

## ORGANIZATION OF INDEPENDENT WORK OF STUDENTS IN THE PROCESS OF TEACHING MATHEMATICS ON THE COMPETENCE-BASED APPROACH

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**Abstract.** *The article presents the necessary aspects of organizing selfstudy in mathematics. In connection with the transition to a credit-modular system in higher educational institutions, students are given more time to acquire independent knowledge. The article discusses the aspects that must be taken into account when developing a system of tasks for students to obtain independent knowledge.*

**Keywords:** *credit module, independent learning, intellectual ability, logical questions, mathematical concepts.*

The organization of independent work of students in the process of teaching mathematics is a complex, goal-oriented, organized educational activity of the teacher and active learning and independent work activities aimed at acquiring fundamental mathematical knowledge, educating students and developing them as individuals. is an educational process.

In conditions of implementation of a competent approach in higher education, the teacher and the student are considered active subjects of the educational process, and the teacher is the managing subject who organizes the educational process. A student who performs educational and professional activities in a goal-oriented manner acts as a subject of management.

*The purpose of organizing independent work of students in the process of teaching mathematics* is to provide quality preparation for mathematics, to improve the independent work of students, to form mathematical thinking, to provide conditions for independent organization and independent development of students. Tasks of independent professional retraining in teaching mathematics at HEIs:

1. Formation of professional competences necessary for the development of professional activities.

2. Development of cognitive skills and activity of students.

3. Self-development and self-improvement of students.

Principles of organizing students' independent work in the process of teaching mathematics:

- the principle of awareness and creative activity;
- the principle of comprehensibility;
- the principle of systematicity;
- principle of scientificity;
- the principle of connection between theory and practice;
- the principle of differentiated approach to students;
- the principle of demonstrability;
- the principle of thoroughness of knowledge.

The implementation of the principle of consciousness and creative activity in the process

of preparation for mathematics requires students to master mathematical knowledge, excluding their mechanical memorization of the material. Students are required to master the methods of thinking activity in the process of learning "new things". In the process of independent work, the formation of the ability of students to be active, which is manifested in their initiative and high level of independence, as well as the formation of a creative attitude to the study and application of mathematical knowledge, a critical approach to the opinions of others, and the formation of the independence of one's own judgments.

*The principle of comprehensibility* in the organization of independent work in the process of teaching mathematics requires that the size and content of tasks, independently studied material correspond to the level of their intellectual development and the existing reserve of mathematical knowledge, skills and abilities. However, comprehensibility, compatibility should not be replaced by "ease", independent work cannot be done without the hard work of students' mental powers. Implementation of the principle of comprehensibility requires the fulfillment of the following conditions - didactic rules: simple to complex; from easy to difficult; from the known to the unknown. In order to expand students' knowledge and, as a result, to increase the effectiveness of their independent work during the study of mathematics, it is necessary to arm students with more rational methods of work on mastering mathematics, because it makes it easier to master more complex educational material.

Implementation of the *principle of systematicity* in the process of teaching mathematics to students should be organized in a certain way so that it can be given in the form of a system. We understand this system as a set of types of work that are interconnected, mutually conditioned, subordinated to common tasks, and different according to the educational purpose and content. In this case, it is necessary to emphasize that the consistency of performing different types of independent work during the teaching of mathematics is an important factor in increasing the efficiency of these works.

In the process of teaching mathematics, the *principle of scientificity* in the organization of independent work allows students to complete assignments at the modern level of scientific knowledge and solve mathematical problems.

In the course of teaching future bachelors in mathematics, independent work should be carried out taking into account the principle of connection between theory and practice, which allows solving situational tasks with the use of mathematical tools, and this allows students to transfer their educational activities to professional activities. It is necessary to note the following: the higher the knowledge acquired by students during independent work in the process of mathematical education interacts with life, the more it is used in practice, the higher the level of awareness and interest in education.

The principle of a differentiated approach to students in the implementation of pedagogical support of independent works in the process of preparation for mathematics is manifested in the teacher's consideration of individual characteristics of students, their intellectual abilities. Its *implementation requires* the development of different levels of mathematical tasks, and the teacher should transfer the students who are successfully completing the tasks to tasks of higher complexity in time.

The principle of demonstrability comes from the essence of the process of perceiving, understanding and generalizing the material independently studied by students in the field of mathematics, providing a connection between concrete and abstract, helps to develop abstract

thinking of students, and in many cases serves as its support. According to scientist Ya.A.Comenius [1], the principle of demonstrability is the "ordinary rule of didactics". It requires a combination of visuality and thought-action, visuality and speech. Both underuse and overuse of visual aids are harmful. A lack of them leads to formal mathematical knowledge, and an excess can slow down the development of logical thinking, spatial understanding and imagination.

In the process of teaching mathematics, the following work is carried out at this stage of organizing independent work:

- students' activity in completing the tasks proposed by the teacher. In this case, it is possible to achieve the goal of organizing students' independent activities on the condition that students understand it, accept their educational mathematical tasks. Here we quote the opinion of the scientist L.P. Yakushkina, which we cannot help but agree with: "a student should not only be able to understand the goals proposed by the teacher, but also be able to express them himself, and hold them until they are realized, without letting others squeeze them, even if they are worthy of attention" [ 2].

- self-organization of students in performing the tasks proposed by the teacher, in addition to understanding the goals, implies that students determine the ways to achieve them, make a plan of independent work, independently choose the "method of changing the given conditions" and determine the sequence of individual actions. It requires students to be motivated, creative, responsible, realize their potential, and reflect.

The materials of teaching courses in mathematics can be used to improve the independent work of students, to develop and apply calculation methods for solving tasks from all fields of knowledge, in particular, from economic fields, to build and research mathematical models of economic tasks.

The considered mathematical sciences are a model practical application apparatus for studying the mathematical component of their professional education of students of the economic direction.

The professional competences in ES (Education Standart) , which are formed in the process of improving the independent work of students in mathematics, are described in terms of structural elements that are the result of the organization of independent work of students.

In order to organize the cognitive activity of economic students in the teaching of mathematics, we distinguish the following types of independent work:

- cognitive-algorithmic;
- search-heuristic;
- creative and research.

Each type of independent work is divided into different types.

We include cognitive-algorithmic type familiarization, reproductive, strengthening, reconstructing, checking, independent work.

Performing independent work helps students to understand the need for new knowledge to solve mathematical problems, to develop their interest in knowledge, to form knowledge in the process of active perception of new information, and to acquire skills to independently find new knowledge.

Reproductive independent work requires the performance of standard tasks according to a given sample, according to a given hypothesis, in a certain way, or according to a typed algorithm.

Such work has an executive character and is directed to the reproduction and practical application of basic mathematical knowledge.

Application of self-reinforcing independent works in the process of teaching mathematics implies conducting thematic general studies and performing various tasks to organize and systematize previously acquired mathematical knowledge.

Performing reproductive work, which involves the independent familiarization of objects and phenomena according to their properties and the application of existing mathematical knowledge in various situations, helps to deepen knowledge, to form and improve the skills and abilities to solve various educational and practical tasks in mathematical content, and thus to create a base for future mathematical education. .

Carrying out self-assessment tasks allows the teacher to monitor students' performance of tasks, to evaluate both intermediate and final results of their activities during the teaching of mathematics, and to conduct an analysis of the quality of students' mastery of the material. In addition, students independently control the material they have mastered, and this undoubtedly helps to increase the level of awareness of mastering and applying the mathematical knowledge they have acquired.

In turn, we include variable, transformative and research independent works of students in research-heuristic type of independent works.

Variant independent works include tasks with variable conditions, which allow for different methods and results of solutions and require students to get out of non-standard situations in the most optimal way. Carrying out such work requires changing the conditions of the assigned tasks, transferring all of the students' mathematical knowledge to solving non-standard tasks, and this helps students to collect and demonstrate new experience of activities in the course of teaching mathematics.

In the process of performing independent work that transforms, students are required to apply certain mathematical methods, models, and solving methods with slight changes in the given situation, to divide the task into decomposition parts, to reconstruct the process of solving it, to make changes to the sequence of actions, to develop a new plan for solving the problematic task.

The research assumes compliance with the nature of the activity of the various independent works of teaching, ensures the diversity of the types of activities and the forms of interaction of the students. Educational tasks of such works encourage students to independently discover new things by delving into the essence of the studied objects, events and processes, analyzing and summarizing them, separating the primary aspects from the secondary ones, and establishing mutual relations between the studied phenomena. Conducting research helps students to show their own initiative, active thinking activity, to find and use the necessary material, to express their thoughts and conclusions, and to generate new ideas.

In our opinion, creative-research type independent works include creative, scientific-research and information-project independent works.

The use of creative independent work in the process of teaching mathematics to improve the independent work of students in higher education institutions is an effective means of forming and developing a creative personality. Here, tasks to create something new, individual, to create an original task, to create one's own problem situation and solve it independently or together, to find a way to a solution, as well as tasks that require the skills of applying existing mathematical knowledge in a complicated situation are meant. During the performance of such work, students

develop an emotional attitude towards the subject being studied, and this undoubtedly helps to deepen the acquired knowledge and increase interest in independent activities in general.

Scientific and research work directs students to create a professional plan and justify research paths, search for necessary information, organize its structuring, solve a completely new framework that requires independent selection of mathematical methods and models, algorithms, tools and technologies. Completing assignments of this type of independent work helps students to develop research activity skills.

Information-designing type of independent work directs students to use information and communication technologies while solving tasks, to implement mathematical (algorithmic and computing) equipment on a computer, to program implementation of studied tasks and to carry out optimization calculations.

Within the content component of the model, the content of mathematical education includes a set of interrelated teaching and methodical support that ensures the effective organization of the independent work of improving the independent work of students. On the basis of a competent approach, the developed educational and methodological support of the theoretical model of organizing independent work of students in the process of preparing for mathematics includes the following:

- 1) working programs of mathematics;
- 2) methodological instructions;
- 3) didactic materials.

The instrumental-technological component of the model specifies the applied pedagogical technologies of teaching mathematics, the forms and means of organizing independent work.

As an example, in the theoretical model of organization based on the approach in the experiment group according to independent results, the following are used as technologies of teaching mathematics:

- the problem-based teaching technology, which combines systematic independent research activities of students with their mastery of ready-made conclusions and motivates students to learn and logical thinking, and is oriented towards research during their teaching of mathematics;
- design teaching technology, which involves the integration of mathematical knowledge and their application in the process of completing complex educational projects;
- technology of interdisciplinary integration that helps students to form an "open" system of mathematical knowledge, which can be integrated into new systems of knowledge in the future [3];
- information and communication technology, which involves improving the independent work of students, increasing the effectiveness of the mathematics teaching process using computer-calculation technologies;
- a differentiated teaching technology that takes into account the psychological characteristics of students, the type of thinking, their intellectual abilities and opportunities, the level of their existing mathematical knowledge in the process of teaching mathematics;
- contextual teaching technology that looks at students' independent mathematical education through the prism of their future professional activities.

The technology of teaching mathematics interacts with the forms of organizing students' independent work. According to the venue, independent re-audience in teaching at the Higher Education Institution, the number of practical and laboratory sessions and the audience

(preparation for lectures, homework, preparation for control work, calculation and graphic work (HGI), preparation of abstracts, preparation for participation in scientific-practical conferences) etc.) are divided into types.

Interrelationship is observed between forms and means of organizing independent work. In the theoretical model of independent preparation of students for mathematics, teaching-methodical complexes of subjects, presentation material, manuals, practical software packages (MsOffice, Statistica), distance learning tools (Moodle system) serve as tools.

The result-diagnostic component describes the effectiveness of the model we developed, it is considered as a set of diagnostic tools used to monitor and evaluate independent work in the process of teaching mathematics students of the economic direction.

Control, calculation-graphic, laboratory work, individual homework, and other tasks that correspond to the criteria of professional competences at the cognitive, activity, and context levels according to the level of complexity are tools for diagnosing the independent work of students.

All tasks were discussed at the meetings of the higher mathematics department, and the economic directions correspond to the typology that we distinguished above, which is used to organize the cognitive activities of students in the process of independent mathematical education.

It should be noted that the result-diagnostic component should have a two-way relationship with the objective, theoretical-methodological, structural-content and instrumental-technological components, and based on the obtained results, corrections should be made to the process of organizing independent work at its various stages during the education of students in mathematics. allows.

The sum of the structural elements of professional competences determined as a result of organizing independent work in the process of teaching mathematical sciences at the cognitive, activity and context levels, to improve the independent work of students, to activate the processes of individual independent development, realization of their opportunities, abilities and potential, to develop their professional competence in mathematical sciences allows.

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