Specific Features of Training School Students for Final Certification in Mathematics for the Course of Basic School in the Context of a Complex Training System

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ABSTRACT

The paper presents the author's technique of preparation for final certification in mathematics for basic school; its key feature is the emphasis on the formation of subject knowledge and abilities, creation of psychologically comfortable situation and confidence in school students. The methodical system considers questions of time management and psychological aspects of examination preparation. The research conducted since 2012 up to present results in the model of a complex system of training school student for final certification for the course of basic school, which includes substantial mathematical preparation and school students' preparation in regard to time management and psychological-pedagogical support of educational process participants; that allows to efficiently achieve education goals for each group of learners. The technique assumes a spirally-cyclic nature of the sequence of passing stages of each lesson; problem character of training material presentation; training by means of specially organized systems of tasks; minimization of theoretical material, use of methods and techniques adequate to the corresponding groups of school students. Materials presented in the paper are of practical value for school teachers, teachers of additional education, administration of educational institutions, school students and their parents as the technique described can be applicable in any educational institution, and be used by school students for independent preparation or preparation with an adult's support; it enables to arrange the training rhythm and the degree to which the material should be studied.

Keywords: mathematics, complex system of training, mathematical education, training in mathematics

INTRODUCTION

The research relevance

Nowadays, the pedagogical science refuses ideas of the human as a means for achievement of a result, and addresses the concept of human as the goal. It is determined by the fact that today the humankind has considerably expanded the knowledge about opportunities of each personality for self-improvement, mastering achievements of modern science and technologies. The ability to adapt to new living conditions falls within the scope of interests of the personality: to critically estimate and find solutions of arising problems, to analyze a situation, to adequately change the organization of activity, to be able to gain information using computer and to competently use it. All

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State of the literature

- Issues of school students' preparation for examinations as the system of interaction of all subjects of this process (teachers, school students, parents, school administration, and additional education teachers) are insufficiently investigated in scientific pedagogical works. As a rule, issues of school students' training for examinations are limited to interaction of the mathematics teacher and the school student; other subjects do not take part in the preparation.
- The vast majority of researches in the field of preparation for final certification in mathematics identify only contents preparation, without considering a psychological component; that prevents mathematics teachers from providing high-quality preparation for examinations.

Contribution of this paper to the literature

- The concept of a complex system of training as the system of measures for organization of educational process at which the choice of contents, methods, ways, techniques, means and forms of education is implemented in accordance with multiple-factor external conditions leading in total to the achievement of high educational results by school students not only within the main educational program but also with the attraction of additional education is introduced for the first time.
- The necessity to use a complex system of training school students for final certification in mathematics for the course of basic school is theoretically substantiated.
- The course of complex training of ninth-grade school students for final certification in mathematics for the course of basic school is proposed.
- The efficiency of a complex system application is proved for preparation of school students for final certification in mathematics for the course of basic school.

this defines the need of transition to a new educational paradigm according to which the school has to provide school students with an opportunity for self-training, self-development and self-improvement in these directions.

At the same time, present day school still focuses on teacher's activity that entails a number of contradictions:

- between valuable orientations in family and school;
- between declared goals of education and their real results;
- between the need to differentiate education and uniformity of training technology;
- between frontal forms of education prevailing at school, explanatory and illustrative nature of teaching and personal-activity character of learning and knowledge assimilation;
- between inevitable results of training by traditional methods and aspiration to develop school students by means of school disciplines.

To resolve the aforesaid contradictions and to organize the pedagogical process that meets a new paradigm of education when school has to give school students an opportunity for self-training, self-development and self-improvement in these directions, it is not enough to rethink and transform some of its chains; it is necessary to improve all methodical system of training in general; at the same time education cannot be considered in isolation from external conditions and factors.

In the last few decades, methodical systems of training providing implementation of educational process in the conditions of differentiation and individualization, profilization, informatization, intensification, fundamentalization, humanization and humanitarization are actively constructed, however all specified techniques are considered separately from each other. Unfortunately, today there is no methodical system of training in subjects which would consider educational process in complex, without isolation from multiple-factor external conditions. In this regard the development of a complex methodical system of school students' training in mathematics is getting urgent. As the final level of middle school students' proficiency can be estimated by the results of the basic state examination (BSE) for the course of basic school, then the treatment of a complex approach

to school students' training for final certification should include cooperation of administration, subject teachers, teachers of additional education, school students and their parents (Kozlova, 2015; Drozhzhachikh & Gorev, 2015; Gorev, 2013; Gorev, 2014; Gorev, 2015)

There arises the issue concerning the necessity for a specific preparation for final certification: either "to drill" and in this way to teach to solve tasks or to teach mathematics systematically observing the principle of gaining profound knowledge. It is obvious that in modern conditions, there is a need to prepare school students for final certification using various forms of this preparation (Gorev & Utyomov, 2015; Gorev & Rakhmatullina, 2014).

Thus, for example, recommendations of sources or selection of material for independent preparation are enough for "straight-A" school students with high motivation to educational work; as for "average" and "weak" ones in particular, the help of teachers, tutors or private tutors is necessary (Balk, 1969; Şandır, 2016; Kaya & Aydın, 2016; Akkaya, 2016). Anyway, it is only possible to speak about successful passing of final certification when, at a preparation stage, each subject (school students, parents, school administration, subject teachers, additional education teachers) has personally contributed to the educational process at the level of multiple-factor external conditions evaluation, regular monitoring, school students' psychological training and, of course, subject preparation.

Goals and research objectives

The goal of this paper is to study the efficiency and expediency of the model elaborated and proposed by the author for school student complex training system for final certification in mathematics. The following is designated as key objectives: to develop a model of school student complex training system for final certification in mathematics; to work out tools for this model implementation; to experimentally verify the efficiency of the elaborated model.

LITERATURE REVIEW

Analysis of Russian scientific and pedagogical literature

The importance and significance of school students' training for final certification as a final stage of training at school is emphasized by many scientists-methodologists who develop and propose to introduce various methodical systems of training providing the implementation of educational process in the context of differentiation and individualization, profiling, informatization, intensification, fundamentalization, humanization and humanitarization of education (Episheva, 1999; Gusev, 1990; Testov, 2012; Martirosyan, 2010; Levchenko, 2013; Berulava, 1996; Mirakova, 2000; Dolgova, 2009; Unt, 1990; Slastenin, 2002; Savvina, 2001; Savvina, 2002; Savvina, 2016; Savvina, 2017). A number of scientists emphasize that fundamentalization of training in mathematics is understood as studying bases of fundamental science of mathematics and as education of school students by means of mathematics as well (Levchenko, 2013). One of the means of differentiation and individualization in training is its profiling (Molchanov, 2006; Voronina, 2006; Shamova, 2006). Much attention is paid to theoretical bases of problem training and project activity in scientific and methodical literature (Verbitsky, 2016; Davydov & Radzikhovsky, 1981).

Issues of preparation for examinations are widely elucidated in scientific works of Russian scientists.

Authors pay much attention to problems of education quality evaluation (Balashov & Lukyanova, 1998; Aleksashkina, 2000; Bolotov, 2004; Bolotov, 2008) and, in particular, reveal some features concerning the use of unified state examination results in education quality management (Zvonnikov et al., 2005). Innovative methods of training school students for examinations are developed (Shmatkov, 2014).

Mathematicians-methodologists, in turn, focus on the selection of tasks for examination preparation and also analyze school students' typical mistakes in methodical recommendations (Zelenina & Krutikhina, 2015; Yashchenko, 2015).

Analysis of foreign researches

The foreign system of education and education quality assessment differs from the Russian one. Examinations do not have a centralized character, as it is in Russia. In some countries they are partially centralized or, in some of them as, for example, in the USA, there are no uniform curricula and national examinations (Sherman, 2002), and therefore, there are no specific methods of examination preparation. Examinations that are held by private organizations aim to define school students' readiness to continue study at a college, i.e. to estimate their abilities and working skills but not the sum of accumulated knowledge. These examinations are in a test form, provided for a fee, and school students prepare to take them independently, without teacher's assistance.

Another situation is in Germany. To get a good final score, it is necessary to study well all the time, otherwise a school student does not have high total scores, no matter how brilliantly they pass examinations (Schukajlow, Leiss, Pekrun & et al., 2012). The teacher who participates in preparing examination tasks does not take part in the examinations to exclude the possibility of any information leakage. Such assessment of school students' proficiency impacts training techniques at which the main emphasis is not placed on examination preparation but high-quality training at all stages of education (Lazarides & Rubach, 2017).

In China, on the contrary, gaokao are held in one day and hour at all schools according to very strict rules (Yuanqing, 2007; Veytsin & Weichao, 2002). Scientists focus attention on the fact that school students' future life depends on this examination, therefore, only experienced teachers are engaged in examination preparation (Pepin et al., 2017). During the whole year, school students write weekly mathematics tests, thereby preparing only for examinations, practically they do not study new material.

Korean school students prepare for final certification for several years; it is called Sunyn; it is a four-five-hour test (Ilsu, 1995). The system of preparation for this test pays much attention to additional education; as a rule, these are additional private lessons or courses. The system of state exams is presented by scientists as a part of pedagogical traditions of the Korean people.

Van Den Heuvel-Panhuizen (1994), a Netherlands scientist, considers issues of school examinations organization in mathematics in her researches: the system of tasks, use of ICT in the course of knowledge assessment, gender features in training mathematics; these aspects are still being studied in detail (Sarouphim & Chartouny, 2017; Forgasz, Leder & Tan, 2014).

As it is noted in researches devoted to the system of examination preparation in Israel (Jacob & Levitt, 2003), high school students take several final examinations, Bagrut. It is stated that preparation for final examinations at the end of the 12th grade is the key objective in the curriculum of a graduation class of high school. Senior year school students and their teachers finish usual academic year in the middle of March, and devote the rest of time to preparation for final examinations.

The level of school students' motivation for examination preparation and their attitude to the studied subject are of great importance (Markovits & Forgasz, 2017). Scientists of New Zealand (Widdowson et al., 2015) have conducted large-scale researches in the sphere of school students, their parents and teachers' motivation. The research results showed that teachers and parents see the key objective of training in the increase of education level; school students, along with this purpose, declare also an economic motive, i.e., they regard quality education as the guarantor of good work in the future, and, therefore, economic stability.

R. Akkaya (2016) has proved that if the mathematics teacher pays attention to the contents and considers psychological aspects in the course of training, then educational results of school students, who are trained by such a teacher, will be better than if the teacher focuses only on the content of the subject. At the same time, a number of scientists in their works (Cueto et al., 2017) emphasize that it is actually important for the teacher to properly evaluate psychological climate in the class and features of family education of school students (Boylan, 2016).

MATERIALS AND METHODS

Research methods

The following theoretical and empirical methods were applied to implement the research.

Theoretical methods: theoretical analysis of the problem and subject of the research at philosophical, psychological, pedagogical, organizational, and didactic levels; theoretical generalization and modeling aimed to identify structural components of the research competence; conceptual analysis of earlier dissertation researches on the problem; comparison and generalization.

Empirical methods: observation, questioning, testing; modeling method; stating and forming stages of the pedagogical experiment; development and application of educational and methodical materials in additional mathematical education; pilot work and experimental verification of basic research provisions; systematical and quality analysis of experimental data and their interpretation.

Experimental research base

In 2012/2013 academic years, on the basis of one comprehensive school in the city of Kirov, we organized a course to train ninth-grade school students for final certification in mathematics (Kozlova, 2013; Kozlova 2014). This course consisted of 68 hours and was taught at school by the author of the paper, an expert of Autonomous Nonprofit organization of additional professional education "Inter-regional center of innovative techniques in education." The course represented a complex system of training including interaction of the subject teacher, administration, school students, parents and additional education teacher. Besides systematization of knowledge in mathematics (both in groups, and individually), consultations on the organization of examination, psychological preparation and time-management were held.

Special attention should be paid to mathematical contents of the course. Knowledge was systematized for the entire course of basic school (5–9 grades). The system of tasks was preceded by theoretical material necessary to pass final certification according to the codifier of requirements to the level of school students' readiness to take BSE in mathematics. The tasks were divided into 3 units: for analysis with the teacher, for independent work and for homework. After studying each section (algebra, geometry and application-oriented tasks), the intermediate control of knowledge assimilation was exercised.

Research stages

The research was conducted within three interconnected stages.

The first informative and search stage (2012) of the research comprised the following: the study of the considered problem development in theory and practice of training at general school; analysis of scientific sources to define the general concept of the research; selection of scientific and pedagogical approaches to implement the research; definition of the object, subject, and goal; development of the hypothesis, main objectives of the research; conceptual framework elaboration; search of the technique to organize the research; substantiation and development of a complex training system of school students for final certification in mathematics for basic school.

The second pilot-experimental stage (2012-2016) covered the selection of diagnostic research techniques, development of the program and procedures to verify experimentally the technology to realize a complex training system of school students for final certification in mathematics for the course of basic school, the stating and forming stages of a pedagogical experiment, development of methodical recommendations. Obtained results were introduced in practice of ninth-grade students' training for final certification in mathematics.

In 2012/2013 academic years, on the basis of some comprehensive schools in the city of Kirov, we organized a course to train ninth-grade school students for final certification in mathematics This course consisted of 68 hours and was taught at school by the author of the paper. The course represented a complex system of training including interaction of the subject teacher, administration, school students, parents and additional
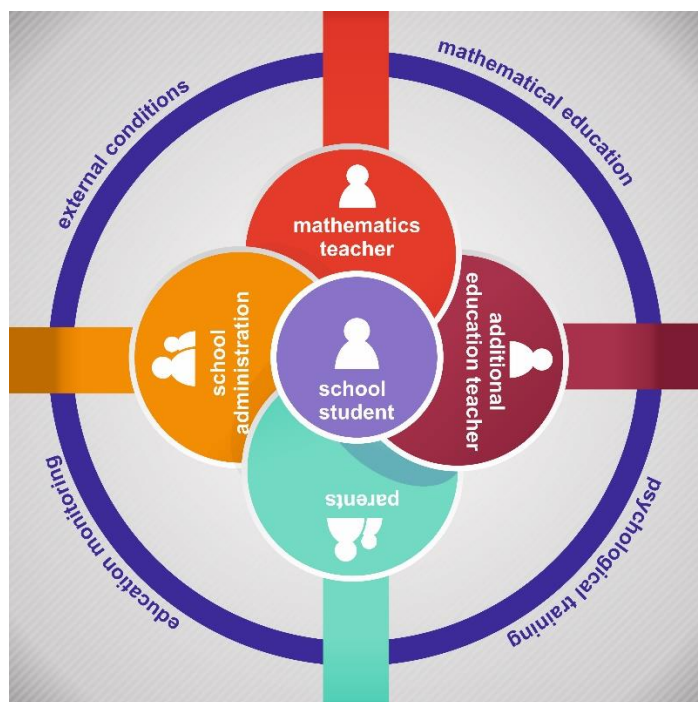
Figure 1. The structure of a complex training system

education teacher. Besides systematization of knowledge in mathematics (both in groups, and individually), consultations on the organization of examination, psychological preparation and time-management were held.

The third final stage (2016) encompasses analysis of pedagogical experiment results, their evaluation and interpretation, definition of the logic to present the gained material, generalization and specification of main theoretical and practical conclusions, design of research materials.

Municipal budgetary educational institution "Secondary general school No. 16" and municipal educational autonomous institution "Lyceum No. 21" of the city of Kirov made the base of scientific research and experimental work.

RESULTS

One of the forms to prepare for BSE that, in our opinion, systematically reflects the preset structure is a special elective course aimed to systematize knowledge (68 hours) (see **Table 1**) for purposeful complex training of ninth-grade school students for final certification under the leadership of the teacher or additional education teacher; the content of this course is represented in an educational-methodical guide (see **Figure 1**) (Kozlova, 2015).

The complexity of such preparation is that along with formation of subject knowledge and abilities, the course is focused on the creation of psychologically comfortable situation and confidence in own forces. It addresses questions of time management and psychological aspects of preparation for examination. Time planning is particularly acute for today's school students; it especially concerns the period of examination preparation: the success of examination preparation depends on how competently they are able to distribute the time and, therefore, forces. Besides, it is worth remembering that any examination is a serious test; that is why the adults' task is to create the most comfortable conditions for preparation to avoid stressful situations.

The main part of preparation is subject focused. Systematization of knowledge in mathematics is conducted for the entire course of basic school. The system of tasks in the study guide is preceded by reference material necessary according to the codifier of elements of BSE contents. Tasks in each of those three large sections

Table 1. Lesson planning of the course

Lessons	Subject
1–2	Time-management for successful examination preparation
3–7	Input diagnostic work in the form of BSE
8	Numbers and calculations
9	Transformation of numerical expressions
10	Coordinate line
11	Numerical inequalities
12	Algebraic expressions
13	Decomposition of polynomials of linear multipliers
14	Transformation of algebraic expressions
15	Solution of linear and quadratic equations
16	Fractional-rational and elementary irrational equations
17	Solution of equations of the highest degrees
18	Numerical intervals and solution of linear inequalities
19	Solution of square inequalities
20	Method of intervals
21–22	Solution of systems of equations
23–24	Solution of systems of inequalities
25	Main functions and their schedules
26	Reading" of schedules of main functions
27	Main techniques of schedules transformations
28	Tasks for percent
29	Tasks on concentration, mixtures and alloys
30	Tasks on the movement
31	Tasks for collaboration
32	Numerical sequences. Arithmetic progression
33	Geometrical progression
34–35	Diagnostic work on "Algebra"
36–37	Analysis of diagnostic work on "Algebra"
38	Basic geometrical concepts
39	Triangles
40	Parallelogram. Rectangle
41	Rhombus. Square
42	Trapeze
43	Circumference and circle
44	Corners in the circle
45	Regular polygons
46–47	Areas of figures
48	Vectors
49	Rectangular system of coordinates
50	Analysis of geometrical statements
51–52	Diagnostic work on "Geometry"
53–54	Analysis of diagnostic work on "Geometry"
55	Statistical characteristics
56	Forms of visual submission of information
57	Placements, shifts, combinations without repetitions
58	Placements, shifts, combinations with repetitions
59	Probability theory
60	Calculations by formulas
61	Psychological recommendations for school students' preparation and passing BSE
62–66	Final work in the form of BSE
67–68	The analysis of the final work in the form of BSE

(algebra, geometry, application-oriented tasks) are divided into three units: for analysis with the teacher in class, for independent work, and for homework. The study of each section is completed with intermediate control of knowledge assimilation; diagnostic operations are included in the guide for this purpose.

At the same time, it is very important to create skills of independent cogitative activity in school students. One of the options to familiarize school students with such activity is to include school students' project activity in the system of preparation for final certification. Independently conducted project activity in modern conditions is priority, socially and personally significant type of cognitive activity that promotes achievement of personal, meta subject and subject results of training determined by FSES (Gorev & Oshergina, 2015; Oshergina & Gorev, 2016; Gorev & Kozlova, 2015; Gorev & Luneeva, 2016; Utyomov, 2012; Utyomov, 2016; Gorev & Utyomov, 2016). Conducting project work, school students master skills of observation, experimenting, comparison and generalization of facts; at the same time in the course of its implementation assimilation of methods and style of thinking peculiar to mathematics, education of conscious attitude to own experience, formation of creative activity and interest in mathematics takes place.

In this regard, one more component of a complex system of preparation for final certification in mathematics for the course of basic school influencing the improvement of graduates' training quality can be a successful implementation of the project comprising joint creative activity of the teacher and school students.

At the beginning of project implementation the teacher offers school students to choose (according to their interests, requirements and opportunities) one or several topics the list of which is made according to the codifier of elements of contents for conducting the final certification in mathematics.

For example, the list can be as such: tasks for changing percentage; tasks for mixtures and alloys; tasks for movement along the straight line and along the river; tasks for the motion along the circle; tasks for teamwork; tasks for arithmetic progression; tasks for geometric progression; combinatorics without formulas; combinatorics: rearrangement and placement; combinatorics: combinations; classical probability; basic theorems of probability theory; functions and graphics; equations (linear, square, fractional-rational, irrational): inequalities, the method of intervals; systems of equations with two unknowns; systems of inequalities; decomposition of polynomials into multipliers, generalized formulas of abridged multiplication; right triangle; isosceles triangle; versatile triangle; parallelogram; trapezoid; rhombus and square; circumference: properties of tangents and chords; angles associated with the circumference; circumference and triangle; circumference and quadrilateral; area, area method; method of auxiliary circumference.

After choosing the topic, school students independently form a system of tasks with solutions on the basis of sources proposed by the teacher (printing and electronic on the Internet). Tasks are divided into three blocks: basic (with detailed solutions, they are supposed to be written by a school student independently), tasks to work on the section and the test. All tasks have answers and solutions.

As at the initial stage, the teacher does not give detailed explanations on types of tasks but provides school students with the list of suggested sources, they realize their potential completely, without being limited.
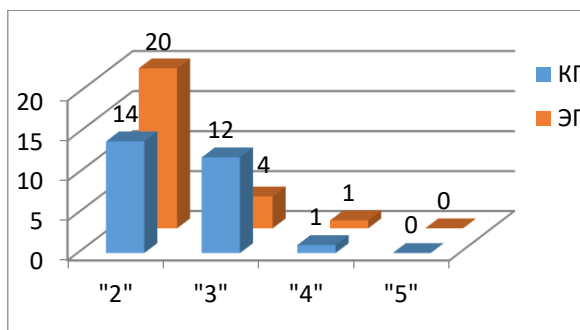
Materials with selections of tasks are presented by the school student to the teacher, they are analyzed by both of them jointly at an individual consultation: are all basic tasks presented; how are they solved; whether the system of tasks is detailed and regular; if the test is correctly compiled; does it agree with the first two blocks of tasks and can it give an objective assessment of this subject assimilation by school students. After that, the student improves the material. Further, ready projects on subjects can be used to train other school students according to the developed system of tasks.

Let us analyze the experiment results obtained in 2012/2013 academic year. The experimental group consisted of 25 people. School students of this group had an elective course of training to prepare for BSE besides lessons of mathematics. 27 school students in the control group did not have an elective course. Both groups are ninth-grade school students whose basic educational program in mathematics is realized by one subject teacher.
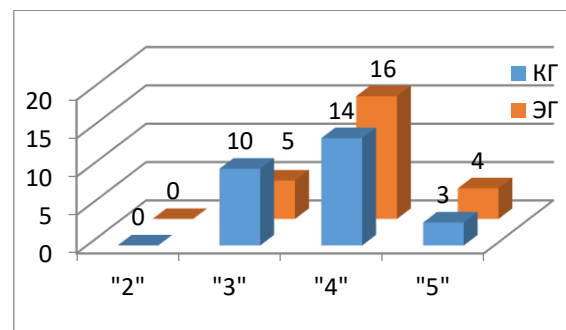
Table 2. Experiment data of 2012/2013 academic year

Number of scores	Mark	Number of students who have got this number of scores			
		Data for the beginning of the experiment (September, 2012)		Data at the end of the experiment (May, 2013)	
		CG	EG	CG	EG
0-7	"2"	14	20	0	0
8-15	"3"	12	4	10	5
16-22	"4"	1	1	14	16
23-36	"5"	0	0	3	4

Figure 2. Data for the beginning of the experiment

Figure 3. Data at the end of the experiment

Let us provide data for the beginning of the academic year and results of BSE in experimental (EG) and control groups (CG). Data are provided in scores (the maximum score is 36) and on a five-score scale. It should be noted that in September, 2012 a test work of BSE corresponding to real conditions of examination was conducted (as shown in **Table 2, Figure 2** & **Figure 3**).

In the experimental group, the average score on the trial testing of BSE for the beginning of the experiment was 5,32, and final certification score was 19,08. Thus, the growth was 13,76. In a five-score scale, the same indicators were 2,44 and 3,96 respectively (growth is 1,52).

The median of some scores for the EG was 4 scores at the beginning of the experiment and 19 (out of 36) after the experiment was accomplished.

In the control group, where school students did not attend courses of preparation for final certification, mean values were the following: 7,85 (at the beginning of the experiment) and 17,52 (at the end of the experiment, just before taking an examination). The average score, in this case, increased by 9,67 scores. In a five-score scale indicators were respectively 2,52 and 3,74 (growth by 1,22).

The median of the scores for CG at the beginning of the academic year was 7 scores at the examination – 18 (out of 36).
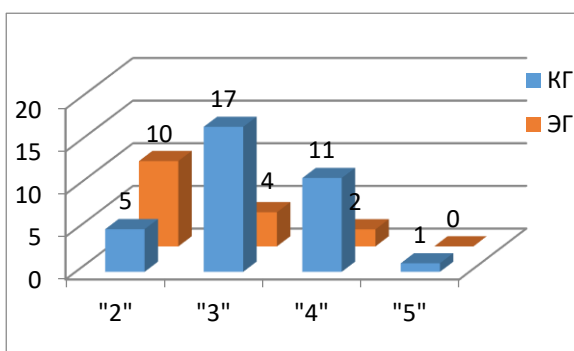
Let us analyze the results of trial BSE at the beginning of the experiment using Wilcoxon- Mann - Whitney U-test. Zero hypothesis: "distribution of school students according to scores does not significantly differ", and the competing hypothesis: "distribution of school students according to scores differs significantly".

Let us determine the empirical value of Wilcox on signed-rank test (at the beginning of the experiment) according to the formula:

$$W_{emp} = \frac{\left|\frac{N \cdot M}{2} - U\right|}{\sqrt{\frac{N \cdot M \cdot (N+M+1)}{12}}} = \frac{\left|\frac{25 \cdot 27}{2} - 171\right|}{\sqrt{\frac{25 \cdot 27 \cdot (25+27+1)}{12}}} = 3,049$$

Table 3. Experiment data of 2012/2013 academic year

Number of scores	Mark	Number of students who have got this number of scores			
		Data for the beginning of the experiment (September, 2012)		Data at the end of the experiment (May, 2013)	
		CG	EG	CG	EG
0-7	"2"	5	10	1	0
8-15	"3"	17	4	15	7
16-22	"4"	11	2	16	6
23-36	"5"	1	0	2	3

Figure 4. Data for the beginning of the experiment
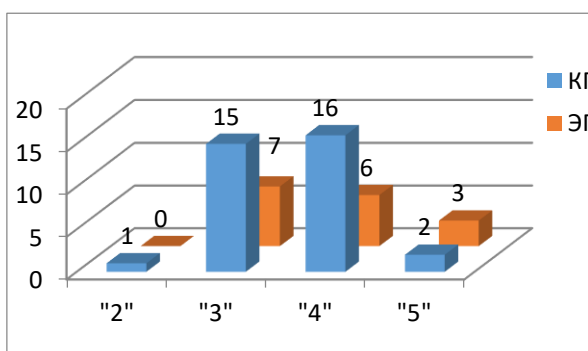
Figure 5. Data at the end of the experiment

W_{emp} (3,049) $\geq W_{0,05}$ (1,96).

Therefore, zero hypothesis is rejected, so, for the beginning of the experiment, distribution of scores of school students in CG and EG differed significantly.

At the end of the experiment, $W_{emp} = 1,227$.

W_{emp} (1,227) $\leq W_{0,05}$ (1,96).

Therefore, at the significance level of 0,05, zero hypothesis is confirmed, so at the end of the experiment (BSE results), distribution on scores of school students in CG and EG do not significantly differ.

Thus, initial (prior to the experiment) scores in experimental and control groups differ, and final (after the experiment) they do not significantly differ. Therefore, it is possible to draw a conclusion that the effect of changes is caused due to the application of the experimental training technique.

The similar experiment was conducted in 2013/2014, 2014/2015 and 2015/2016 academic years. The experimental group in 2013/2014 academic year consisted of 16 people. School students of this group had an elective course of training to take BSE besides lessons of mathematics. 34 people in the control group did not attend the elective course. Both groups are ninth-grade school students whose basic educational program in mathematics is realized by one subject teacher.

Let us provide data for the beginning of the academic year and results of BSE in the experimental (EG) and control groups (CG). Data are provided in scores (the maximum score is 36) and on a five-score scale. It should be that in October, 2013 a test work of BSE corresponding to real conditions of examination was conducted (as referred **Table 3, Figure 4** & **Figure 5**).

In the experimental group, the average score on the trial testing of BSE for the beginning of the experiment was 7,19, and final certification score was 17,44. Thus, the growth was 10,25. In a five-score scale the same indicators were 2,50 and 3,75 respectively (growth is 1,25).

The median of some scores for the EG was 5 scores at the beginning of the experiment and 17 (out of 36) after the experiment was accomplished.

In the control group consisting of children who did not attend courses of preparation for final certification, average values were the following: 12,18 (for the beginning of the experiment) and 15,29 (at the end of the experiment just before taking an examination). The average score in this case increased by 9,67 scores. In a five-score scale indicators were respectively 3,24 and 3,56 (growth by 0,32).

The median of the scores for CG at the beginning of the academic year was 12 scores at the examination – 15 (out of 36).

Let us analize the results of trial BSE at the beginning of the experiment using Wilcoxon- Mann-Whitney U-test. Zero hypothesis: "distribution of school students according to scores does not significantly differ", and the competing hypothesis: "distribution of school students according to scores differs significantly".

Let us determine the empirical value of Wilcoxon signed-rank test (at the beginning of the experiment):

$W_{emp} = 2,274$

W_{emp} (2,274) $\geq W_{0,05}$ (1,96).

Therefore, zero hypothesis is rejected, so, for the beginning of the experiment, distribution of scores of school students in CG and EG differed significantly.

At the end of the experiment, $W_{emp} = 1,269$.

W_{emp} (1,269) $\leq W_{0,05}$ (1,96).

Therefore, the zero hypothesis is confirmed, so at the end of the experiment (BSE results), distribution of scores of school students in CG and EG do not significantly differ.

Thus, initial (prior to the experiment) scores in the experimental and control groups differ, and final scores (after the experiment) do not significantly differ. Therefore, it is possible to draw a conclusion that the effect of changes is caused due to the application of the experimental training technique.

Similar results were obtained for two more years of the experiment.

DISCUSSIONS

Nowadays the pedagogical science refuses ideas of the person "as means for achievement of a result, and addresses the concept of person as the goal". It is substantiated by the fact that today the humankind has considerably expanded their knowledge about opportunities of each personality in self-improvement, mastering achievements of modern science and technologies. The ability to adapt to new living conditions of life falls within the scope of interests of the personality: to critically estimate and find solutions for arising problems; to analyze a situation; to adequately change the organization of the activity; to be able to gain information by means of computer and to competently use it. In this regard, methodical systems of training providing implementation of educational process in the context of differentiation and individualization, profilings, informatizations, intensifications, fundamentalizations, humanization and humanitarization of education are actively designed in the last few decades. At the same time, unfortunately, there is no methodical system of training in subject domains which would comprehensively consider educational process without separation from multiple-factor external conditions, and would take into account psychological features peculiar to school students during examination preparation period, when they have a severe stress and psychological pressure from adults, and remain one-on-one with fears and problems.

CONCLUSION

According to the results of four years' experimental work, school students from experimental group having a lower level of knowledge at the beginning of the experiment showed higher quality indicators at the State

Final Examination for the course of basic school than school students from the control group. As the mathematics teacher in both groups was the same and worked according to identical educational programs, it is possible to draw a conclusion that obtained results are connected with classes organized by the additional education teacher.

The data obtained as a result of the experiment confirm that while training school students for final certification in mathematics for the course of basic school, it is expedient to focus on the *integrated approach* promoting the maximum educational result.

The author suggests considering the proposed model of examination preparation as a part of complex training system. A complex training system is a system of measures aimed to organize educational process at which the choice of contents, methods, ways, techniques, means and forms of education is implemented; multiple-factor external conditions (humanization, humanitarization, differentiation, individualization, informatization, intensification, fundamentalization, training profiling) leading in total to school students' high educational results both within the frames of the educational program and in case of additional education should be taken into account.

The developed model shows how important it is in the course of examination preparation to pay attention not only to substantial subject training but also to questions of time planning, to issues of psychological support of school students. At the same time, the model does not include only two usual subjects of educational process - a school student and the teacher - it encompasses administration of an educational institution, parents and additional education teachers. All listed subjects exert positive impact on the process of preparation for final certification and on its result, if they interact.

Each teacher has to remember that the greatest educational effect can be reached only by means of an integrated approach to the organization of school students' training, orientation to the prospect of personal advance, formation of a high level of independence and responsibility, flexible schedule of curricula assimilation and introduction of new methods of additional training. The development of a complex methodical training system in mathematics and its realization in educational practice demands a more detailed consideration. But even today, in the context of school education modernization, it is obvious that application of an integrated approach in school students' training in mathematics may lead to high educational results.

RECOMMENDATIONS

Materials in the paper are of practical value for teachers working at schools, additional education teachers, administration of educational institutions, school students and their parents.

This complex system of school students' preparation for final certification in mathematics for the course of basic school can be implemented both by the subject teacher, and the additional education teacher; some of its elements can form a basis for a complex system of training at any stage of school education.

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