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The Conception of the development of Mathematical education in Russia

The president of Russia V. V. Putin on the day of his inauguration May 7, 2012, signed the number of decrees on the development of the social sphere in Russian Federation, including one on the preparation of the Conception of the development of Russian mathematical education. It was elaborated in 2012-2013 and approved in December, 2013 by the Government of Russian Federation. Here we discuss its basic positions.

Nowadays, developed in mathematics and mastered by a person major concepts, definitions, statements, proofs, algorithms, measurements and models became universal, common cultural and significant tools. They can be applied far beyond limits of mathematical research. The global mathematical education including saturation of our environment and media space by fascinating images, ideas and historical examples of mathematics is required. In modern society each citizen must possess the necessary mathematical competence, and the formation of that competence should begin at early age. There are no children, “incapable to mathematics” – the teaching should be based on the identification of individual dynamic zones of development, maintenance children’s self-confidence and their interest to mathematics and its applications to the real life.

Since the last decades, the area of presence of mathematical methods extended dramatically. It is connected with the rise of information (digital) civilization which becomes mathematical in more extent today. Material objects are more often projected to a digital form and analyzed in that form. Creation of means and instruments of information technologies is ultimately a mathematical activity. Information (digital) civilization and the knowledge-based economy demand new types and levels of mathematical literacy, culture and competence.

What mathematics is necessary to what category of students? Today in Russian education, as well as in many other education systems, it is possible to distinguish the following categories of participants of educational process (indicating estimated percentages):

- 1 . Leaders: possibly less than 1%
- 2 . Promising (“good”) 5% – 20%
- 3 . The mass – up to 80% or even more

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4 . Lagging behind – they are always distinct from the mass, and for this group the special strategy of teaching mathematics must be developed.

For example, in a regular secondary school it is possible to allocate the following categories of pupils:

1. Pupils who have shown outstanding achievements who on the achievements and can successfully continue their education at any university of the world.
2. Pupils with a constant eagerness to mathematics and adequate results in learning the subject.
3. Pupils having objective difficulties (connected with health, geographical access to education etc.) in attaining standard requirements.
4. “Ordinary” pupils representing the mass: condition of their mathematical competence matches the general condition of education and society.
5. Pupils really not matching any reasonable expected minimum, neither from the point of view of the motivation, nor from the point of view of participation in the process, nor from the point of view of achievements.

The Conception is addressed to each of these categories.

Besides the important distinction between categories of students, there is also a distinction in their vital interests and goals. Education, on the one hand, must have features of universality, and on the other hand it should take into account this distinction. Today in Russian Federation it is admitted that such distinction arises in upper secondary school i.e. since 10th grade. For example, in case of mathematics the pupil learning in upper secondary school can learn an advanced course of mathematics of 6 hours a week and also obligatory elective courses in the amount of 2 hours per week.

Present approach of authorities in Russia consists in division of powers: decisions in the field of the higher education are made by federal authorities and in the field of the general education by municipal and regional authorities. It is offered, keeping on the regional and municipal authorities their responsibility in the field of mathematical education, to extend the responsibility of federal authorities. For example, in case of the general education all educational institutions receive standard per capita financing according to the number of pupils of each level. The federation government will incur the additional expenses supporting the education for leaders on the best world level, ensuring the effective realization of all extensions of the State Standards.

In the realization of educational programs of tertiary education, the essential role will belong to distance educational technologies. In such remote option the lecturer of a leading university delivers a course, advises instructors from other higher education institutions, and the instructors provide the quality of acquiring of subject matter by students of those institutions. The higher education institution can itself create and successfully realize a course of high level. Quality of the course and results of work of students can be seen in the information environment. Such course must receive federal financing if it obtains the formal approval by the mathematical community on federal level. Free supply of all demands of mathematical education in information sources (textbooks, books of problems) and tools (programs of visualization, the statistical analysis, computer algebra, etc.) must be offered, too. This is also on the responsibility of federal authorities (with competitive procedures, public control etc.).

Teachers of mathematics are the main link in the implementation of the Conception. Possibility of successful realization of the purposes stated in the Conception depends on this link. As well as in other cases, there is a number of fundamental questions, partially or completely absent in the Conception but worth mentioning. First, it is the dependence of the success of the Conception on the perspectives of Russia, and, in particular, on country's perspectives as modern hi-tech competitive superpower. The most serious state policy must be directed on this purpose. The second: the quality of teacher's work depends on her/his financial position and also on the prestigiousness of the profession, on the attitude towards it in society. Today the government started and successfully realizes the following purpose: the salary of the teacher should not be below the average salary in the region.

On the federal level, additional programs of distance professional education for teachers in which also university instructors can participate, must be organized.

Within these programs the following elements will be offered:

- permanent work of students at school (on the basis of federal financing);
- intensive course of the solution of problem solving (in elementary mathematics);
- the state final certification with participation of the university mathematical staff and representatives of local governing bodies;

- the guaranteed teacher’s job from local educational governing bodies.

In such program can take part students not only of pedagogical universities, but also of technical and classical universities, in this case the participants learn also psychological and pedagogical components. Necessary element of this work is introduction of effective system of the certification based on the Professional standards for teachers. Basis The certification should be based on the expert evaluation of the work of the teacher, recorded in the information environment. Furthermore, solving elementary mathematical problems and reviewing pupils’ works can be used.

As a result of the implementation of Conception, the following aims should be reached:

- The tendency of the last decades of decrease of the level of mathematical education should be overcome, the leading position of Russian mathematical education in the world should be recaptured.
- The professional level of in-service and pre-service mathematics teachers should raise;
- Accessibility of mathematical education should increase
- The mathematical literacy of various categories of citizens according to public needs and individual requirements should increase;
- Leaders of mathematical education will get support: new institutes and individual teachers, new active and young leaders will emerge;
- Level of fundamental mathematical research will raise;
- Carrying out of applied mathematical research in industry will be provided with staffs of necessary competence;
- The public status of mathematics and interest to this science should increase.

During the implementation of the Conception, professional requirements to school teachers of mathematics will be strengthened, the best mathematical schools and teachers will receive the federal status, the number of mathematics teachers satisfying the professional standards will raise, the number of foreign authors and members of editorial boards, the international popularity and citation index of Russian mathematical journal will grow.