MATHEMATICAL BACKGROUND OF STUDENTS AT THE PRESENT STAGE OF SOCIETY DEVELOPMENT: IMPORTANCE, MODEL, QUALITY

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Abstract

The importance of the research is conditioned by the increasing core role of mathematical education for performing tasks of implementing long-term goals of socio-economic development of the country, and creating an innovative economy. The article analyzes the importance of mathematical background of students at the present stage of society development. A structural-functional model of teaching mathematics is provided, including functional and purposeful, informative and technological, performance and criterial modules. The results of the quality of mathematical training of Russian schoolchildren in international TIMSS and PISA researches are specified.

Keywords: mathematical background, present-day society, model of teaching mathematics, importance of mathematical education, quality of mathematical training, TIMSS and PISA research results, students.

MAIN TEXT

In recent years the role of mathematics in modern science and education has been significantly growing. More attention is paid to the formation of understanding the necessity of high-level mathematical education to execute tasks on the creation of innovative economy, implementation of long-term goals of social and economic development of the country.

History and methodology of science have always given special attention to mathematics; it was mathematics that symbolized the search of the truths of science. Mathematics had a significant impact on all spheres of intellectual development of society; it demonstrated that it is not only a universal language of science, but a perfect method of research (Sarantsev, 2001). In his works mathematician and philosopher Pierre Gassendi noted, "If we know anything, we know it by mathematics". Mathematics is also considered as certain means or methodology of thinking arrangement. In mathematics there is an internal intellectual world in which some people live a significant part of their conscious experience. Mathematics is also considered as an abstract science: mathematics is a set of abstract forms – mathematical structures, or it is considered as an applied science which is necessary for process and social and economic development of society (Kolmogorov, 1988).

Because of its universal and functional character mathematics is a science dealing with forms and quantity, schemes of their manifestation, as well as an efficient research method, means of getting scientific knowledge, accurate language of description. According to M.V. Lomonosov, "it is necessary to study mathematics because it arranges order in mind". Let's present essential factors and their interaction in the form of structural and functional model of teaching mathematics as a multi-level system, including the following interrelated modules: functional and purposeful, informative and technological, performance and criterial (Fig. 1)

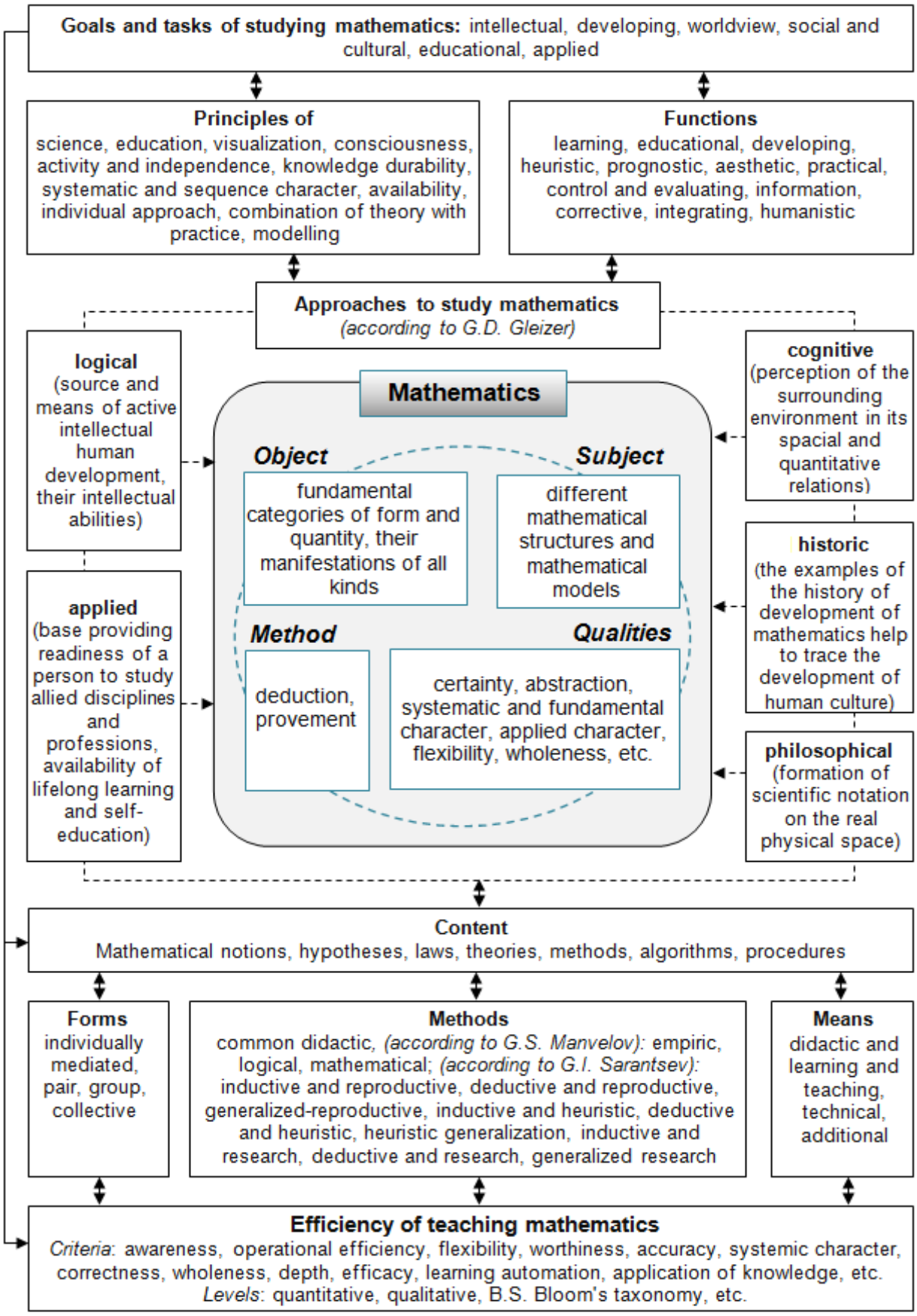

Figure 1 – Structural and functional model of teaching mathematics.

Functional and purposeful module of the model includes main goals and tasks, principles and functions, different approaches to studying mathematics.

Informative and technological module of the model provides the integration process for the content, forms, methods, teaching aids, as well as implementation of functional ties between model components. Content-related component is determined by the objective content of mathematics (notions, hypotheses, laws, theories, methods, algorithms, procedures, etc.).

Performance and criterial module of the model executes functions of diagnostic, corrective and reflexive character. The arrangement of the conversion process of mathematical information into knowledge by students is in direct relationship to the process allowing to provide the achievement of the abovementioned goals and definite level of knowledge quality.

Let's take the international programmes of educational results quality assessment TIMSS and PISA, the participation in which gives the possibility to find out and analyze education quality peculiarities of this or that country. *TIMSS* (Trends in International Mathematics and Science Study) allows measuring dynamics in the development of educational achievements of pupils of the 4th and 8th grades in mathematics and natural sciences (Trends, 2016). Quantitative and qualitative analysis of the results of 2003, 2007, and 2011 allowed drawing a conclusion that 40-48% of pupils demonstrated the highest and high levels of training in mathematics, but at the same time the percentage of pupils with low and the lowest levels mathematical background is high enough: 18-36% (Fig.2).

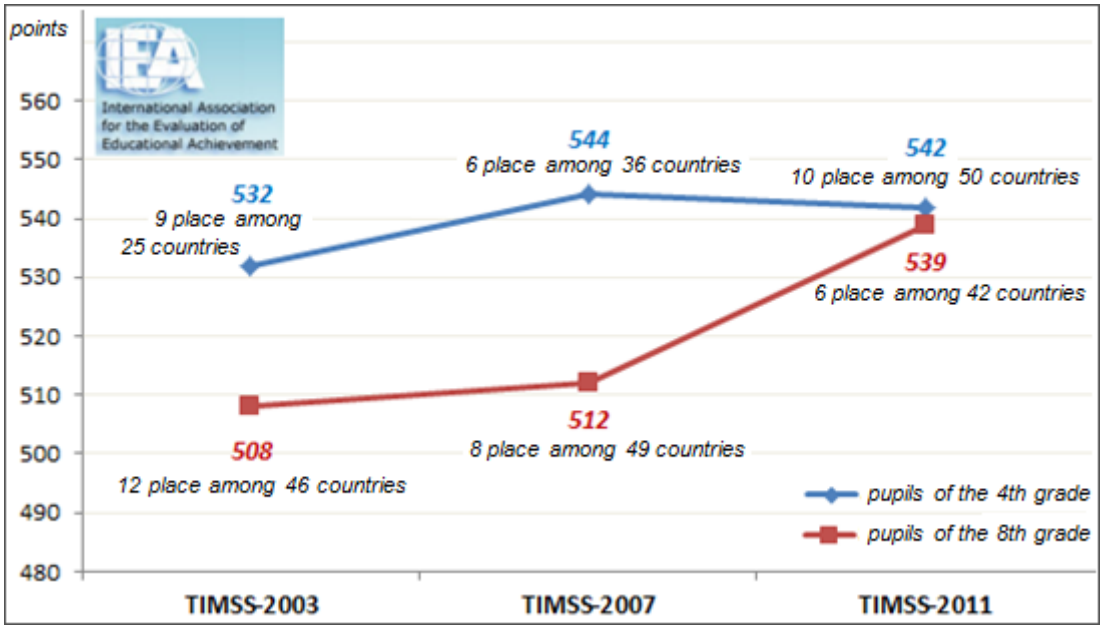

Figure 2 – Results of Russian pupils according to the data of TIMSS research.

PISA (Programme for International Student Assessment) measures literacy in the field of mathematics, natural sciences and reading (Programme, 2016). According to the analysis PISA–2012, Russian participants take 31–39 places in the level of mathematical literacy having 482 points; in the frameworks of PISA–2009 38–39 places (468 points) among 74 countries-participants (Fig. 3). During the years of participation of our country the international programme PISA has not have any significant changes in the state of mathematical literacy of Russian pupils. In PISA–2012 there were some improvements in the results, but they are at the level which is lower than an average international one (500 points).

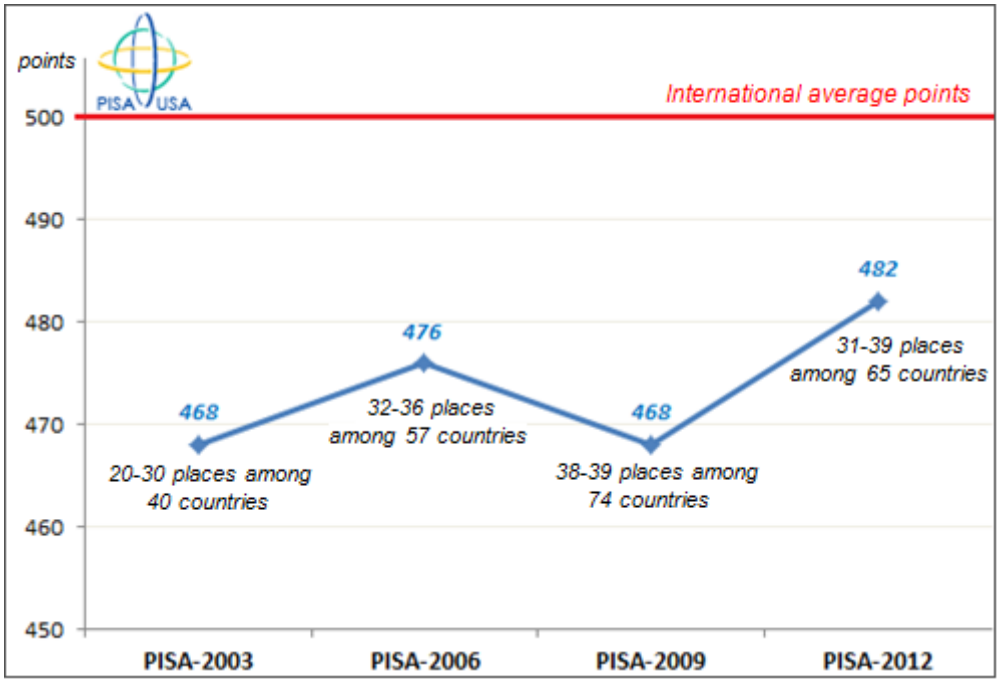

Figure 3 – Results of Russian pupils according to the data of PISA research.

According to the research (Polivanova, 2015), the results of Russian eighth-grade pupils (according to TIMSS) and 15-year-old pupils (according to PISA) have a unique interpretation: good level of mathematical knowledge and inability to apply them, which is connected with unpreparedness of Russian school pupils to solve tasks of practice-oriented character. Tasks directed to data analysis and justification, their application in nonstandard situations, explanation of the problems of surrounding reality cause the biggest difficulties among pupils. In this respect the paradoxical situation has come about: many higher educational institutions interested in the quality of students training are forced to arrange additional courses or modules in the elementary mathematics of school educational programme for the first-year students before proceeding with teaching HEI mathematical subjects. There is also a problem of content-related character: out-of-date content of mathematical education, its isolation from real life; breakdown of continuity between educational levels; absence of adaptive and differential training for different groups of students; isolation of educational content from modern science and practice, fall of its level, etc.

Rapid growth of information volume, appearance of new results in mathematical science, reduction in the quantity of hours devoted for studying mathematical disciplines in the HEI complicate carrying out intensive innovations in the field of modernizing the content of mathematical education. Wide introduction of e-learning information and communication technologies and means allows speeding up this process effectively (Toktarova, 2015) perfecting methodology and strategy of selection of learning content, methods and forms taking into account tasks of student's personality development in information society.

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