

2 Бидосов Ә. Математиканы оқыту әдістемесі. – Алматы: Мектеп, 2003. – 224 б.

3 Әбілқасымова А.Е. Студенттердің танымдық ізденімпаздығын қалыптастыру. – Алматы: Білім, 1994. – 190 б.

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UNDERSTANDING THE MATHEMATICAL ABILITIES IN PSYCHOLOGY AND PEDAGOGY

Abstract. The purpose of this work is to analyze the understanding and content of the concept of mathematical abilities and develop methodological recommendations for developing the mathematical abilities of high school students. One of the most important characteristics of the modern educational process is the development of mathematical abilities of students. This problem is interesting both in theoretical and in practical aspects. Today, due to the presence of various psychological currents in the understanding of mathematical abilities, there is no precise and rigorous understanding of the content of this concept. The ability to study mathematics is understood to mean individual psychological characteristics that meet the requirements of educational mathematical activity and determine, under otherwise equal conditions, the success of creative mastering of mathematics as a subject of study, in particular a relatively quick, easy and profound mastering of knowledge, skills, and skills in the field of mathematics. Achievement of the goal implies a decision to analyze the understanding of mathematical abilities in psychology and pedagogy, to reveal the level of development of mathematical abilities in modern high school students.

Key words: understanding mathematical abilities, reveal the level.

Аңдатпа. Бұл жұмыстың мақсаты математикалық қабілеттер тұжырымдамасының түсінігін және мазмұнын талдау және жоғары сынып оқушыларының математикалық қабілеттерін дамыту бойынша әдістемелік ұсыныстарды әзірлеу болып табылады. Заманауи оқу үрдісінің маңызды сипаттамаларының бірі студенттердің математикалық қабілеттерін дамыту болып табылады. Бұл проблема теориялық және практикалық жағынан да қызықты. Бүгін, салдарынан математикалық қабілеттерін түсіну әр түрлі психологиялық үрдістердің болуына, осы ұғымдар мазмұны жоқ дәл және қатаң түсінік бар. Математиканы

зерттеуге қабілеттілігі математика пәнінің талаптарына сай келетін және басқаша жағдайда тең жағдайда математиканы шығармашылық меңгерудің пәні ретінде, атап айтқанда, математика саласында білім, дағды және дағдыларды игерудің салыстырмалы жылдам, жеңіл және терең меңгеруін анықтайтын жеке психологиялық сипаттамалар деп түсініледі. Бұл жұмыс психология мен педагогикадағы математикалық қабілеттерін түсінуге, жоғары сынып оқушыларының математикалық қабілеттерін дамыту деңгейін анықтауға мүмкіндік береді.

Түйін сөздер: математикалық қабілеттер тұжырымдамасы, деңгейді анықтау.

Аннотация. Цель данной работы проанализировать понимание и содержание понятия математических способностей и разработать методические рекомендации по развитию математических способностей старшеклассников. Одной из важнейших характеристик современного образовательного процесса является развитие математических способностей учащихся. Данная проблема интересна как в теоретическом, так и в практическом аспектах. Сегодня в силу наличия различных психологических течений в понимании математических способностей, нет точного и строгого понимания содержания этого понятия. Под способностями к изучению математики понимается индивидуально-психологические особенности, отвечающие требованиям учебной математической деятельности и обуславливающие при прочих равных условиях успешность творческого овладения математикой как учебным предметом, в частности относительно быстрое, лёгкое и глубокое овладения знаниями, умениями, навыками в области математики. Достижение поставленной цели предполагает решение проанализировать понимание математических способностей в психологии и педагогике, выявить уровень развития математических способностей у современных старшеклассников.

Ключевые слова: понимание математических способностей, выявить уровень.

The problem of developing abilities at the present time has become a social problem. Abilities are the subject of psychological and pedagogical studies, conducted from different positions and points of view. Abilities are something that is not limited to knowledge, skills and skills, but explains their rapid acquisition, consolidation and effective use in practice (ВМ Теплов).

A significant contribution to the development of a general theory of abilities introduced by В.М. Теплов. Ability, according to ВМ Теплов, can not exist otherwise than in the constant process of development. The ability that does not develop, which in practice people stop using, is lost in time.

There are several classifications of abilities. A.G. Maklakov [1] in his classification emphasizes, first of all, natural, or natural, abilities (basically biologically conditioned) and specifically human abilities, having a socio-historical origin. In addition to the division of abilities into general and special AG. Maklakov shares the ability to theoretical and practical.

Also A.G. Maklakov divides abilities into educational and creative. They differ from each other in that the former determine the success of learning, the assimilation of knowledge and skills by a person, while the latter determine the possibility of discoveries and inventions, the creation of new objects of material and spiritual culture. Summarizing the approach to the classification of abilities AG. Maklakova, we determined the place of mathematical abilities in the general system of human abilities. Mathematical abilities are included in the special higher intellectual abilities of a group of specific human abilities. Let us now consider the mathematical abilities in more detail. In the study of mathematical abilities, such vivid representatives of various trends in psychology, as A. Binay, E. Torndike and G. Reves, and such outstanding mathematicians as A. Poincaré and J. Adamar, contributed. A wide variety of areas of psychology determines a great variety in approaches to the study of mathematical abilities. Attempts to define mathematical abilities have been made repeatedly, but there is still no established definition of mathematical abilities [2]. The only thing in which all the researchers agree is the opinion that one should distinguish between ordinary, "school" abilities for mastering mathematical knowledge, for their reproduction and independent application, and creative mathematical abilities associated with the independent creation of an original and socially valuable product.

Back in 1918 A. Rogers' work noted two aspects of mathematical abilities, reproductive (related to memory function) and productive (related to the function of thinking). V. Betz defines mathematical abilities as the ability to clearly understand the inner connection of mathematical relations and the ability to accurately think with mathematical concepts. From the works of domestic authors it is necessary to mention the original article by D. Mordukhai-Boltovsky «The Psychology of Mathematical Thinking», published in 1918. The author, a specialist mathematician, attached special importance to the «unconscious thinking process», arguing that «the thinking of mathematics is deeply embedded in the unconscious sphere, then, surfacing on its surface, then plunging into the depths. A mathematician does not realize every step of his thought, as a virtuoso of the bow movement» [3].

The sudden appearance in consciousness of a ready solution of a problem that we can not solve for a long time, we explain by unconscious thinking, which continued to deal with the task, and the result emerges beyond the threshold of consciousness. According to D. Mordukhai-Boltovskiy, our mind is capable of producing laborious and complex work in the subconscious, where all «rough» work is done, and the unconscious work of thought even has

a lesser error than the conscious. The author notes the completely specific nature of mathematical talent and mathematical thinking. He argues that the ability to mathematics is not always inherent in even genius people, that there is a significant difference between the mathematical and the non-mathematical mind. Of great interest is the attempt of D. Mordukhai-Boltovsky to distinguish the components of mathematical abilities [4].

D. Mordukhai-Boltovsky also speaks about the types of mathematical imagination that underlie different types of mathematicians – «geometers» and «algebraists». Arithmeticians, algebraists and generally analysts, whose discovery is made in the most abstract form of breakthrough quantitative symbols and their interrelations, can not imagine as a «geometer».

In addition to general theoretical studies of the problem of mathematical abilities, attempts were made to perform an experimental analysis of the structure of mathematical abilities. This was first done by VA Krutetsky in his monograph «The Psychology of the Mathematical Abilities of Schoolchildren». Under the ability to study mathematics, he understands individual psychological characteristics that meet the requirements of educational mathematics and that, under otherwise equal conditions, determine the success of creative mastering of mathematics as a subject of study, in particular, a relatively quick, easy and profound mastering of knowledge, skills, and skills in mathematics [5].

D.N. Bogoyavlensky and N.A. Menchinskaya, referring to the individual differences in the learning abilities of children, introduces the concept of psychological properties that determine, other things being equal, success in teaching. They do not use the term «abilities», but in essence the corresponding concept is close to the definition given above. Mathematical abilities are a complex structural psychic formation, a peculiar synthesis of properties, an integral quality of the mind, encompassing its various aspects and developing in the process of mathematical activity. This set of properties are closely related, affect each other and form in their totality a unified system, the manifestations of which we conditionally call «mathematical giftedness». Consider the approach to identifying the structure of mathematical abilities, proposed by VA. Krutetsky [6]. The experimental material collected by the researcher allows us to speak of components that occupy an essential place in the structure of such an integral quality of the mind as mathematical talent. General outline of the structure of mathematical abilities at school age: Obtaining mathematical information.

a) The ability to formalize the perception of mathematical material, covering the formal structure of the problem.

Processing of mathematical information.

a) Ability to logical thinking in the sphere of quantitative and spatial relations, numerical and symbolic symbols. Ability to think with mathematical symbols.

b) The ability to quickly and broadly generalize mathematical objects, relationships and actions.

c) The ability to coagulate the process of mathematical reasoning and the system of appropriate actions. Ability to think with folded structures.

g) Flexibility of thought processes in mathematical activity. etc.) Striving for clarity, simplicity, economy and rationality of decisions.

e.) The ability to quickly and freely restructure the direction of the thought process, switching from direct to reverse thought.

Do not enter into the structure of mathematical endowments those components whose presence in this structure is not necessary (albeit useful). In this sense, they are neutral with respect to mathematical endowments. However, their presence or absence in the structure (more precisely, the degree of development) determines the types of mathematical mindset:

1. The speed of thinking processes as a temporary characteristic. The individual pace of work is not decisive. A mathematician can think slowly, even slowly, but very thoroughly and deeply.

2. Computational abilities (abilities for fast and accurate calculations, often in the mind). It is known that there are people who are able to produce in the mind complex mathematical calculations (almost instantaneous squaring and cube of three-digit numbers), but not able to solve any difficult problems. It is also known that there were phenomenal «counters» that did not give mathematics anything, and the outstanding mathematician A. Poincaré wrote about himself that even addition can not do without error.

3. Memory for numbers, formulas, numbers.

4. Ability to spatial representations.

5. Ability to visualize abstract mathematical relations and dependencies.

It should be emphasized that the scheme of the structure of mathematical abilities corresponds to the student's mathematical abilities. It is impossible to say to what extent it can be considered a general scheme of the structure of mathematical abilities, to what extent it can be attributed to fully developed gifted mathematicians.

It is well known that in any field of science, giftedness as a qualitative combination of abilities is always diverse and is unique in each individual case. But with a qualitative variety of giftedness, it is always possible to outline some basic typological differences in the structure of giftedness, to single out certain types that differ significantly from one another, in different ways, reaching equally high achievements in the corresponding field.

Analytic and geometric types are mentioned in the works of A. Poincaré, J. Adamar, D. Morduhay-Boltovsky, but with these terms they are associated more likely with a logical, intuitive way of creativity in mathematics. From domestic researchers, NA Menchinskaya dealt a lot with the individual differences of students in solving problems in terms of the ratio of abstract and

figurative components of thinking. It allocated students with a relative predominance:

- a) of figurative thinking over the abstract;
- b) abstract over figurative;
- c) the harmonious development of both types of thinking.

One can not think that the analytic type is manifested only in algebra, and geometric in geometry. The analytical warehouse can be manifested in geometry, and geometric - in algebra. VA Krutetsky [7] gave a detailed description of each type.

The established types seem to have a common meaning. Their presence is confirmed by many studies. In this point of our work we have examined the understanding of mathematical abilities in the psychological-pedagogical literature. Mathematical abilities occupy a prominent place in the overall structure of abilities. Mathematical abilities are a complex structural psychic formation, a peculiar synthesis of properties, an integral quality of the mind, encompassing its various aspects and developing in the process of mathematical activity. This set of properties are closely related, affect each other and form in their totality a single system, the manifestations of which are conditionally called «mathematical giftedness». Therefore, it is impossible to consider mathematical abilities as a simple ability to count, or solve mathematical problems.

Mathematical abilities are specific for each age period. In accordance with the subject of our study, let us consider in more detail the level of development of the mathematical abilities of high school students.

References:

- 1 Aristova, L.P. Activity of the schoolchildren's studies / L.P. Aristova. - M.: Enlightenment, 1968. – 138 p.
- 2 Aseev, V.G. Motivation of behavior and personality formation / V.G. Aseev - M.: Thought, 1976. – 158 p.
- 3 White-fronted, A.V. Teaching mathematics in accordance with the individual characteristics of the child / A.V. Breamy. – Questions of psychology. – 2001. – №5.
- 4 Gilev, D.K. On the question of the motivations of students' learning activity / D.K. Gilev. – Questions of development of cognitive interests in the process of training. – Sverdlovsk, 1970. – Pp. 3-20.
- 5 Gromtseva, A.K. Formation of readiness for self-education among schoolchildren / A.K. Gromtseva. – M.: Enlightenment, 1983. – 144 p.
- 6 Davydov, V.V. Theoretical foundations of developmental learning / V.V. Davydov – Primary school. – 1999. – № 7. – pp. 13-18.