

Effectiveness of the System of Preparation for Mathematical Olympiads in the Schools of Kyrgyzstan

Eficacia del Sistema de Preparación para las Olimpiadas Matemáticas en Escuelas de Kirguistán

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ABSTRACT:

Article is describing results mathematical olympiads schoolchildren of the Kyrgyz Republic in order to identify the effectiveness of the preparation. Qualitative result of mastering the olympic program in mathematics in the experimental group of students was 12,95% higher than the results of the control group, and the mastery of the basic school curriculum of mathematics was higher by 15,25%. Of quality performance in theory and methods for solving the olympiad problems was observed in more than 54% of schoolchildren.

Keywords: mathematics, olympiads, a school, olympic reserve, a bachelor

RESUMEN:

Este artículo describe los resultados de las olimpiadas matemáticas de la República Kirguistán para identificar la efectividad del sistema de preparación implementado. El resultado cualitativo del programa de preparación olímpica en matemáticas del grupo experimental de estudiantes fue 12,95% más alto que los resultados del grupo de control, el dominio del currículo escolar básico de matemáticas fue superior en 15,25% y el rendimiento de calidad en teoría y los métodos para resolver los problemas olímpicos se observó una superioridad del 54% de los participantes.

Palabras clave: matemáticas, olimpiadas, una escuela, una reserva olímpica, bachiller

1. Introduction

Olympiads of different levels from the school to the international one, from traditional to distant, are effective forms of work with gifted pupils. A clear structure of mathematical olympiads has emerged in the Kyrgyz Republic that embraces all regions and is accessible to every pupil. In the meantime, new forms of the organization of olympiads have a positive

impact for all participants. Personal experience of the authors in teaching mathematics at the I. Razzakov school-gymnasium № 20 with advanced study of mathematics that counts for 26 years, in the school of the olympic reserve, in the preparation of pupils of some schools of the city to participation for olympiads, as well as in developing methods of teaching of mathematics in the Osh state university, lecturing on the courses of the teachers retraining, heading the pedagogical internship and the methodological society of students at the department of mathematics and information technology is reflected in this research.

Studying effectiveness of the content of preparation of pupils for mathematical olympiads, it is worth mentioning that training is a double-sided process that includes mathematical knowledge of pupils and methodological activity of teachers. "In the process of assessment of the schools' activity, the quality of organization of the educational process, a level of implementation of curricula, professional competence of the pedagogical personnel and their activity in provision of the needed results in education, individual achievements of pupils, and parameters of the schools' achievements as a whole in ensuring the quality of education are identified" (Kaldybaev, 2015). The significance and role of mathematical olympiads is supported by the fact that the subject olympiads, along with transfer and final exams and the tests at the republican level are included in different systems of assessment of the educational achievements in the secondary school education (Kaldybaev, 2017).

2. Methodology

Taking into account all mentioned above, the content of the system of preparation of pupils for mathematical olympiads designed on the basis the competence approach, was analyzed in this paper. It includes the following criteria:

- 1) Methods of training of pupils for participation in olympiads, executed by such a new form of supplementary education as the school of the olympic reserve.
- 2) Training of bachelors for performing olympic activity with pupils at the classes on the elective disciplines.
- 3) Possibilities of the diagnostic attestation of teachers of mathematics in preparing pupils for intellectual contests.

When developing the theoretical background for training of pupils for participation in mathematical olympiads of different level, we defined the experimental assessment of effectiveness of content of the system of preparation of pupils for participation in mathematical olympiads, tested in schools of the republic during last five years, as the purpose of our research.

The analysis of the psychological, pedagogical and methodological literature in the field, analysis of the existing methods of training of pupils for olympiads on different subjects, experimental testing of the effectiveness of methodological guidelines on the organization of teaching of bachelors focused on preparing of pupils for mathematical olympiads and training of pupils themselves for participation in mathematical olympiads by introduction of the curriculum of the school of the olympic reserve to the process of teaching have been used as methods for this study.

For the period of 2010 to 2018, different aspects of the problem of preparation and organization of subject olympiads of schoolchildren were studied. Guidelines on developing of the research skills of the upperclassmen in the process of preparation for the contests and olympiads were designed (Lubinskaia, 2010), the issue of training of pupils for the olympiads on chemistry were studied (Belan, 2010), formation of cognitive competences of pupils in the situation of olympiads were analyzed (Ilinskii, 2012), development of tele-communicative competences of pupils in the system of distant heuristic olympiads were researched (Skripkina, 2013), methodological guidelines on training of pupils for the subject olympiads, contests of the scientific works and projects were elaborated (Mamchenkov, 2015). The authors of the article are of the opinion that the participation of schoolchildren in subject olympiads, their training in solving olympiads problems in

mathematics implements a competence-based approach to learning (Baisalov & Keldibekova, 2017; Keldibekova, 2017a; Keldibekova, 2017b; Keldibekova, 2017c; Keldibekova & Omaraliev, 2018).

3. Results

The Ministry of Education and Science together with the Kyrgyz Academy of Education, scientific and pedagogical community and educational institutions on the annual basis organize olympiad for the pupils of schools, where both basic and advanced study of subjects is arranged. Traditionally, it has four stages, and for each of them, the composition of teams is formed from the winners of the preceding stages.

I. School olympiads take place in November. All pupils who wish to participate can participate after decision of the school organization committee.

II. Regional olympiads that take place in January.

III. Municipal (city level) olympiads take place in January and February, and there are two phases. In stages two and three, the participants are the pupils of the 9th to 11th grades of the schools of general education and the status schools.

IV. Republic olympiad that takes place in March with participation of the pupils of the 9th to 11th grades.

3.1. Organization of olympiads in the elementary school

In the Kyrgyz Republic, preparation to participation in mathematical olympiads begins in the elementary school. Since 1992, the Republican Children Engineering and Technical Academy "Altyn tyiyn" has been working in the country with the tasks to identify young talents in the sphere of technological education. Its functions are aimed at the development of creative potential in the technical sphere among young people. Today, there are 25 directions and 90 interest groups working in the academy (Tuloberdieva, 2016). Tasks of non-standard type, including these of the international competition "Kangaroo", form the content of classes in these interest groups.

Republican correspondence school of mathematics operates in the structure of the academy that annually organizes the republican correspondence mathematical olympiad for the pupil of 3rd to 6th grades. Therefore, in 2012-2013 academic years, 1226 pupils from all regions of the republic participated in the correspondence olympiad. The pupils of the I. Razzakov School-Gymnasium № 20 from the city of Osh, Mamyraliev School from the Sokolukskii district, Schools № 26 and № 70 from the city of Bishkek, School № 2, the city of Tash-Komur, Kaindinskii School-Gymnasium of the Panfilov district, Atamov Secondary School № 12 of Ala-Bukinskii district, A. Moldokulov National Computer School-gymnasium № 5, the city of Bishkek, meaning representation of all the republic, were the best ones among 44 participants of the face-to-face round of the olympiad.

In addition to that, the International Educational Institution "Sapat" supported by the Ministry of Education and Science, in order to develop interest to the study of mathematics, improve different kinds of intellectual contests among pupils of the republic, identify talented children, and create conditions for their further support, conducts mathematical olympiad for the pupils of the 6th grade of secondary schools. In 2018, the olympiad was carried out in three stages on the materials of curricula of the 5th and 6th grades: the district level, in which participated pupils from the schools, gymnasiums and lyceums of a district (5 pupils from each high school); the regional level, in which 5 pupils – winners of the first stages from each of the district olympiads took part, and the republican level, in which participated the regional teams, the teams of the city of Osh and the city of Bishkek consisting of 3 pupils, who became the laureates of the second stage.

3.2. The analysis of results of the municipal stage of olympiads

Representatives of professor and pedagogical personnel of the higher educational

establishments of the republic, specialists of the municipal departments of education and teachers of leading schools of the republic work in the commission for assessment of the 2nd, 3rd and 4th stages of the republican olympiad of pupils. The pupils of the 9th to 11th grades, who passed through the preliminary rounds, can participate in the olympiad. The tasks for the olympiad are developed by the Ministry of education and science. Let us consider the results of the municipal level of mathematical olympiads of pupils for the period of 2014-2017 (Keldibekova, 2016), as referred in the table 1.

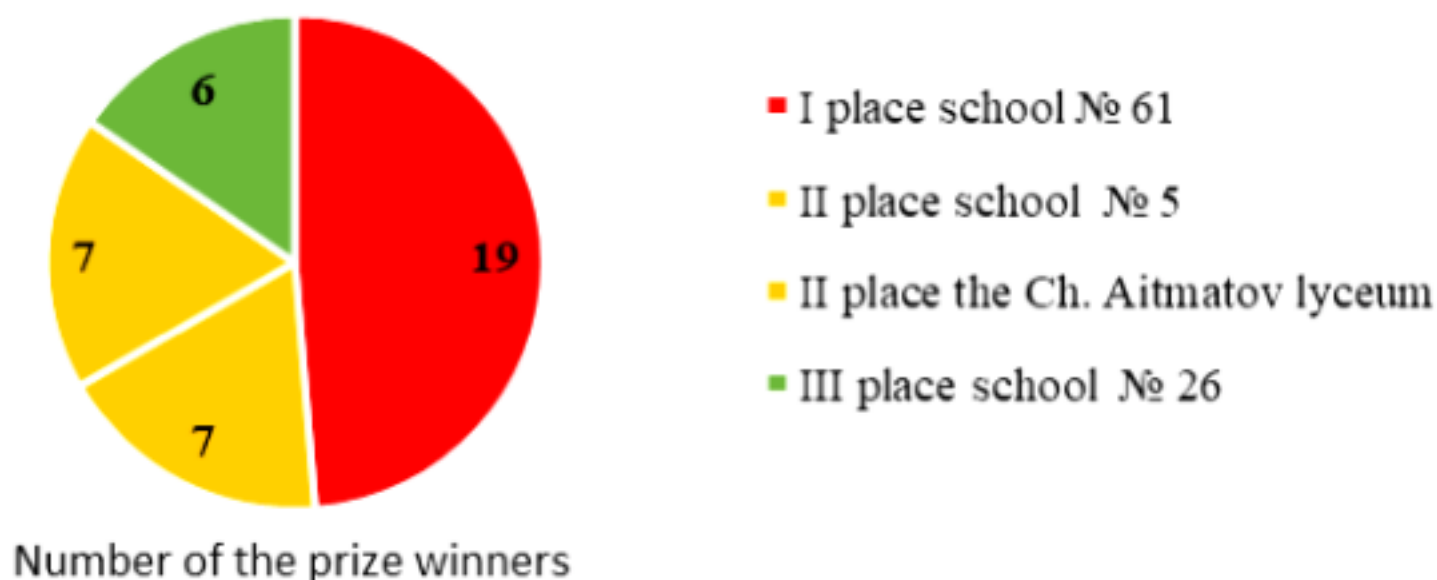
Table 1
Participation results of pupils in the olympiad of 2014

Year	Number of				Rank		
	participants		prize places		1	2	3
2014	423		138		number of pupils		
schools	public	private	public	private	45	46	47
	306	117	96	42			

(Keldibekova, 2016)

In the municipal olympiad of 2015, among the schools of Bishkek, the leaders of the ranking are the schools № 61 and № 5, the Ch. Aitmatov lyceum, and the School № 26, as shown in the figure 1 below:

Figure 1
Ranking of the schools in Bishkek in the municipal olympiad of 2015



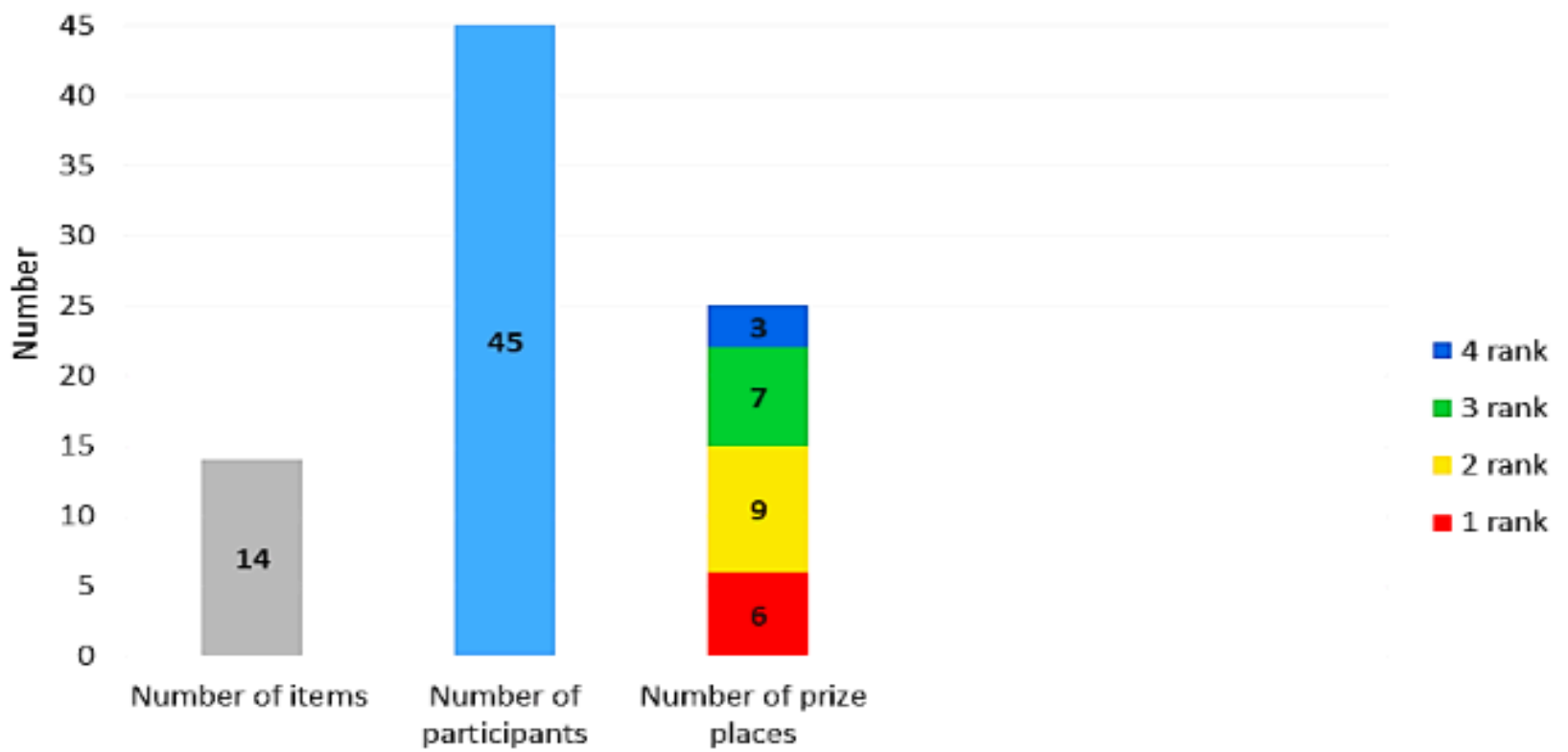
(Keldibekova, 2016)

327 pupils of the schools of city of Bishkek participated in the municipal olympiad of 2017. 95 pupils from the schools of the national capital became the prizewinners.

3.3. The analysis of results of the republican olympiad

The pupils' olympiad finishes with the fourth stage of the republican olympiad. The pupils of the 10th and 11th grades, the winners of the 3rd stage, participate in the final stage. The winners of the republican olympiad form the national teams that represent Kyrgyzstan at the international competitions. As a result of the republican olympiad of 2012, the team of the olympic reserve from the city of Osh took the second place in the overall standings (Keldibekova, 2016), figure 2:

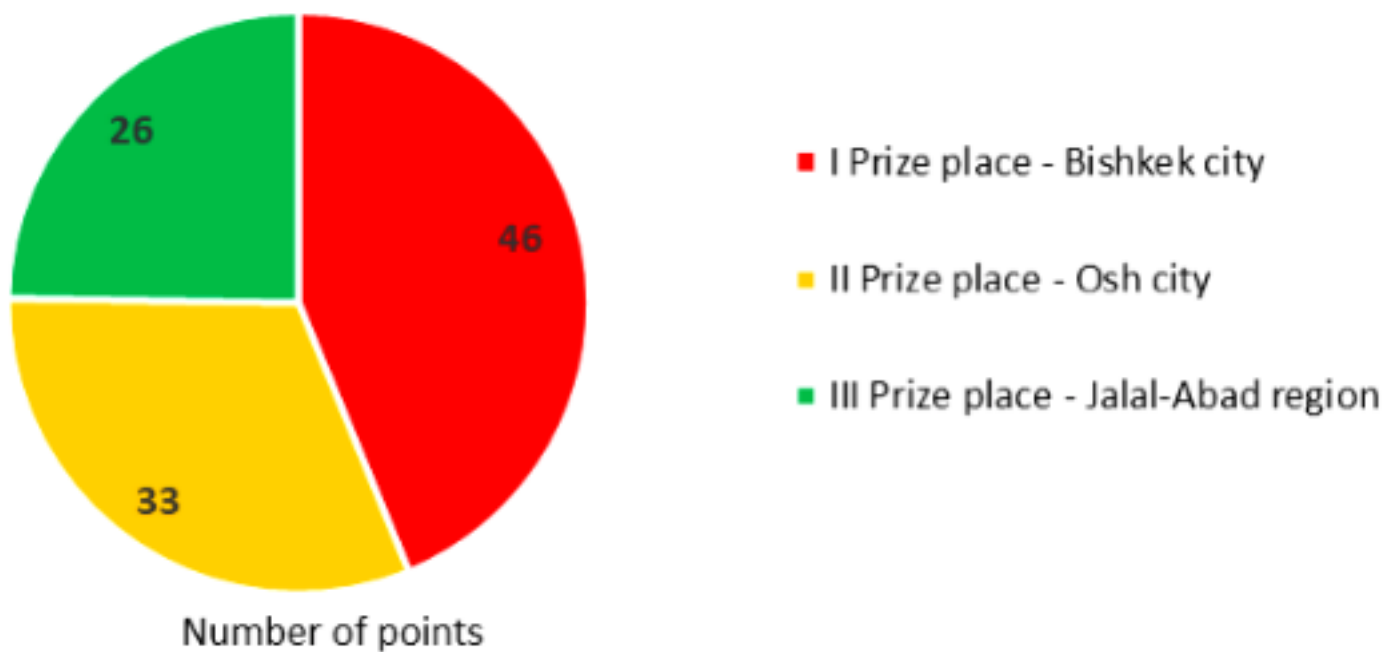
Figure 2
Results of the republican olympiad
of 2012 among schools in Osh



(Keldibekova, 2016)

322 prizewinners of the regional and municipal olympiads from seven regions of the republic took part in republican olympiad of 2013. The subject commissions identified 102 prizewinners. The organization committee decided on the first place in the team standings, figure 3:

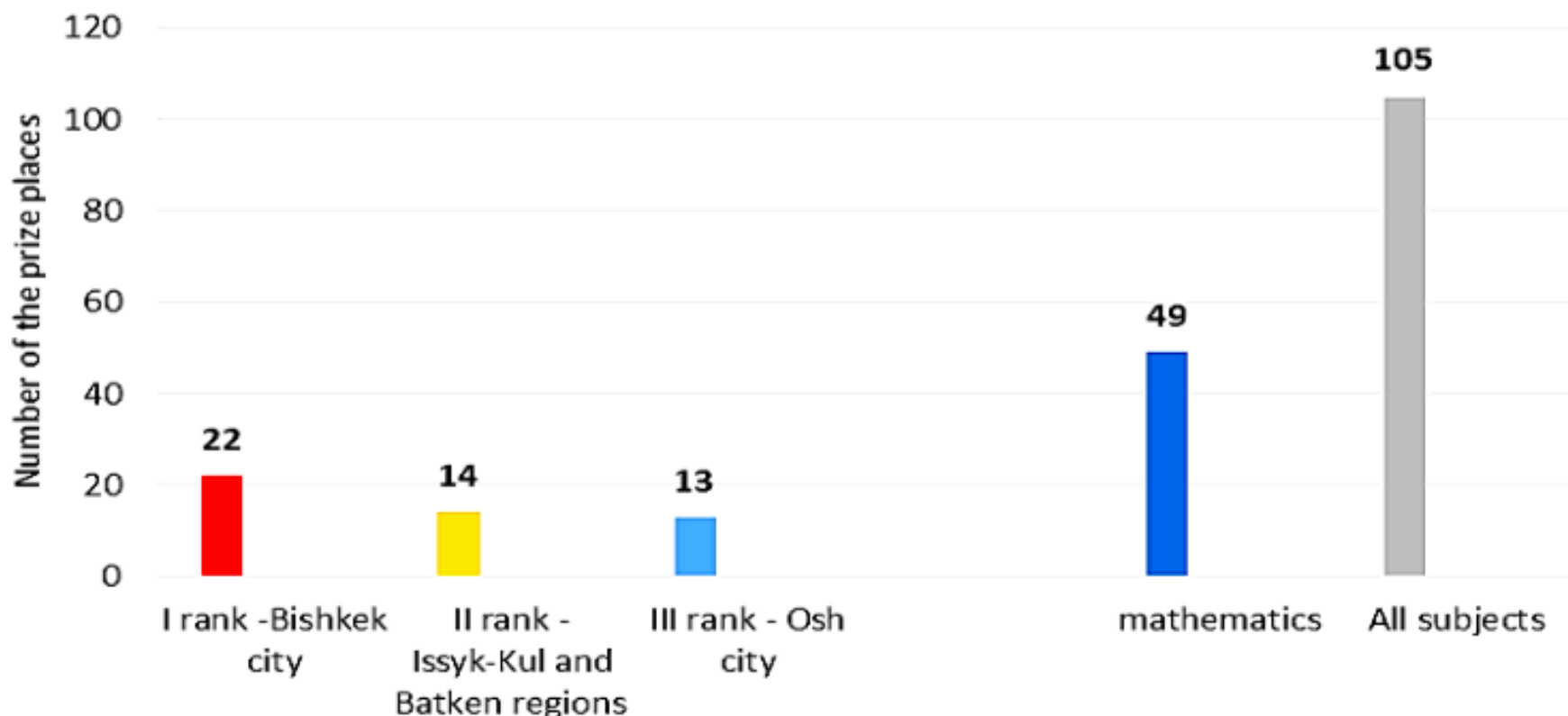
Figure 3
Distribution of places in the republican olympiad of 2013



(Keldibekova, 2016)

According to the data of the Ministry of Education and Science of the Kyrgyz Republic, in 2014 in the republican olympiad participated 298 prize winners of the preceding stages, and 17 prize winners of the republican olympiad of 2013 (Keldibekova, 2016), figure 4:

Figure 4
Results of the republican olympiad of 2014 in Kyrgyzstan

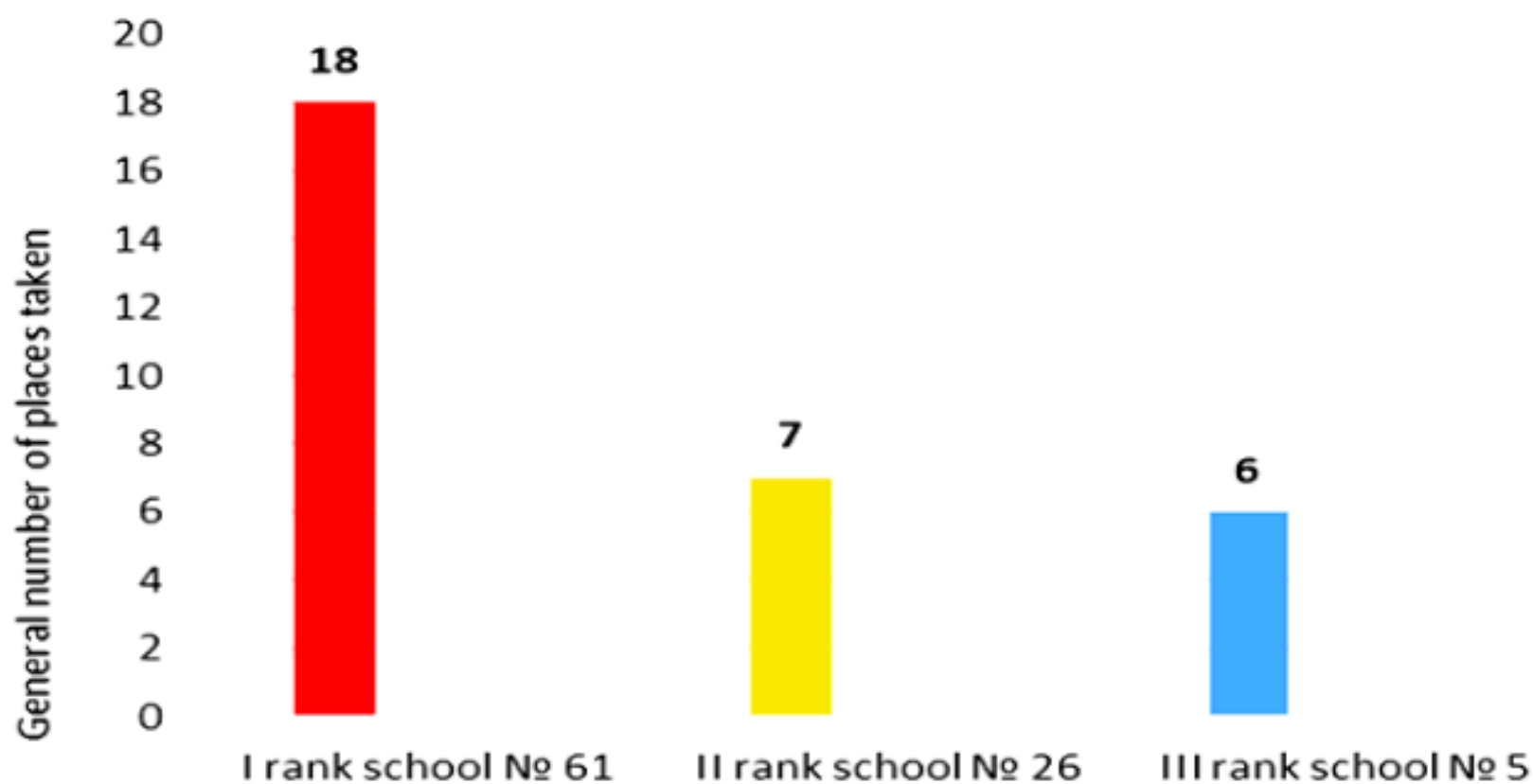


(Keldibekova, 2016)

According to the data of the Department of the Education Management of the Mayor Office of the city of Bishkek, the school № 61 has the best results in the republican olympiad of 2015 (Keldibekova, 2016), figure 5:

Figure 5

Schools leading in of the republican olympiad of 2015



(Keldibekova, 2016)

316 pupils representing all regions of the country participated in the olympiad of 2017. Knowledge was tested in 10 subjects. The Talas region took the second place in the overall standing in all subjects. According to the data of the center of assessment in education of the Talas region, in total, the region was represented by 35 participants, and 13 of them won the prize places. The pupils of the educational institution "Sapat" represented the majority of the winners from the Talas region. As stated by the organizers, the major difference from the previous olympiads was in the fact, that this time there was on-line broadcasting of the event on the website live.manas.edu.kg, and also on the YouTube channel and in the public network of Facebook.

3.4. The results of the international olympiads

The pupils from Kyrgyzstan take part in a number of prestigious international olympiads in different subjects, table 2:

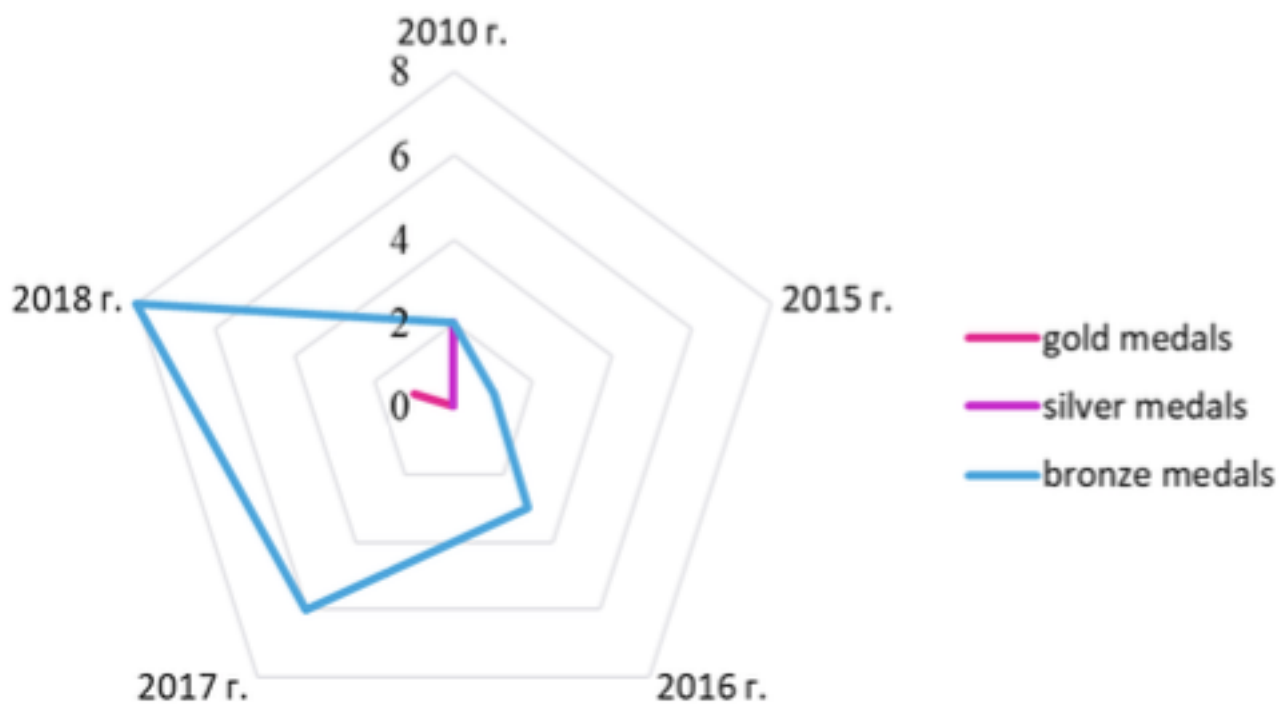
Table 2
Results showing participation of Kyrgyzstan
in the international olympiads

Year	International olympiads	Host city	Prizes of the residents of Kyrgyzstan
2010	The 44 th Mendeleev olympiad in chemistry	Baku	1 silver medal
	642 nd olympiad in chemistry	Tokyo	certificates
	41 st olympiad in physics	Croatia	certificates
2015	12 th international junior science olympiad	Taegu	1 bronze medal
	1 st round of the world scholar's cup	Izmir	5 gold and 6 bronze medals
2016	The 50 th Mendeleev olympiad in chemistry	Moscow	1 bronze medal
	47 international physics olympiad	Zurich	1 bronze medal
	52 international biology olympiad	Hanoi	1 bronze medal
2017	2 international olympiad of megacities	Moscow	4 bronze medals: 1 in mathematics, 2 in physics, 1 on computer science
2018	49 international physics olympiad	Lisbon	2 bronze medals, 2 certificates
	international olympiad in physics and astronomy	Samarkand	1 golden medal
	3 international megapolis olympiad	Moscow	4 bronze medals: 2 in physics, 2 on computer science
	Eurasian programming olympiad	Almaty	3 bronze medals
	international olympiad "laboratory of talent training" (subjects: mathematics, physics, chemistry)	Baku	1 bronze medal

(Keldibekova & Baisalov, 2019)

Figure 6 shows the results of the participation of schoolchildren of the Kyrgyz Republic in international olympiads in subjects of the natural science cycle:

Figure 6
Results of Kyrgyz schoolchildren at international
natural science cycle olympiads

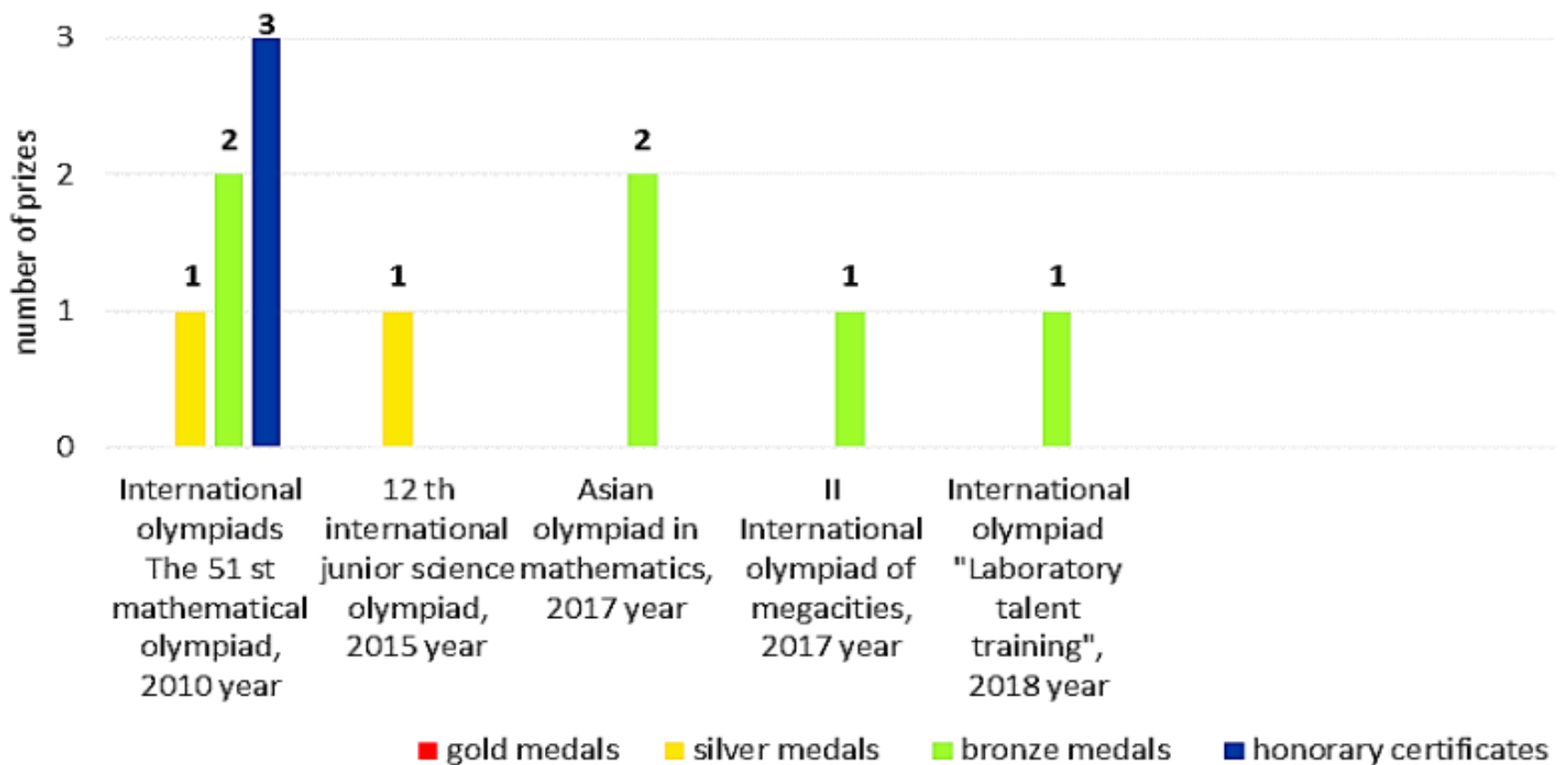


(Keldibekova & Baisalov, 2019)

Schoolchildren of Kyrgyzstan take part in international mathematical competitions, figure 7:

Figure 7

Chart for participation of Kyrgyzstan in international mathematics Olympiads



(Keldibekova & Baisalov, 2019)

It can be seen from the figure that in after 2010, the results of Kyrgyz schoolchildren in international olympiads declined. The reason for this is a reduction in the number of educational hours in mathematics in general education schools from 6 hours to 4 hours a week (Keldibekova & Baisalov, 2019).

According to the data of the press service of the state committee on industry, energetics and subsoil use, the pupils of the 9th to 11th grades of the schools of Bishkek participated in the 10th and 11th all-Russia open field olympiads of young geologists in 2016 and 2017. In 2016, they had received the 5th place. The event took place in the city of Kemerovo with participation of more than 30 teams from Russia, Belarus, Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan. It is being planned to organize seven teams in each region of the Republic in the near future.

The pupils of the republican children engineering and technical academy "Altyn Tuyun" annually represent their works for the municipal, zonal, republican and international exhibitions of technical creativity. So, in April, 23, 2017, there were competitions of robots arranged in Bishkek with participation of the pupils of lyceums and elementary schools of Kyrgyzstan. As a result of the competition, the team of the lyceum "Aychurek" from the city of Bishkek took the first place; the pupils of the elementary school "Seitek-Tunguch" became the winners among the elementary schools.

Positive results of the pupils from Kyrgyzstan in the Malaysian international young inventors' olympiad in 2016 became a consequence of the activity of the center. In the olympiad that took place in the city of Penang (Malaysia), 12 countries of the world, which submitted 216 projects, were participated. The national team of Kyrgyzstan with representation of the pupils of lyceums from the city of Osh, Kadamjay, Kyzylkia, Tokmak and Bishkek presented 24 projects. Our pupils received 5 gold, 6 silver, and 13 bronze medals, 24 medals in total.

3.5. The results of the national admission test

On the data of the Ministry of education and science of Kyrgyzstan, 10 applicants, who have the gold certificate of the national admission test (NAT) of 2017, graduated from the schools in the regions, and 40 more in the city of Bishkek. Among the schools-leaders on a number of the gold certificates of NAT in 2017, there are the schools, the pupils of which are regularly awarded with prize places on the olympiads of all levels, table 3:

Table 3

The schools-leaders on a number of the highest points in NAT-2017, 2018

Year	ORT average score in the republic	Whole	Amount schools	City, region	Maximum points of the NAT
2017	117,8 points	33 schools	24	Bishkek city	219-236
			3	Chui region	220-223
			2	Osh city	221-225
			2	Tokmak city	219-223
			1	Jalal-Abad city	225
			1	Naryn city	220
2018	119,4 points	32 schools	19	Bishkek city	219-237
			4	Osh city	219-223
			3	Naryn region	220-224
			2	Issyk-Kul region	221-224
			1	Jalal-Abad region	222
			1	Talas region	222
			1	Chui region	221
			1	Batken region	220

(Keldibekova & Baisalov, 2019)

The data in the table referring to the schools-leaders in NAT confirm the conclusion that those schools win the olympiads, in which a goal-oriented training to the olympiads is executed, and in-depth study of disciplines is arranged. Head of the united municipal and district education departments of the city Talas B. Kerimbaev supports this conclusion and explains low level of education in regular secondary schools by the deficit of personnel as one of the major bottlenecks in the rural area. The influence of social status on the educational level of a student is also noted in the work of a foreign scholar: «While children

from upper socioeconomic backgrounds experience problem solving, those from lower socioeconomic backgrounds undergo rote learning. Because not all children have the opportunity to learn the same quality mathematics, the emerging concern of this study is the issue of equity in mathematics teaching» (Sztajn, P., 2003).

The teacher of biology in one of the lyceums of the "Sapat" network in the Talas region O. Toktobaev also believes that «Despite the fact that there are gifted pupils in regular secondary schools, two years is not enough for training for the olympiads. It is necessary to train children for participation from the junior school ages". Herewith, the teacher points out that the existing textbooks do not correspond to the requirements of the olympiads.

3.6. The results of the experimental tests of knowledge

During the last five years, we have been engaged in development of the didactical backgrounds for preparation of pupils for participation in mathematical olympiads of all levels. The task of the research we have seen as the verification of effectiveness of the experimental methods of preparation of pupils of the secondary schools to participation in mathematical olympiads and attracting teachers of mathematics and specialists of the departments of education to participation in the pedagogical experiment.

The experimental research took place during 2013-2018 and had three stages. At the first stage (2013-2014) we used observations, arranged interviews and questioned teachers and pupils of the secondary schools, and also teachers and students of the higher educational establishments of the city of Osh, and managed to identify state of preparedness to olympiads among pupils of urban and rural secondary schools in the Kyrgyz Republic, to study the pedagogical experience in terms of preparation to olympiads among students of mathematics at the universities, which educate future teachers. Six higher educational establishments from the south of the republic, six schools of the city of Osh and six rural secondary schools from Chatkal, Alay and Chui districts participated in the ascertaining stage of the experiment.

Four heads of the pedagogical internship in the higher educational establishments, four heads of the municipal and regional departments of the education management, 12 principals of the schools, 120 school teachers, 300 pupils and 270 students took part in the survey. In course of the ascertaining experiment, we have clarified the issues of the preparatory work among pupils for participation in mathematical olympiads arranged by the teachers of mathematics in the process of teaching; the problems of training of students, the future teachers of mathematics, in connection with preparation to olympiads in the higher education establishments of the republic, the desire of pupils to participate in olympiads, and the issues concerning elaboration of the methodological guidelines for development of professional competences of a teacher of mathematics referring to preparation for olympiads.

Based on that, we identified the levels of knowledge and skills necessary for executing of preparation to olympiads with pupils of the secondary schools; the level of professional and subject competences among teachers of mathematics of the secondary schools; the measures on attracting to the organization of olympiads for teachers and specialists of the education management system. The analysis of information about the preparedness to olympiads among pupils of the secondary schools has been carried out on the materials of the subject "mathematics" in accordance with such levels, as the assimilation of theory of the olympiad mathematics; the extent, to which pupils know the theory and practice of solution of the olympiads tasks; the extent of development of preparedness of pupils to participation in olympiads; development of ideas of teachers of mathematics about training for olympiads.

At the second stage, in 2014-2015, based on the connotation of professional and mathematical competences of the future teachers of mathematics as "the integrative quality of an individual defined by the complex of mathematical abilities, ... volitional and reflexive qualities of a personality that is manifested in the readiness to successfully use

these qualities on practice" (Yarduhina, 2009). We modelled the content of the methodological training of the future teachers of mathematics, elaborated experimental variants of the curriculum for the discipline as an elective course for bachelors, and the curriculum for the school of the olympic reserve on mathematics, executed experimental verification of effectiveness of the methodological guidelines on the organization of teaching of bachelors for the work with pupils for preparing them to mathematical olympiads at the department of "Mathematics and Information Technology" of the Osh State University, and studied the possibilities of eliminating shortcomings in their preparation for the work with the olympic reserve in schools. The third stage, in 2016-2017, was devoted to the comparative analysis of the effectiveness of curriculum of the school of the olympic reserve, and methodological guidelines for teachers on training pupils of the city of Osh to participation in mathematical olympiads.

Since we interpret stable knowledge of fundamental provisions, theories and methods, obtained by the pupils, and also the formation of knowledge and skills in the sphere of preparedness to olympiads as the results of teaching, we qualify the level of pupils' learning of factual and theoretical material of the olympiads mathematics, and the level of knowledge and skills in solution of the mathematical olympiads tasks as criteria for the verification of knowledge

The systemic consultancy work has been arranged for the university teachers and teachers of the secondary schools, who participated in the experiment. The participating university teachers have familiarized bachelors and students of teacher training courses with the objectives and tasks of the elective discipline, with the curriculum of the school of the olympic reserve and the interest group "Mathematical olympiads of pupils" and explained the theoretical content of the basic provisions and taught methods of solution of the olympiads' mathematical tasks at the seminars. The factual material characterizing the effectiveness of teaching in the experimental groups of students against the control groups and the level of learning of the theory and methods of the olympic mathematics has been analyzed in course of the experiment that helped to improve the materials.

Defining the effectiveness of training for olympiads, we have outlined the level of knowledge of the following: the school's curriculum in mathematics, the specifics of work in the conditions of olympiads, the age peculiarities of pupils; theoretical and practical materials in mathematics; methods and forms of training of pupils for olympiads. We have also identified methodological skills, such as: elaboration of a work plan of training for olympiads, syllabi for the school of the olympic reserve, setting the objectives, the content, and conducting classes; and organization of work with pupils taking into account their propensities and mathematical knowledge.

We have identified three basic directions in the content of the olympic activity of teachers dealing with pupils, such as the methodological work on training of pupils to the participation in olympiads, classes with the olympic reserve and the organization of the olympiad research. We have also defined, to what degree the materials of training for olympiads were accessible for the formation of methodological and mathematic competences.

In course of verification, we have outlined three elements of skills of the teachers of mathematics, who train pupils for the olympiads, namely the development of work plans for training of pupils for the olympiads, the development of the plans of classes at the school of the olympic reserve, and the utilization of the content of teaching for participation in olympiads. The preparedness of teachers to train pupils for participation in mathematical olympiads has been judged in accordance with the level of their basic knowledge, profoundness of the professional and mathematical competences, professional motivation and comprehending the ways of executing of teaching of their pupils for participation in olympiads.

The actuality of the issue of readiness of teachers for executing training of pupils for the olympiads supports the opinion of the legendary principal of the famous school № 61 in the city of Bishkek E.B. Yakir, who stipulates that for the success of training two components are necessary – the pupils and the teaching personnel. "It is necessary to work with the personnel; it is needed to involve former alumni, who are inclined to the work of a teacher.."

(Yakir, 2014). Therefore, we believe that if the participants of the experiment decide choosing profession of a teacher of mathematics upon completion of their study, and they participated in mathematical olympiads, these are the indicators of effectiveness of our methodology. The decisions of the alumni, educated in the framework of methodology of training pupils for participation in mathematical olympiads, on their professional activities, are presented in the table 4:

Table 4

The choice of professional activity by the alumni, who participated in the experiment

Total number of alumni	Choice of profession of the mathematical profile	Choice of the pedagogical activity			
		In the higher educational establishments		In the secondary schools	
		number	%	number	%
250	41	48	56%	140	75%

Successfully passed through the adaptation period, they actively participate in the school, district and municipal contests and take part in the work of jury of the school, municipal and regional Olympiads, as referred in the table 5.

Table 5

Activity of the participants of the experiment after completion of their study

Total number of alumni	Winners of the contest "Teacher of the year"	Teach in higher educational establishments	Leading specialists in the municipal departments of education management, head teachers and principals	Studied on the master programs on the directions of "Physics and mathematics" and "Management in education"
250	7	48	34	63

Most of the training has taken place in course of the lectures, pedagogical internship, on the classes of the elective discipline and the interest group; therefore, we included the students of the 3rd and the 4th years, which specialized on the department of methods of teaching of mathematics, to the process of training for executing the olympiads activity.

For the period of the experiment, we have received 175 feedbacks from teachers and school managers on the work of bachelors, who had received training in the basis of the preparation for olympiads. Their analysis is presented in the table 6.

Table 6

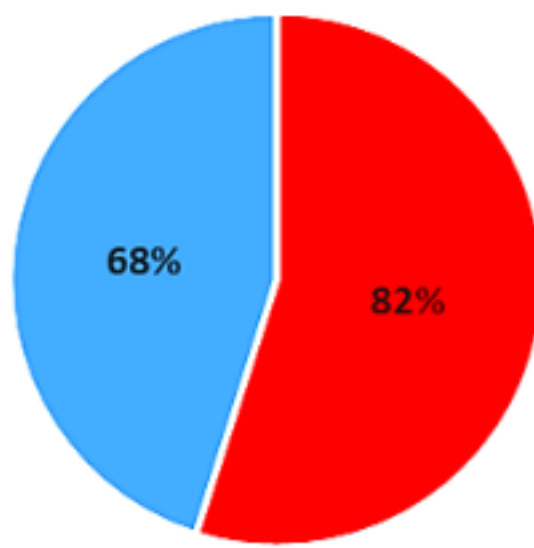
Characteristics of work of the participants of the experiment

Number of		Characteristics of work
feedbacks	works	
175	145	reasonableness, focus on the formation of competences of the olympiad activity of pupils, and the creative approach

The content of the olympiad preparedness of the students contributed to the improvement of the professional competences, as in the figure 8:

Figure 8

Showing the knowledge and skills in the field of the olympiad mathematics by the students



■ Participants of the experiments - 82,16% ■ Students of the control groups - 67,5%

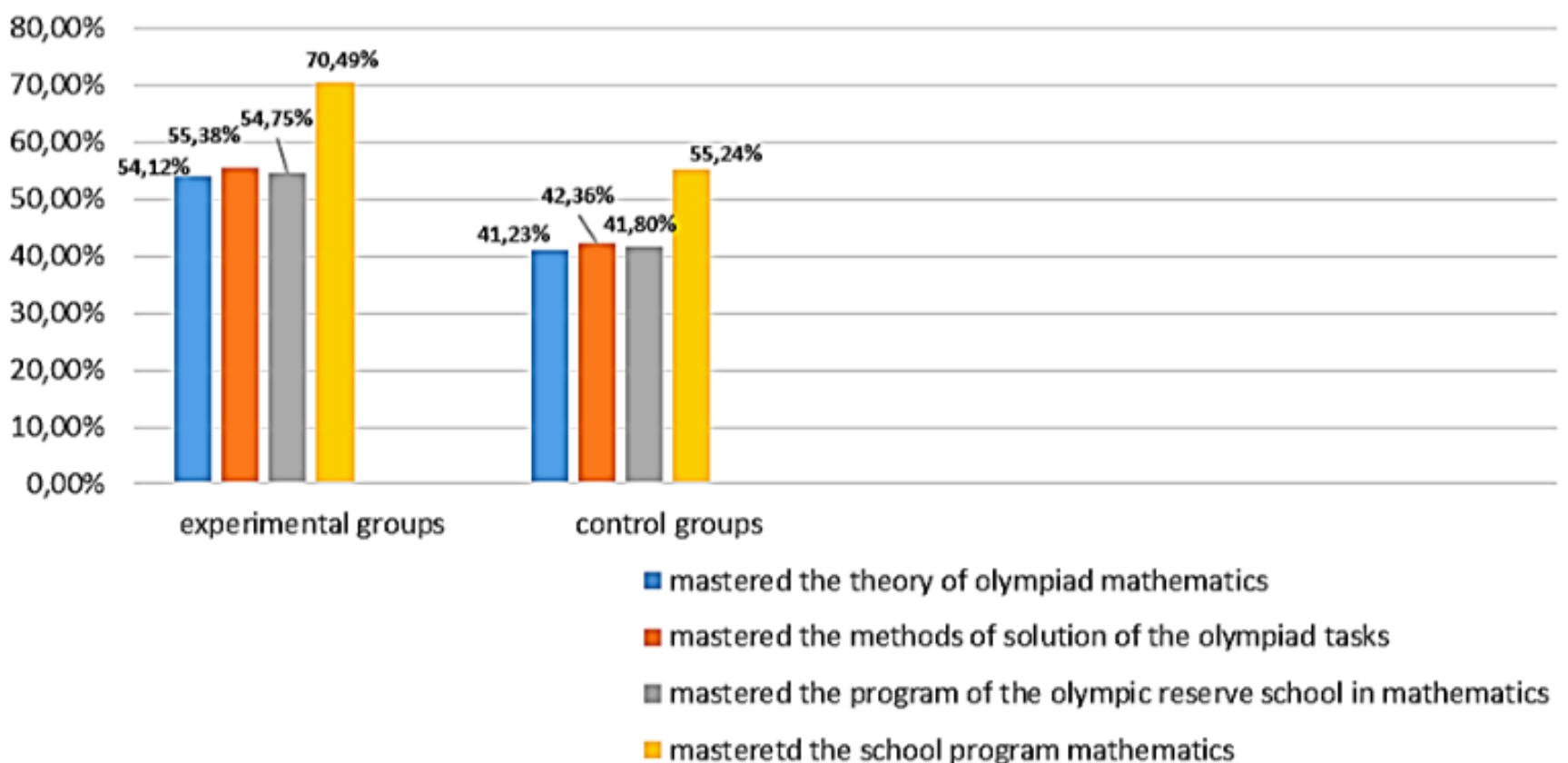
So, the level of knowledge of the theory and practice of olympiad mathematics in the experimental group of students to rise by 14,66%.

The increase of the professional and mathematical competences of the future teachers of mathematics is the major objective of the elective discipline. On this reason, it is important for us to investigate opinions of the participants about its use and quality. The feedbacks of 150 students of the discipline about the content, forms and methods testify that the classes allowed deepening methodological, pedagogical and mathematic competences in executing training of pupils for olympiads, when studying mathematics. The detailed results of the experimental training of the bachelors are presented in (Baisalov & Keldibekova, 2017).

3.7. Results of the experimental work with pupils of the schools

There has been a significant improvement in mastering of the theory and methods in the experimental groups of pupils, as in the figure 9:

Figure 9
Results of the experiment with pupils



The increase in the knowledge of schoolchildren in the theory and practice of olympiad mathematics was 12,95%. The quality of knowledge of the school mathematics program has increased by 15,25%. The index of absolute performance on the theory and methods of

solving olympiad problems in experimental groups was 96%, in the control groups 78%.

We have referred the following skills as the qualities of pupils for independent acquisition of knowledge: development of summaries of teaching materials, preparation of reports and presentations on the subjects of the olympiad mathematics and on the history of the olympiad movement, ability to work with the sources of the olympiad knowledge, information and reference books, and ability to create individual portfolios of achievements. Herewith, the pupils participating in the experiments demonstrated interest to solution of the olympiad tasks, participation in the intellectual contests and competitions, have motivation to obtain knowledge and know how to build the educational route of participation in olympiads and the ways how implement it.

We consider the admission of the experiment's participants to higher education institutions on a grant basis as one of the criteria of the relevance of the system of training for participation in olympiads, since our pupils have received high points in NAT, please refer to table 7.

Table 7
Information about admission of pupils to higher educational establishments

Years of the experimental training	Number of pupils, who participated in the olympiad training	Results of NAT, in points	Admission to the higher educational establishments on the grant basis	Studying with the discounts of 30% or more
2013-2018	26	177-218	15	11

The pupils have been admitted to the prestigious higher educational establishments, such as Kyrgyz-Russian Slavonic University, the American University of Central Asia, universities of the Czech Republic, Malaysia and Moscow, Siberian Federal University, Higher School of Economics in Moscow, Kyrgyz State University of the construction, transport and architecture named after N. Isanov.

The introduction of our syllabi in the curriculum of the school of the olympic reserve in the gymnasiums № 20, № 42, № 50 of the city of Osh led to the positive consequences, as demonstrated by the results of the olympiads. Specifically, 54 schools and 1175 pupils participated in the municipal olympiad in 2016, and the school-gymnasium № 20 demonstrated one of the best results among schools with the kyrgyz, russian and uzbek languages of teaching in the city of Osh (Keldibekova, 2017c). Its pupils received diplomas of international olympiads that confirm its success, please refer to the table 8.

Table 8
Results of participation of the gymnasium № 20 in olympiads

The period participation of the gymnasium № 20 in the olympiads	Of number of the prize winners of olympiads	
	municipal olympiads	republican olympiads
2007-2018	307 pupils	43 pupils

In the framework of the project "Execution of trainings for the workers of education of the Kyrgyz Republic" the Osh state university in 2015-2018 organized teachers' of mathematics training courses, in course of which we lectured and carried out seminars for the subjects of the olympiad mathematics. 97 teachers of mathematics from the south of the republic took nine hours training course in methods of solution of the olympiad tasks on mathematics. As a result of that, we observe positive results of participation of pupils of the city in mathematical olympiads. So, on the results of participation in the first round of the subject olympiad in 2016, three pupils of the 9th-11th grades of the school № 3 were selected for

the second round. The pupils of the school № 42 took the third place in the municipal olympiad among schools with the advanced level of studying of mathematics. The teachers of mathematics of the school № 50 prepared pupils of the 9th and 11th grades to participation in the republican olympiad in mathematics in 2017, in 2018 and one of these pupils became the first laureate. The pupils of the 6th grade participated in the republican olympiads AKMO-2017, AKMO-2018 and took the 1st, the 3rd and the 4th places. In addition to that, the teachers of mathematics of the gymnasiums № 20, № 50, and № 42, who participated in the training course in preparation to the olympiads, took the first places in the diagnostic olympiad of teachers arranged by the municipal department of the education management in the city of Osh and demonstrated the maximum result of 100 points having joined the best ten teachers of mathematics in the city.

4. Conclusions

The study revealed the availability of the proposed training content, such as the level of mastering by students of knowledge and skills necessary for the execution of the olympiad training of pupils of the secondary schools; the level of mastering of professionally significant knowledge and skills in mathematics by pupils of the secondary schools in the situation of the collaborative work of the teachers of mathematics and student interns; the impact of the collaborative work of the teachers of mathematics and students, who have received methodological training in shaping of interests of pupils to participation in mathematical olympiads of the secondary schools' pupils; the interest of the pupils to participation in mathematical olympiads of the pupils.

The practical utilization of professional knowledge of bachelors in the elective discipline and the interest group in preparing for participation of pupils to olympiads allows getting a qualitative level of mastering of the theory and methods of solution of the olympiad tasks by the students that will contribute to increasing professional competences of the future teachers of mathematics. It also confirms that such classes in organic combination with the disciplines studied at the department of methodology of teaching of mathematics, improve the quality of the mathematical knowledge of bachelors, their professional competence, and create readiness and high adaptation capability to the execution of the pupils' olympiads activities.

The utilization of the system of training of pupils to mathematical olympiads developed by us on practice, increases professional competence of the teachers of mathematics and contributes to their activity in training their pupils to participation in olympiads in mathematics.

Teaching in accordance with the curriculum of the school of the olympic reserve forms the learning competences of the pupils of schools, contribute their preparedness to participation in olympiads of all levels. The classes arranged in the school of the olympic reserve and the interest group of training for olympiads increase the level of knowledge of participants and positively impact the overall performance of the whole class. The results received in course of this research testify positive influence of the classes in the school of the olympic reserve on the growth of quality of mathematical and olympiads knowledge of the pupils participated in the experiment.

Activity of the children centers, lyceums, correspondence mathematical schools and the school of the olympic reserve as a form of additional education focused on the development of mathematical capabilities of the gifted children has a large potential for training of pupils to olympiads of all levels.

Our results allow us making a conclusion about the positive dynamics of competences of the pupils of the Kyrgyz Republic in the field of the olympiads mathematics. The analysis of the three-staged pedagogical experiment confirms the effectiveness of the developed experimental methodology, its means and positive influence on the attracting teachers of mathematics and specialists of the system of the education management to participation in the pedagogical experiment, the impact of the collaborative work of the teachers of mathematics and methodologically competent students on shaping interest of pupils to participation in mathematical olympiads of pupils and on the effective training of pupils of

the educational institutions of the Republic for participation in olympiads in mathematics.

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