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METHODS FOR SOLVING LINEAR EQUATIONS AND SYSTEMS OF EQUATIONS USING MODERN INFORMATION AND COMMUNICATION TECHNOLOGIES

Annotation. The article discusses the use of means and methods of electronic information tools for educational and methodological purposes in subject-matter mathematical activities as a tool for solving mathematical problems that develop the practical skills of schoolchildren and students in practical classes in algebra when solving algebraic systems of equations.

Key words: information and communication technologies, mathematics education, computer mathematical systems.

Today there is a growing need to improve the efficiency of education through the widespread use of innovative pedagogical and information technologies in the educational process. The use of new information and communication technologies in mathematics lessons saves time, increases the complex knowledge of students by solving many problems and examples, allows them to think independently, independently carry out the conditions of the task, gain a deep understanding of the subject and independently express their ideas.

The ongoing changes in the socio-economic development of Uzbekistan, which have led to reform in all areas, require improving the quality of professional training of university specialists. In this regard, there is a need to improve the training of future teachers in the context of informatization of education. The use of information and communication technologies in pedagogical activities is aimed at improving the preparation of a future teacher for teaching mathematics in the conditions of informatization of mathematics education. This opens up unique opportunities for school teachers and university mathematics teachers to intensify the processes of cognition and activity of students, making it possible to improve the quality of information and communication competence of students and the quality of assimilation of educational material.

In this regard, the problem of using information technology in the educational process of a modern pedagogical university as an effective teaching

tool is of particular relevance. The involvement of mathematical systems is possible and advisable in school education - both in the basic school mathematics course and in the course system of a specialized school, where elective courses aimed at deeper mastery of the capabilities of mathematical systems can be used for this purpose. In this case, one should proceed from the fact that computer mathematical systems are not an end in themselves: they are based primarily on mathematics, and only then on technology - as an auxiliary element that expands and develops the worldview and competencies. This eliminates the factor of replacing the process of development of mathematical thinking with the formal use of computer tools. It is necessary to introduce computer mathematical systems into the domestic education system in such a way as to preserve all the best in it and at the same time equip the teacher and student with new technology, give the teacher a new methodology that will improve the quality and efficiency of teaching.

We use computer technologies in teaching as a tool for solving mathematical problems to implement new didactic approaches to mathematical activities that develop the practical skills of schoolchildren and students based on the inclusion of tools and methods of electronic information tools for educational and methodological purposes in the subject mathematical activities. One of the main types of electronic information tools for educational and methodological purposes is intelligent learning systems (ITS).

An intelligent learning system (ITS) is an e-learning system that includes elements of artificial intelligence and allows you to solve the problem of constructing the sequence of studying a course that is most suitable for a student, adapting the course to the knowledge or other characteristics of the student.

Intelligent training systems should be presented in the form of systems that have a unique sequence of training in accordance with the specified criteria of the individual characteristics of the learner.

Intelligent learning systems consist of three components. The first of these is the learner model. This model is a block with information about the student, his chosen learning strategy and the mistakes he makes. The second component is a model of the learning process. It specifies the form for presenting information to the learner and the type of assessment of the quality of the learner's activity. This block includes the process of training a student of the course, as well as establishing a list of tests. In addition, this includes final control procedures on the topic being studied. The model interface is the connecting link between the expert block of the intelligent teaching system and its other blocks.

There are certain principles for building intelligent learning systems. These principles include the principle of pragmatic diagnosis, the principle of comparing

the current model of the learner with the model of the ideal learner, the principle of "generative interfaces", non-equifinality of training and the principle of the necessary diversity of learning influences. The principle of comparing the current student model with the ideal student model implies the inclusion of diagnostics and comparison of the curriculum with the list of tasks completed by the user. The principle of pragmatic diagnosis implies the creation of a curriculum framework and a structure for subordinating the course student's error diagnosis system to the learning management system. The principle of "generative interfaces" implies the selection and adjustment of elements of the educational process that differ in content, depending on the specific needs of the student and his knowledge at the time of selection. The principle of non-equifinality of learning speaks about different approaches to presenting the learning process based on the different level of knowledge of a student in a certain course. The principle of the need for a variety of educational influences suggests that the teacher must have in-depth knowledge about the options for influencing the student.

Modern intelligent teaching systems have various intellectualization algorithms. The purpose of their use is to carry out the process of teaching natural science subjects. They have the functionality to evaluate a step in the user's decision process based on the criteria of "correct" and "incorrect." In addition, such intelligent training systems provide hints indicating the user's wrong step or his further actions. An integral function of such systems is that they assign grades based on the results of the course. When operating a system of this class, the user's decision process is checked against the criteria of completeness and correctness. These criteria are checked by comparing the steps of the user's solution and the steps that are specified in the system by default.

If the substitution results in an identity, then the formula is correct. Suppose that the user entered the formula $c = f + 2$. From the conditions of the problem it follows that $c = 4$, $f = 2$. Since $4 = 2 + 2$, the formula entered by the user is correct. Calculating progress in solving a problem is much more difficult. In this case, the simplest way to measure progress in solving will be to present solutions to the problem known to the program in the form of lists of formulas and compare the formulas entered by the user of the intelligent learning system with formulas from these lists. In this case, to measure progress, it will be necessary to first select one of the known software solutions that is closest and most suitable to the student's solution, and then review what percentage of the formulas it contains are contained in the student user's solution steps. The higher this percentage, the greater the progress in the student's solution. The disadvantage of using such a relatively simple method of storing and processing information about solutions to problems

is the need to introduce into the intelligent learning system a fairly large set of possible solutions that differ from each other by one, two or more formulas.

It can be noted that the success of automated management of the educational process strongly depends on the degree of faith of the student in the intelligence of the program. This belief depends significantly on how well the program understands his actions. The automated learning management algorithm should be advisory in nature. It should also be possible to turn it off at the request of the student. Meanwhile, in cases of irrational user behavior (for example, students' abuse of short text prompts while solving problems), it is necessary to include an impact on the learning process with the involvement of additional teachers of the subjects being studied. To summarize, we can say that intelligent teaching systems could significantly facilitate the learning process for students and teachers, but if students want to deceive the system and have incorrect motivation (it is not interesting to study the subject, but it is interesting to get good grades), it will still be difficult to do without the participation of the teacher.

Mathematics classes are held in a computer lab equipped with an interactive whiteboard.

By using Excel to solve some examples and problems, an accurate and simple solution can be obtained in a much shorter period of time. At the same time, an image of the exact solution of the system is created in the Excel program window. This, in turn, allows students to learn by listening, seeing and doing.

Solving algebraic systems of equations in the MathCAD package. A system of linear equations can be solved using the matrix method (either via the inverse matrix or using the lsolve(A, B) function) and using the two Find functions and the Minerr function. Systems of algebraic equations are solved in the computing unit. We set initial approximations for all variables. Enter the keyword Given.

Let us write down the system of equations specified for the solution. When writing equations, the equal sign must be entered not with the = (equals) key, but with the key combination Ctrl + =. An expression containing a Find function with unknowns is entered as parameters. The calculation result is given in the form of a vector. This is the solution to the system. The computing unit allows you to solve systems from 1 to 200 equations.

We check the found roots. To do this, we substitute the found roots into this equation.

By clicking the Advanced Options button, you can set additional options in addition to selecting methods.

We will show the solution of algebraic systems of equations using the lsolve function. Note that M can be neither degenerate nor nearly degenerate for use with

lsolve. A matrix is called singular if its determinant is zero. A matrix is almost singular if it has a large condition number.

The Lsolve function is specified as: lsolve (A, B), where A is the matrix of the system of linear algebraic equations, and B is the vector of free terms on the right side of the system of linear algebraic equations.

Method for solving a system of linear algebraic equations

$$2x + y + 2 = 7 < x + 2y + r = 8 \; x + y + 2r = 9$$

The use of information and communication technologies in solving systems of algebraic equations allowed us to save time when solving systems of more than three complex equations; check the correctness of the solution if the system was initially solved without computer technology using traditional methods; generalize and consolidate acquired knowledge.

Thus, the practical use of information and communication technologies in the educational process when solving algebraic systems of equations is advisable due to the following main circumstances:

- allows teachers to achieve a fairly high relative efficiency in organizing search activities and self-control of students;
- saves time for acquiring skills in using computer technology, and the level of mastery of educational material is not lower than that achieved using traditional methods.

The introduction of electronic information tools into educational practice to a certain extent at different levels of full-time education makes it possible to improve the quality of information and communication competence of students and is aimed at improving the preparation of future teachers for specialized teaching of mathematics in the conditions of informatization of mathematical education.

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