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# PROGRAMMING STUDENT PRACTICE METHODOLOGY OF SKILLS FORMATION BASED ON STRUCTURED MODULAR TECHNOLOGY

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**Abstract**

The main feature of the pedagogical technology used in the educational process is to ensure the guaranteed achievement of the planned educational results. The methodology of effectively organizing the educational process based on logically structured elements of the content of programming is a necessary condition, but not sufficient to achieve guaranteed effective knowledge. All students try to master and complete the subjects of the subject effectively, but not all of them can achieve the same high results. In our opinion, in order to further improve and increase the quality of the educational process, it is proposed to organize the educational process on the basis of a graph scheme, which represents the sequence of effectively describing the content of logically structured topics according to the levels of the student's knowledge acquisition.

**Keywords:** *educational science, analysis, methodology, logical structure, graph scheme, module, educational process, efficiency*

## Introduction

In higher education, in addition to classroom training, the organization of independent work of students under the guidance of a teacher is considered one of the main, most important factors in the preparation of future professionals. In the current trend of modern teaching, a great deal of attention is focused on increasing the efficiency, productivity, scientific practical potential and other similar factors of the student's independent work under the supervision of the teacher. From year to year, the amount of hours allocated to independent education under the guidance of a teacher in the component of teaching subjects in the curriculum of specialization is 60% of the amount of hours allocated for some subjects. This is natural, because in today's rapidly developing era of information and communication technologies, a lot of attention is paid to the organization of independent education.

The student's independent work should not be considered as a simple method of acquiring knowledge, on the contrary, it is one of the main principles of the activity of the higher education institution. Self-directed learning is a necessary component of a unified learning process, as it is organized, targeted, regulated and controlled by the learning process. Therefore, organizing the

student's independent work, especially in the conditions of the development of information and communication technologies, is one of the priority and effective ways of improving the quality of education (Juikova, O.V., 2013, 290; Yusupov F., Sapaev U., 2016, 84).

In the subject of programming, like other subjects, the student's knowledge is monitored step by step (current control, mid-term control, final control). Students' knowledge is monitored in practical and laboratory sessions on each topic. Control over lecture materials is carried out on the basis of logically completed topics, as well as tasks given for independent learning.

In order to develop the student's ability to perform independent practical activities in the field of programming, it is necessary to organize students' acquisition of algorithms and programming principles and effective methods on the basis of continuous, active, systematically structured modular technology. Now the student develops internal motivation to learn, self-learning skills are formed and activated. Therefore, it is necessary to stimulate the theoretical, practical and creative potential of the student (materially and spiritually).

For this purpose, it is necessary to create structured modules in the form of a tree (graph-scheme) of logically completed educational elements of the content of the subject in order to organize the learning activity of the student in various forms (under the guidance of the teacher, independent work of the student) (Maksanova L.A., Zolotareva A.M., 2001; Yusupov F., Shamuratova I., Yusupov D. and Khudayberganov T., 2019; Narman H.S. et al., 2020; Yusupov F., Nafasov I.S., 2023). The use of the logical structure scheme of the science in the form of a tree provides an opportunity to conduct the student's independent work on the basis of a planned schedule of topics during the semester. Therefore, more than 1.000 examples and problems have been prepared and placed in the algo system in the section of programming subjects.

## Methodology

Based on the structured modular technology, we consider the formation of practical skills of the student in the topic of algorithmization and programming of sequential calculation processes (Yusupov F., Sapaev U., 2016; Yusupov F., Shamuratova I., Yusupov D. and Khudayberganov T., 2019).

Example 1. y1 = a + b + c; y2 = a – b – c; Create an algorithm and program for calculating the value of expressions y3 = a * b * c. The 3 expressions in the example are not related to each other, you can start counting from any one you want. A structured modular scheme of the example algorithm and program is presented in (Fig. 1).

Figure 2 below shows the schema of the semantic graph corresponding to the structured modular schema of the topic.

This article presents the methodology of teaching the topic "Algorithm and programming of sequential calculation processes" of Programming 1 subject based on logically structured modular technology to activate the student's activity in lectures and practical sessions.

For each learning element, completed logical concepts (program structure, constants, variables, selection of libraries, data entry in the program, input from the keyboard, grammatical syntax rules for writing expressions, algorithm, programming, error correction, description of the result, etc.), from various methods, didactic materials are prepared using tools (textual, graphic, presentation, animation, multimedia tools) (Zakirova, F.M., Saidova, F., & Zakirova, M., 2018).

Training objectives. Educational: providing students with structured information on the topic "Algorithm and programming of sequential computing processes", showing presentations. To explain the concepts of sequence calculation and their organization methods and options with the help of visual materials, to teach the methods of creating and describing sequences in any programming language.

Educational: in-depth acquisition of professional knowledge, education of duty and responsibility towards society.

Developmental: formation of applied knowledge, development of logical thinking and independent work skills.

Form of training: practical (80 minutes). The teacher distributes the time according to his ability and the level of initial preparation of the students.

Training method: computer training.

**Figure 1.** *An example of a structured modular scheme*

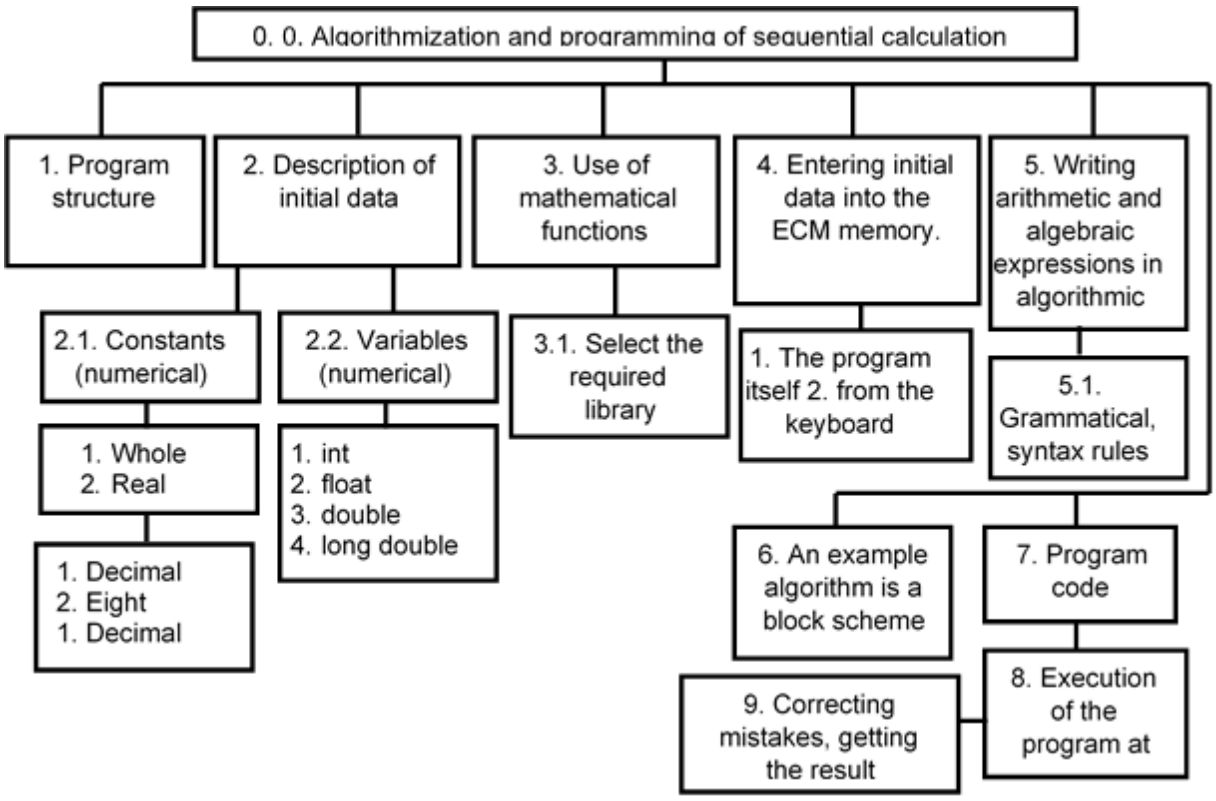
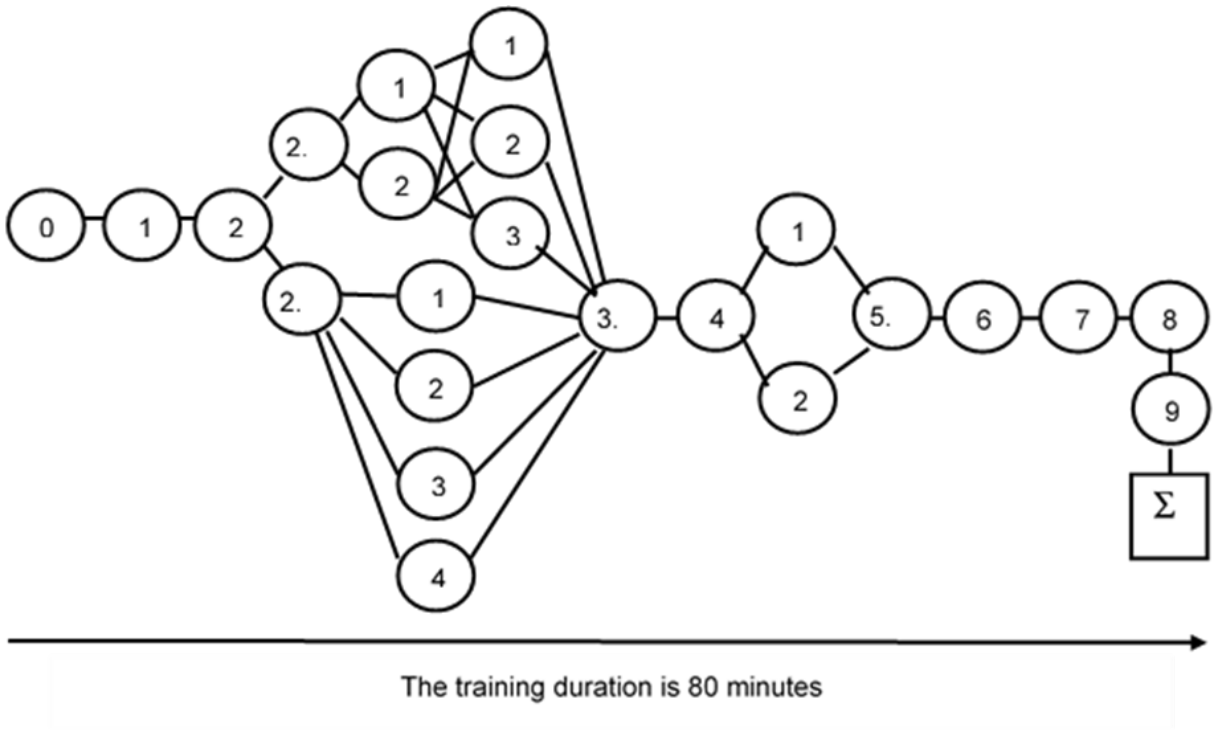



**Figure 2.** *Topic semantic graph scheme*



**Expected results of training.**

Course of the training:

– organizational moment. Motivation: arousing interest in creating algorithms for specific problems based on algorithmization of sequential calculation processes and programming examples;

– activation of knowledge: all students are given an individual personal creative task.

Equipment: computer, projector, lecture text, description of practical training, sample solved examples, tests, methodical recommendations for algorithmizing and programming examples.

**Stage 1** (5 minutes). The teacher launches the lecture text "Algorithm and Programming of Sequential Calculation Processes" from the HEMIS system and offers to use it in practical training.

**Stage 2** (10 minutes). The teacher explains the topic of the practical exercise and explains that the main purpose of the exercise is to build an algorithm for sequential calculation processes, write a program in S++, program adjustment, check and debug procedures. The teacher explains the procedure for conducting the practical training:

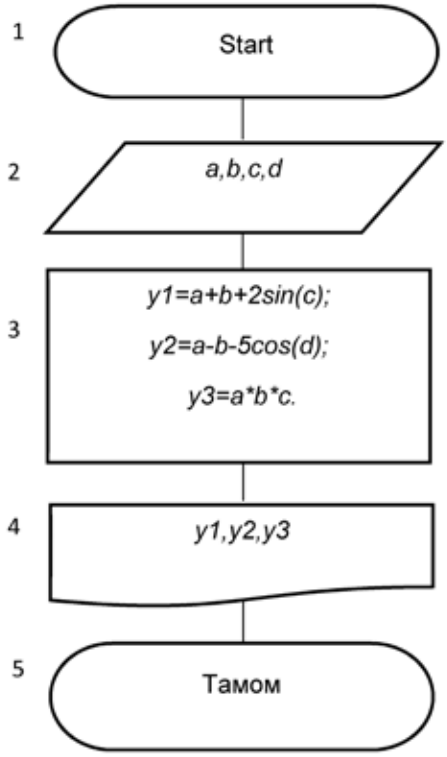
- the purpose of practical training;
- setting of the problem (each student is given an individual example);
- determining the variables in the example and their types, determining the sequence of calculating expressions, building the algorithm for solving the example;
- write the program of the example based on the algorithm in S++ language;
- flash-testing process. Checking, correcting, testing and debugging the program text;
- description of the obtained results;
- instruction on the use of the program.

**Stage 3** (10 minutes). The teacher explains in detail that sequential calculation processes are used a lot in solving technical and economic issues of an enterprise, in creating information systems, especially in personnel department, accounting work, and its importance. In the framework of this practical exercise, the problems of performing typical operations on single-expression and multi-expression calculation processes are considered. Basically, it is recommended to create an algorithm and program for the following types of problems:

| **Option-1.** | **Option-2.** |
|---|---|
| 1. $y= qa^2+\sin(b^2)$, | 1.$x= 2z+10d$, |
| 2. $x= a^2+z^3-3f$, | 2. $t=\frac{2a+b^2}{c+d^3}$, |
| 3. $Z= 23q^2+\cos(y)$, | 3. $d=2a+3c^2$, |
| 4. $f = 5z^2+\ln(d)$, | 4. $z=\frac{\sqrt{t+1}-12a}{c^2+d^2+12}$, |
| 5. $q=2t+7k$. | 5. $u=\frac{2y+x^2}{\sqrt{x+y}}$ |

Typical algorithms and their programs for the above-mentioned examples are explained and shown in slides. Students can use these slides during class.

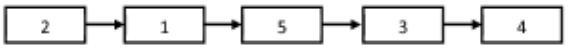
The algorithm and program of the example we are looking at is presented in the slide below.

| Algorithm | Program. |
|---|---|
|  | // Program of sequential calculation process<br>#include<iostream.h><br>#include<conio.h><br>#include<math.h><br>using namespace std;<br>int main ()<br>{<br>float a, b, c, d, y1, y2, y3;<br>cout << ”a, b, c, d = ”;<br>cin >> a >> b >> c >> d;<br><br><br><br><br><br>y1 = a + b + 2 * sin(c); y 2 = a – b – 5*cos(d);<br>y3 = a * b * c;<br>cout<<endl;<br>cout<<" y1 = " <<y1<<endl;<br>cout<<" y2 = " <<y2<<endl;<br>cout<<" y3 = " <<y3<<endl;<br>getch();<br>return 0;<br>} |

Example-2. Calculate the value of several expressions below:

*1. $x = ay + d$; 2. $y = a + 2c^2$; 3. $z = ax/q - y^3$; 4. $u = (x + y)/q + z$; 5. $q = (2x+3y)/(2+b^2)$.*

The sequence of calculation of these expressions is as follows:




The expressions in the given sequence are written in the 3rd block of the above algorithm, the resulting quantities “x, y, z, u, q” are written in the 4th block and changes are made to the program accordingly.

**Stage 4** (40 minutes). Students will proceed to perform the algorithms for solving their examples individually according to the options given in step 2. At this time, if any student faces difficulties in completing his practical work, he refers to the presentations of solved sample cases. In a short period of time, the student learns by looking at methodological developments and recommendations in the form of presentations. Students build algorithms and write programs to solve the examples they have received by option. If there are misunderstandings, he asks the teacher for help. The teacher gives guiding and developing answers to students’ questions.

**Step 5 (**10 minutes). Students test their written programs in the algo system, and if the program fails, they correct the errors and retest, this process can be repeated several times.

**Evaluation criterion:** the algorithm of the example is evaluated with 2 points, and the program tested in the algo system is evaluated with 3 points. The total practical training of the student is evaluated with 5 points. The work of students whose program has not passed the test in the algo system is evaluated with 2 points depending on the correctness of the algorithm.

**Step 6** (5 minutes). At the end of the lesson, the teacher gives students individual assignments for independent work on the topic. The teacher concludes the lesson by saying that they will prepare for the next practical lesson using the electronic or paper version of the teaching-methodical complex of the subject.

The times allocated for the levels are not fixed, the teacher allocates them according to the readiness, ability and mastery of the students.

As a result, it is possible to create informational, algorithmic, program-pedagogical tools, demonstration slides, simple and multimedia animations on the basis of structured elements of the topic of algorithmization and programming of sequential calculation processes. These will ultimately help the student to activate his activity in this subject, which is one of the requirements of the time. Similarly, the method of logical structuring of the content of the subject can be the basis for the creation of modern electronic textbooks.

Thus, on the basis of the recommended structured modular technology, the computerized teaching methodology and the method of advancing students' mastery of science, the planning of independent work on topics, are giving effective results in the initial courses of our branch. Organization of the teaching process based on the graph semantic structure of science (science, departments, modules, blocks, topics) creates opportunities for effective use of modern teaching concepts and information communication technologies in the educational system.

Creating a modern electronic resource base based on the graph semantic structure of sciences not only arouses students' interest in science, but also creates great opportunities for them to use electronic resources of science and receive advice whenever they want. In addition, science teachers now look at their subject and its components with a special eye and constantly enrich them with new knowledge, try to find new methods of teaching, and keep pace with the times.

Activating the student's learning process on the basis of structured modular technology of the content of programming science serves as a basis for ensuring the formation, development, independent creative thinking and other aspects of practical skills in algorithmization and programming, namely: Initiative – feeling responsibility in completing tasks and completing them; Foresight is the feature of bringing the solution of the educational problem to the intended goal; Self-assessment – the student's adapted attitude to the next educational tasks; Self-monitoring – adapting one's independent work to the set requirements; Creative approach – searching for effective methods, algorithms for performing tasks, learning.

As a result of using the proposed structured modular teaching technology, the educational process is individualized, new motivations appear in students in mastering subjects, feedback plays a strong role in the student-teacher system, the objectivity of knowledge assessment increases, the collection of statistical data is simplified, some aspects of students' mastery of knowledge (good, low) is evident, the teacher has the opportunity to change the structure of the lesson (in accordance with the initial level of preparation of the students), creates an opportunity to differentiate the educational process, increases the mastery of the subject, the subject, and increases interest in it. The use of computer technologies in the educational process supports the teacher technically and technologically, it saves a lot of time for live communication with students, communication with students in Atija is collective and individual, close to each other, in the form of a master-student.

## References

Juikova, O.V. (2013). Organization of independent work of technical university students when studying graphic disciplines: Knowledge. Understanding. Skill. Izhesk,– 2.– P. 288–293.

Yusupov F., Sapaev U. (2016). On the issue of organizing independent work of students at a technical university in an ICT environment: young scientist.– 9(5).– P. 83–85.

Maksanova L.A., Zolotareva A.M. (2001). Structural-logical diagram – a tool for optimizing students' independent work: Methodology and technology for optimizing the educational process. Ulan-Ude, RIO VSTU, 7.

Yusupov F., Shamuratova I., Yusupov D. and Khudayberganov T. "Improving the effectiveness of teaching the course "Data structure and algorithms" based on structuration and integration of the discipline," 2019 International Conference on Information Science and Communications Technologies (ICISCT), Tashkent, Uzbekistan, 2019.– P. 1–4. Doi: 10.1109/ICISCT47635.2019.9011846.

Narman H.S. et al., "Augmented Reality for Teaching Data Structures in Computer Science." 2020 IEEE Global Humanitarian Technology Conference (GHTC), Seattle, WA. USA. 202.– P. 1–7. Doi: 10.1109/GHTC46280.2020.9342932.

Yusupov F., Nafasov I.S. (2023). Methodology of Student Activation on the Subject of Determining the Roots of a Nonlinear Equation Based on a Decomposited Graph Scheme. European Journal of Education and Applied Psychology 2023.– No. 3. URL: https://doi.org/10.29013/EJEAP-23–3–31–35

Zakirova, F. M., Saidova, F., & Zakirova, M. (2018). Blended learning for the development of academic staff creativity: The experience of advanced training of pedagogical staff in the Republic of Uzbekistan. In 2nd International Conference on Digital Technology in Education, ICDTE2018. – Thailand. 143696. DOI: https://doi.org/10.1145/3284497.3284501

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