an environment of virtual teaching/learning through an integration model based on Multi-Agent System (MAS), Intelligent Tutoring Systems (ITS), and Computer Supported Collaborative Learning (CSCL), offering adaptability through the planning of educational content as well as interaction with the formation of study groups that are guided by protocols specified in different strategies of collaborative work. It should be noted that this system will be assessed through the implementation of a prototype which is being developed in the CIA project (by its acronym in Spanish Cursos Virtuales Inteligentes Adaptativos)"[15] as well as SHENSHENG TANG says about pedagogical importance of modeling and running simulation programs in the teaching process "Microcontroller is a required course in most Electrical, Computer, and Mechanic Engineering (Technology) programs at U.S. institutions. Most engineering courses (e.g., microcontrollers), by nature, introduce abstract concepts, definitions, and models, and use primarily lectures and readings (words, symbols) to transmit information. This traditional engineering educational method has its unique advantages but also serious shortages. They analyze the features of the traditional engineering education method and investigate two major reasons that may cause students not to learn engineering curricula, and try to remedy them by proposing an interactive simulator-based pedagogical (ISP) approach for enhancing the teaching and learning process, without compromising the depth or breadth of course materials. Demonstration examples are presented. The effectiveness of the ISP approach is evaluated from both the questionnaire-based assessment and the outcomebased assessment. The ISP approach can be incorporated into a variety of educational settings"[16].

It must be noted that A.Abduqodirov, an Uzbek scientist, also mentioned in his works information on computer technology, technology of programmed teaching, method of study design, requirements for the use of teaching methodology, types of goals [12].

The implementation of these opportunities is especially relevant in relation to the study of special disciplines in a technical institution. Firstly, because they belong to the category of certain directly unobservable technological processes, and the understanding of the essence of these phenomena occurs on the basis of model ideas about them. Secondly, experiments with some technical objects contain a danger; therefore, they take place in conditions of strict observance of safety rules and often do not provide for the possibility of experimental testing of student's own hypotheses. At the same time, such an opportunity, as well as the student's right to make mistakes, must exist in order for the interest in the subject of research to be informal, and the educational research itself to be brought closer, in this regard, to scientific creativity. Thirdly, mathematical calculations of technological processes are voluminous and require free possession of differential and integral calculations, operator methods, direct and inverse transformations of functions and originals, which, when performing computational

work, leads to the predominance of the importance of mathematical calculations over the significance of conclusions, and in experimental activity - difficulties in evaluating the data obtained. Fourth, all these difficulties are exacerbated by the implementation of the pedagogical aim for the study of processes occurring in complex technological objects from the position of the fundamental basis of special disciplines.

Coming to the topic of the application of computer modeling in the study of special disciplines it is necessary to determine both the general approach to the problem and the specific area of activity for its implementation. According to [10], three approaches to the introduction of computer technologies in the practice of training can be distinguished: the first is the achievement of initial computer awareness, the second is the subject approach, which involves the study of computers as an independent field of knowledge, and the third is a general approach consisting in the use of computer and microprocessor technology as a technical tool for solving various kinds of tasks in all academic disciplines.

The use of computer modeling in lectures is appropriate for illustrating phenomena and processes in the form of animated or video pictures, as well as for creating vivid visual images of analytical and graphic structures. Visibility is one of the basic pedagogical principles, and the so-called "visual school" [11] follows its development path.

METHODOLOGY

For students of technical institutions, special disciplines is the ground for obtaining the specialty on which the study of special subjects is based. From this point of view, it is advisable, in-depth and more applied training of special disciplines of computer modeling, as a means of studying complex technological processes and phenomena. Currently, there are a number of software products for use in training special disciplines such as COMSOL Multiphysics, FeatureCAM, "Electronic Workbench", FeatureRECOGNITION, "Microcap", PowerSHAPE, "MATLAB, etc.). Let us dwell on the summary of each program.

With the help of **COMSOL Multiphysics** software packages engineers and scientists can model structures, devices and processes for engineering, industrial and scientific research [4]. **COMSOL Multiphysics** is a platform for integrated modeling and includes all stages of modeling: from creating geometric structures, materials used in the process, physical effects to customization and process handing, and these allow to achieve accurate and sustainable results.

You can implement the COMSOL Multiphysics software package through Capacity Modules to create models for specific practical and engineering tasks. Integration enables the use of modules during modeling, the use of other engineering and mathematical software tools for the development of devices and processes. Once you create a model, you can turn it into a custom user interface-modeling program that will be available separately from developers.

FeatureCAM is a CAD / CAM system based on the principle of rational processing of elements. FeatureCAM allows automatic or manual identification of elements of a solid-state model: the process engineer-programmer shows which elements he wants to process, and the system itself generates control programs for the processing of these elements.

FeatureRECOGNITION (recognition of elements) Module is a powerful tool that facilitates and accelerates the programming process. Elemental programming in FeatureCAM is based on

CAD (computer model) geometric data, which can significantly reduce production time. It is possible to recognize manual, interactive and fully automatic elements in the system [5]

PowerSHAPE is a modern hybrid-modeling program with a solid body and surface. Solid-body modeling means easy and fast merging, cutting and intersection operations. Surface modeling is the complexity of infinite elements of width and the unique capabilities of editing them.

The modeling tool provides the following opportunities:

- Ability to create surfaces in a set of optional curves;
- Dynamic positioning and editing of surfaces;
- Using Object-Oriented Editing PowerSHAPE program

LabVIEW is a graphical viewfinder application that allows you to visualize the optional details in the process, customize the devices, display and adjust the measurement data. This visualization enables the integration of measuring devices for optional device providers, displaying complex control algorithms in a schema, easily developing data analysis algorithms, and building special interface for user [7].

SolidWorks is one of the most popular computer applications for engineering design and 3D modeling. This software package not only provides 3D printing of technical details, but also can be used for other technical purposes. So, SolidWorks is a great tool for 3D modeling and is software package for automated design of various products. In essence, it is a set of capabilities for digital design of products, which stores a large number of additional equipment and enables them to perform various virtual technical experiments on the model [6].

Adams software group is used for modeling and perfecting custom structures (from all moving mechanical and electromechanical devices to sophisticated machines and aircraft, railroad equipment, spacecraft).

Feature and great advantage of the Adams software package is that the user's interface is easy and effective. Using this interface, the Adams package user can quickly create a model that is calculated from a geometric primitive database.

The Adams software package has effective means of analyzing results in a short period to find ways to improve the model, which is a user interface, and to integrate dynamic process characteristics into real processes.

STATEMENT OF THE PROBLEM

These are powerful professional packages, the capabilities of which are redundant for the production of the virtual experiments in question. However, in the future, in advanced courses and in professional activities, the need to use such tools will only increase, so their inclusion in the practice of training engineers today is a vital necessity. Education will not be ***scientific*** if it does not use modern tools.

Each of the programs mentioned above has a specific role in the educational process. Some of them are intended for consecutive presentation of material, others for evaluation of students' knowledge, and some of them are used for modeling practical exercises and so on.

Software for monitoring the level of knowledge, skills and abilities automates the process of assessing the student's knowledge.

Testing system has been used in the education system for a long time. However, it should be noted that the modeling of teacher-student interaction in the assessment of acquired knowledge is a very sensitive matter from an information point of view. In many cases, it cannot be implemented qualitatively without the use of modern information technologies and artificial intelligence techniques. For example, an interactive math test system should follow the student's logic of response (which requires the use of sensitive techniques such as automatic proof of theorems), as well as the underlying knowledge base of the subject being studied. Developing such systems will require significant labor, time and financial costs. Fortunately, the use of such sophisticated technologies is not always required. We have developed software to control the temperature and pressure of the extraction process with compressed CO_2 [8, 9] for training in the subject “Modeling of technological systems and processes”.

This program helps students more effectively understand the importance of process modeling. It also provides students with the opportunity to understand the essence of the effective application of process modeling for industry. The software we created provides the ability to establish boundary temperatures and pressures, as well as cyclically check the temperature of the solvent in the process. In addition, the program allows creating projects in which the temperature and pressure values are calculated within the time limits and the values are stored in the database. It is possible to dynamically monitor the graph of changes in temperature and pressure, and save them as graphic files in computer memory for further analysis. Stored data in projects with temperature and pressure values can be opened on the display analyzed and received reports. Another feature of the program is that all types of reports can be exported in Microsoft Excel format and printed in a convenient form.

RESULTS

The following statistics processing diagrams show the number of students who used this software and the results of their understanding of modeling after applying another teaching methodology for the subject “Modeling of technological systems and processes”.

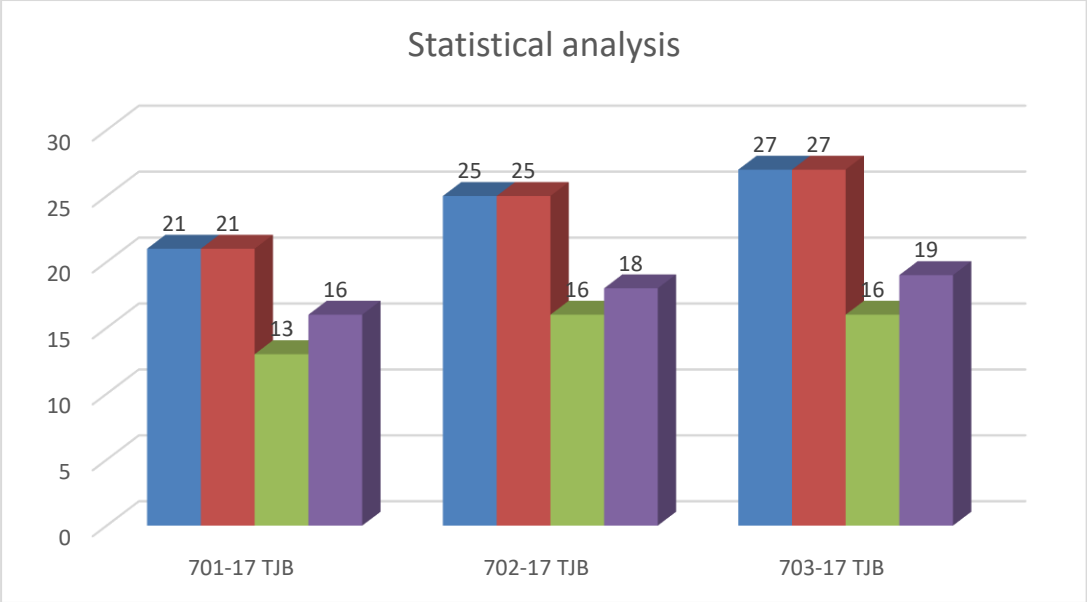

Diagram 1. Static analysis of students' understanding of the essence of modeling on the example of the extraction process with compressed CO_2.

In this diagram:

1) Groups: *701-17 TJB, 701-17 TJB, 701-17 TJB are groups for the experiment.*

2) Colors in diagram:

- – Number of the students;
- – Number of students using software;
- – A number of students understood the meaning of modeling without using software;
- - A number of students understood the meaning of modeling using software;

Determining the number of students who understood the meaning of modeling was used by the teacher on various pedagogical technologies. For example: tests, questionnaires, brainstorming, etc.

Because of the influence of computer software on students' understanding of a subject or topic, we used static correlation and regression analysis and from the graph, we can see that the use of modeling programs to understand the subject is very high. That is, the points located on the top of the line are the number of students who used the program and understood the essence of the lesson. The points that are located at the bottom of the line are the number of students who also understood the essence of the lesson but without using modeling programs and used standard teaching methods.

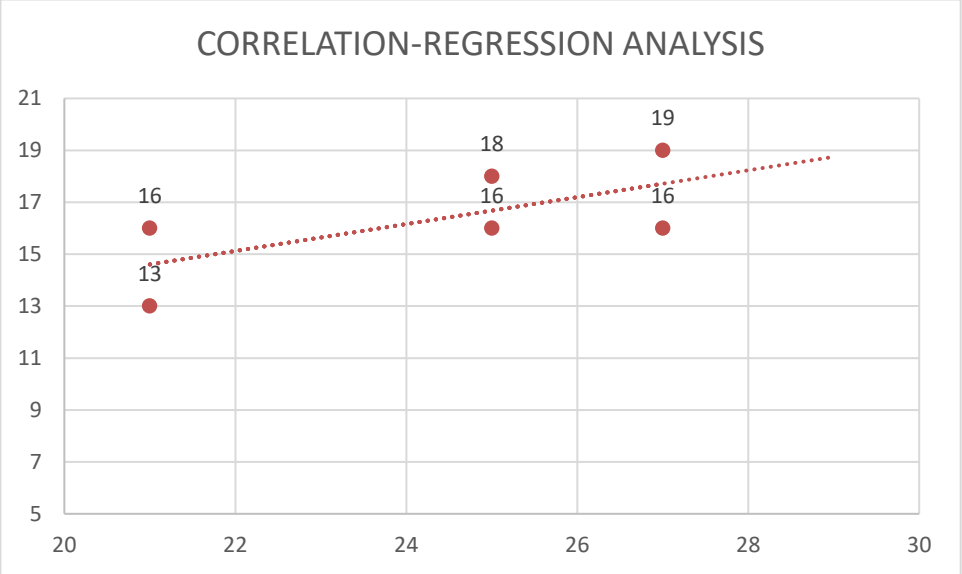

Diagram 2. Correlation-regression analysis of the results.

CONCLUSIONS

Based on the analysis of the possibilities of using computer modeling in the practice of teaching special disciplines of a technical university, we can draw the following conclusions.

1. There are obvious prospects for the inclusion of computer modeling in the practice of conducting both lecture and laboratory classes. When transmitting information from one computer technology to many will complement the information flow, including in it high-quality demonstrations and illustrations. In a laboratory workshop, computer modeling can be applied in the form of means of pre-experimental preparation of students, and as tools for processing data and presenting the results of experiments

2. With the help of computer modeling of processes occurring in real technological processes, it is possible to implement a demonstration lecture experiment, which

gives the stated material an informal character, ensuring the continuity and cyclicity of the learning process and bringing the subject closer to real scientific activity

3. The independent work of students can be optimized by supplying them with software products that contain not only tasks for such work with comments to them, but also means of checking calculations and assumptions. Computer mathematical packages are the tool to increase the efficiency of calculations

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