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(Warsaw, Poland)**



**Instytut Integracji Europejskiej
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**PROBLEM SPACE OF MODERN SOCIETY: PHILOSOPHICAL-
COMMUNICATIVE AND PEDAGOGICAL INTERPRETATIONS**

Collective monograph

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This collective monograph offers the description of philosophical bases of definition of communicative competence and pedagogical conditions for the formation of communication skills. The authors of individual chapters have chosen such point of view for the topic which they considered as the most important and specific for their field of study using the methods of logical and semantic analysis of concepts, the method of reflection, textual reconstruction and comparative analysis. The theoretical and applied problems of modern society are investigated in the context of philosophical, communicative and pedagogical interpretations.

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EXPERIENCE OF MATHEMATICAL OLYMPIADS IN LATVIA

***Abstract.** Discussions about teaching mathematics both at school, and universities have appeared in recent years. There are a lot of talks on how to get pupils and students interested and involved in acquiring mathematics. One of the ways to involve the best students into additional mathematics studies is inviting them to participate in the mathematical olympiads. Regular mathematical olympiads in Latvia happen since the academic year 1945/46. Nowadays not only the amount of mathematical olympiads is rising, but also their variety: every year there is a State Mathematical olympiad, Open Mathematical olympiad, RIMS Meridian Mathematic competition olympiad, International olympiad “This much or How much?”, International Mathematic competition – game “Kangaroo”, International Scientific mathematical olympiad. Organization of a student mathematical olympiad is also developing in Latvia. For already 8 years there is a Mathematical olympiad for Baltic states students. The aim of the mathematical olympiads is to promote pupils and students interest about mathematical problem solving to create skills and abilities to solve non-standard tasks.*

Introduction.

Mathematical competitions are spread all over the world and their origins go as far as middle ages. From history of mathematics it is known that mathematical tournaments were held already in the 16th century. Those times, middle ages, scientists did not hurry to share the secrets they discovered. Knowing these secrets put them in a more beneficial state towards others. A mathematician, discovering something new, could call out for a competition everyone willing to compete, and, by becoming a winner, receiving the fame of an unbeatable mathematician. In addition, he or she received all the prizes, including money. Only, unlike nowadays, such tournaments happened between 2 people. Usually opponents handed each other 20 – 30 tasks that needed to be solved. The winner was the one who solved the most tasks. Nowadays, mathematical competitions together with people and organizations that are involved in that create big global net. This net has several roles. First of all, it helps identify pupils and students with high mathematical abilities. It motivates students develop their talents and gain success in science.

Competitions positively influence also the development of the educational institutions. And finally, mathematical olympiads help preserving classical heritage of elementary mathematics, which is not insignificant nowadays, too [4]. But, as the society, education and technology is constantly developing, the movement of mathematical olympiads also has to change to comply with the demands of today's world.

Mathematical olympiads and competitions are an important additional component to the mathematical education. Sometimes they stimulate not only mathematical studies, but also the interest about other school subjects [3].

To create interest in mathematics and find the most talented mathematicians among pupils, there are mathematical olympiads in almost every country in all the continents. Mathematicians from the Republic of South Africa have done a detailed analysis of the tasks and results of mathematical olympiads in 7 year period: from 2006 to 2012. There is analysis on both tasks, and results of the olympiads in the Work [2]. It was concluded that pupils' knowledge of algebra are superior than knowledge of geometry and statistics. Taking part in evaluation of some mathematical olympiad results, we can say the same about the knowledge of Latvian pupils.

1. State Mathematical olympiad of Latvia

Origins of the Mathematical olympiads for secondary schools in Latvia are dated back to academic year 1945/46 when State University of Latvia (now University of Latvia), department of Mathematics organized the first olympiad. This type of mathematical competitions for pupils are regular since academic year 1949.50, but numbering of olympiads begin with academic year 1950/51, when Pioneer castle of Riga (now Student castle of Riga) started taking part in the organising it. Later, stimulated by the Ministry of Education, olympiads covered all Latvia. Last year there was already the 69th State Mathematical olympiad of Latvia.

For several years already, the 3rd and 4th phase of olympiad is organized by A. Liepa off-site mathematical school of University of Latvia (LU). For many years the task sets for the State Mathematical olympiad for all phases were created by the LU professor Agnis Andžāns. But, starting from academic year 2009/2010, task sets for the State Mathematical olympiad are developed by a specially created commission.

Preparation for olympiads, as well as, work in afterschool mathematics classes require appropriate study materials. At the olympiad, pupils receive 5 tasks to solve, 0 – 10 pints for each task.

Pupils achievements in olympiads co-create the reputation of schools. Experience proves that results of olympiads show not the work done during the lessons, where teacher has very little time for individual work, but the quality of afterschool work, and the priorities of school and municipality. [6]

2. Open Mathematical olympiad of Latvia

Open Mathematical olympiad is an initiative of the A. Liepa off-set mathematics school of LU (OSMS), that is why all the questions related to its organization are on OSMS collective. In 1974, students of the 5th course of the faculty of Physics and Mathematics had an idea to organize a republic range mathematical olympiad, where any pupil, who is interested in mathematics, regardless of the successes in the phases of the State Mathematical olympiad, could take part in. The second aim was to give a chance to participate in the olympiad the pupils from younger classes.

So, the 1st Open Mathematical olympiad happened in 1974, where 316 pupils participated: pupils from forms 7 to 11 from all over Latvia. In the following years also younger pupils participated in the olympiads. The idea of the Open olympiad appeared fruitful and attractive: in the following years similar olympiads were organized also by physics, astronomers, geographers, philologists, and others, as well as, they were organized also by foreign organizers. The Open Mathematical olympiad has gained also an international authority: delegations from other countries have participated several times. Open Mathematical olympiad is the place where everyone stands at the same line, regardless of parents prosperity, native language, place of inhabitant, size of school or recognition. It is a place to show themselves especially for pupils from the suburbs, reaching for further successes, whether it is entering the university of their dreams, their own business or the position of the President of the country. It is worth participating even if mathematics is not even close to pupil's one of the favourite subjects. It is an opportunity to check their own knowledge and find out what they already succeed in and what needs to be worked on more. There are 5 tasks offered at the Olympiad, 0 – 10 points for each task.

Now the Open Mathematical olympiad has become the most popular olympiad in Latvia. In 2018, the Open Mathematical olympiad happened for the 46th time. Since academic year 1998/99, every year, about 4000 pupils applications are received for the Open Mathematical olympiad. In this olympiad, which happens at the end of April, on Sunday, pupils from form 5 – 12 take part, some pupils from forms 3 and 4 (these students solve tasks for form 5) [6].

3. RIMS Meridian Mathematic competition (MMC) olympiad

An olympiad is being organized for the 6th time in the premises of the private school “RIMS – Riga International meridian school”. The initiator of the olympiad of the range of Latvia in the founder of the school „RIMS – Riga International meridian school Ltd” member of the board Sinan Ciftler.

In 80 minutes pupils show their mathematical abilities, doing 34 test type tasks and one open type task. There are maximum 120 points at the olympiad. The olympiad is lead and tasks are available both in Latvian, and Russian, according to child's native language. Pupils from forms 3 to 9 participated in the last year's mathematics olympiad and it was called “MMC – Pangea 2016/17”.

Olympiad is realized in two phases. In the first phase pupils do the olympiad tasks in their own schools. The best 50 participants from each form groups are invited to participate in the second phase, doing 25 second phase tasks. The olympiad is held in the premises of the private school “RIMS – Riga International meridian school” [15].

4. This much or... How much?

The idea of the olympiad developed in cooperation with the Lithuanian colleagues. The university of Siauliai organize mathematics olympiad every year for pupils for form 4 – 5 in 3 phases – school, region, country. In winter of 2004 they offered other countries to participate in this olympiad. So, in May of 2004, some school in Latvia organized such olympiad. Then pupils were offered to do the tasks from the State olympiad of Lithuania.

Starting with an academic year 2004/05 this olympiad was introduced also in Latvia as a traditional yearly event for pupils of younger forms, where in the first three phases they are offered our own created tasks, but the 4th phase is organized simultaneously with the State olympiad of Lithuania, and the task sets for this phase are created together with Lithuanian (and maybe also other countries) colleagues. Basically, olympiad “This much..How much?” is a competition for pupils of form 4. Olympiad happens every year in 4 phases. The first three are organized at schools, the 4th phase is organized in several “centres”, which are chosen by the geographical positioning and by mutual agreement.

The materials for the first three phases (tasks, answers, evaluation instructions, table for results) are electronically sent to a contact person of the school shown in the application. One lesson hour is intended for the completion of the tasks in the first three phases. The works of the first three phases are corrected at school according to the given evaluation instructions. A. Liepa OSMS of LU gather and analyze the results of the first three phases and choose participants for the 4th phase, taking into consideration the total sum of the points gathered in all three phases. There is at least one participant chosen from each school to participate in phase 4 [10].

5. Mathematical contest – game “Kangaroo”

“Kangaroo”– it is an international mass mathematical contest – game with a slogan “Math for everyone”. Now the contest is also officially represented in Latvia!

Contest is a real competition. The main goal is to show children the attractive side of the mathematics, give them a chance to feel joy from an intellectual effort, and, even though small, wins and discoveries. For many children it is important to know that the contest is international, and that, pupils from many other countries are doing the same tasks together with them. And, if the queue of the participants for the content raises every year, it means that it corresponds to the important needs of the children of some age groups.

At the beginning of the 80s last century, Piter Holloran, professor of mathematics from Sydney, decided to organize a new type of the contest – game for the pupils of Australia: survey with possible answers that are corrected by the computer. Thousands of pupils could take part in the contest simultaneously. The success of a National Australian mathematical contest was huge.

In 1991, two French mathematicians decided to organize this game in France, naming it “Kangaroo” in honour of their Australian friends. The first game gathered 12000 college students. Later pupils from schools and lyceums also took part. In June 1993, organizers of the French “Kangaroo” organized a meeting for the leaders of the mathematical contests of the European countries in Paris. The invited mathematicians were very surprised by the success of the contest “Kangaroo – math for everyone” in France: 1991 – 120000 participants, 1992 – 300000, 1993 – 500000.

In May 1994 Belarus, Hungary, Spain, Netherlands, Poland, Russia and Rumania decided to take part in the contest and it secured the great success of the game. In July 1994, in Strasburg, European Parliament meeting, the General Assembly created an Association “Kangaroo without borders” from 10 European countries.

Now this association gathers participants from many countries. The goal of the association is wide spreading of the general mathematical culture, and, of course, organization of the contest – game “Kangaroo” that happens at the same day in all the participating countries. The form of the contest remained – list of questions with the possible answers, the date and time of the contest, and the main principle - “prize for everyone” for every participant. Every country has its own organization committee, own prizes, results of the different countries are not compared to each other.

This year the contest “Kangaroo” happens in Latvia already for the 8th time!

The contest has one phase, without selection contests. This contest happens in March, in one day, one hour, and consists of 30 questions, which are ordered by the increase of the level of difficulty, there are 5 answer options for each question. The discoverers of this contest in Riga in 2006 became private school ISMA “Premjers” pupils, who showed very good results.

In 2013, pupils from 17 schools – 1297 pupils in total, joined the “kangaroos” of the school ISMA “Premjers”.

Until 2013, contest was organized in cooperation with the committee of the Russian Organization, which was created in St. Petersburg, in institution of Productive Education of the Academy Of Russian Education and centre of Technological testing “Kangaroo plus”.

From 2014 we became a full-fledged members of the association Le Kangouron sans frontières (Kangaroo without borders). Today it has more than 82 European, Asian and American countries, but the number of participants is more than 6 million. The idea of accepting Latvia in the association belongs to Classical Grammar school and school ISMA “Premjers”. The main organizational work takes Latvian organizational committee “Kangaroo” in the custody of the Youth association “Bright Youth”.

Amount of schools and pupils participating in the contest increases every year: in 2015 more than 15000 pupils from 199 schools participated in the mathematical competition; in 2016 – 19286 pupils from 219 schools of Latvia; 2017 – 23855 pupils from 247 schools of Latvia. [<https://www.kengurs.lv/lv/konkurss/v-sture>]

6. International pupils scientific mathematical olympiad

To promote interest in mathematics and creativity, on 27th February, 2017, there was an International pupils scientific mathematical olympiad (HSPSMO) in Lithuania for the seventh year in a row, which was organized by the University of Siauliai in cooperation with Mathematics department of Latvia University of Agriculture (LUA). This year Latvia was represented by 22 pupils from 6 schools. The aim of the olympiad was to acknowledge those pupils who are interested in the exact sciences and are gifted in mathematics, as well as, motivate these pupils to a further career in this field. Analyzing the tasks and results of the olympiad, main differences between olympiads in Latvia and Lithuania were acknowledged. In the evaluation of both pupils and teachers, tasks in Pupils mathematical olympiad of Latvia, have a very little connection with the mathematical school course, they have higher level of abstraction, and levels of difficulty vary very little. Tasks in the Olympiad of Lithuania are more precise. Opposite to Latvia, where pupils have to know additional problem solving methods, they can be characterized as deepened mathematical school course.

7. International students mathematical olympiad

In turn, the tradition to organize an International students mathematical olympiad was founded in 2011, in the frames of Latvian-Lithuanian cross-border project “Cross-border cooperation net to incorporate mathematical competences in the social-economical development of the region” (MATNET) and last year it was organized for the eighth time.

The aim of the olympiad is to promote interest about mathematics among young people, strengthen the education that is gained at school by providing creative opportunity for its implementation, and to promote the cooperation development among young people with same interests. That is why, invited to participated in the olympiad are those who are good at mathematics, who are interested in problems of a particular type, who like “hard nuts”, as well as, all those who want to try out their strength in the mathematical competitions.

At first the olympiad was organized only for students of University of Siauliai and Latvia University of Life Sciences and Technologies (LLU). Then, next year, students from Riga Technical University also joined. Because of the fact that for the evaluation of the students' individual works of the olympiad there is only one hour intended, amount of participants is limited, for all eight years it has remained in between 36 to 81. Thus, the number of universities, students of which participate in the olympiad, grew almost every year, but especially it has grown in the last two years. Number of universities – participants of the olympiad – is seen in Fig. 1. In 2018, 36 participants from 10 universities had applied for the olympiad: 7 own students, 12 – from Lithuania (University of Siauliai and Alexandra Stulginska University), 3 – from Estonia, as well as students from several universities in Latvia: Riga Technical university, Ventspils University, Vidzemes University, Rezekne Technological academy, University of Daugavpils and University of Latvia. LLU Erasmus+ exchange students from Italy, India and Bangladesh also participated in the group works. Number of participants was limited.

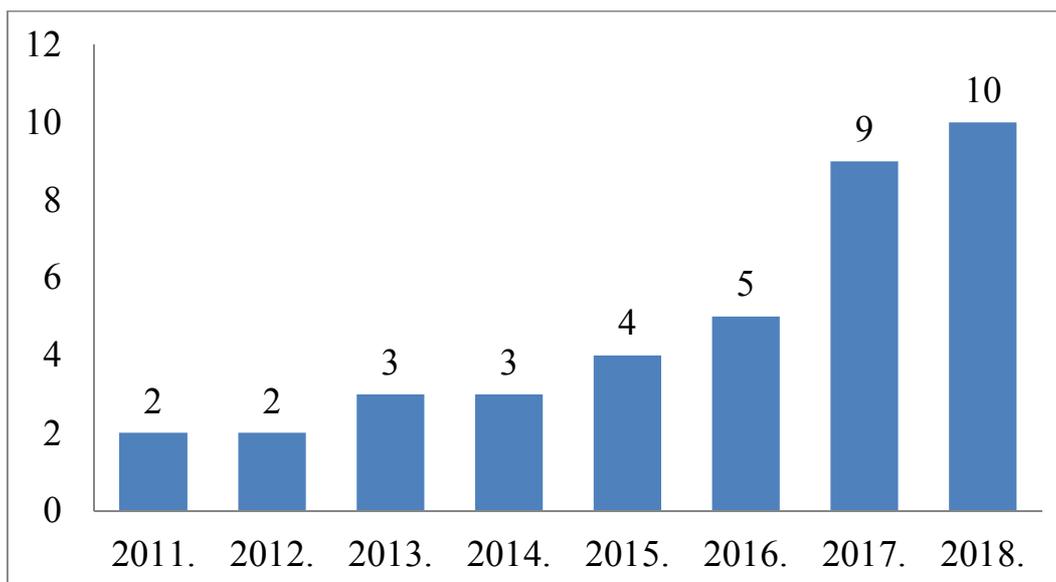


Fig. 1. Number of universities – participants of the olympiad – in years 2011-2018.

As previously mentioned, International students mathematical olympiads in Latvia happen once a year, starting from 2011, and its main organizer is Mathematical department of Latvia University of Life Sciences and Technologies (LLU). Students from Riga Technical University participate in these olympiads since 2012, in addition, showing good results and receiving one of the award-winning places every year.

As the level of the olympiad does not exceed secondary school knowledge, but knowledge gained at university can also be used – solving the equation systems, extremes, for three years (2015-2017) pupils from secondary schools were also invited to attend. In 2017, 81 participants from 18 educational institutions had applied: 22 own students (from LLU), 19 students from Lithuania (University of Siauliai and Alexandra Stulginska University), 3 students from Estonia (EMU), as well as, students from 4 universities in Latvia. Erasmus+ exchange students from Portugal (Instituto Politecnico Braganca) also participated in the olympiad.

Olympiad was divided in two parts. First part includes individual contest and is one hour long. There were several puzzle tasks also included, but in the second part – group work. Groups are created randomly on the spot, so that each group is represented by different educational institutions. Group work of five – seven students consisted of solving two combinatorial geometry tasks, as well as, acknowledging connection of students' hobbies with mathematics. Group work also involves experience exchange among students about learning and teaching mathematics in their universities, what is common, what different, as well as, what is good; what should be improved in the study process.

Individual tasks for each participant are given in their native language. Group tasks – in Latvian, Lithuanian, Estonian and English. Communication between students is in English.

Beginning with 2012, every year students from Riga Technical University (RTU) participate in these olympiads and every year receive award-winning places. Although, for the last two years, students from the Faculty of Physics and Mathematics of University of Latvia received the first place, RTU received the highest points in the team rating. Picture 2 shows team rating of university teams in 2017, abbreviation graphics beneath mean: ASU – Aleksandra Stulginska University (Lithuania), EMU – Estonian University of Life, IPB – Polytechnic Institute Braganca (Portugal), LiepU – Liepaja University, LLU – Latvia University of Life Sciences and Technologies, LU –University of Latvia, RTU – Riga Technical University, ShU – Siauliai University (Lithuania), VeUAS – Ventspils University of Applied Science.

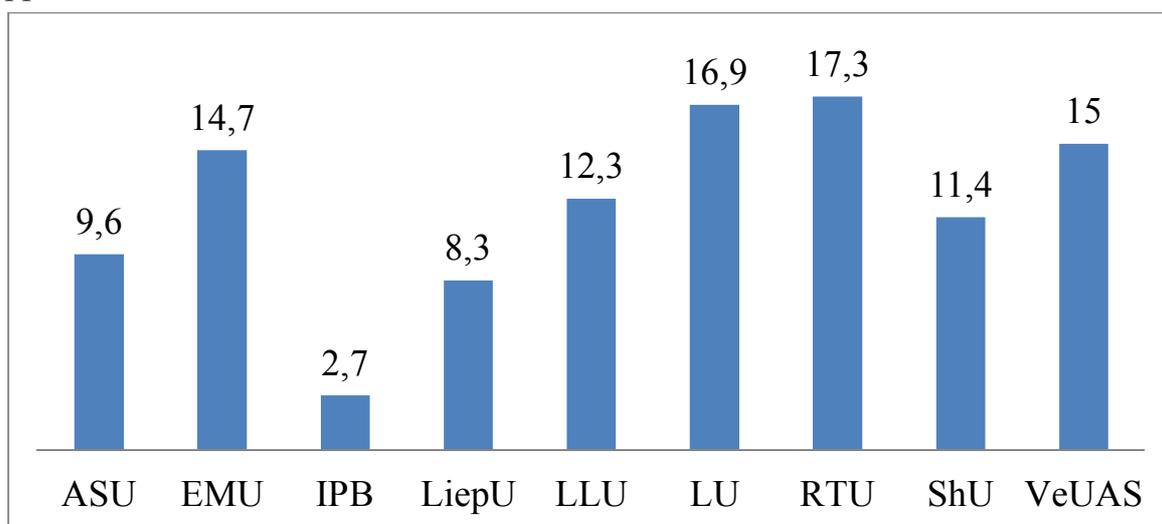


Fig. 2. Average points each university team received in the olympiad

Teams received also additional task – share the experience about the studies of mathematics, determine the common and different in the mentioned educational institutions, as well as, give suggestions on the improvement of mathematical studies. The link of mathematical studies to a real life and the usage of the gained knowledge is the main topic of the discussion. To improve mathematical studies, students suggest adjusting mathematical course to a particular speciality, using more interactive materials, as well as, simulations, also more logic tests and tasks. In turn, theoretical approach, in students' opinion, promotes general skills. Interesting is the fact that both, students from LLU, and RTU sees the need of mathematical studies, but students from Siauliai University and Jelgava Technical school have doubts about applying the taught mathematics in future. Students from Vidzeme University think that only few topics are interesting and useful for the chosen profession.

The common in all mathematical studies of all universities are homework, tests, practical works in relatively small groups, as well as, accessibility of electronic study materials (e-studies and other teaching platforms). Although, homework is a regulation for credit points in several universities, in RTU they are evaluated and give extra points.

Students agree that it helps passing the course. RTU students welcome also additional course to revise secondary school knowledge. These courses are for students who fail the test about the knowledge of elementary mathematics. But, other students can also attend these additional courses to both, remember the forgotten secondary school topic, and to acquire the topic of the higher mathematics additionally.

It must be stated that the greatest value in Siauliai University is a student friendly study environment, accessibility of technologies, and also, lecturers are very welcoming and give a lot of good examples during the study process. In turn, students from Ventspils University are surprised that a lecturer after the lectures not only asks if students understood everything and if they have any suggestions or wishes, but also take their responses into consideration.

After the discussion, students and pupils consolidate the confidence that mathematics is not only complicated and precise science necessary for research of scientific discoveries, but it is also being used in an everyday life. To improve mathematical studies students suggest varying the tasks that are offered for an individual work, creating even smaller groups for practical classes to involve all students in solving the task, as well as, using more visual materials. Students would also like a slower study pace.

During the International mathematics olympiad in Jelgava not only students gain new conclusions, but also lecturers. First of all, a lot can be taken from the evaluation of the mathematics curriculum and its teaching, and the suggestions for its improvement. Secondly, parallel to olympiad, there was a seminar-discussion for teachers and lecturers of mathematics about mathematical education at universities in the context of sustainable development. Beginning the next academic year – 2018/2019 schools and pre-schools in Latvia (aged 1.5 to 18) will start a gradual shift to an improved study curriculum and a changed in accordance to it a new teaching approach, to develop as a result of it in students “knowledge, skills and attitudes necessary for living in the 21st century” (school 2030). State Education Content centre (SECC) project “Competence approach in Study content” indicates creating a support mechanism for schools and teachers, municipalities and parents in 5 years period for a successful change of teaching approach [16]. The change of paradigm in the school study curriculum will create a string of changes also both in programs of mathematics at universities, and their implementations.

During the implementation of the competence based approach, program of the subject will remain, but teacher cooperation in the school frames, work planning and implementation will increase. “Changes are necessary because the pupils themselves have changed!” [12]. It is essential to shift from giving a ready made knowledge and frontal teaching form, where teacher gives information in front of the class, to leading the learning. Teach and learn differently is possible already in the frames of an existing curriculum, and in many schools it is happening.

8. Team mathematical olympiads

Team olympiads in mathematics were created in 1979 in Lithuania. Today, they are even more popular in our neighbouring country than an individual olympiads. Since 1982, 3 tasks in the form of team competitions are offered in an annual Austria – Poland New Mathematician competitions. A special form of team competitions as so called “mathematical fights” that were created in Calliningrad and are still a very popular in the in-depth teaching system of mathematics in Russia. Internationally the form of the team olympiads stabilized in 1990 when organizers of mathematical competitions of Latvia, Lithuania and Estonia agreed on an annual competitions “Baltic road” between the teams of these countries; later other around the Baltic sea or friendly to Baltics countries also got involved.

Opposite to the classical mathematical olympiads, where individual solvers participate, “Baltic road” is a team competitions, where five solvers, consulting among each other, in 4.5 hours solve and hand in results for 20 tasks. It is clear that such type of rules require not only mathematical knowledge and fast reaction, but also cooperation skills, get other ideas and realize them, rationally plan time and strength, and etc.

The team consists of not more than 5 pupils, team leader and the leader assistant. Traditionally, there are 5 tasks in algebra and analysis, 5 tasks in geometry, 5 tasks in number theory and 5 tasks in combinatorics. Every result of the task is valued with 0÷5 points.

The mode of the olympiad is very tight. At first team leaders and their assistants are introduced with tasks and their results sent from all participating countries. Then, in a voting process, 20 competition tasks are chosen. After the team works are handed in, the leaders of the team have their hottest work time – evaluation of the results and “defending” in front of the coordinators, who, according to a linked system evaluating all the results, determine the final evaluation. The winners receive a travelling cup, which is handed to the next winner next year.

The first “Baltic road” competitions happened in Riga in 1990. In 1991 they happened in Tartu, Estonia. In the first two competitions there were two teams from the three Baltic States.

In 1992 other countries that are situated along the Baltic sea were invited to participate. Special invitation received Iceland, which was the first (in 1991) to acknowledge the independence of the Baltic States. In that way, in 1992, there were teams from 8 countries participating in the “Baltic road” - Denmark, Estonia, Iceland, Latvia, Lithuania, Poland, Saint Petersburg (Russia) and Sweden. Finland participates in the “Baltic road” competitions since 1993, Norway – since 1996, but Germany – since 1997.

Traditionally, the teams of the mentioned 11 countries are invited to participate in the “Baltic road” competitions. In 2001 Israelite team was invited to participate, in 2004 – Belarus team, 2005 – Belgium team, but in 2011 – South African team.

9. International Mathematical Olympiad

Pupils from Latvia show good results not only nationally, but also in the international level. There is an International Mathematical Olympiad every year in summer (IMO). The first World Olympiad happened in 1959 in Romania, Bucharest, and only 7 countries participated. Gradually the number of participants grew, in 1989 it reached half a hundred; at the end of the 90s, the number of participating countries exceeded 80; in the recent years there are about 100 countries participating in the olympiad. In the team of each country there are no more than 6 pupils. Pupils solve the olympiad tasks for 2 days. Every day there are 3 tasks given, time for solving them – 4,5 hours. Maximum points: 7 for each task (points are given only in whole numbers, i.e. 0, 1, 2, 3, 4, 5, 6 or 7).

During the first years, 8 pupils from each country could participate in the IMO; in 1982 it was lowered to 4, but in 1983 – increased to 6 pupils from a country, as it is also now. In such way, the amount of participants (pupils) in the olympiad exceed 500. There were 5 pupils from Latvia participating in the International Mathematical Olympiad in Brazil in 2017. Last year 6 pupils from Latvia participated in the 59th International Mathematical Olympiad in Romania and received two awards. Pupils – participants of the olympiad, themselves agreed that results could have been better. Psychological aspect played its role here – lack of experience of such level and huge responsibility. Olympiad was happening in the centre of a huge sports arena, where 614 participants of the International Mathematical Olympiad were placed. Next, 60th International Mathematical Olympiad will happen July 11 – 22, 2019 in England.

10. European Girls' Mathematical Olympiad

Usually the majority of the participants in the mathematical olympiads are boys, the number of girls is lower. To give girls a possibility to participate in mathematical competitions of an international level, European Girls' Mathematical Olympiad was organized. The first European Girls' Mathematical Olympiad happened in April 2012, Cambridge, England. The 7th European Girls' Mathematical Olympiad will happen in 2019, April 7th – 13th Kiev, Ukraine. Four pupils from each invited country participate in the olympiad. Competitions last 2 days, there are 4 tasks to solve each day. For each tasks there are 0 – 7 points.

11. Analyses of the tasks of olympiads

Tasks of olympiads usually differ from the tasks solved at school. It creates difficulties both pupils who get ready for the olympiad, and teachers who help them in this preparation work. None of them know how to prepare for olympiads. If the pupil is not well prepared for olympiad, he or she gets bad results, which in turn, scares pupils away from additional mathematics acquisition and re-participation in olympiads. But, if pupil gets good results, it stimulates him or her to study even more and get even better results.

Until 2014, olympiad tasks in State Olympiad of Latvia and Open Olympiad consisted mainly of so called “repeated” problems. Those were non-standard tasks that repeated every 2 – 3 years. There are 5 tasks to be solved in 5 hours in total, every one of those is given 10 points.

That means that the maximum points are 50. Pupils results were low in these olympiads: only 11% of pupils received more than 25 points, and what is even worse, 45% of the participants received less than 10 points, which means, they did not solve completely not even one task [1]. That is why there was a survey in 2014 for mathematics teachers and pupils-olympiad participants about what tasks to include in the olympiads. After gathering data from the survey it was decided to include one school task in the State and Open olympiads, only a bit harder than the ones solved in class, and one “repeated” task. Beginning with 2015, there was one tasks included in olympiad, so called “topic” problem. The aim of these tasks is to teach pupils something new. Pupils and teachers are sent theoretical description and task solving examples for some new method. Pupils acquire it themselves or with the help of a teacher, and similar task is included in the olympiad. After these changes, pupils results in the olympiads visibly improved.

Analysing the tasks of the State and Open Mathematical olympiads for secondary school pupils for the last 3 years, we concluded that the types of tasks in these olympiads are similar: usually 2 algebra tasks, 2 combinatorics or number theory and 1 geometry task. True though, not always it is easy to distinguish which group does the task belong to, because, part of the tasks are combined, they include elements from several mathematical groups. As tasks from previous years are freely available in the Internet [8], it helps pupils to better prepare for olympiads. Tasks from previous years for the International Mathematical contest “Kangaroo” are also available in the Internet [13]. Tasks in this contest are easier, but, there are more of them and the time is shorter. Pupils must solve 30 tasks in 75 minutes: 10 of them are graded with 3 points, 10 – with 4 points and 10 – with 5 points. In all tasks pupils have to choose the correct answer from the 5 options given. Opposite to the State and Open olympiads, where the solving process is evaluated and for each task you can get a partial evaluation, only answers are evaluated in the “Kangaroo” - so pupil gets the maximum points for the task, or 0 points. Tasks of logics, number theory and combinatorics dominate in the “Kangaroo” contest, as well as, in most mathematical olympiads.

Analysing the tasks of the last 3 years from the “Kangaroo” for forms 9-10 and 11-12, we concluded that about 44% of the tasks are classified as tasks of logics, number theory or combinatorics, in turn, tasks of algebra and geometry are equal – about 28% of tasks are algebra and the same amount, that is 28%, are geometry (see Fig. 3).

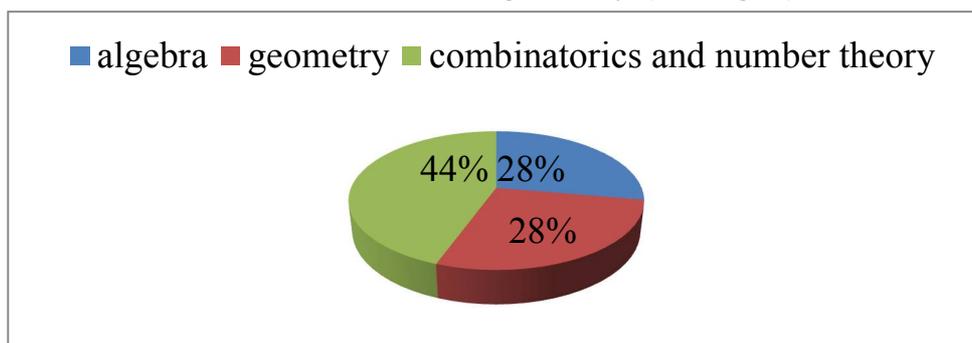


Fig. 3. Division of amount of tasks (%) in topics in the “Kangaroo” contest

Comparison of the tasks for forms 9-10 and 11-12 show that for forms 11-12 there were more geometry tasks, and less number theory and combinatorics (see Fig. 4).

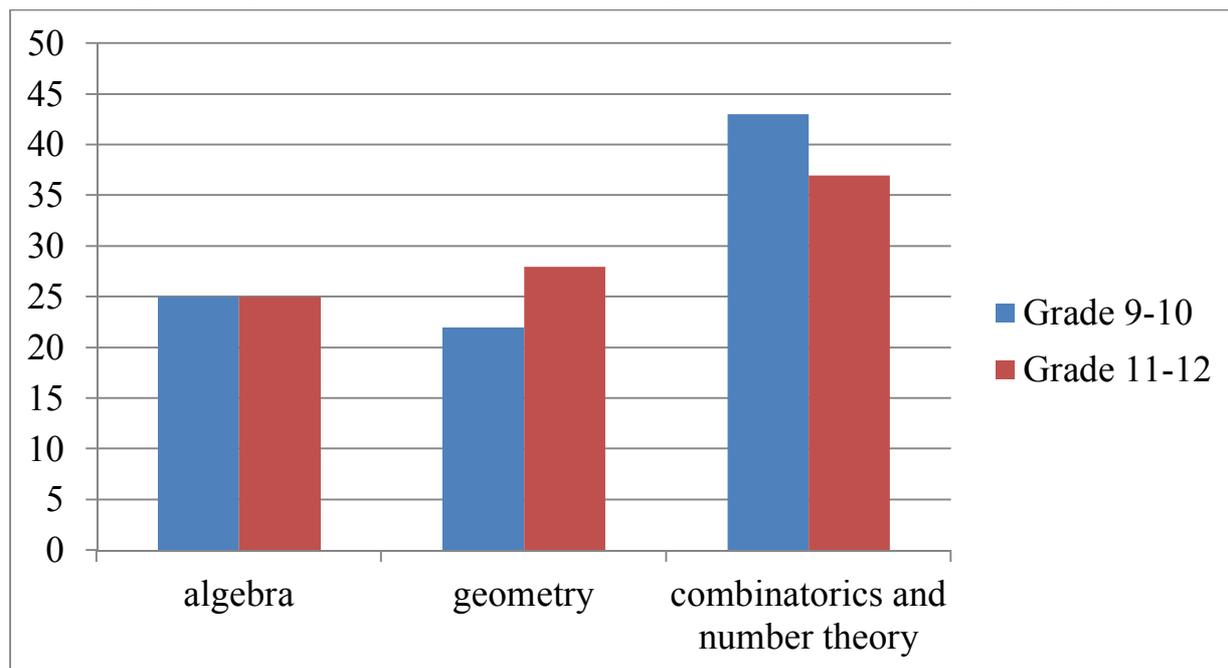


Fig. 4. Comparison of the tasks for forms 9-10 and 11-12

Analysing tasks by years, the tendency for tasks of logics, number theory and combinatorics increases at the expenses of number of tasks in algebra and geometry (Fig. 5).

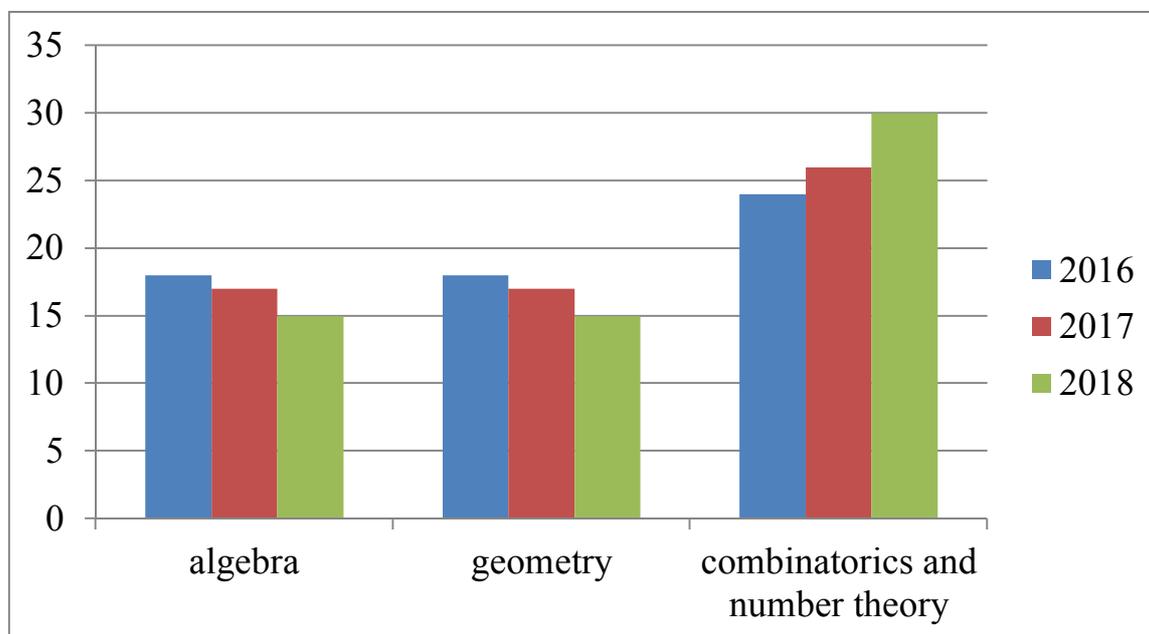


Fig. 5. Comparison of the topics of the tasks in the “Kangaroo” contest by years.

As a conclusion we can express a statement that non-standard tasks dominate in the olympiads, they differ from the tasks solved at school, and mainly, those are tasks, for solving which, not only knowledge is needed, but also logical and critical thinking.

Conclusions.

1. Schools and teachers and greatly promote pupils interest in mathematics and passion about it, as well as, give teaching this subject a greater role. Nowadays society often speaks about old methods being used at school, that pupils are bored and they lose interest in learning.

2. Mathematical olympiads promote interest about mathematics among young people, develops cooperation skills among thinking alike young people.

3. International Students' Mathematical Olympiad is an example of good practises of sustainability of the results of an international projects.

4. International Students' Olympiads, where students can exchange experiences about mathematics studies and express suggestions for improvements of mathematics studies, gives lecturers a possibility to hear the opinions of the best students about the methodology of mathematics teaching and improve it.

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