

Singularities of preschool mathematical education in Russia

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Abstract. Consideration of singularities of mathematical education of preschool children is determined by those reforms, which are carried out in Russia over the last years at all levels of the education system. The article analyzes the singularities of the purposes, contents, forms, and methods of teaching preschool children in mathematics based on domestic and foreign publications, which have been released over the last years in the field of mathematical development of preschool children. Elements of mathematical education technology are covered according to the documents adopted in Russia, which regulate the educational activity of preschool educational institutions on the government level, and also in the context of the concept of mathematical education development in Russia.

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Introduction

In Russia, considerable attention has been traditionally paid to mathematics study. In 1950-1980s, the mathematical knowledge was highly esteemed and considered a necessary element of culture, and of social, personal, and professional competence [1]. Efforts are currently made to revive and save this tradition by developing mathematical education starting from preschool age. The concept has been accepted, which deals with the issues of the quality and the content of mathematical education in Russia starting with preschool education and ending with education of the scientific and pedagogical staff.

In the sphere of preschool education, new government acts have been adopted. The law "On Education" recognizes preschool education as a level of the general education [2]. According to the law, preschool education is carried out according to the Federal State Educational Standard of Preschool Education [3].

The problem of mathematical education of children at Russian kindergartens consists in that the practice of preschool education has not yet approached the issues mentioned in the concept of development of mathematical education in Russia during the period of transition to implementation of provisions of the State Educational Standard. It is necessary to achieve the understanding of the singularities of the preschool mathematical education development with account of the requirements of new government acts and to appeal to the domestic and foreign scientific researches reflecting modern approaches to selection of the content, methods, and technologies. Another equally complex problem is the training of teachers who are to be capable of teaching mathematics to children at kindergartens in the new circumstances.

Body of the work

The standard of preschool education defines contemporary requirements to the structure of the main general educational program of preschool education. The content of preschool education at any kindergarten should include approaching five directions of children's development: physical, socially communicative, cognitive, artistic and esthetical, and verbal [3]. According to the new requirements, formation of elementary mathematical representations belongs to the cognitive direction. For the first time, educational programs do not have an independent area defining the content and the objectives of the mathematical education of preschool children. It is offered to carry out solution of problems of children's mathematical development by means of cognition by the child of the world around and of himself, based of integration of educational areas taking into account age-specific abilities and peculiar features of pupils.

The solution of problems of psychological and pedagogical work on formation of elementary mathematical representations should be implemented in different types of activity: communication, games, and experiments. Thus, kindergartens chose not to use direct education of children and the system of standard classes, which had been being formed during decades, and which had become so habitual for teachers. The authoritative approach to teaching mathematics to preschool children was replaced with the person-oriented approach guaranteeing an individual educational path for every child. A child starts playing an active role in the choice of the content of his education and becomes the subject of education.

It is impossible to disagree that the mathematical knowledge of a child of younger age is of integrated nature [4]. This regularity has also been

proved by domestic researches [5]. At the same time, legitimacy of such an approach with respect to children of senior preschool age is doubtful, as mathematics is a special science, and it cannot be a minor or additional one especially at the stage of preparation for education at school.

Speaking about children of 6-7 years of age, researchers note that the singularity of teaching mathematics is, in particular, that already at initial stages, it should be based on, first of all, a certain level of development of the preconceptual forms of thinking of a child and on characters and symbols. These elements underlie the organization of educational activity, the modelling of the content being under study, and the development of the semiotic function of thinking. Their learning requires a certain level of development of such thinking mechanisms as analysis, synthesis, abstraction, generalization, etc., and development of their interaction [6, 7, 8].

The most important problem of mathematical development of children is formation of prerequisites for universal educational actions, such as randomness of behavior; ability to purposefully own strong-willed efforts and establish correct relations with adults and peers; accumulation of experience in fulfillment of such universal educational actions as work on a template; registration of difficulties in the activity, identification of causes, selection of ways to overcome the difficulties; consideration and planning of one's actions, check of the results of the actions, correction of mistakes, etc. [6].

A necessary condition for successful teaching mathematics at school is formation of interest to mathematical knowledge and development of relevant motivation [9, 10, 11]. Researches have shown that motivation for a task connected with mathematics, and progress in arithmetic are interconnected: the higher motivation for a task children showed at the beginning of the academic year in a pre-school group, the higher level of progress in arithmetic they showed at the end of the academic year. Besides, the higher level of progress in arithmetic the children originally were on, the bigger interest they later showed to mathematics [12].

Emotions are the central mental function of the preschool period of a child development. The educational environment should provide emotional wellbeing of children [3]. The emotional component is also important for successful teaching mathematics. Emotional and behavioral reactions of children to difficulties are an important indicator of success at school [12].

The question of the purposes and the content of mathematical education of children is a question of

principle. The choice of the content of mathematical education on all education levels continues becoming outdated and remains formal and idealistic. The continuity between education levels has been broken [1].

Several researchers by Russian scientists describe conceptual and methodological principles of modern mathematical education of children, its continuity in the kindergarten and at school [6, 13, 14, etc.]. It was noted that mathematical education of preschool children should be of developing nature and be oriented to development of cognitive abilities [15], which are interconnected with the development of cognitive processes, and first of all, of imagination [16] and children's creativity [17].

The purpose of mathematical development of a preschool child is defined as: "stimulation and development of the mathematical style of thinking (components and qualities of this style, which correspond to his age)" [6]; "development of intellectual and creative abilities of children through their learning of logical and mathematical representations and methods of cognition" [14]; "nurturing the necessary mathematical culture of the growing person as well as the culture of logic, analytical, and algorithmic thinking" (including elements of work with widespread technological objects, computer equipment; formation of the ability to carry out reflexion with respect to oneself and to the results of educational and cognitive activity) [13].

The purpose orientation defines the content of mathematical development of preschool children. It is often called "pre-mathematics" (A.A. Stolyar). It was accepted to include in the content of mathematical development of preschool children: 1) representations and concepts (quantity, number, set, subset, size, measure, form, geometrical figures, etc.); 2) dependences and relations (equality in number – inequality in number, order relations in natural series, temporal relations, dependences between properties of geometrical figures, size, measure, and the result of measurement, etc.); 3) mathematical actions (count, measurements, calculations); 4) cognitive, intellectual actions (comparison, classification, seriation, abstraction, etc.) [18]. However, the practice shows that the traditional content neither duly aids the development of logic structures of thinking, nor considers formation of the personality qualities, which are necessary for adaptation to the process of informatization of the modern society, in which children will have to live.

The works of the researcher prove that the content of the mathematics program for preschool children can be represented as a list of mathematical concepts and types of modelling actions (material

modelling – designing and graphic modelling – drawings and schemes), in the course of which children assimilate these concepts [6]. Such approach targets development of mathematical abilities of children in the system of continuous mathematical education at kindergarten and school. At the same time, it represents a system of classes in mathematics in all age groups, which today is offered to be rejected, and is not focused on information changes of the society, as well.

The content of mathematical education of preschool children includes mathematical representations (properties and relations, numbers and figures, geometrical shapes, size, space and time, dependences and regularities, and algorithms), logical and mathematical means (standards, models, and speech), and methods of cognition (comparison, seriation, and classification). Such content provides development of the critical elements of the child's personality – his intelligence and intellectual and creative abilities [14].

Another point of view describes the content of preschool mathematical education, which bases on the logic of formation of mathematical knowledge in the phylogeny and the corresponding development of informative mechanisms of its assimilation. According to the authors of this concept, the content of mathematical education should assume help of an adult to children in penetration, immersion into the essence of relations between surrounding objects (homogeneity-connectedness-complicacy-structuredness-constructiveness-consistency) and formation of principles of corresponding mathematical categories: uniformity (identity), motion (change), order, and integrity [19].

In the concept addressing the culture of mathematical education during the early childhood period, the content is represented as a set of arithmetic, algebraic, algorithmic, geometrical, and values concepts. The author proves that it is necessary to select such content of mathematical education, which will assist a child to be acquainted with the information science and to form respective competences helping him to study at school successfully later [13]. This concept takes into account all the most important processes of the modern society: the accelerating process of informatization and implementation of high technology narrowly connected with the mathematical education. As we see, purpose-oriented and substantial components of mathematical education correspond to the developing orientation of the educational process at kindergarten and can be implemented within the content of sample programs of preschool education.

And the question about the technology of mathematical education of preschool children is equally important. It is noted in publications that, currently, kindergartens must arrange assimilation of mathematical representations by children by means of information and communicative technologies [20]. Representation of mathematical tasks should have the form of problem situations, which children could model graphically [21]. Technologies should be focused on the originality of each child and provide supportive position of an adult. It was proved that with the technologies “focused on the child”, children design their knowledge and develop more actively than with a technology where the teacher heads the process of education [22].

The technology of personification is found to be the most adequate to the requirements of individualization of the pedagogical process. The personified approach differs from the person-oriented, individually differentiated, and nature-aligned approaches, as it targets development of the “self-forming principle” with the subjects of the educational process [23]. Technology of mathematical development of preschool children should provide mechanisms of self-change, self-development, and self-education of children. Cultural distinctions and ethnic peculiarities render certain impact on the development of mathematical representations of children [22, 24], which has been taken into account currently in the standard of preschool education and is necessary for multinational and polycultural Russia.

In spite of the fact that the new documents modernizing the pedagogical process of preschool institutions have been adopted, it is difficult for teachers being in a situation of transition from the experience they have been accumulating for decades to the new to change their consciousness and practice of working with children, and to pass from the directly teaching position of a teacher to the supporting one. A poll of 1,000 kindergarten teachers showed that 65% had a positive attitude to new approaches and changes in mathematical education of children and were ready to master new programs; 25% of them felt uncertainty and disappointment in connection with the innovations; and 10% of the responders felt insufficiency of their proficiency in the field of mathematical development of children. Scientists emphasize the need in special mathematical training of students of pedagogical colleges and universities in formation of elementary mathematical representations with children taking into account the new requirements. Training of teachers should be conducted based on the modern content, techniques, and technologies of working with children of respective age [1].

Researchers consider this question in the context of diversification of education and development of the new model of a teacher [25]. The academic staff of the university is reconsidering traditional teaching of students and searching for the most effective, interactive, activity-based problem technologies. And the “pedagogical engineering” line is a perspective one in these terms. The digital epoch requires adequate revision of pedagogical approaches to didactics according to the demand of modern students and the search of new ways of using information and communicative technologies for teaching and training.

Conclusion

Identification of singularities of the current stage of development of preschool mathematical education in Russia was the objective of this research. The carried-out analysis of references gives reasons to conclude that in Russia, urgent researches are carried out aiming to respond to the unsolved problems arising in the preschool mathematical education. At the same time, on the level of implementation of scientific provisions in practice, no active implementation of these results in kindergartens is observed. In particular, the task of developing algorithmic thinking of children, teaching them to deal with computers, preparation for life in the hi-tech information society is poorly implemented.

Summary

In Russia, the society is aware of the importance of high quality mathematical education starting from the preschool age. Kindergartens are restructuring the purposes, the content, the forms of organization, and the methods of teaching children in mathematics in view of the stepping up governmental requirements to preschool education. Changes are of humanistic, person-oriented nature, and they are considered based on both researches of Russian scientists and the international experience in preschool education. Teachers of all levels will have to do a lot in order to achieve the high level of mathematical education of preschool children and their preparation for studying at school.

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