

# A SYSTEMATIC APPROACH TO THE DEVELOPMENT OF MATHEMATICAL COMPETENCE AMONG STUDENTS OF TECHNICAL UNIVERSITIES

**Jamshid Fayzullaev**

Applicant of Ferghana Polytechnic Institute  
Ferghana, UZBEKISTAN

## ABSTRACT

The basis of the methodology of the presented scientific research is composed of systemic and activity-based approaches that are focused on a holistic study of objects by identifying the diverse elements and relationships between them. This approach, reflecting the dialectical unity of continuous and discrete, holistic and structural, allows you to create models of complex processes, facilitating their study, makes their study more simplified. A holistic process, divided into parts, is easier to analyze..

**Keywords:** Math, competence, student, technician.

## INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

The term "systematic approach" refers to a group of methods by which a real object is described as a set of interacting components. The need for a systematic approach is due to the enlargement and complication of the studied systems, the need for systems management and the integration of knowledge.

A number of scientists believe that the general theory of systems was born, to the honor of national science, in our country. So, according to A. A. Malinovsky, the first system concepts are connected with the names of Russian scientists (E. S. Fedorov; A. A. Bogdanov; K. A. Timiryazev; M. M. Zavadovsky), appeared at the beginning XX century, although a number of foreign and domestic authors attribute the origin of the general theory of systems when the program for constructing this theory as an interdisciplinary science was first put forward. By the beginning of the 60s, cybernetics, information theory, solution theory, topology, and others were included in the general theory of systems. V.I. Vernadsky.

The study of literary sources allowed us to identify two guidelines for using a systematic approach to scientific research:

- research with a predominance of a theoretical orientation, when there is a need "to embrace and synthesize heterogeneous knowledge and some complex object" in a single theoretical perspective, as "the sphere of interdisciplinary research";

- studies of a pronounced applied nature, focused on solving specific practical problems.

The basic concept in a systematic approach is the concept of "system", which is a specific type of reality and is in constant motion. A system (Greek) is a whole consisting of parts, a set of mutually interacting components.

A system, as a concept, is characterized by two properties that are opposite in meaning: limitation and integrity. These properties characterize its internal and external states: isolation, limitation of the system from the environment is an indicator of its integrity and individuality. This gives reason to consider the system as a set that reflects the objective existence of specific individual interconnected sets of bodies, and does not contain specific restrictions inherent in

private systems. This characterizes the system as a self-moving aggregate, allowing us to conclude that it is constantly moving and changing.

The systematic approach involves: considering the object of activity as a system, as a limited set of interacting elements; determination of the composition, structure and organization of the elements and parts of the system, the discovery of the main connections between them; the identification of external relations of the system, the allocation of the main ones; determination of the function of the system and its role among other systems, analysis of the dialectics of the structure and function of the system; detection on this basis of patterns and trends in the development of the system.

There are several varieties of a systematic approach, which allows you to consider it at different levels:

- complex, when only the composition of the system is studied, excluding the relationship between elements, elements and the whole;
- structural, when the composition of the system is studied, the relations between the elements of the system, but the relations of the elements and the whole are absent;
- holistic when all relationships are considered.

The systematic approach is applied to individual objects and their components, sets of objects, as well as to the properties or integral characteristics of objects. Consideration of the object of study from the perspective of a systematic approach involves the determination of system-forming properties, the main characteristics of the system. The systematic approach to pedagogy is a methodological direction that, according to a certain principle, identifies a certain group of elements in a holistic pedagogical process and considers interactions within it and with external objects, with the environment.

The methodology of the system approach is system analysis and the conceptual series used in the course of such analysis, denoting the properties of an object, the combined presence of which defines the object as a system.

System descriptions are a means of solving many theoretical and applied problems facing educators and psychologists today. A systematic approach allows you to identify gaps in knowledge about this object, to detect their incompleteness, to determine the objectives of scientific research. Systemic methods allow you to present educational information in an adequate form for perception and memorization, give a more holistic description of the subject of science and move from inductive teaching methods to inductive-deductive.

Today it is quite obvious that knowledge is not transmitted, but acquired in the process of performing a certain system of actions. Knowledge itself, without certain skills and abilities to use them, cannot solve the problem of educating and preparing a student for his future professional activity. Therefore, the goal of education is not just knowledge and skills, but certain personality traits, the formation of competencies that should prepare the student for a future life in society.

In this regard, the urgent problem of the implementation of the activity-based approach in the system of formation of mathematical competence for future engineers. As noted by N.K. Baklanova, A.A. Verbitsky, I.A. Winter, A.A. Bodalev, the essence of the activity approach, is that the content of the historical experience of people is not acquired by transmitting information to the student, but in the process of his own educational and cognitive activity aimed at objects and phenomena of the world that are created in the process of civilizational development of human culture. According to scientists, a university graduate should be ready

"... to choose an individual style of professional activity, a specific role for themselves among other subjects, to develop their own goals for work and the means to achieve them ...". The active approach is manifested not only in the specific methods, the nature of the organization of the educational process of the university, but also in its direction, target setting - professional preparedness and readiness of the graduate for a comprehensive, holistic implementation of the future engineer's functional.

The concept of the activity approach was formed on the basis of psychological, psychological and pedagogical provisions developed by the above scientists, as well as A.V. Zaporozhets, D.B. Elkonin, V.V. Davydov, P.Ya. Halperin, G.I. Sarantsev, N.F. Talyzina, A.K. Markova and many other researchers. The process of activity is simultaneously a process of the development of human abilities and functions, and the unit of activity is the objective action.

Currently, there are several theoretical approaches to designing the activity content of education, in which different conceptual ideas are implemented. The essence of the activity content of education is to resolve the contradiction between the subject content and the form of training. To build a system of scientific knowledge, it is necessary to develop theoretical thinking among students, teach them the methods of organizing activities related to the development of new knowledge. As you know, the activity approach leads to a change in the student's personality as a subject of activity, and the method (principle) of activity is the elementary unit of the activity content of education. Mastering the methods of activity in the student's educational activity is carried out in the form of solving educational problems. Thus, the development of the student's activity abilities is ensured, allowing him to independently build and change his own life activities, to be its true subject, to be included in existing ones and to create new types of activities and forms of communication.

The process of training should be organized as an active, independent and productive activity, revealing and developing the student's potential, ensuring his subjective, responsible position, both in the learning process and in future professional activities.

The concept of "activity" is a fundamental category of the theory of knowledge. In materialistic dialectics, "activity" means the practical transformation of social natural reality. Under the activities understand and work aimed at the creation of material values, and the organization of labor of entire collectives, and upbringing and training (pedagogical activity), and research activities, etc., etc.

Training is carried out in the framework of educational activities. By definition proposed by DB Elkonin, "educational activity is, first of all, such activity, as a result of which changes occur in the student himself. This is an activity of self-change, its product is those changes that occurred during its implementation in the subject itself" [176, p.150]. B.C. Bezrukova defines educational activity as "a special kind of active activity of students, which is aimed at self-change, at the transformation of students themselves as subjects of learning" [10, p. 60]. According to V.Ya. Liaudis, "learning activity is the activity of transforming mental activity, of self-changing the subject of learning, the subject of learning activity is the learner's experience, which is converted into learning by appropriating elements of social experience". Common in all definitions is the emphasis on the definition of the learner as an active subject of educational activity, aimed at changing not only the stock of his knowledge of skills, abilities, but, very importantly, in the level of formation of the sides of his activity, on self-change.

The active approach is based on the principle that the human psyche is continuously connected with its activity and activity. In this case, activity is understood as a deliberate activity of a person, manifested in the process of his interaction with the surrounding world. The implementation of the activity-based approach in learning means that in the learning process it is necessary to solve the problem of forming the learners' ability to carry out activities.

According to DB Elkonin, "the educational activity in its structure repeats, reproduces the structure of all human activity. It stands out: motives and learning tasks, learning activities, monitoring and evaluation actions ... Full-fledged learning activities are always the unity and interpenetration of all these components. "

An active approach provides for a review of the content of training, which should not be a given system of knowledge, but a given system of actions and knowledge to ensure the development of this system. To know from these positions does not simply mean to remember certain knowledge, but to carry out certain activities related to this knowledge. They are assimilated in order to perform actions, solve problems, carry out activities with their help, and not so that they are simply remembered and serve only to increase erudition.

G.I. Sarantsev analyzed the manifestations of the activity campaign in the methodology of teaching mathematics. The analysis showed that the activity approach acts as one of the components of the methodology of mathematics teaching methods. The methodology of teaching mathematics took shape by the end of the 20th century. The main structural components in the methodology of teaching mathematics are: the object and subject, the methodological system of teaching mathematics and its external environment, the applications that connect the external environment with the methodological system, the methods of methodological research, which are based on dialectics, system analysis and activity approach, the relationship of theory and practice of teaching the subject. Thus, the activity approach acts as an important component of the methodology of teaching mathematics along with dialectics and system analysis. This approach allowed us to change our view of the essence of the concept of "knowledge". So, for example, if knowledge was previously understood as information, the assimilation of which is reduced to storing facts and reproducing them, moreover, the development of the student was associated with an increase in the volume of knowledge, now the essence of this view is that "knowledge there is activity. " The concept of the activity approach proposed by G.I. Sarantsev, "involves building an activity adequate to knowledge and compiled by the motivational sphere, various kinds of actions, methods of activity, heuristics, control and self-control."

In the methodology of teaching mathematics, the ideas of the activity approach are more widespread in high school. For example, intensive education technology based on schematic and iconic models of educational material (V.F. Shatalov), enlargement of didactic units (UDE) (P.M. Erd-niev), pedagogical technologies based on systems of effective lessons (A.A. Okunev) and others. The concept of the activity approach has allowed the development of the UDE theory. For example, in the dissertation of I.V. Ulyanova's UDE concept, built on the basis of an activity-based approach, was applied to the construction of teaching methods for schoolchildren in solving geometric problems. In the concept developed by the author, as the didactic units of the learning process that are subject to enlargement, actions are adequate to its substantial components. Moreover, the action is a structural component of the considered methods. In the study, the author singled out logical operations on actions, identified methods for enlarging actions that are adequate to methods for solving geometric problems, methods for integrating such methods, principles and techniques for constructing blocks of enlarged

problems in geometry, conditions for enlarging an individual geometric problem, developed a technique introducing blocks of enlarged tasks in the process of studying geometry along with methodological recommendations for studying a specific geometric section. Blocks of enlarged tasks are the means of implementing methods of enlarging actions that are adequate to methods for solving geometric problems. The principle of the formation of such blocks is the provision that the solution of each subsequent task contains, as part, the solution of one of the tasks preceding it, enlarging it by performing one or more new actions. The techniques for constructing blocks are: replacing the task requirement with a new requirement; extension of the drawing of the task; task inversion; replacing the problem condition with any new condition. According to the author, it is advisable to use the methods of generalizing tasks, their concretization, consideration of analogues.

G.I. Sarantsev developed an activity concept for the formation of concepts and work with the theorem. So, the activity-oriented concept of organizing work with a theorem is implemented in the following stages: motivation to study the theorem, familiarization with the theorem, mastering the content, memorizing the wording, familiarizing yourself with the method of proof, proving and applying the theorem, establishing connections between the theorem under consideration and previously studied material. The process of studying concepts is determined by the motivation for introducing the concept, familiarization with the essential features of the concept, the assimilation of the logical structure of the definition of the concept, the application of the concept, the clarification of the relationship of the concept with the previously studied. Considering that tasks are the main means of forming ideas and working with a theorem, the author compares the tasks corresponding to each of these stages.

At present, the ideas of the activity approach are becoming increasingly common in teaching mathematics at a university.

Our studies show that the ideas of the activity approach provide an effective solution to the educational problems of not only secondary, but also higher education. Meanwhile, in the course of studying scientific and methodological literature, it turns out that the problem of using an activity approach has not yet been studied enough, moreover, in the process of studying at a university it is less than at school. Many of its provisions, revealing the activity approach as one of the components of the methodology of teaching mathematics, have not received their further development. There is no doubt that the specifics of the activity approach at the university will differ from the school level of presentation of the material, which in turn requires the development of a motivational sphere, operational-activity composition of concepts and theorems of the course being studied, control, etc..

In our further research, we will consider the category of activity as a research methodology, which includes building an activity adequate to the training material and compiled by a motivational sphere, various kinds of actions, methods of activity, heuristics, control and self-control. In our work, we will rely on the category of activity and use it at all stages of the study of mathematics at a university.

The process of training a specialist with mathematical competence includes the following activity components:

- goals and content of mathematical education;
- purposeful activity of students in the formation of mathematical competence;
- development of students' abilities, professionally significant qualities of a person, and other components of mathematical competence.

Mathematical competence cannot be isolated from the specific conditions for its implementation, and can also be manifested only in one or another activity and subject to the student's personal interest in this type of activity. It closely links the simultaneous mobilization of knowledge, skills and behaviors in specific situations. Mathematical competence is formed in the process of activity and for the sake of future professional activity.

Based on the analysis, the following provisions of the activity approach in the formation of mathematical competence in future engineers can be distinguished:

- mathematical competence is an activity category, which is manifested only in a certain activity;
- to have mathematical competence means to be able (able) to mobilize a system of acquired mathematical knowledge and experience in a given situation;
- A significant factor in the formation of mathematical competence is mathematical education.

Thus, the essence of a systematic and activity-oriented approach to teaching students mathematical methods lies in the fact that the student himself is at the center of training, and that on the basis of the updated content of mathematical education his mathematical competence will be formed, and the process of mastering the selected content will be active in nature. Consequently, the teaching technologies will be aimed at developing the ability of the future specialist to carry out various types of activities, and in the process of carrying out activities, students will effectively develop mathematical competence.

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