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Methodology of Development of Programming Skills in Mathematical Systems in Students Based on Computer Simulation Trainers

Imamova Shafoat Mahmudovna
Associate Professor of Applied Mathematics and Programming Technologies department., Bukhara State University., Uzbekistan
E-mail: s.m.imomova@buxdu.uz

Abstract: In the current situation of rapidly developing digital technologies, advanced pedagogical and modern information and communication technologies, which include new approaches to teaching, are being put into practice in higher education institutions. In the current scenario of training mature specialists for the field of applied mathematics, adequate teaching of working in mathematical systems and programming is one of the main goals of the educational process. The process of teaching the science of computer mathematical systems through simulation-trainer in higher education institutions is the process of forming the professional competence of students to develop their skills of working with mathematical systems, and in the process of working with the functions of mathematical systems, their interaction with the subjects of professional activity. aimed at riding. It is an urgent issue to improve students' professional skills by developing programming and working skills in the Maple program. Development of students' programming skills in Maple and improvement of their professional competencies through a computer simulation-trainer should be carried out in accordance with the requirements of regulatory documents (SES, qualification requirements, training programs).

Keywords: simulation simulator, professional competence, programming skills, professional qualification, mathematical system, Maple, programming elements.

1. Introduction

Personal development of students in higher education institutions with such situations as their independent thinking, creativity, activity, deepening and enrichment of relationships, stability of character and outlook, formation of needs for self-control and education. is described. For future professionals, the process of education in educational institutions is the most optimal period of development and self-improvement on the basis of professional knowledge, quality, competence and criteria that are considered important for the successful implementation of labor activity. In this process, students embody such situations as gathering, storing, transferring knowledge, creating their logical structure, and effectively using them in organizing their professional activities in the future.

The use of the simulator in the educational process improves the knowledge of students in all subjects. The principle of the most important professional direction of teaching, the principle of thinking activity, the principle of the principle of education, the principle of learning by immersion in organizational activity, the principle of integrativeness, the principle of functionality allows to apply in practice. In this sense, we can say that the application of computer simulation-trainer to the educational process in higher educational institutions in our country is an urgent issue today. The task of forming a person with improved professional skills based on the application of digital technologies to the educational process, developing non-traditional forms and methods of education, providing education and training to a creative student who can work with various information sources and conduct independent thinking and deep observation will be resolved.

2. Literature review

One of the most effective methods of formation and development of professional skills is teaching with the help of intelligent computer simulators and an automated educational system. These systems provide structures for efficient information retrieval, collection, and storage, incorporating high-level logical capabilities using

artificial intelligence for training and formulating learner-machine interactions in natural language. consists of a class of educational programs. It is an important task to form and develop the professional skills of students through the methods of teaching subjects in higher education institutions.
The purpose of teaching "Computer Mathematical Systems" in higher education institutions is to form students a clear idea of the full capabilities of computers and computer systems; create a general understanding of mathematical packages; to develop the ability to effectively use software to solve mathematical problems necessary for the work of a specialist in the field of information technologies; based on new information technologies, it consists in acquiring skills to effectively use modern software systems and apply them in one's profession.
One of the tasks of the subject "Computerized Mathematical Systems" in higher education institutions is to provide students with full training in mathematical systems to solve the mathematical model of processes and phenomena occurring in nature. When solving mathematical problems, using programming functions of mathematical systems by constructing their algorithm is considered the same term. A student can solve a mathematical problem without using any programming language using the programming section in mathematical systems. With this, programming skills are developed by working with mathematical systems.

3. Analysis

Students' programming skills are actively developed as a result of performing various tasks through computer simulation-trainers on programming in mathematical systems in class and independent education. Students' imagination, memory and speech improve. Learning to program in mathematical systems through computer simulation-trainers has a positive effect on the development of professional motivation. As a result, students' interest in programming as a new approach to developing their professional competencies increases.
The components of the methodology for developing programming skills in mathematical systems based on simulation simulators are as follows.
1. Tasks of teaching science through simulation simulators. The simulator has enough didactic potential in organizing lessons. Students improve their knowledge and skills on the subject of science by practicing on simulators. Creative thinking, creative abilities and necessary professional competencies are formed in them.
Pedagogical conditions for the development of professional competence of students in mathematical systems through simulation-trainer:
a) Motivation to study mathematical systems in order to develop professional competencies of students;
b) Active use of simulation-trainer capabilities as a simulator for modeling and developing real practical situations of professional activity in the field of applied mathematics;
c) Contextuality of the contents of development of students' professional competences in mathematical systems;
d) Use of information and technical resources and tools in the process of teaching mathematical systems to students.
The use of simulators in the educational process gives effective results for all learners today. From the theoretical part of the simulator, the student learns the necessary topic and develops his knowledge by performing various exercises in the training part.
1. The process of forming the professional competence of students is carried out using the simulator. The simulation-trainer is a comprehensive software and pedagogical tool based on the system of information sources, supports and methodological tasks, which allows to solve the problems that arise in the process of working with mathematical systems specific to the field of applied mathematics. The main functions of the trainer are diagnostics, advice and control. Learning to program in mathematical systems through simulation simulators is very interesting for students and increases their enthusiasm for programming. For example, if someone does not know the function of an operator related to programming in mathematical systems through the simulator, he can get help by applying to the support department of the simulator.
2. The following are the main principles of modeling professional activity in the educational process with the help of a simulation trainer:
- systematicity, availability, consistency;
- the completeness of the developed tasks (that is, the proposed system of tasks should include the full content of professional activity in a certain field);
- relevance of professional-theoretical and professional-practical training;
- to recreate the subject and social content of professional activity;
- assignment typology;
- consideration of typical errors;
- choosing appropriate forms, methods and tools for solving problems.

In this case, the educational potential of the simulation simulator plays an important role in the development of programming skills in mathematical systems. It takes into account students' theoretical knowledge of programming elements.

4. Discussion

While learning how to work with mathematical systems through the simulation simulator, encouraging students to familiarize themselves with the rules of using the simulation simulator, to use the simulation simulator's functional capabilities consciously and effectively, provides an opportunity to learn mathematical systems perfectly.
Every subject should be taught in a higher education institution through a simulation simulator. Studying subjects through simulation simulator helps students to develop their knowledge, skills and abilities.
Teaching the science of computer mathematical systems through simulation-trainer contributes to the formation of students' professional knowledge. After giving information on the subject while passing the topic "Elements of programming in Maple" from the subject of computer mathematical systems, the capabilities of the simulation trainer can be used to develop students' knowledge on the subject. We will learn how to teach programming in mathematical systems using a simulation simulator.
Like any software, Maple has a set of operators for programming. Basic concepts are objects and variables, which form mathematical expressions. The simplest objects in Maple are consts and strings. If you are familiar with a programming language, then these objects are understandable for you.

Necessary components. Simulation simulator, computers.

Picture 1: Simulation-trainer view.

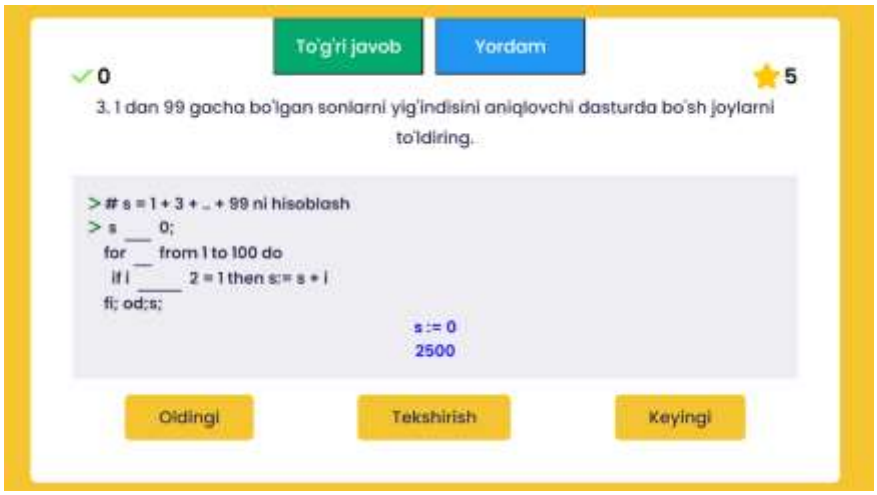
In the lesson, the teacher gives information about the topic. At first, the student tries to program the Maple program on the elements of programming. Then from the practical part of the simulator, he solves the tests on the topic "Elements of programming in Maple". Then he goes to the exercise part of the simulator and performs exercises based on the "easy-to-complex" principle.
Exercise 1. Fill in the empty parts of the program to extract the necessary letters from the line given below. The exercise is shown in the simulation-trainer as shown in Pic. 2.

Picture 2.

Exercise 2. Fill in the blanks in the program that determines whether a number is even or odd. The exercise is shown in the simulation-trainer as shown in Pic. 3.

Picture 3.

Exercise 3. Fill in the blanks in the program that determines the sum of numbers from 1 to 99. The exercise is shown in the simulation-trainer as shown in Pic. 4.

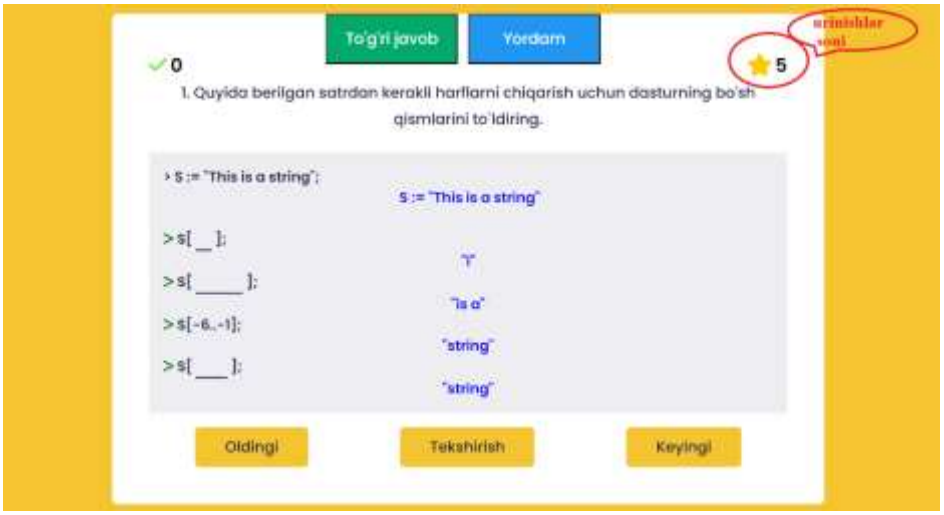


Picture 4.

Exercise 4. Fill in the blanks in the program to calculate the modulus of the given number. The exercise is shown in the simulation-trainer as shown in Pic. 5.

Picture 5.

There are 4 exercises on "Maple programming elements" in the training section of the simulator.
As we know, the simulator is not only a teacher, but also plays an important role in improving the acquired knowledge. The student improves the theoretical and practical knowledge he learned through practice. Here, the student can try 5 times to do the exercise correctly. This situation is illustrated in Picture 5.



Picture 5

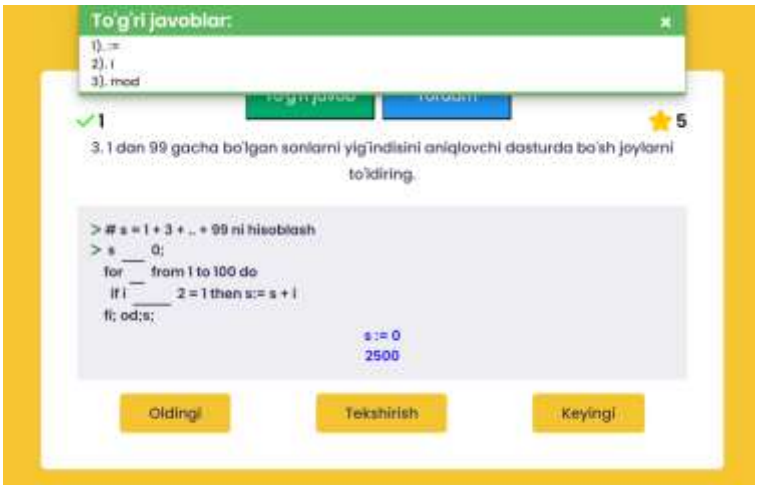
After completing the exercise, the student determines whether he solved the exercise correctly or incorrectly by pressing the button 

.
After completing the 2nd exercise, the student can collect 3 points. The correct answer is shown in green and the wrong answer in red. This is illustrated in Picture 6.

Picture 6.

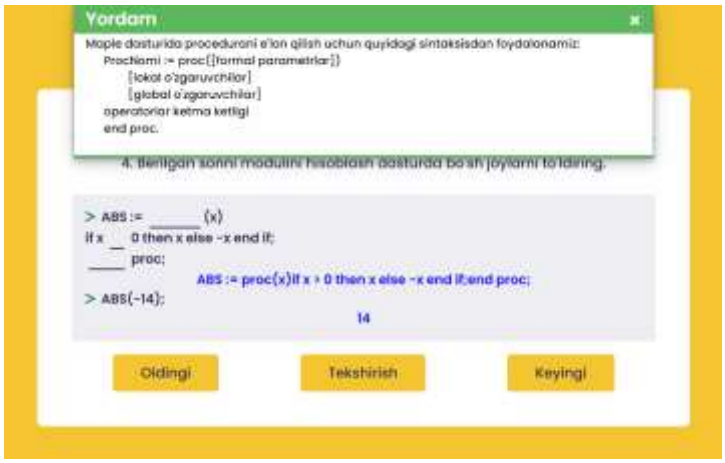
Picture 6 shows that one of the student's answers is correct. So, the student got one point.

If the student has difficulty performing the exercise, he can get help through To'g'ri javob and Yordam buttons of the simulator. Picture 7 shows how to see the correct answer to the exercise in the simulator.



Picture 7.

Pic. 8 shows the acquisition of theoretical information as an aid to the execution of the exercise in the simulator.



Picture 8

If the student solves the exercise correctly in the first attempt, he will get 100% result. 5% will be deducted from the result for each attempt. If he gets help, he loses 30% of the result, if he sees the right answer, he loses 50%.
Exercises on maple programming in the simulation simulator are structured in such a way that if the student tries to create a program in the maple program himself, by performing the exercise in the simulation simulator, the ability to think logically will increase and programming skills will develop.
It is an important task to develop students' skills in working with mathematical systems and programming. To do this, it is necessary to acquire the necessary theoretical information and apply it in practice, creating an educational environment that is suitable for the educational process. Nowadays, when a number of innovations are being introduced into the educational process, it is also important to develop the information and communication skills of students based on digital technologies.

5. Conclusion

Based on the above-mentioned considerations, we can say that if a teacher in a higher education institution uses an imitation-trainer in the teaching of subjects, the students' enthusiasm for studying the subject increases, and knowledge, skills and experience within the subject are increased. skills develop. Also, learning with the help of an imitation simulator serves to improve the professional competence of students.

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