

**Математиканы ЖОЖдо окуутудагы
компетенттүүлүк мамиле
Компетентностный подход в преподавании
математики в вузе**

**COMPETENCE-BASED APPROACH IN TEACHING MATHEMATICS
IN HIGHER EDUCATIONAL INSTITUTION**

Аннотация: макалада «компетенттүүлүк», «компетенция» түшүнүктөрүнө болгон белгилүү бир мамилелер жана анын жогорку билим берүүнүн сапатын жогорулатуудагы ролу каралган. Макаланын максаты болуп компетенттүүлүк түшүнүгүнүн маңызына болгон ар түрдүү көз караштарды изилдөө жана талдоо, ошондой эле математикалык компетенттүүлүктөр менен ЖОЖдун студенттеринин өй жүгүртүүсүнүн деңгээлдеринин ортосунда байланыш түзүү.

Аннотация: в статье рассмотрены отдельные подходы к понятию «компетентность», «компетенции» и ее роль в повышении качества образования высшей школы. Целью статьи является изучение и анализ различных взглядов на сущность понятия компетентность и установление связи между математическими компетентностями и уровнями мышления студентов вуза.

Annotation: the article describes some approaches to the concept of “competence”, “competency” and its role on improving the education quality in a high school. The aim of this article is to study and analyze different views on the essence of the competence notion, as well as establishment of the links between mathematic competences and the levels of thinking of the university students.

Негизги сөздөр: компетенция; компетенттүүлүк; билим берүүдөгү компетенттик; математикалык компетенттүүлүктүн деңгээлдери.

Ключевые слова: компетенция; компетентность; компетентностный подход в образовании; уровни математической компетентности.

Keywords: competence; competency; competence-based approach in education; levels of mathematical competence.

Improving the quality of education is one of the most topical challenges for the world pedagogic community. The solution to this problem is, first of all, connected with the modernization of educational content, optimization of methods and technologies of the organization of educational process and, of course, re-interpretation of the educational purpose and outcome of education.

State and the society impose certain requirements for the preparation and training of qualified personnel. One of these requirements is the implementation of state educational and professional training standards in higher educational institutions, which describe the educational content, specialists' competence level, as well as the prognosed outcomes. Higher educational Institutions in Kyrgyzstan, after the Great Charter of universities was signed in 2011, faced the utmost need to develop new models of training with regard to the obligations under the Bologna agreement based on competence approach. This imposes that the competence-based approach enhances the practically-oriented education, its pragmatic, subjectively-professional aspect, aimed at the formation of vitally important competencies.

To understand the most arguable questions regarding the role of the competence-based approach in the rise of education quality, we should go into the short analysis of the essence of this term developed by various authors:

The term “competence” and “competency” is widely used in pedagogic studies of education and training in a high school. At the same time, the analysis of psycho-pedagogical and educational and methodic literature on this subject indicates the complexity, multidimensionality and ambiguity of interpretation of the very notions of the terms “competence” and “competency”.

To determine the nature of a new, competence-based approach in education, we would analyze the notion of “competency”. Translated from Latin, it means a range of issues in which the person is well aware, with enough knowledge and experience. According to A.V. Khutorskoy, a person competent in a certain area, has the appropriate knowledge and skills, which enable him to judge soundly about this area and act effectively in it. I.A. Zimniaia under the term of competence imposes social and professional experience of a person, which is based on knowledge, intellectual and personal experience [2, p.21]. This definition of the competence is especially close to specialists’ training in higher educational institutions.

What is the most controversial in the designation of the competence approach to improve the quality of education?

- Competence - based approach – determines as updating of the education content in response to the changing social-economic reality (I.D. Frumin);

- Competence-based approach is implemented as a generalized condition of a person's ability to operate effectively outside the educational subjects and learning situations [1].

- competence is determined as the radical means of modernization of Russian education (B.D. Elkonin);

- Competence is defined as “the willingness of a specialist to be engaged in a certain professional activity” (A.M. Aronov), or as an attribute of preparation for the future professional activity (P.G. Schedrovitsky). Under the competency we understand the integrative quality of a person, which show itself in the general ability and readiness for activity, based on knowledge and experience.

In some studies, the competence-based approach is defined as the effort to focus the participants of the educational process to the results of education, and in the result is not seen as the sum of the assimilation of information (or knowledge), but the ability of the individual to act in different situations and uncertainties. [8]

Analysis of the above stated opinions of the researchers in their understanding of competence suggests that competence in some cases may contain general functions, such as: the special quality of individual, readiness for professional activity, etc. In other cases, the competence includes only a partial aspects, such as the ability to apply knowledge in a particular situation, or to operate effectively in a learning situation, etc. In the process of teaching mathematics and management of independent work of students, we have found that there is also a ‘specific’ competences, namely ‘mathematical competences’. It is the ability to properly use the rules, laws and properties of the formula for solving problems related to the competence of the plotting and geometric shapes, etc.

In this regard, we believe that the concept of “competence” today is determined ambiguously by the scientists. It is known that in pedagogy competence require a certain ranking. For example competences can be: universal, over-educational (training), thematic and even a task competences.

The latter are divided into smaller (separate) ones– competency in solving arithmetic, algebraic, geometric, trigonometric tasks, etc.

In the scientists’ researches there is a term “competency” which exists along the term “competence”. As is well-known, the competence-based approach is based on the concept of “competence” and “competency” that are closely interconnected. The issue of those terms is closely reviewed in the studies of I.A. Zimniaia [9]. In glossaries and dictionaries the term competence is covered from the perspective of “awareness”, “authority”, the knowledge of a person in any area. And competency is viewed as a range of issues and events in which a person has authority or a range of powers, with which he is endowed to meet the challenges [10].

But competency is a combination of personal qualities of the student (value orientations, knowledge, skills, abilities), it is the ability to work in a particular personally significant field [6,p.43]. In the article of G.K. Selevko “Pedagogical competence and competencies” the concept of “competence” is used to refer to:

- educational resource, which is expressed in the level of qualification of the graduate, the real possession of methods and means of activity, in the ability to cope with the set tasks;
- a form of a combination of knowledge and skills, which allows to set and achieve goals, to transform the environment [4, p.34].

N.I. Almazova defines competences as the knowledge and skills in a particular field of human activity, and competency is a qualified use of the competences [5].

The problems of competence-based approach in the domestic and foreign science are started to be dealt with since the end of the 1980s, but the most important studies refer to the beginning of the XXI century.

According to M.A.Akhmetov, in the formation and implementation of the competence-based approach in higher education institution it is necessary to put the identity of the student as a basis, and the entire process should be adjusted so that the student in the beginning got some knowledge and education, and then proceed to self-education [7, p. 32-33].

The essence of the competence-based approach and problems of formation of key competences is analyzed in the works of such researchers as A.V. Khutorskoy, I.A.Zimniaia, G.K. Selevko, G.A. Ivanova, O.E.

Lebedev, P.P. Borisov, V.A.Bolotov, I.S. Yakimanskaya, and other foreign scientists as: R. Barnett, J.Raven (Great Britain), W. Wester (Netherlands), and others.

The importance of professional competence for the future professional activity imposes its development in the educational process of the university. Students with specialties in different fields are the most difficult audience to develop mathematical competence. Modern society requires the orientation of university graduates for the preparation of a competitive specialist. An important criterion of competitiveness of the specialist is his/her expertise in various fields, including in the mathematical field.

Our work is directed to the use of competence-based approach in teaching mathematics in higher educational institutions.

We believe that the subject “mathematics” is particularly important especially for those students who dream of a profession in the field of economy, technology, and other sciences. However, as a subject, which develops logical thinking and learning to think of abstract concepts, mathematics and is very useful for students who are attracted to the humanitarian and creative activity. In this regard, teachers of mathematics in our high schools face the following main objectives that go beyond the requirements of state standards of high school:

First, the level of mathematics teaching must meet the universities requirements.

Second, due to the differences in the teaching of mathematics in secondary school and high school mathematical disciplines often cause objective difficulties. Therefore, as one of our goals of teaching mathematics, we see a smooth transition from the study of elementary mathematics to the study of higher mathematics at the university.

Third, the study of mathematics is a unique opportunity for the training of logical and abstract thinking.

In the core of the competence-based approach there is the federal component of the state educational standard of the main (full) general education in mathematics. In the standards the learning outcomes are presented in the requirements for the level of training of graduates. Requirements are structured in the 3 components:

1. Know / understand;
2. To be able to;
3. Use the acquired knowledge and skills in practice and everyday life.

When implementing competence-based approach, special attention should be paid to the last component, which in our opinion is aimed at competence-based approach in mathematics in secondary school.

For the implementation of competence-based approach in teaching mathematics teachers at their lessons use various teaching technologies: project activities; ICT applications; brainstorm; gaming technology; modular training, etc.

Mathematical literacy of students is defined as “a combination of mathematical knowledge, skills, experience and abilities”, which ensure the successful solution of various problems that require the use of mathematics.

Competence-based approach implies the development of various kinds of skills among students, that enable them to operate effectively in the future in situations of professional, personal and social life. Moreover, particular importance is attached to skills, which allow to operate in new, uncertain, problematic situations, for which there is no advance developed and appropriate means. These means should be found in the process of solutions finding in similar situations and achieve the desired results.

In other words, the competence-based approach serves for the strengthening of applied, practical character (including the subject teaching).

Mathematical competence is the ability to structure data (situation), pick out mathematical relationships, to create a mathematical model of the situation, analyze and transform it, to interpret the results. In other words, the mathematical competence of the student contributes to the adequate application of mathematics to solve emerging problems in everyday life. The set of competencies, the availability of knowledge and experiences required to operate effectively in a given subject area, is called competence. The notion of mathematical competence is reflected in a variety of sources.

According G. Selevko “mathematical competence is the ability to work with numbers, and numerical information (i.e. possess mathematical skills)” [3, p.139].

Hence, it becomes clear that mathematical competence is the possession of mathematical skills. It can be argued that the mathematical competence is a combination of mathematical knowledge, skills + practical experience, the ability to apply “*zun*” into practice in reality.

On the basis of the conducted scientific analysis of the concept of “competency”, under the mathematical competence of the university students of specialties in different fields, we understand the unity of mathematical knowledge and skills, mathematical thinking, experience of their application in the professional activities, as well as the desire for continuous self-education and self-improvement in learning and application of mathematics in the future professional activity.

Formation of mathematical competence of students has the following structural composition: the purpose, the components of mathematical competence, stages of formation, pedagogical conditions, scientific and methodological support, the levels of formation of mathematical competence, proficiency criteria and indicators.

Formation of mathematical competence in the classroom implies the trainings with the use of techniques, directed to the needs for external and internal knowledge application, skills of pupils, the inclusion of students into the active work for solving a particular problematic situation, solving the context tasks.

The first level (reproduction level) is a direct application of known facts, standard procedures in a familiar situation, recognition of mathematical objects and properties, the implementation of standard operating procedures, the use of known algorithms and technical skills, work with standard, familiar expressions and formulas, direct performance of computing.

The second level (level of links establishment) is based on the reproductive activity of solving problems, which, although not typical, but still familiar to students or they are beyond the well-known only to a very small degree. The content of the problem suggests which material of mathematics should be used and how to apply the known methods. Typically, these problems contain more demands to the interpretation of

solutions, they suggest the establishment of links between the different views of the situation described in the problem, or the establishment of links between the data in the problem.

The third level (level of discourse) is constructed as a development of the previous level. To solve the problems students are required to have a certain level of intuition, thinking and creativity in the choice of mathematical tools, the integration of knowledge from different areas of the mathematics, development of an algorithm of actions. Tasks typically include more data, the students often need to find a pattern, to compile and explain or justify the results.

Analysis of the concept of mathematical competence allowed us to determine the structure of the mathematical competence of students of the university in the form of its components.

Mathematical knowledge and skills are needed in all professions. This requires knowledge of algebra, analytic geometry, mathematical analysis, probability theory and statistics. Academician V.M.Tikhomirov said that “it would be natural if basic education in the first year of higher educational institutions was largely uniform, but everyone has to understand its necessity and reasonability”.

The process of assimilation of mathematical knowledge, which are presented as a well-organized system of interconnected elements, generates systemic and structural thinking. The process of solving mathematical problems requires constant analysis, comparison and synthesis of information. Work with mathematical concepts reveals the processes of generalization and classification.

Mathematical thinking have in its origin some detail-substantial reality. Mathematical thinking of a student is a special kind of theoretical thinking, a specific process of reflection of objective reality, which is based on mathematical concepts and reasoning, and spatial representations.

If at the lessons of mathematics a teacher systematically uses the competence-oriented tasks, it will contribute to the formation of key competencies of students, increase students' mathematical literacy. In mathematics it is necessary to form such competences as:

- information;
- research;
- readiness for self-education.

Therefore, the main idea of my concept of teaching is based on the methodology of competence approach in teaching.

In accordance with the requirements of state educational standards in higher education institutions of the Kyrgyz Republic, the students of different specialties should study mathematics course. The study of set of educational disciplines, usually starts primarily with mathematics. In higher educational institution math plays about the same universal role that race plays in sports: during the math lesson the hidden mechanisms of the brain, previously unused or little used in the daily life start to be active.

Scientific and methodological support of formation of mathematical competence of the university students includes: the traditional teaching methods, information technology, professionally directed training. Traditional training, in its essence, corresponds to the concept of learning itself.

Today, the main form of teaching is a “live” lecture, which was practiced for a long time before in teaching history. The university lecture is the main link of didactic training cycle. Its goal is the formation of a rough basis for further assimilation of educational material by the students. In the 30s some universities stopped lecturing as an experiment. However, the experiment did not have success. The level of knowledge among students dramatically reduced. Currently, we have both, the supporters and the opponents of the presentation of educational material in the form of lectures. However, the experience shows that the rejection of the scientific lectures reduces the level of students training, destroys the consistency and uniformity of work during the semester. Therefore, the lecture still continues to be the leading form of organization of educational process in higher educational institution. Along with lectures, the educational process in higher education institutions provides practical training. Such practical

trainings are designed for in-depth study of discipline, they play an important role in the development of students' skills of their knowledge application for salvation of practical problems. Practical exercises are designated to deepen and expand, refine the knowledge gained in the lecture in a generalized form, and to contribute to developing the skills of professional activity. They develop scientific thinking and speech, make it easier to check the students' knowledge and act as a means of immediate feedback. In addition to classroom work, students' independent work is also a form of educational process and is an essential part of it. Independent work also has educational value, since it generates such personal characteristic as self-independence, which plays a significant role in the structure of the personality of modern highly qualified specialists.

Modern classes in higher educational institutions are impossible to imagine without the use of innovative technologies. Computer training allows you to solve a wide range of teaching tasks through special computer training programs, expanding information educational base (electronic library, domestic and foreign databases, the Internet). To acquire professional skills it is necessary to make a great effort. That's why students just need a variety of computer techniques, such as learning trainers, which help to learn new material in, allow to grasp the essence of the subject deep enough, to obtain the appropriate skills and technological competences.

In conclusion, it should be noted that the understanding by the university teacher of the essence of competence, its types and levels will help to interact with the students more closely and productively. And the identified mathematical competencies for each university discipline will determine the intra-subject competences.

In the future, we need to seriously study not only the mathematical competences, but also thematic ones and even competence in solving certain types of mathematical tasks.

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