

*МАТЕМАТИКА И МАТЕМАТИЧЕСКО ОБРАЗОВАНИЕ, 2013*  
*MATHEMATICS AND EDUCATION IN MATHEMATICS, 2013*  
*Proceedings of the Forty Second Spring Conference*  
*of the Union of Bulgarian Mathematicians*  
*Borovetz, April 2–6, 2013*

## **SOME THOUGHTS AFTER THREE YEARS OF WMTC**

**Quan K. Lam, Zhou Guozhen**

Despite having thousands of math competitions around the world, World Mathematics Team Championship (WMTC) stands out as one of very few team-oriented international math competitions. In this article, we want to show how WMTC is different from many of the traditionally run math competitions. We will also describe how WMTC raises and cultivates the math interest of students, especially female students and students from disadvantaged background, and how it instills skills that students need when they enter colleges and job markets. At the end, we will detail some of the difficulties in designing problems for international competitions.

In January of 2010, the authors thought it would be very beneficial for the international math community to organize a team-oriented international math competition. This competition, the WMTC, would be held in Beijing.

The first competition lasted for four days, and subsequently, we have lengthened it into a five days event, during the last week of November 2010. Almost eighty teams from eleven countries and regions, consisting of a total of about five hundred students, attended the competition. Since this is mainly a team competition, each team consists of six students with one or two alternates and goes through three rounds of competition: the Team Round, the Relay Round, and the Individual Round. During the four days, students and coaches spend one day to know other students and coaches and have registration/meetings. One day is dedicated for the Opening Ceremony and the actual competition. The remaining days are spent on sightseeing tours and the Award Ceremony. Based on the overwhelmingly positive response from parents and students, we are excited to make this an annual event. One parent even wrote how she noticed her son's attitude toward academic work and toward people had changed after they all came back from the trip.

Unlike other math competitions that focus mainly on high school-level students, WMTC specifically targets 3 levels – Junior, Intermediate, and Advanced. By exposing the traditionally low representation of girls and students from disadvantaged backgrounds to math at a young age, a love of math can be instilled in them before societal pressures could potentially turn them away from math, science, and technical fields. The organizers of WMTC noticed a lack of collaborative environment in other math competitions and camps and wanted to fill that void by focusing on team-building and group-oriented challenges. By encouraging students to work together toward a common goal, math competitions become less intimidating, giving them the opportunity to participate and to think creatively. The bond students build with each other is highly valued and the

ultimate goal is to inspire them with a deep curiosity for math that will follow them for the rest of their lives.

Working in teams gives each student a voice and essential role in the teams' success, thereby not only encouraging and nurturing their interest in math, but also ensuring that it is instrumental in unlocking each student's own potential. We have found girls and disadvantaged students are much more likely to join math activities when they are doing team math rather than competing individually, as it is less intimidating to them. Our primary objective is not to find students who are already exceptional in math, but to find students who are passionate about math. Team-work through group problem sets and relay rounds help empower these participants into believing in their ability to understand and articulate math.

Mathematics is an integral part of a student's academic training, especially if this student is planning to go into technical fields when entering the job market. However, in order to be successful in a company, it takes more than just technical skills. It takes good communication and teamwork skills so a worker can share his/her ideas with colleagues and be able to work cooperatively in a team environment. There are many international math competitions that allow the most elite students from around the world to compete and to excel but they do not provide the opportunity for the students to work collaboratively. What this competition offers is an international math competition that gives students a place to solve problems together as a team and to demonstrate their math skills as individuals. WMTC differs from most of the other competitions in three main aspects:

1. WMTC puts more emphasis on teams rather than on individuals. We believe math competitions should be more than just determining winners or finding the person with the highest score. WMTC promotes the spirit of cooperation. Students have to learn how to share tasks, they need to know the strengths and weaknesses of their team members, they need to learn time management, they have to check each other's solutions, and in the case they have derived different answers, they have to be able to reconcile their differences and come to an agreement. WMTC recognizes both individual and team winners.
2. The competitors live together and participate in recreational activities together. Students spend four days in Beijing competing, participating in activities, and touring the world famous Beijing sights. Not only do they get to know their team members better, they get to interact with members in other teams from other areas. We would like to think that WMTC is more than just a math competition; it promotes and encourages members to make friends with others, to appreciate cultures from other regions of the world, and to discover how other students learn and solve math problems.
3. We believe an important outcome of a competition is not just to determine top students or winners, but to also raise a student's interest in mathematics and to discover the beauty and logic in it. Traditionally, there is an absence of female students and students from disadvantaged backgrounds in the field of mathematics. This absence is not so profound in primary school or even in middle school level. However, by the time a student reaches high school, he or she is either very

interested in math or not at all. We believe we should cultivate a student's interest in mathematics when he or she is in primary school where they are more receptive to learning mathematics. That is the reason why WMTC has three levels of competition: Junior, Intermediate, and Advanced.

WMTC is fundamentally built around collaboration and communication. This instills the participants with the belief that they all have a say in the outcome, that each of their voices is important, and that their method is just as important as the answer. We want to recruit students and offer them an early start in training and cultivating an interest in math. We encourage our students to look beyond our border and see what other regions are doing in math training, especially at the primary and middle school levels. We think it is important to bring our primary and middle school students to interact and to compete with similar level students from all over the world, as it would be an excellent way to cultivate their interest in mathematics.

### Description of competition

**Team:** 40 minutes to solve 20 problems, 5 points per problem, total 100 points.

Discussion is allowed. Each team submits one answer sheet.

Points count toward team score equal to the total score of the team round.

### Individual:

10 minutes each round for 5 rounds;

Rounds 1–3 – 4 problems each round, 2 points per problem, total 24 points;

Rounds 4–5 – 2 problems each round, 4 points per problem, total 16 points;

Points count toward team score equal to 1.5 times the average score of 6 members in a team.

**Relay:** Each team divides into 3 groups with 2 persons in each group;

8 minutes each round for 3 rounds;

Each round has 2 problems as a set for each group to do relay;

For each set, only the answer from the second member of the relay group will be counted;

5-minute answers worth 20 points, 8-minute answers worth 15 points;

Total possible points for each group is 60;

Points count toward team score equal to the average score of 3 groups in a team.

	Rounds	Problems	Times	Points each problem/set	Points each round	Method Team Score	Team Total
<b>Team</b>	1	20	40 min.	5	100	$\times 100\%$	100
<b>Relay</b>	3	6	24 min.	20/15	60	Average	60
<b>Indiv.</b>	5	16	50 min.	2/4	40	Average $\times 1.5$	60

Language: Chinese & English

Electronic devices such as calculators or computers (including laptops, notebooks, tablets and mobile phones) are not allowed during any of the above rounds.

## Awarding process

### Group Divisions in 2012

**Junior Level** – For participants born in 2000 or later

**Intermediate Level** – For participants born in 1997 or later

**Advanced Level** – For participants who are not high school graduates in 2012 and who were born in 1994 or later. Younger age participants may participate in higher level.

## Awards

**Team Awards:** In each division, the top 1/3 of the teams are ranked and get trophies and each of the team members gets a gold medal and a certificate. The other 2/3 teams get participation awards.

**Individual Awards:** In each division, the top 10% scoring individuals get gold medals, the next 20% scoring individuals get silver medals, the next 30% scoring individuals get bronze medals, and the next 40% scoring individuals get merit medals. Each individual gets a corresponding certificate. Individuals are also ranked by scores and each of the top three scoring individuals in each division gets a special trophy and a scholarship to honor his/her ranking.

## Statistics

- 2010: 73 teams of 6 members each;  
19 teams from outside mainland China (26%);  
No member from outside mainland China had placed on top three;  
Taiwan Taizhong Team placed 3<sup>rd</sup> in Advanced Level.
- 2011: 63 teams of 6 members each;  
17 teams from outside mainland China (27%);  
1 Philippine student placed first in Junior Level;  
Philippines Team placed 2<sup>nd</sup> in Junior Level;  
USA Team placed 3<sup>rd</sup> in Intermediate Level.
- 2012: 92 Teams of 6 members each;  
40 Teams from outside mainland China (over 45%);  
5 out of 10 scholarship winners were from outside mainland China (50%);  
Hong Kong Team placed 1<sup>st</sup> in Junior Level.

We are happy to say that WMTC is marching toward our goal of a truly international competition after three years of operation.

## Difficulties in designing problems for international competitions

1. To minimize the request for translation, problems must be short, concise, and use simple words.
2. Problems must be diversified reflecting teams from various parts of the globe. To make an international competition to maintain this diversity, teams from different regions must actively and aggressively contribute problems that represent these regions' culture and math education system.

3. Problems must reflect the mathematics level of students from these various regions.
4. Problems should not contain reference to stories or background that only students from one region can understand.
5. Problems should not require judgmental or relational answers.
6. Problems should not require multiple choices in which students can easily take wild guesses.
7. Mathematics education system is constantly changing. Problems should reflect the current international mathematics trends.

Quan K. Lam  
105 Julian Way  
Pleasant Hill  
California 94523, USA  
e-mail: quan.lam@berkeley.edu

Zhou Guozhen  
WMTC Co-Founder

## **НЯКОИ МИСЛИ СЛЕД ТРЕТОТО ИЗДАНИЕ НА СВЕТОВНИЯ МАТЕМАТИЧЕСКИ ОТБОРЕН ШАМПИОНАТ (СМОШ)**

**Куан Лам, Чжоу Гуоджен**

Независимо, че има много математически състезания по света, Световният математически отборен шампионат (СМОШ) е едно от малкото международни отборни състезания. В статията авторите показват някои от спецификите на СМОШ, отличаващи го от традиционните математически състезания. Показано е по какъв начин СМОШ провокира и култивира интерес към занимания с математика, особено при момичета и ученици с ограничени материални възможности. Отбелязана е ролята на шампионата при изграждането на умения у учениците, необходими им в коледите и в бъдещата им професионална реализация. Споделени са и някои проблеми при съставянето на състезателни задачи за международни състезания.