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METHODICAL FEATURES OF THE FORMATION OF MATHEMATICAL LITERACY

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The article presents the results of our research related to some aspects of the formation of mathematical literacy of students. Providing a working definition of mathematical literacy, the study identifies four components of mathematical literacy. The formation of each component of mathematical literacy is determined by its structural features. Signs of the first component are possession of program special and general educational cognitive knowledge, abilities, skills and ways of educational activity, methods of the doctrine. The second component is determined by the ability to quickly and broadly generalize mathematical objects, relations, actions, free adjustment of the thought process, switching from direct to reverse thoughts, consistent, correct, dissected logical reasoning, formalized perception of mathematical material, the structure of the problem. Features of the third component - the ability to formulate and write problems in the language of mathematics, the results of solutions and others. The fourth component is expressed in the implementation of the previous components in life situations.

Key words: *literacy, mathematical literacy, educational and cognitive competence, functional literacy, features, components, ability*

Modern society makes new demands on the level of professional training of the future teacher. In modern education, mathematics is an element of general culture, functional literacy and everyday use. Mathematical competence in various forms should be enhanced in all categories of the population. This competence in society can be represented as a pyramid, at the apex of which there is a small group of professionals involved in the creation of key elements of modern world mathematics, and at the bottom is the entire mass of the population for whom mathematical literacy is an indispensable element of culture, social, personal and professional competence [1; 81]. The key participant and factor in the system of mathematical education is a teacher-mathematician. He must have not only mathematical knowledge in the form of a set of definitions and proofs reproduced and transmitted to pupils, but first of all be ready to solve new, previously unseen tasks in relevant areas, transfer to students a mathematical model of activity. The Review of Secondary Education in Kazakhstan, conducted by the Organization for Economic Cooperation and Development (OECD) in 2014, concluded that academic subjects are taught with a focus on theory, not paying due attention to their possible practical application, with the result that students are not able to sufficiently effectively apply and use the knowledge gained in non-standard situations. In terms of ensuring international competitiveness and the quality of domestic education, the state program has in mind the places that our students will occupy according to the results of the three most common systems of international testing [2;19]. They assess the quality of mathematical, natural-scientific training, the ability to read and understand texts, as well as the functional literacy of schoolchildren, that is, the ability to apply knowledge in extra-curricular situations.

In general, our schoolchildren receive strong subject knowledge, however, often they do not have the skills to apply them in life situations.

Today, school education in Kazakhstan is at the stage of a new start. Currently, the priorities are infrastructure development and the transition to updated content. As part of the implementation of the Plan of the Nation, "100 concrete steps" initiated by the President of the Republic of Kazakhstan N.A. Nazarbayev has planned five steps in the field of education, aimed at improving the quality of human capital based on the standards of OECD countries. Three of them relate to general secondary education:

Step 76: Phased implementation of a 12-year education, updating school standards for the development of functional literacy. The introduction of per capita funding in high school, the creation of a system of incentives for successful schools.

Step 79: Phased transition to the English language of instruction in the education system - in high school and universities.

Step 89: Development and implementation of the national project "Nurly Bolashak". The introduction of values "Mangilik el" in the current curriculum of school education.

Global transformations and global trends require an accelerated pace of updating the content of school education. In the 2018-2019 school year, 3, 6, 8, 10 classes will be transferred to the updated content. In the 2019-2020 academic year - 4, 9, 11 classes.

Within the framework of updating the content of education, the development of functional literacy of schoolchildren is determined as one of the priority goals of education [3; 74].

Functional literacy as a result of learning is formed through each school subject. The tools for the development of functional literacy of schoolchildren, as well as verification of its formation, are tasks of a creative nature (tasks of research, entertaining nature, tasks with economic, historical content, practice-oriented tasks, etc.).

Functional literacy refers to the ability to use knowledge and skills acquired in school to solve a wide range of life tasks in various spheres of human activity, as well as in interpersonal communication and social relationships.

Types of functional literacy are assessed in the framework of the external assessment of the educational achievements of students: reading literacy (Kazakh and Russian), mathematical literacy, natural science literacy (physics, chemistry, biology, geography).

Reading literacy refers to the ability of students to understand written texts and reflect on them, to use their content to achieve their own goals, to develop knowledge and opportunities for active participation in society. It is not the reading technique and the literal understanding of the text that are evaluated, but the understanding and reflection on the text, the use of the read to accomplish life goals.

Natural science literacy - the ability to use natural science knowledge, identify problems and make informed conclusions necessary to understand the world around us and the changes that human activity makes to it, as well as to make appropriate decisions.

Mathematical literacy is the ability of a person to define and understand the role of mathematics in the world in which he lives, to express well-founded mathematical judgments and use mathematics so as to meet the present and future needs of a creative, interested and thinking citizen [4].

The article presents the results of our research related to some aspects of the formation of mathematical literacy of students. We believe that students who possess academic competencies and who know how to learn mathematics will become mathematically literate.

Currently, one of the main tasks of education is the development of student learning competencies [5]. Student possession of learning competencies is a necessary condition for him to be able to study mathematics, and the latter is one of the sufficient conditions for his mathematical literacy.

According to the results of the study, the following *components* of mathematical literacy are defined:

- the formation of educational and cognitive competencies;
- the establishment of links and the integration of material from different mathematical topics needed to solve the task;
- mastering the culture of mathematical speech;
- The use of mathematics to solve a wide range of life problems.

Let us dwell on each of the components of mathematical literacy.

Educational and cognitive skills are readiness to consciously implement a system of practical and theoretical actions for mastering knowledge and methods of educational and cognitive activity in various conditions [6; 43].

Establishment of links and the integration of material from different mathematical topics needed to solve the task is the establishment of connections from different mathematical topics needed to solve the problem. This implies the ability to quickly and broadly generalize mathematical objects, relationships, actions; the art of a consistent, correct, dissociated logical reasoning; the ability to quickly and freely restructure the direction of the thought process, switching from direct to reverse thought; the ability to formalize the perception of mathematical material, grasp the formal structure of the problem; ability to find similar objects from several unrelated regions; analyze the methods used; the ability to reason, draw conclusions based on information presented in various forms (tables, diagrams, graphs).

One of the most important tasks of teaching mathematics is the formation of a culture of mathematical speech of students. From the successful solution of this problem, the students' ability to explain the educational material depends, and ultimately the development of mathematical abilities depends.

The use of math tools to solve problems encountered in life situations is accomplished through the ability to use educational and cognitive competencies, if necessary; possession of the experience of perception of the world picture, the recognition of problems that arise in the surrounding reality and which can be solved by means of mathematics; striving for clarity, simplicity, economy and rationality of the solution.

The main problem of the teacher is “the search for means and methods for the development of students' educational competencies as a condition that ensures the qualitative mastering of the program”.

The content of the audit in this study is grouped around some common phenomena or types of problems that arise when considering these phenomena. The following are proposed as such phenomena: quantity, space and form, change and dependencies, uncertainty.

One of the important aspects of mathematical literacy is the use of mathematics in various situations that are related to personal and school life, local society, social life, work and leisure.

Test tasks are created in such a way as to group around general educational mathematical activities that are present at all stages of training:

- Mathematical thinking and reasoning, including the formulation of questions characteristic of mathematics; knowledge of the nature of the answers that mathematics offers for such questions;

- Mathematical argumentation, which includes knowledge of what mathematical proofs are and how they differ from other types of mathematical reasoning;

- Communicative mathematical skills, which include the expression in written or oral form of their thoughts related to mathematical content; understanding written or oral mathematical statements made by others.

- Modeling, which includes the designation of the proposed situation so that it can be modeled; translation of the real situation in the mathematical structure; interpretation of the mathematical model taking into account the real situation; work with a mathematical model; evaluation of the correctness of the model; reflections, analysis, critique of the model and the results obtained; a record describing the model and the results obtained; systematic control of the modeling process.

- Statement and solution of problems, including formulation, formulation and definition of various mathematical problems and solution using various methods of various mathematical problems.

- Presentation of available data in various forms, including decoding or, conversely, data encoding, translation, interpretation, distinction and definition of the relationship between various forms of representation of mathematical objects or situations; selection or transition from one form to another form of data presentation, corresponding to the condition of the problem.

- The use of technical means, including the knowledge and ability to use various tools and instruments that can contribute to the activity of mathematical activity; knowledge of the limitations of such tools and instruments.

Using a competent approach, one can fill a mathematical education with the knowledge, skills and abilities associated with personal experience and the needs of the trainer, so that trainer can carry out productive and conscious activities in relation to objects of reality. At the same time, one of the main roles should be given to educational and cognitive competence, since the degree of its formation sometimes to a greater extent determines the quality of the result. Educational and cognitive competence includes elements of logical, methodological, educational activities, correlated with real cognizable objects.

The structure of educational and cognitive competence includes the following skills:

- set a goal and organize its achievement, the ability to clarify its goal;
- organize planning, analysis, reflection, self-assessment of their learning and cognitive activity;

- ask questions about observable facts, look for the causes of phenomena, indicate their understanding or misunderstanding in relation to the problem being studied;

- set cognitive tasks and put forward hypotheses; select the conditions of the observation or experiment; select the necessary instruments and equipment, possess measurement skills,

work with instructions; use elements of probabilistic and statistical methods of knowledge; describe the results, draw conclusions;

- speak verbally and in writing about the results of his research using computer tools and technologies (text and graphic editors, presentations).

With these skills formed, the learner masters the creative skills of productive activities: obtaining knowledge directly from reality, mastering actions in unusual situations, heuristic methods for solving problems. Within this competence, the requirements of the relevant functional literacy are defined: the ability to distinguish facts from conjectures, proficiency in measuring skills, the use of probabilistic, statistical and other methods of knowledge. We believe that the mathematical methods and the content of the subject fully contribute to the formation of this competence.

The presence of cognitive interest has a positive effect not only on the process and the result of the activity, but also on the formation of the student's personality and his preparation for adaptation in the modern world.

For the formation of cognitive competence, we outlined the development of the following methodological methods of training:

- the use of traditional and innovative teaching methods in combination;
- the use of historical information;
- the creation of problem situations;
- organization of project activities;
- artistic and aesthetic improvement of didactic material;
- the use of elements of entertaining in the lessons of mathematics.

The choice of teaching method, the use of traditional and innovative teaching methods in combination is due to the fact that traditional teaching provides a sufficient level of academic knowledge of schoolchildren, but does not prepare them to independently acquire, analyze and effectively use knowledge.

In domestic education, attempts to move away from the traditional system of education have been made several times, but fragmentary introduction of changes has been superimposed on the old content of education. This led to an overload of the educational process and the transfer of a large amount of ready information. And until now, the overwhelming majority of students continue to remain a passive “receiver” of knowledge.

When using traditional teaching methods, the problem of students' cognitive activity is not always posed; dominated by the memory of thinking; there is a passivity in educational work, cramming, overload, tenuous knowledge.

This type of training, unfortunately, does not currently meet the requirements for the education system.

Therefore, there is a need to search for innovative methods that can ensure the elimination of these shortcomings of traditional teaching methods.

The basis of innovative teaching methods is the following: “do → learn → understand → create” and guided by ancient Chinese wisdom: “Tell me, and I will forget, show me, and I will remember, involve me - and I will understand.” The method of using traditional and innovative methods in combining mathematics is considered in the graduate study of S.Kalkabekova [7; 23].

The second way of learning is to use historical information in the lessons of mathematics. The practice of working with the history of mathematics shows that it is precisely with the help of the history of science, which is methodically correctly included in the content of the lesson, that the student can form ideas about mathematics as part of common human culture.

The way of creating problem situations in the classroom influences the modeling of mental processes.

The method of organizing project activities of students is considered as a didactic means of enhancing learning and cognitive activity. The active inclusion in the creation of projects gives students the opportunity to master new ways of human activity and allows them to form some important personal qualities.

The artistic and aesthetic improvement of didactic material in the learning process helps to ensure the emergence of positive emotions in relation to the educational activities, to its content, forms and methods of implementation.

The method of application of the elements of entertaining in the lessons of mathematics contributes to the development of flexibility of the mind, the development of skills for non-patterned thinking, increasing interest in the subject of mathematics.

Currently, research continues in the direction of the theoretical development and practical implementation of these teaching methods.

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МАТЕМАТИКАЛЫҚ САУАТТЫЛЫҚТЫ ҚАЛЫПТАСТЫРУДЫҢ ӘДІСТЕМЕЛІК ЕРЕКШЕЛІКТЕРІ

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Мақалада оқушылардың математикалық сауаттылығын қалыптастырудың кейбір аспектілеріне байланысты зерттеу нәтижелері беріледі. Сонымен қатар математикалық сауаттылық ұғымының жұмыс анықтамасы келтіріледі. Зерттеу нәтижелері бойынша математикалық сауаттылықтың төрт компоненті анықталды. Математикалық сауаттылықтың әрбір компонентінің қалыптасуы оның құрылымдық белгілерімен анықталады. Бірінші компоненттің белгілері-бағдарламалық арнайы және жалпы оқу танымдық білімдерді, оқу іс-әрекетінің дағдылары мен тәсілдерін, оқу әдістерін меңгеру. Екінші компонент математикалық объектілерді, қарым-қатынастарды, іс-әрекеттерді жылдам және кең жалпылау, ойлау процесін еркін қайта құру, тура ойдан кері жүріске ауыстыру, дәйекті, дұрыс, бөлшектелген логикалық ойлау, математикалық материалды формальды қабылдау, есеп құрылымы қабілеттерімен анықталады. Үшінші компоненттің белгілері-математика тілінде мәселелерді, шешу нәтижелерін және т. б. тұжырымдау және жазу қабілеті. Төртінші компонент өмірлік жағдайларда алдыңғы компоненттерді іске асырудан көрінеді.

Түйін сөздер: сауаттылық, математикалық сауаттылық, оқу-танымдық құзыреттілік, функционалдық сауаттылық, белгілері, компоненттері, қабілеті

МЕТОДИЧЕСКИЕ ОСОБЕННОСТИ ФОРМИРОВАНИЯ МАТЕМАТИЧЕСКОЙ ГРАМОТНОСТИ

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В статье даются результаты исследования, связанные с некоторыми аспектами формирования математической грамотности учащихся. Приводится рабочее определение понятия «математическая грамотность». По результатам исследования определены четыре компонента математической грамотности. Сформированность каждого компонента математической грамотности определяется его структурными признаками. Признаки первого компонента - владение программными специальными и общеучебными познавательными знаниями, умениями, навыками и способами учебной деятельности, методами учения. Второй компонент определяется способностями быстрого и широкого обобщения математических объектов, отношений, действий, свободной перестройки мыслительного процесса, переключения с прямого на обратный ход мыслей, последовательного, правильного, расчлененного логического рассуждения, формализованного восприятия математического материала, структуры задачи. Признаки третьего компонента - способность формулировать и записывать проблемы на языке математики, результаты решения и другие. Четвертый компонент выражается в реализации предыдущих компонентов в жизненных ситуациях.

Ключевые слова: грамотность, математическая грамотность, учебно-познавательная компетенция, функциональная грамотность, признаки, компоненты, способность

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