

Preparation of the Future Teacher for Work with Gifted Children

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Abstract

The paper is devoted to the problem of creating a system of training of future teachers for work with gifted schoolchildren in mathematics. The authors analyze the existing curricula and basic professional educational programs for the preparation of Bachelors in the directions of training "Pedagogical Education" and "Mathematics and Computer Science" in terms of ensuring the professional competencies of future teachers for the work in the conditions of existence of a professional standard. The authors propose a technology for preparation of students, involved the production of Bachelors with high competencies in the field of working with gifted children in mathematics. The purpose of the article is to analyze the actual level of Bachelor's training for working with gifted children in mathematics and, on this basis, to present the developed system of training future teachers for work with gifted schoolchildren in mathematics. The research methodology is based on a system of basic principles, methods and concepts of the psychological-pedagogical theory of mathematical giftedness: the content analysis of curricula and basic professional educational programs for Bachelor's training, a test for determining the readiness of a teacher to work with gifted children, a test for determining the propensity of a teacher to work with gifted children. The authors have developed and proposed a structure of vocational training of students to work with mathematically gifted children. Some shortcomings in the professional training of future teachers are revealed. The results of experimental work on the improvement of the basic professional educational program in the training directions "Pedagogical education" and "Mathematics and computer sciences" are presented. The existing problem of the lack of competencies of future teachers should be compensated with the help of development of means, techniques, technologies and methods that contribute to the competence of students in working with gifted children in mathematics.

Key words: *gifted children; mathematical giftedness; professional training of future teachers; professional standard; competences.*

Introduction

Formulation of the problem. The priority direction of Russia's modern social policy is the modernization of all levels of education. Representatives of the society are involved in

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creating educational standards, updating the infrastructure and content of education, assessing the effectiveness of the work of educational organizations. The Concept of the Development of Mathematical Education, adopted in Russia in 2013, determined the need for the organization of purposeful and systematic work of teachers to identify and develop gifted schoolchildren in this field (Concept of Development of Mathematical Education, 2013). It is noted in the concept that "... mathematics occupies a special place in science, culture and social life, being one of the most important components of the world scientific and technological progress (Korableva et al., 2017). The study of mathematics plays a system-forming role in education, developing the cognitive abilities of the person, including logical thinking, influencing the mastering of other disciplines. Quality mathematical education is necessary for everyone for his/her successful life in modern society" (Rodionov et al., 2017; Askhamov et al., 2016; Ganeeva et al., 2017).

New requirements for the psychological and pedagogical training of pedagogical staff of educational organizations are interrelated with changes in the approaches to the organization of the educational process with gifted children in mathematics. At the present time, the work of the teacher with gifted children acquires new content in connection with the adoption of the professional standard "Teacher of the Educational Organization". The standard is designed to define the requirements and assess the competencies of teachers of various educational organizations, including the teachers of both schools and pre-school educational organizations (Tarman et al., 2015).

Changes in the training of teachers of educational organizations are also connected with the introduction of Federal state educational standards into educational practice, since for the first time the standard is defined as a form of social contract in education. In view of this definition of the standard, the training of pedagogues of educational organizations should be aimed at the production of specialists with high qualification in the field of working with gifted children. A special competence of the graduates of programs aimed at teaching math at school should be the ability to train students in accordance with their requests to the level of training in mathematics education. The future teacher should provide each student, regardless of the place of residence and living conditions, the ability to achieve any level of training according to his/her individual needs and abilities (Diezmann et al., 2012). This suggests that when educating future pedagogues of educational organizations, attention should be paid to preparing them for inclusion in the educational process so that they can provide the number of graduates needed by

the country, the mathematical preparation of which is sufficient for continuing education in various fields and for practical activities, including teaching mathematics, mathematical research, work in the field of information technology, etc.

Solving theoretical and practical problems of organization of the educational process with gifted children in mathematics in the educational organization is gaining a greater significance in connection with humanization and democratization, the growing role and importance of protecting human rights and freedoms, the development of market relations. Therefore, for the effective organization of the educational process with gifted children in mathematics, the future teacher needs a deep understanding of the pedagogical and psychological foundations of the organization of the educational process with them. Although these mechanisms are still poorly understood, the already available research results can significantly expand the teacher's abilities to create conditions fostering the formation of the interest of the members of the collective in the productive work of the organization (Çalışkan, 2015).

However, we should pay attention to the existence of disagreements in the requirements for the university graduate according to the Federal state educational standard of higher education (FSES HE) in the directions of training "Pedagogical Education" and "Mathematics and Computer Science" and the professional standard of the teacher (Professional standard "Teacher of the Educational Organization "). When analyzing these documents, it is revealed that the existing FSES HE in the preparation of future teachers does not prepare them for training children with a different abilities for mathematics. In the professional standard, much more personality qualities of the teacher are stated than in the Federal state educational standard of higher education. To solve this problem, it is necessary to adjust the educational process at the higher education institution in such a way that in the future the graduate will meet the employer's requirements.

This problem led to the urgency of developing a system for preparing future teachers to work with gifted schoolchildren in mathematics. The obtained results will allow discovering new mechanisms for preparing future teachers to work with mathematically gifted schoolchildren and to bring work with gifted children in line with the requirements of the professional standard.

Methodology

The research methodology is based on the system of basic principles, methods and concepts of the psychological and pedagogical theory of mathematical giftedness; includes the notion of "mathematical giftedness"; the concept of the development of mathematical education; the principle of an integrated typological approach to the study of abilities and individuality. To solve the problem of the present paper, the methods of theoretical analysis and generalization of the results of completed studies in the field of mathematical giftedness were applied; empirical methods (content analysis of curricula and basic professional educational training programs, tests to determine the readiness and inclination of the teacher to work with gifted children) (Erbilgin, 2017).

A study of the preparation of future teachers for work with gifted schoolchildren in mathematics was conducted at the Elabuga Institute of the Kazan Federal University in November 2017. In the study, 125 students participated of the 2nd, 3rd and 4th year of study in the field of training 44.03.05 "Pedagogical Education" for the profiles "Mathematics and Physics" and "Mathematics of Informatics". The following methods were used for the study:

1. Test for the determination of the teacher's readiness to work with gifted children (V.S. Yurkevich) (Yurkevich, 2000).
2. Test to determine the inclination of the teacher to work with gifted children (D.B. Bogoyavlenskaya, A.V. Brushlinsky) (Bogoyavlenskaya and Brushlinsky, 1988).

Theoretical methods allowed specifying the definition of the concept of "mathematical giftedness" and identifying the problem associated with the professional preparation of the teacher to work with gifted students in mathematics. The method of concretizing the content of the principle of a complex typological approach to the study of abilities and individuality is in the foundation of the consideration of the curriculum and the basic professional education program (BPEP) for the preparation of Bachelors from the position of the main document sources designed to provide quality vocational training of teachers to work with the mathematical talent of students. An analysis was performed of the curriculum and the basic professional educational program in the direction of training 44.03.05 "Pedagogical Education" for the profiles of training "Mathematics and Physics" and "Mathematics and Informatics".

Literature review

The results of analysis of scientific literature allow concluding that different researchers interpret the concept of mathematical giftedness in different ways.

V.A. Krutetsky believes that "mathematical giftedness is characterized by a generalized, compact and flexible thinking in the sphere of mathematical relations, numerical and sign symbolism and mathematical mentality. This feature of mathematical thinking leads to an increase in the rate of processing mathematical information (which is connected with the replacement of a large volume of information with a small amount, due to generalization and contraction) and, consequently, saving neuro-psychic forces" (Krutetsky, 1988, p.85).

The prominent Russian scientist N.V. Metelsky thinks that the basis for the development of mathematical gifts and abilities is "... only a good level of thinking in general and mathematical intuition" (Metelsky, 1977). V.A. Krutetsky sees in the mathematical giftedness the presence of innate functional characteristics of the brain and believes that the brain of gifted people in mathematics distinguishes from the surrounding world the stimuli such as spatial and numerical relations and is able to adequately perceive and operate with them (Krutetsky, 1988). He notes that the teacher should awaken the interest of students in mathematics and the tendency to engage in it, believing that a student "captured" by mathematics can quickly achieve great success. And as an example, he refers to famous Russian mathematicians N.I. Lobachevsky, M.V. Ostrogradsky, N.N. Luzin, and others.

Kholodnaya M.A. also notes that mathematically gifted schoolchildren are distinguished by higher indicators of the formation of conceptual experience: when formulating questions, they construct a more complex semantic context in establishing connection between three isolated concepts, formulate more complex problems and connections with a given object on the basis of a deeper analysis of its characteristics (Kholodnaya, 1977).

Shadrin V.Yu. considers the mathematical giftedness of schoolchild as a complex formation, including the general and special intellectual abilities of the individual (Shadrin, 2008).

In her study, E.A. Kryukova represents mathematical giftedness as an integral, multilevel, multicomponent, dynamic formation, which has various forms of manifestation (Kryukova, 1996). Like her predecessors, who studied the phenomenon of mathematical giftedness, she

notes the importance of special mathematical activity for the development of mathematical giftedness.

In determining the development level of mathematical abilities, V.A. Testov proceeds from the understanding that mathematical giftedness is a complex mental formation, a kind of synthesis of properties, an integral quality of the mind, encompassing its various aspects (attention, perception, thinking, memory), but developing in the process of mathematical activity (Testov, 2010).

Thus, with all heterogeneity of the definitions of mathematical giftedness, it should be noted that the mathematical giftedness is undoubtedly connected with the features of thinking and the qualities of the man's personality. A decisive role in the development of mathematical giftedness of schoolchildren is played by a properly organized educational process. It is the competence and professionalism of the teacher that largely determines the level of interest of children in mathematics, the possibility of its development, the development of curiosity and the mathematical abilities of pupils (Shagivaleeva et al., 2017; Mirzagitova & Akhmetov, 2015).

Results

A study of the preparedness of future teachers for work with the schoolchildren gifted in mathematics was conducted at the Elabuga Institute of the Kazan Federal University during the 2017-2018 academic year among students of the 2nd, 3rd and 4th year of studying in the training directions 44.03.05 "Pedagogical Education" for the profiles "Mathematics and physics" and "Mathematics and Informatics".

Let us analyze the curricula and the basic professional education programs for the training course in the directions 44.03.05 "Pedagogical Education" for the profiles "Mathematics and Physics" and "Mathematics and Informatics" in terms of their fostering the formation of the competencies of future teachers to work with the mathematically gifted schoolchildren.

The basic professional educational programs for the Bachelor's degree in the profiles "Mathematics and Physics" and "Mathematics and Informatics" are a system of documents developed and approved, taking into account the tasks of forming competences regulated by the Federal State Educational Standard of Higher Education (FSSES HO) in the corresponding area of training, and taking into account the recommended approximate basic professional education program (BPEP), which regulates the objectives, the expected results, the content, conditions and

technologies for the implementation of the educational process, the evaluation of the quality of the graduate's preparation in this area of training, and includes: the curriculum, the working programs of the academic courses, subjects, disciplines (modules) and other materials that ensure the quality of the trainees' training, as well as the programs of educational and production practice, a calendar training schedule and methodological materials that ensure the application of appropriate educational technologies.

In the field of training, the overall goal of the basic professional education program in the training direction 44.03.05 "Pedagogical education (with two training profiles)" is the students' obtaining higher profiled education that allows the graduate: to successfully carry out research and development aimed at applying fundamental knowledge in the field of psycho-pedagogical and special disciplines in the future professional activity; successfully carry out research aimed at improving the methods of solving standard problems of professional activity on the basis of information and bibliographic culture using information and communication technologies and taking into account the basic information security requirements (Faizrakhmanov & Akhmetov, 2016); have universal and subject-specific competencies that contribute to his/her social mobility and stability in the labor market. The goal of training itself does not include the development and application of those psychological and pedagogical technologies (including inclusive ones) that are necessary for future teachers for individual work with different contingent of students, including gifted children. The curriculum contains the discipline "Psychological and pedagogical support of inclusive education", but there is no discipline related to studying the special characteristics of gifted children, mastering skills of working with them and organizing the education of mathematically gifted children. The annotations of the academic disciplines and the program of practice also do not reflect the tasks set in the professional standard of the teacher.

Solving the research problems put forth the need to conduct an experiment to determine the teacher's readiness to work with gifted children and to determine the inclination of the teacher to work with gifted children. The purpose of this study is to analyze the formed competencies of FSES HO in the future work with gifted children in mathematics. To achieve this goal, the following tasks of the research objectives were realized:

1. The base for carrying out the experiment was created. The Elabuga Institute of the Kazan Federal University (EI KFU) acted as an experimental base.

2. The composition of the participants in the experiment with which the experimental work was carried out was determined. The participants included 125 students of the 2nd, 3rd and 4th year of studying in the direction of training 44.03.05 "Pedagogical Education" for the profiles "Mathematics and Physics" and "Mathematics of Informatics". All students are enrolled in full-time study.

The average age of the respondents was 20 years. The testing was attended by teachers Bochkareva T.N., Akhmetshin E.M., Osadchy E.A. The testing was conducted during one working day. It was conducted on the basis of an educational organization. For systematization and analysis of the survey results, the Microsoft Excel spreadsheet was used. To conduct a survey and analyze its results, written permission was obtained from all respondents to use and process their personal data. No one refused to participate in the survey. The statistical error was 5%.

Diagnostic methods for the research have been prepared and selected. Based on the study of psycho-pedagogical literature, the following methods for diagnosing were selected: a test for determining the readiness of the teacher to work with gifted children (V. S. Yurkevich, 2000) and a test for determining the inclination of the teacher to work with gifted children (D. B. Bogoyavlenskaya, A. V. Brushlinsky) (Bogoyavlenskaya and Brushlinsky, 1988).

1. Test for the determination of the teacher's readiness to work with gifted children (V. S. Yurkevich, 2000). This test allows finding out how much the teacher understands the problem of nurturing giftedness, whether the teacher can judge the giftedness of the child, understand the reasons for the insufficient development of abilities in a healthy child. The questionnaire consists of 30 questions, including answers like "yes" or "no." In addition, it is impossible to find answers to certain questions in the text, and a correct answer to them indicates a pedagogical or parental intuition (or enlightenment in this area).

After testing the students to determine the readiness of the future teacher to work with gifted children, we got the following results: out of 125 students interviewed, none answered all questions correctly, which indicates a possible decrease in the motivation and interest of students to work with gifted children. 29 students (23.2%) incorrectly answered only 5-7 questions, which is an indicator of their willingness and desire to work with gifted children. However, the overwhelming majority, 96 students (76.8%), gave incorrect answers to more than half of the

questions, which testifies to the need for a quality organization of training students to work with mathematically gifted children (Figure 1).

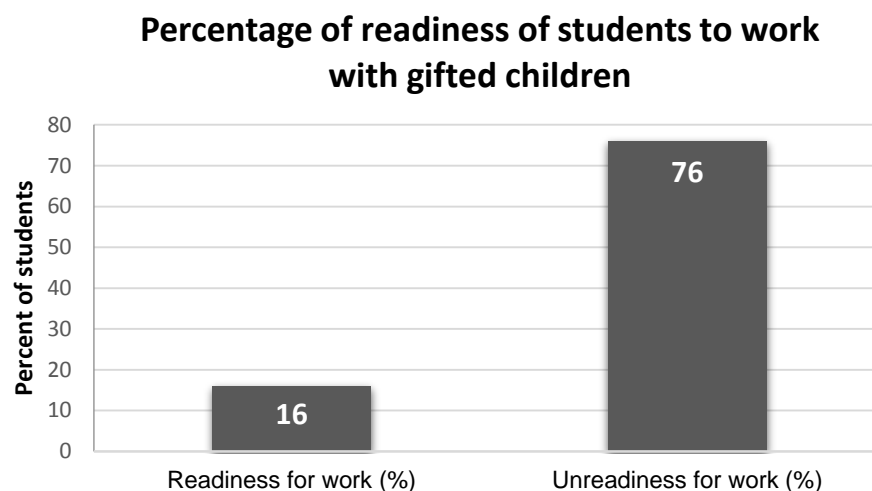


Figure 1. Percentage of readiness of students to work with gifted children

As can be seen from the diagram data in Figure 1, the percentage of students who are not ready to work with gifted students exceeds by 3.3 times the number of students ready to work with such students.

2. Test for determining the inclination of the teacher to work with gifted children according to the method of D. B. Bogoyavlenskaya, A. V. Brushlinsky (Bogoyavlenskaya and Brushlinsky, 1988). This technique allows identifying the propensity to work with gifted children, the presence of potential opportunities, the need for the correct choice of the object of focus of the creative interest of students. Testing to determine the teacher's inclination to work with gifted children consisted of 18 questions aimed at identifying the abilities of the future teacher to work with gifted children.

After testing the students to determine the propensity of the teacher to work with gifted children, the following results were obtained: the average level of propensity to work with gifted children was revealed in 95 students (76%), which indicates the need for additional educational and motivational resources for them. 10 students (8%) have low propensity to work with gifted children and are less capable of such work. A high level of propensity to work with gifted children was found in 20 students (16%), which indicates that these students have the necessary resources for such work (Figure 2).

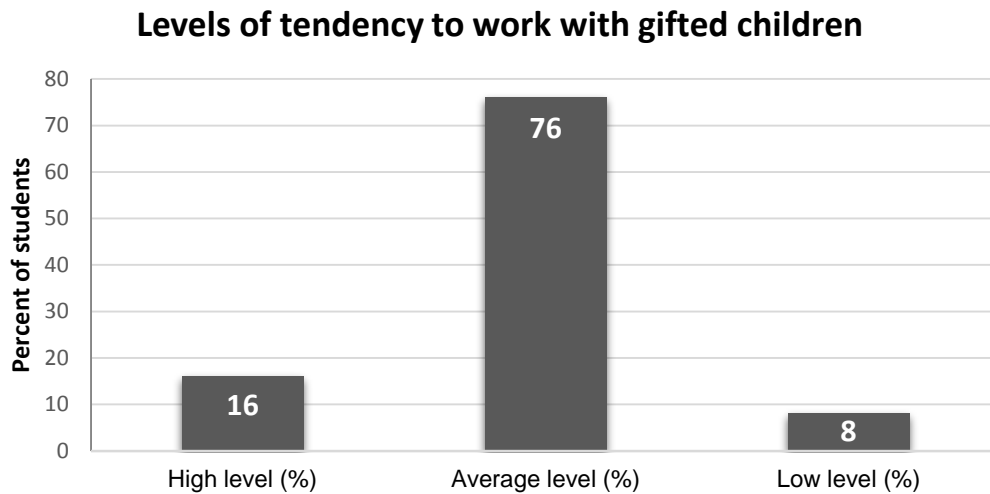


Figure 2. Levels of propensity to work with gifted children, in percentage

Based on the analysis of the diagram data in Figure 2, we can conclude that the overwhelming number of students have an average level of propensity to work with gifted children; thus additional motivation, resources and active self-regulation in the intellectual process is required for future teachers. Students need the right choice of the object of focus of the creative interest of schoolchildren.

Discussion

Thus, it can be concluded that most students have the inclination to work with gifted children, but their degree of readiness for such work is low. The obtained data testify to the need for a purposeful organization of the educational process for the preparation of future teachers for work with mathematically gifted children.

In their studies, E. F. Vertyakova and I. V. Zabrodina, considering the issue of preparing future teachers for work with gifted children, refer to the experience of studying the propensity of the teacher to work with gifted children according to the method of D. B. Bogoyavlenskaya and A. V. Brushlinsky at the Department of Training of primary school teachers at the Chelyabinsk State Pedagogical University of the Russian Federation (Vertyakova and Zabrodina, 2016). The research results of E. F. Vertyakova and I. V. Zabrodina are pretty much identical with the results that the authors obtained, which confirms the need to make adjustments to the educational process with the professional preparation of the future teacher.

E. P. Grin'ko also considers it necessary to revise the system of training the future teacher in order to improve working with mathematically gifted children (Grin'ko, 2014). To improve the efficiency of teacher training in the work in this direction, he proposes the following criteria and indicators: the motivation criteria (the desire to work with gifted children, the desire to gain the necessary professional knowledge and skills in working with gifted children, the ability to self-improvement); the criterion of knowledge (the level of knowledge in the academic disciplines aimed at creating a willingness to work with gifted children); the criterion of activity (the multidimensionality of the content of activity, the effectiveness of the activity); the criterion of management (the quality of pedagogical leadership, the level of self-organization, the level of self-regulation) (Grin'ko, 2014).

M. A. Rodionov, A. I. Tyapina and N. N. Sharapova noted the existence of such problem as social underestimation of the importance of mathematical education, and in the process of analyzing scientific sources came to the conclusion that there is as yet no single position on the theory and methodology for preparing future teachers to work with gifted students in mathematics, in particular, concerning its structure, the possibilities of combining with the traditional components of pedagogical education, the specifics of the methods used for the lessons in math and methodological disciplines (Rodionov et al., 2017).

Thus, on the basis of the conducted analysis of the basic professional educational program, the curriculum and the results of the diagnostic study, the authors developed and proposed a system of didactic units of professional training of students for working with mathematically gifted children. The following components were included in this system:

1. Psychological features of gifted children. Mathematical giftedness of schoolchildren.
2. Psychological-pedagogical technologies of the organization of mathematical education of gifted children.
3. Pedagogical conditions of the organization of interaction with the parents of gifted children.
4. Organization of research and project activities of mathematically gifted children.
5. Forms of the organization of psychological and pedagogical support of gifted children.
6. Diagnostics of the mathematical giftedness of schoolchildren.

As for the forms of organization of the educational process, it is necessary to make greater emphasis on interactive and active forms of teaching, such as trainings, master classes, seminars, conferences, colloquia, meetings with educators working with gifted children, attending their classes, etc.

The next step in the work of the authors in improving the professional training of future teachers was the revision and adjustment of the work programs of the disciplines in order to provide the work with mathematically gifted children.

Conclusion

Thus, the professional training of future mathematics teachers to work with gifted children requires adjustment and improvement. This can be organized both at the stage of training in the higher education institution, and at the stage of post-graduate practical work of teachers. The problem of professional training is related to the need to prepare students for the specifics and characteristics of teaching gifted children directly in the subject area, adequately to the psychological characteristics of mathematically gifted children.

The professional standard of the teacher will require from the teacher of mathematics the mastering of certain labor actions of teaching students with different educational needs – gifted children; socially vulnerable children; children in difficult life situations; migrant children; orphans; children with special educational needs (autistics, children with attention deficit disorder and hyperactivity, etc.); children with disabilities; children with behavioral deviations; children with addiction problems (Liu et al., 2017). Therefore, the task of professional training in the higher education institution of the future teacher is related to the need to develop the level of possession of certain competencies and relevant labor functions. The use of active learning technologies, different in form of the organization of the educational process, will improve the quality of preparation for the future mathematics teacher.

However, from the authors' point of view, the most important is that in each academic discipline the student learns to perceive him/herself as a teacher at the lesson in school and simulate how he/she will teach schoolchildren with different levels of mathematical readiness.

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Endnotes

[1] Professional standard "Teacher of the Educational Organization". Retrieved February 19, 2018, from <https://минобрнауки.рф/>

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