AMERICAN JOURNAL OF SOCIAL AND HUMANITARIAN RESEARCH

ISSN: 2690-9626
Vol. 3, No. 6, 2022

Features of the Methodology of Teaching Information Technology Based on Integrated Science in Education

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ABSTRACT: The search for optimal methods of use, the fullest realization of the potential of modern information technologies in the educational process are an urgent problem of modern education. In this article, as one of the approaches to solving this problem, practical experience of using modern information technologies in the educational process in the form of interactive training programs and computer tests, their positive aspects, limitations and place in the educational process is proposed.

KEYWORD: mathematical models, web – webinars, computer systems, intermediate control

Let's consider one of the most important aspects of informatization of education - the use of IT directly in the educational process. Modern information technologies have a number of properties that contribute to the effective performance of the basic functions of learning. These properties can be summarized in the following list:

1) the ability to store large amounts of educational information and issue it in accordance with complex training algorithms, including branched ones, capable of taking into account the individual characteristics of the student, for example, the pace of his work, his level of preparedness and his ability to conduct a dialogue;

2) the possibility of studying complex processes in a visual form as a result of laboratory work and setting up various experiments not on expensive equipment, but on mathematical models of phenomena and processes with visualization of the results on computer screens in a user-friendly form;

3) the possibility of automated or fully automatic control of students' knowledge using computer testing technology and the theory of computer testing currently being developed;

4) the ability to influence the learner and transmit information to him simultaneously through several channels of perception: visual, auditory, tactile (multimedia learning environment);

5) network computer technologies that allow implementing distance learning, broadcasting lectures of highly qualified teachers to a wide network audience, which have already become popular on the web - webinars, remote control of knowledge, and even interactive on-line interaction with a teacher over long distances, very effective, for example, when learning foreign languages with native teachers by skipe technologies;

6) the phenomenon of the global computer network Internet, which is a convenient, unprecedented in volume source.

ISSN 2690-9626 (online), Published by "Global Research Network LLC"
under Volume: 3 Issue: 6 in Jun-2022 https://grnjournals.us/index.php/AJSHR

Sometimes society associates an indispensable improvement in the quality of education with the introduction of information technologies into the educational process. But, despite all the advantages listed above, it is impossible to talk about information technologies as a panacea that can radically change the educational process, raise its effectiveness to a level not previously achievable in principle and, most importantly, significantly improve the quality of knowledge received by graduates. As practice shows, the introduction of information technology in education, unfortunately, does not lead to the desired effects listed above, including the most important one - a cardinal improvement in the quality of knowledge obtained. This indicates not the primary, but only the auxiliary role of information technology in the educational process.

What are the reasons for this discrepancy between expectations and reality? Despite the fundamental kinship of the information processes of cognition and computer information technologies, they still have significant differences. If the way of organizing information processes, the mechanisms of memorizing and processing information in humans and modern computer systems were, the same or at least similar, then such computer technologies would be the main and irreplaceable educational technology. Education would be reduced to pumping information (knowledge, skills and abilities) from the universal information base directly into the brain of the subject of the educational process. However, since the nature of these processes is different, the role of information technology in education in its current form is on the second, auxiliary plan.

An interactive training program is a program that, during training, regularly monitors the degree of assimilation of educational material by the user and, depending on the results of control, directs the learning process in the right direction. In a training program devoted to a topic, the training material is divided into integral logically interconnected modules or blocks. At the end of each module, a computer test is provided with tasks corresponding to this module. Thus, the degree of assimilation of the material is regularly monitored, depending on which the training program decides on the further course of training. The results of passing the tests for each of the sections are saved, and the teacher has the opportunity to see how fully the educational material has been mastered.

The methodology of conducting a typical practical lesson using interactive training programs and computer testing is built as follows.

In the thematic plan of the discipline and the schedule of the sequence of passing the discipline, mainly four-hour practical classes are planned. At the beginning of the lesson, after the announcement of the topic, goals and order of the lesson, the basic knowledge of the trainees is updated according to the material passed in the form of computer testing (input control of knowledge) lasting 15-20 minutes. Then students independently work with an interactive training program with intermediate testing on a given topic. At this stage, there is a more in-depth and detailed study of the theoretical material given at the lecture, or the study of an additional theoretical block not provided for at the lecture. The algorithm of the interactive training program provides, as mentioned above, intermediate control of the degree of assimilation of educational material. If gaps or an insufficient level of material assimilation was found during the intermediate control test, a transition occurs to the beginning of the module of the educational material for which unsatisfactory knowledge was revealed, and the student repeats this theoretical block again. This procedure is repeated until an acceptable level of assimilation of the educational material is reached. The threshold for moving to the next section of the training program is set when developing intermediate tests by configuring test parameters. It takes about 60 minutes to work with the training program.

Then about 25-30 minutes are allocated for the final control of knowledge throughout the lesson in the form of a computer test. The tasks of the final test usually include tasks from all intermediate tests of the training program, and questions passed during the practical task may be included. The final grade for the lesson consists of the grades received by the student for each of the stages of the training session.

ISSN 2690-9626 (online), Published by "Global Research Network LLC"
under Volume: 3 Issue: 6 in Jun-2022 https://grnjournals.us/index.php/AJSHR

From the description of a typical lesson, it can be understood that the peculiarity of teaching using interactive training programs and computer testing is to increase the level of independent work of students with a computer. When studying the disciplines of the information profile, this has a double effect: new material is being studied and computer skills are being consolidated at the same time. In addition, the features of such a technique consist in a significant automation of the teacher's work, which allows him to free himself from routine repetitive pedagogical procedures and concentrate his attention on explaining the most difficult moments of the educational material, helping laggards, etc.

Automation of knowledge control using the Assistant computer testing system has also revealed a number of advantages:

1) The possibility of automating a rather time-consuming and responsible activity related to finding out the level of readiness of the subject or the degree of assimilation of new educational material in the case of intermediate testing;

2) Reducing the time spent while increasing the quality of knowledge control. For example, when organizing the input control of knowledge, you can use a small test for 10-15 minutes. At the same time, each student will be offered his own set of tasks from a large general database of tasks on a specific topic. If the testing is carried out in a computer classroom, the time allotted for the input control is significantly reduced, since all trainees are tested at the same time;

3) The development and inclusion of such new features in the Assistant testing system as automatic correction of scores of individual tasks based on the analysis of accumulated statistical information, a mechanism for clarifying the assessment by means of classical mathematical statistics, made it possible to increase the accuracy of pedagogical measurements and the objectivity of the assessment;

4) As the trainees themselves note, more comfortable psychological conditions for knowledge control are being implemented, there is no psychological pressure from the teacher and there are no controversial points.

The testing time can be determined based on the time of the test by the teacher (the subjects are allocated 3-5 times more); averaged empirical data on the performance of a separate task at the rate of 0.5-2 minutes per task or trial testing data.

If the speed of the test is not of paramount importance, then a tight period becomes an obstacle to an objective measurement of the level of preparedness. In this case, as a rule, sufficient time is taken for the absolute majority of subjects to complete the test during trial testing.

The main idea of the system implementation is related to the fact that the subject area includes a problem-oriented language - a programming language. Syntactic verification of the text in this language can be passed to the compiler of the selected programming language. In addition, semantic verification is carried out by testing a syntactically correct program with a given set of source data.

The developed system is designed not only for testing knowledge of the basics of programming, but also for the final control of this knowledge in the form of a test or exam. It is important to note that the system is intended for students studying programming as a general education discipline. Therefore, the system should relieve the student from the need to know the subtleties and details of the implementation of the programming language, the libraries used and the features of a specific development environment, a specific implementation of input and output. In addition, the system provides a means of preparing materials for testing (a teacher's tool). One of the main principles of the organization of the automated testing system is the ability of a teacher to independently or through an operator to enter tasks into the system without resorting to the services of a programmer.

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under Volume: 3 Issue: 6 in Jun-2022 https://grnjournals.us/index.php/AJSHR

Further stages of test development include:

- Creation of tasks in a test form: formulation of a question-answer, conducting an expert analysis of the quality of the content of the ZTF, selecting them for the test based on the results of the examination (with revision if necessary), ranking by degree of complexity according to expert estimates;
- Formation of a sample for approbation testing and creation of test invariants that meet the requirements of reliability and substantive validity of the test (test invariants must also undergo an expert evaluation procedure);
- Development of instructions for all participants of trial testing (students, teachers);
- conducting trial testing to collect empirical results with their subsequent statistical processing;
- Interpretation of test results, which allows you to reject and add new test tasks to improve the quality of the test (increase the reliability and validity of the test, optimize the degree of complexity of the ZTF, and improve their system-forming properties);
- Re-approbation to confirm the improvement of the quality of the test and the establishment of standards of test performance for students with the construction of scales of evaluation of test results.

The degree of reliability of the test is determined by the stability (stability) of the indicators during repeated studies using the same test or its equivalent. Quantitatively, this indicator is characterized by the probability of achieving the planned test results (correctness of values). Competently compiled and tested tests have a reliability coefficient close to 0.9. To achieve this value, you can resort to increasing the number of questions in the test while reducing the thematic diversity of test tasks. In other words, the test should be focused on testing knowledge within the educational element / submodule, since the test aimed at testing the knowledge of the entire modular program (the entire course of the discipline being studied) has a significantly larger volume of learned material and thus has a higher, compared with the first, content diversity and, consequently, less reliability.

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