# Math Olympiads for the Public Schools in Brazil II

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**Abstract**

In this article we give an overview of the most important aspects of the OBMEP.

## 1 Introduction

This article is a update of [1], in which a general description of OBMEP from its inception up to 2008 can be found; we also recommend [2] for more information. Another reference for OBMEP in general is its webpage at `www.obmep.org.br`. In the folowing sections we present a (highly) condensed view of the most important present aspects of OBMEP, but for the benefit of the reader who did not read [1] or [2] we present below some basic information.

In 2002 the Brazilian Mathematical Society (SBM) presented to the Ministries of Science and Technology (MCT) and of Education (MEC), as well as to the Presidency of the Republic, a project for a Math Olympiad as a way of addressing the serious condition of Math teaching in the Brazilian middle and high public schools. The basic idea was, and still is, to challenge students and teachers with Math problems which can be solved without deep techniques and theorems, but which demand reading skills, logic, organization of data, analysis, analogy and informal induction, with a little bit of proof added occasionally; in other words, problems not found in the usual textbooks. In this way we believe that the mental skills aquired by those which tackle our problems will help them regardless of their career choices. Of course we do locate and nourish mathematical talent; more on this later. In this sense, one should look at OBMEP not only as as Math Olympiad, but as full fledged educational project.

OBMEP took off succesfully in 2005 and has attained the status of a permanent national project. Its headquarters are at the Instituto de Matemática Pura e Aplicada (IMPA) in Rio de Janeiro, which made

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OBMEP an integral part of its mission and is responsible for the whole project. We now reach around 19.000.000 students yearly and practically all middle and high schools in Brazil; in particular, out of 5565 towns in Brasil, only 33 did not have at least one school taking part in OMBEP in 2014.

Students are divided in three levels according to scholarship, each with its specific exams, which are given in two stages. In the first one, exams consist of 20 multiple choice questions and are given to all students; their logistic function is to help each school select its own 5% higher scoring students to take part in the second stage. In this stage, exams consist of six open questions, with two to four items each. From these last we select, through an involved correction process, the medalists; as of this writing, we distribute 500 gold, 1500 silver and 4500 bronze medals, as well as up to 46200 honour certificates. The total number of medals will eventually reach 10000 in 2017. Prizes are also given to teachers, schools and cities whose students do well.

Exams are concocted by a committee made up of professional mathematicians and, as of now, one retired high school teacher. External readers help us debug the exams; they tackle everything from grammar and Math to the perceived difficulty and the order of questions. An anthropologist (who knows Math!) reads the exams over in order to avoid inadequate contextualizations and use of language, and Braille specialists take care of exams for visually impaired students.

Details about the enormously complicated logistics needed to implement this project in a country of continental dimensions can be found in [1]. We should, however, make the following remarks. First, OBMEP is integrally funded by MEC and MCT, through their funding agencies CNPq (National Council of Reserch) and CAPES, respectively. Secondly, 69 regional coordinators, chosen among university professors, are responsible for the contact between OBMEP and the schools, with the help of state and municipal education authorities, as well as at least one Math teacher per school involved. As can be seen, OBMEP is the result of a strong and fruitful interaction between all levels of Brasilian government, universities and the public school system.

To finish this introduction, we would like to say that OBMEP is permanently under construction. We would be glad to get feedback, critiques and new ideas and, on the other hand, we will happily share our knowledge and experience. Whatever the case, we welcome you to get in touch with us at `contato@obmep.org.br`.

## 2 Programs for medalists

Here we present OBMEP programs which have the development of mathematical talent in mind.

### PIC (Scientific Training Program)

All medalists receive a CNPq scholarhip, which allows them to enter a one year program of Math studies which includes presential meetings and mandatory participation in *The Hilbert Hotel*, a special forum for virtual discussion. Advising is done by university professors and special texts are written on purpose. Teachers who receive prizes and, ocasionally, non-medalists also take part in this project. Its mains goals are to introduce the students to Math not seen in the usual curricula, to train them in Math thinking and culture and to motivate them towards careers in Math, Science and Technology in general. Another objective here is to engage teachers and to foster cooperation between higher learning institutions and schools. PIC happens in 188 different locations and involves 6616 students.

### PICME (Programa de Iniciação Científica e Mestrado)

OBMEP offers a scholarship to all former medalists getting an undergraduate degree. This is done for the duration of their studies, regardless of career choices, the requirement being that they enter a program of selected Math courses under the supervision of specially chosen advisers. After that, and still regardless of career choices, a scholarhip is offered to those who enter a regular graduate program in Math. The main idea is to get people to understand the importance of Math and its methods in all areas of knowledge and also to have non-Math professionals able to interact with mathematicians. PICME involves, as of now, 510 undergraduate, 61 M. Sc. and 6 Ph.D. students. The 40 undergraduate and graduate programs which are OBMEP's partners in this project are all certified by MEC.

### PECI (Programa Especial para Competições Internacionais)

This program prepares the top medalists for participation in international Math Olympics. As of now, former olympians train yearly 24 students in presential meetings and other 48 in virtual ones. It should be noted that Brasil's international medals, formerly restricted to private school students, now have a significative contribution from public school ones.

# 3 Programs for students

In this section we talk about the ways OBMEP interacts with students of middle and high school.

## POTI (Polos Olímpicos de Treinamento Intensivo)

OBMEP offers all students, from the last two years of middle school on, a special virtual course in Algebra, Combinatorics, Geometry and Number Theory, in order to train them for participation in OBMEP and in OBM (Brazilian Math Olynpiad). A total of 1035 students and 28 university teachers are involved in this process; study materials include 142 videos and 147 texts.

## Math Clubs (Clubes de Matemática)

This program offers schools and students materials for the creation of problem solving groups and organization of Math competitions and other related activities. Participation of students and teachers of all levels in the same group, including univertisty students and professors, is encouraged. Students and schools create their own groups, register them at OBMEP and get access to two virtual forums, mediated by OBMEP advisers. One of those is dedicated to general activities such as discussion of problems, news, sources of Math info and problems of other olympiads. The other contains information of a more technical nature, such as instruction on Math softwares. The idea here is to provide students with a space in which they can talk Math in a way which is not possible in the school environment. There are, at the moment, 584 registered clubs, with 3725 students and 361 advisers, chosen by OBMEP among school teachers.

## Math Portal (Portal da Matemática)

In this program students are offered, according to their level, video classes on various curricular Math topics, related texts, homework sets with solutions, study guides and interactive activities. The teachers which deliver the video classes are selected having in view their expositive and mathematical abilities. Here we try to offer the students the opportunity to supplement and reinforce the Math they learn at school. This project aims to cover the full curriculum of middle and high school. In this program there are 6006 registered individual users, 229 registered schools and 237 video classes available, as well as a number of interactive activities.

# 4 Programs for teachers

In this section we describe OBMEP programs which have middle and high school teachers as their specific targets.

### PROF (Programa Oficinas de Formação)

This program aims to train teachers in problem solving activities for the classroom. This is done in a one semester period by way of weekly meetings and virtual activities. Teachers work with a special team of university professors, using the Problem Sets and past OBMEP exams as their basic material. PROF poles are concentrated on a few states in Brasil; at the moment, enrollment is of 175 teachers.

### OBMEP in the School (OBMEP na Escola)

Here OBMEP selects and certifies, by way of a national exam, middle and high school teachers with high mathematical ability. They are then trained, via presential workshops and virtual tutoring, in the use of OBMEP materials so as to lead extra class problem solving activities in their own and neighboring schools.

# 5 Publications

Here we present a brief view of OBMEP publications.

### Exams and solutions

OBMEP makes available all the exams and their solutions. These solutions are carefully written by members of the Exam Committee and are intended to serve as models of mathematical exposition, as well as tools for classroom work. Solutions are also provided in video format; in those videos, carefully chosen expositors solve the problems on a blackboard, as if on a classroom.

### Problem sets

Every year OBMEP sends schools a thick volume of problems, both original and culled from other sources, intended for both class and extra class work. Again, solutions are provided and written very carefully.

### PIC texts

These texts are written by professional mathematicians and are intended for use in PIC. Subjects are chosen so that the students will have the opportunity of working with non-curricular topics.

### Videos

Besides the videos of the solutions of the exams and others mentioned above, OBMEP provides a large number of videos of instructional nature. It would take us too long to describe all of them here; we refer the reader to the corresponding link in OBMEP's webpage. However, we should make mention of the ongoing *Video-aulas* project, whose aim is to make available video lessons which will cover all the Math curriculum of middle and high schools. These lessons are given by a carefully selected number of teachers from middle and high schools, as well as universtity professors.

### Math around the world

We should also mention this link in OBMEP's homepage, where one can find links to articles and sites of interest, publications, other olympiads, Math societies around the world, resources for teachers and students and many other Math-related subjects.

## 6 The future

Finally, in this section we mention a couple of ideas not yet fully developed, but which we expect to see taking place in the near future.

### OBMEP $10^{\text{th}}$ Aniversary Meeting

We plan to mark OBMEP's $10^{\text{th}}$ Aniversary by a special meeting of the mathematical/educational comunity in Brasil. The idea is to discuss what we have achieved so far, to reflect on what we did right or wrong and to plan for the future.

### Math Festivals (Festivais de Matemática)

We intend start a program similar to those of the project *SNAP Mathfairs* (`www.mathfair.com`), aimed at kids in fundamental school. This is under preliminary discussion at the moment.

## 7 One quantitative result

In this section we report a result found in [3]. Every two years, in order to evaluate the quality of teaching in general, MEC gives all public shool students finishing middle school an exam called *Prova Brasil*. Schools who took part in OBMEP in the period 2005-2011 were divided in groups of low, average and high participation and their students' average grade in the Math section of *Prova Brasil* were compared. It was found that the difference between the average scores of students of high and low participation schools was of 9 points in 2007, 11 in 2009 and 15 in 2011. In the scale used in this study, 18 points correspond to the average expected yearly proficience. What this data says, then, is that high participation in OBMEP, compared with a low one, increased students' proficiency in Math by almost one school year as of 2011 and, furthermore, that this is an increasing trend. This shows that, indeed, OBMEP has a strong impact in the teaching and learning of Math in the public school system in Brasil.

## 8 One qualitative result

Here we relate a typical OBMEP story; uncountable others of the same nature happen all over Brasil.

Dores do Turvo is a small town in the rural region of the Minas Gerais state, with a total population of 4500 and only one middle and high school. Since the first edition of the OBMEP, students of this school have received 10 gold, 10 silver and 28 bronze medals, as well as 118 honour certificates, on an increasing pace over the years; this makes this school the top scoring one in Brasil. This happened because a teacher decided singlehandedly that the school would do well in OBMEP and started training students out of class; a school direction and parents who gave full support to the initiative, which became a continuing program; and strong support from City Hall.

Results, though, are not measured in OBMEP prizes alone. The kids in this school now excel in other olympiads such as Portuguese, Astronomy and Physics; they have also developed a strong feeling for teamwork, as well as the values of study and knowledge. And, more important than anything, they are getting – in increasing numbers – university degrees in areas as diverse as Engineering, Computer Science, Law and Medicine. We can confidently say that OBMEP, together with devoted teachers and community and government support, was a tool in changing their lives for the better.

## References


[1] Druck, S. and Spira, M.: "Math Olympiads for the Public Schools in Brazil". *Mathematics Competitions*, Vol. 21 no. 2 (2008), pp.20-30.

[2] Camacho, C.:"The dissemination of Mathematics in Brazil: Searching for Talent among Schoolchildren". EMS Newsletter, September 2011.

[3] Soares, C. M. M., Leo. E. and Soares, J. F.: "Avaliação do impacto da Olimpíada Brasileira de Escolas Públicas (OBMEP) sobre o desempenho dos alunos na Prova Brasil de Matemática". Preprint, Belo Horizonte, May 2014.