IMPROVING THE EFFECTIVENESS OF PROGRAMMING LECTURES BY APPLYING STRUCTURING METHODS FROM THE SCIENCE OF PROGRAMMING PARADIGMS

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Abstract

In this article, we focus on various technologies currently used to facilitate the teaching and learning of computer programming courses in higher education. Programming is an important subject in computer science and information systems development, and today the demand for it in the computer industry is increasing day by day. New application programs are created and existing applications are recoded on demand. Smartphone and mobile phone sales have a huge audience today and users need relevant software applications for their daily work. In addition, the software development industry needs skilled programmers who know the required programming language. However, there is a shortage of programmers due to various reasons. One of the reasons is that learning programming is a complex process. Universities need to inspire students' interest in programming and integrate innovative technologies into their programming courses like never before to encourage students to become qualified programmers. Today, there are challenges in the use of technology in the educational process, and in the future, effective solutions for the integration of technology into university-level programming courses must be included.

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1. INTRODUCTION

The Government of the Republic of Uzbekistan allocates large funds for targeted training of specialists in the field of information technology and computer programming and financing of their start-up projects. These measures, introduced by the government, challenge universities to produce qualified programmers for our society. Today, there are some research works by Western and Russian scientists aimed at developing methodological approaches to teaching programming, including: activity approach [2], systematic approach

[1], cognitive approach [6], semiotic approach [4], problem approach [5] . Many researchers in different countries of the world have conducted research on the application of innovations in education. They have collected valuable information about "innovation", "interactive methods", "innovative technologies", but there are not enough specific recommendations to increase the effectiveness of teaching "Programming methods and paradigms" course in technical universities.

The method of logic-graphic diagram implies the goal of achieving high results in a short time without spending too much mental and physical effort, and it is more effective in teaching "Programming methods and paradigms", "Programming" and "Algorithm design" courses taught in technical universities. Viewing objects is an important concept of the logic-graphic diagram approach. It aims at revealing the integrity of the object, identifying various connections in it and bringing them to a unified theoretical view. Effective sequence material created with the help of a logic-graphic diagram was developed in "Object-oriented programming paradigm" section of "Programming methods and paradigms" course, categorized by special tasks, test marketing tools, and in-depth subjects.

The technical university aims at creating automated systems for students, independent studies, and directly in order to increase the efficiency of the educational process. Using the built-in pedagogical software, the student studies the texts of lectures, laboratory work, seminars, independent work and practically determines his work on the topic, checks his knowledge using examples of specially classified test tasks.

A system is a set of elements that interact and communicate with each other, forming a certain unit [8]. In addition, researchers of the systematic approach [9] emphasize that the system is a set of objects, and their interaction causes the emergence of new integrative qualities that are not characteristic of individual components that make up the system. [8].

A structure is a set of stable connections between elements that ensure the unique integrity and uniqueness of an object, that is, the preservation of the main characteristics during various external and internal changes.

It should be noted that the systematic approach to knowledge and change of any object is the leading general scientific approach. The application of this approach in teaching programming is such a component as a system of teaching programming with all its features: integrity, communication, structure and organization, system levels and their hierarchy, management, self-organization of the system; its activity and development are necessary.

In the context of teaching Programming methods and paradigms, the main idea of a systematic approach is to consider educational tasks in close connection with programming tools, methods, and the technological process as a whole. Each of these areas should not be studied separately, but in close connection with each other.

Taking into account the interdisciplinarity of Programming methods and paradigms with other technical university disciplines and scientific knowledge fields, it can be stated that a systematic approach is central to its teaching, and other methodological approaches that can be used to teach programming paradigms should complement and extend its core ideas and principles, and not contradict it.

The activity approach in teaching is based on the "fundamental position that the human psyche is inextricably linked with its activity and its activity is conditioned." The activity category is central to this approach. At the same time, activity means the intentional activity of a person manifested in the process of his interaction with the outside world, and this interaction consists in solving vital tasks that determine the existence and development of a person.

The problem of selection and systematization of educational material components has been widely discussed by pedagogues, experts and scientists for a long time. Currently, many models represent the logical structure of educational material. Despite the nature of these diverse models, they have successfully passed experiments in a real pedagogical process based on practical methods, approaches, and have given positive results. As a result of the analysis of the essence of the educational process, many authors emphasize that it has a dual character [7, 8, 9, 10].

The content of the structure of the educational material, in particular, the nature of the development of education applied in the form of "problems" in programming science, and the description of the related organizational and didactic structures. Taking into consideration the problematic nature of thinking, the essence of a specific topic or section is as follows, that is, "In the form of a logical sequence of cognitive questions, and the educational process as a chain of educational situations, its questions as the core of its knowledge, and the essence of students is the joint, harmonious work in problem solving using teaching methods and various educational tools".

The concept of an activity approach in teaching Programming methods and paradigms includes:

➢ forming the student's readiness to actively, adequately and effectively use information and telecommunication technologies in the process of teaching the subject;

➢ identifying and forming the creative individuality of the student;

➢ development of future professional views.

Under universal educational efforts, in a broad sense, "the ability to learn, that is, the subject's ability to develop and improve himself through conscious and active assimilation of new social experience" is understood.

Cognitive views take priority in improving the effectiveness of learning programming paradigms. Cognitive universal educational activity constitutes a system of ways of knowing the surrounding world, independent search, research process and a set of operations for processing, systematizing, summarizing and using the received information. In this, general educational activities, symbolic, logical activities, problem setting and problem-solving activities are distinguished.

The formation of universal actions of general education allows students to:

➢ identify and formulate the problem independently, determine the goal, tasks, find the necessary information, search for a solution to the problem;

➢ form knowledge;

➢ conscious use of programming terms in speech in various fields of science;

➢ choose the most effective way to solve the programming problem depending on the specific conditions.

Significant and symbolic actions play a special role in increasing the effectiveness of teaching programming, which provide concrete methods of changing the educational material, represent modeling actions that perform the function of demonstrating the educational material. These include:

➢ replacement - transferring important features of the object to the model;

➢ coding - writing an algorithm in a language understandable to the executor;

➢ schematization - representation of the results of the previous two stages in a visual, perceptually simple form.

➢ modeling - the transformation of an object from a sensual form into a model (spatial-graphic or sign-symbolic), where important features of the object are highlighted.

Logical universal actions play an important role in choosing convenient methods for solving problems, in determining optimal algorithms. Their level of development affects students' ability to perform tasks of transferring the notation of a problem-solving algorithm from one symbol system to another. These tasks include:

➢ analysis of the main and non-essential parts of objects to highlight their features;

➢ synthesis - assembly of parts into a whole by filling in missing components;

➢ selection of bases and criteria for classification, comparison, categorization of objects;

➢ summarizing the concept, publishing results

The diversity of the content of each of the listed educational activities creates the necessary conditions for solving programming problems. The teacher must make sure that the students have all the necessary system of actions that constitute the programming ability. For this, it is necessary to connect the stages of solving programming problems with the structure of action:

1) The subject of action. The subject can be both a material object and words, expressions of the concept;

2) The purpose of the action. In order to successfully master the action, students must be taught to accomplish the goal. The goal is inextricably linked with the motive of action.

3) Motive. It motivates a person to set various goals and to achieve them, to perform appropriate actions. If the student does not see the need to perform certain actions, this will make the educational activity not interesting for him, he will not see any meaning in it.

4) The system of operations. Action includes several operations that must be performed in a certain sequence: action algorithm. In some cases this algorithm is fixed, and in others it can be changed.

5) A guiding basis is a system of conditions on which a person actually relies when performing an action. It may be complete or incomplete, true or false; the effectiveness of problem solving depends on how complete and correct the indicative framework is.

6) Result. The result of an action is always some product (tangible or hypothetical) and may or may not be consistent with the goal. The ratio of the result and the goal is determined.

We will consider the method of using structural logic in lectures on the topic "Object-oriented programming paradigm" in "Programming methods and paradigms" course. The teacher is provided with a technological map of the subject and a presentation on the topic. The student is given the text of the lecture: plans, main concepts, theoretical part, control questions, literature on the topic, documentary form of the lecture, audio and video lecture format, examples on the topic, tests and basic concepts. The learning objectives of the course are to introduce students to the Object Oriented Programming Paradigm. A programming paradigm is a mathematical theory or consistent set of principles for a computer programming approach. Each paradigm supports a set of concepts that are used to program a particular problem. For example, using object-oriented programming is the preferred method for problem solving.

The educational aim of the lesson is to provide students with in-depth knowledge about their professional activities, to form a sense of duty and responsibility towards society.

The objectives of the course are to form students' ability to apply knowledge, develop logical thinking and independent work skills. Methods of using logic-graphic diagram, consists of a 7-stage teaching methodology of the lecture class on the topic "Object-oriented programming paradigm" in the subject "Programming styles and paradigms".

THE FIRST STAGE. In preparing for the lesson, preparing students for the lesson, knowing the theory of the subject, using information and communication technologies; to know certain information; checking and analyzing homework. In addition, at this stage, it is necessary to activate the theoretical knowledge necessary for students in lectures. In order to do this, information is displayed simultaneously to students on all parallel displays.

The teacher launches files on the topic of the lecture. Students watch the activity of the teacher with concentration. The main goal is to focus students' attention, and it can be limited to 5-10 minutes.

THE SECOND STAGE. The teacher announces the topic, introduces the students to the goals and tasks of the subject, the sequence of the topic plan, the main concepts, the content of the lecture, and the results expected from the lecture. Explains the relationship between current and past topics. Students listen to the information given by the teacher, and the teacher should motivate the students based on the information given. This stage lasts 10 minutes.

THE THIRD STAGE. At this stage, the teacher explains the topic to the students using a logic- graphic diagram. To increase training efficiency it is appropriate:

➤ abandoning the uniformity of methods used in training;

➤ use of adequate elements of the program in the educational process;

➤ ensure rational use of time;

➤ effective use of problematic educational elements;

➤ use of video and multimedia tools in the course of the lesson

During the lesson, the speech of the teacher should be emotional, simple and understandable. The focus should be on explaining key phrases and new concepts rather than using unnecessary words. The main goal of this stage is to systematically provide students with basic expressions and scientific information, to develop social cooperation and creative interest in them. The duration of this stage is 25 minutes.

THE FOURTH STAGE. At the analysis stage, the teacher creates conditions for intensive analysis of ideas presented by students. Students analyze some aspects of the data and determine the most appropriate solution through intensive analysis of ideas and thoughts. At this stage, students are required to boldly express their personal opinion by increasing academic activity during the lesson, developing free, logical thinking. Students use every opportunity to think broadly and understand the essence of the problem. The duration of the stage is 15 minutes. THE FIFTH STAGE. During the supervision phase, students are observed with the main concepts of the lecture, program algorithms and methods of acquiring new knowledge. In this case, the teacher uses tests and examples divided into paper (handouts) or electronic (via computers) options according to their complexity. Students learn algorithms on the subject and develop a sense of error correction, activity, creativity and a desire to learn more about them. The duration of this stage is 15 minutes.

THE SIXTH STAGE. At the assignment stage, students are shown examples of creating programs of problems, as well as they are given the task of independently creating programs of relevant problems. In addition, it is necessary to collect the necessary materials from the Internet, analyze them, find useful sites on the topic, create logical graphic design solutions and use them. At this stage, students should understand the tasks and feel responsible for their completion. The duration of this stage is 5 minutes.

THE SEVENTH STAGE. At the last stage, the teacher provides information about the basic concepts of the topic and concludes the lesson. At this stage of the lecture, the main attention is paid to the analysis of the work done. In this process, the student evaluates his success, that is, in the electronic version; the teacher can send his suggestions and requests or answer the questionnaire, give methodological instructions for the topic of the next lecture.

ANALYSIS OF THE RESULTS OF THE PEDAGOGICAL EXPERIMENT.

To evaluate the effectiveness of the above methods in teaching "Programming paradigms" course in higher education, 23 students from Group 941-20, 24 students from group 942-20, and 13 students from Group 943-20 were selected. In this case, classes in "Programming methods and paradigms" course was conducted in the form of a simple lecture in Group 941-20, and in the rest of the groups, classes were conducted using innovative technologies. Based on the results of the mid-term and final evaluation, the following indicators were recorded in the groups.
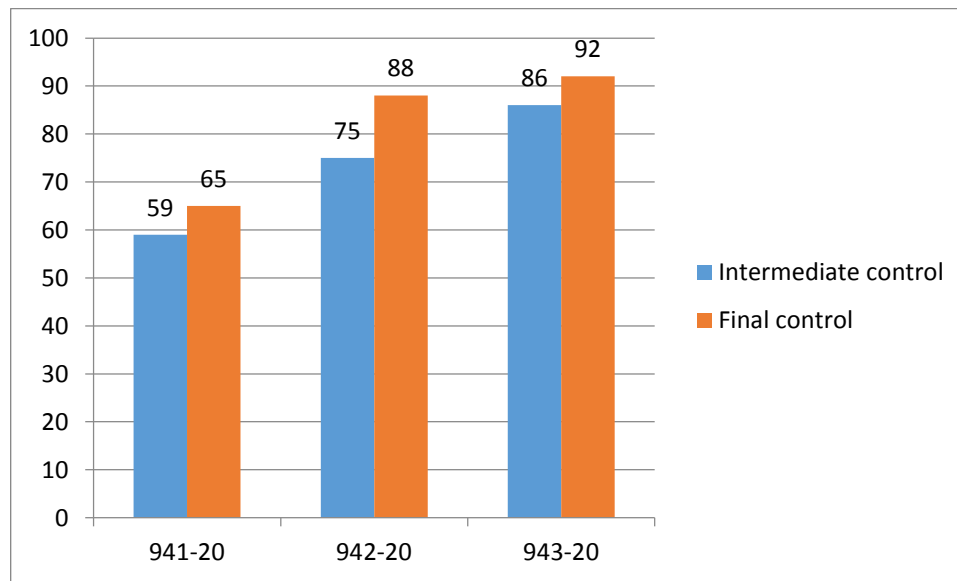
Picture 1. Science mastery indicators of group students.

As it can be seen from the experiment, teaching the course in the form of a traditional lecture recorded a 65% indicator in the final evaluation, while the groups trained on the basis of innovative technologies achieved 87 and 91% indicators. . Furthermore, the students of Urganch branch of TUIT named after Muhammad al-Khwarizmi participated in ICPC 2022-23 International Algorithmic Programming Olympiad in Kazakhstan, and 2 teams actively participated in the semi-finals of the Olympiad. In addition, students are taking pride of place in Informatics and information technologies at the Republican Olympiads. We have come to the conclusion that the use of new innovative methods to achieve high efficiency in higher education in teaching programming paradigms course is highly effective.

2. CONCLUSIONS

Thus, object-oriented programming is the main paradigm in modern application development. Its feature is the representation of the object domain in the form of objects that combine data and behavior. Based on the developed logical structure of the subject (discipline, department, module, block), programming according to the methodology of teaching students in the programming courses of the university helps to implement the modern concept of education in the field of information technologies, to develop modern teaching methods. The modern electronic resource base, created on the basis of the logical structure of the course, not only increases the interest of university students in the studied subjects, but also allows the teachers themselves to preserve the achievements in the arsenal of educational subjects.

An example topic in our structured method, the "Object Oriented Programming Paradigm" section of "Algorithms and Programming Fundamentals" course, along with experimental verification, showed educational effectiveness in teaching these information technologies and improving the systematic knowledge of university students.The selection and composition of the content of modern educational science and the topic "Object-oriented programming paradigm" (a collection of terms and concepts, facts, types of educational and research activities) provides interaction between the subject and methods of teaching, science methodology and the field of knowledge. Orientation of educational materials to the formation of an integrated system of professional and educational skills increases the quality of higher professional education.

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