

Rising the national education level should be an objective of mathematical competitions

Proposal to DG 19: "The role of mathematical competitions and other challenging contexts in the teaching and learning of mathematics"

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January 22, 2008

Abstract

Usually, when organizing mathematical competitions at national level, we concentrate in having the best possible team: choosing the best competitors and training them the best way. After some years, the organization of the selection and preparation of the international teams runs by itself, is our experience in Mexico, although we still have to increase the level of our competitors. However, the more important part and what will contribute to raise the mathematical education level of the country is to look back at all those students left behind that are not part of the selection, and also all the professors in charge of preparing their students, for them the competitions are an excellent motivation.

I am convinced that the primary long term objective of the organizing committee of a mathematical contest has to be the national education level. I have participated in the Mexican Mathematical Olympiad as a student, teacher and team leader. The most motivating work I had done with the olympiad were the lectures I gave to high school professors with the project of the mathematical calendar. I will explain this experiences and the path I see to use the mathematical olympiads to go further in changing Mexico's national level of (mathematical) education.

*Financed by Consejo Nacional de Ciencia y Tecnología, Mexico.

For the last eight years I have participated in the project of the mathematical calendar. This project began in one state of Mexico and was realized in collaboration with the national committee of the Mexican Mathematical Olympiad (MMO) and the national ministry of education. The calendar is printed each year and contains one problem for each day of the week. Some copies are given to high school professors for free so they can use them in their classrooms. The process of giving such copies to high school professor involves going to different parts of the country to work with them using the problems that appear in the calendar. This activity is done through problem solving classes, thus we introduce them to this approach to teaching and to challenging problems as the ones that appear in the olympiad exams, usually less mechanical than the problems used in ordinary school classes. Another part of this project consists in going to weak states to help them with the organization of the local process of selection and preparation of the students that will participate at the national contest.

In the first activity, some professors where quite interested in the approach we have to students in the olympiads, that is letting them think independently on the problems. However, most of them where not interested in changing their way of teaching, but I think we have to insist to change at least one of them at a time.

Can problem solving be a way of teaching in ordinary school?

Is there enough time to cover the program of a year with this approach?

As a mathematician, I keep thinking that the only way to truly learn mathematics is when you think by yourself. Professors, for me, should give the right problems and lead students to look for their own solutions.

But, is this possible in an ordinary school classroom?

How to deal with non motivated students, or how should professors motivate all of them?

The second activity of the project was motivated by the difference of level between different teams, at the national contest of the Mexican Mathematical Olympiad. This difference is huge and gets larger as the years go by. Strong teams become stronger and weak teams do not ameliorate. I think this is a current situation in almost all contests and minimizing such a difference should be an objective of the organizing committee. This is why, another part of the project consists in going to weak states and help them preparing the local team. Working with the selected students of such states was highly regarding, I was surprised by the progress of their team after one week of hard work. The consequences of this work were stunning not just for the results of

that year team, students and professors became more interested in preparing next year's team and so on. I realized that this states are weak not because there is no motivated people to organize the local contest, but because they do not know how to do it and how to prepare their students. Almost all the professors involved where incapable of understanding the problems in the olympiad books.

I think encouraging strong states to help others so they can be at the same level is a fundamental activity towards making the contest more known and fair. Preparing students today, implies having motivated people to work on the olympiads and on education tomorrow. Professors and students of such states will be more interested in participating, there will be more contestants at a first local stage of the composition. The selection will be done between a larger number of students, which is not only a positive thing towards having a better national team, it is also an excellent way of introducing problem solving as a way of teaching.

Olympiads have two invaluable resources: the ancient competitors and the experience of teaching through problem solving. Ancient competitors are normally enthusiastic in teaching new competitors and motivating students of their school to participate. Organizing and supporting them in this kind of activities can make the olympiad go in the other direction: that is changing the national education level and not just creating an elite of highly prepared students. Actually both resources go together, as participants of the olympiads take their new knowledge to their schools, professors will have the opportunity to see this approach to mathematics. In the case of Mexico, this is completely knew for almost all high school professors.

Going a little bit further, I propose another approach for rising national level of mathematical education: to work directly with younger children that are actually in primary school. The change of education should start at this level as it is well known. The collaborators of the mathematical calendar, are actually working on a project of a classroom on a trailer to reach isolated communities of our country and have the opportunity to work directly with young children. We want to make children think by their selves. The approach we choose are challenging games and we will complement our work with artistic activities. We think that eventually parents and local teachers will approach to us and will participate in the activities. Our idea is going to a community for a period of three weeks and then come back at least three times during the year. The implication of the local teachers will be fundamental for this project.

Seeing Mexico's level of mathematical education makes me sometimes think that this efforts do not go anywhere, that what we need is to change all teachers (or almost all). But real changes are not done by magic, there should be a process. That is why I think that giving one professor or one student the possibility to approach mathematics differently, to understand mathematics and to discover its beauty is a first step in changing. There are lot of political problems involved in the education system, this projects are a good way to approach children, students and teachers without dealing with most of the politics.

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