Journal of the Korean Society of Mathematical Education Series D:
Research in Mathematical Education
Vol. 13, No. 4, December 2009, 331–339

韓國數學敎育學會誌 시리즈 D:
<數學敎育硏究>
제 13 권 제 4 호 2009 년 12 월, 331–339

The Olympic Mathematics Education in China[1]

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(Received May 30, 2009. Accepted December 13, 2009)

The research on the Olympic mathematics education has become an internationally recognized educational activity. In some cities of China, especially big cities, the Olympic mathematics education is developing like raging fire.
Many parents send their children to training school to get the Olympic mathematics education, no matter whether the children are willing to or not. They hope that through the training, their children can be outstanding when entering higher school. However, this practice has deeply affected children's learning initiative. In this paper, we analyzed both the history and the present situation of the Olympic mathematics education in China. We have some suggestions based on the problems emerging nowadays.

Keywords: Olympic mathematics education
MESC Classification: B60
MSC2010 Classification: 00A06, 97B60

1. INTRODUCTION

What is the Olympic mathematics education? It has been more than hundred years since the first organized competition on mathematics, the Hungarian Mathematics Competition in 1894 (Zhu, 2007). In 1934, the former Soviet Union organized the secondary school mathematics competition in Leningrad and, from 1935, All Union Mathematics Competition was held in Moscow. In 1959, Romania hosted the first

[1] The authors were supported in part by the Teaching Research Fund of Shaoyang University, Project #2008JGY15.

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International Mathematical Olympiad (IMO).

As an international event set by mathematics educational experts in the world, the topic scope of the IMO surpasses all nations' compulsory education level, and its difficulty is greatly beyond the university entrance examination. The previous IMO competitions show that the event is very functional in the promotion of the international science and education exchanges, a higher level of science education, and the mutual understanding of young students of countries, thus inspiring the majority of secondary school students' interests to learn basic scientific subjects, helping to discover and cultivate young talents.

This activity has provided mathematics talents in the world with a stage for competition and exchange of their experience; more countries joined the IMO competition, and it has received the concern and support from UNESCO and other international organizations. The Olympic mathematics education comes into being in accordance with the IMO competitions.

2. THE OLYMPIC MATHEMATICS EDUCATION IN CHINA

The Olympic mathematics education is playing a much major role in China. China pays great attention to the Olympic mathematics education comparing with other countries in the world (Zhu, 2007). In China, especially in big cities, there exist many of the Olympic mathematics training schools, and more and more students go there during summer and winter holidays, even weekends.

In recent years, many kinds of out-of-school mathematics training classes whose teaching level is higher than regular classroom mathematics course seek to be crowned by the "Olympic mathematics class," causing the Olympic mathematics training to be separated from the regular track for the selection of the Olympic mathematics match contestants, highlighting the pan-popularity characteristic.

Although many well-known mathematicians and mathematics educators warn against the off-tracking of the Olympic mathematics, it is still difficult to prevent the connotation of the Olympic mathematics from being magnified due to the subtle relation between contestants' performance in the competition and their entrance to colleges. Many out-of-school training classes and various cup matches, for example, "Tsu Chongchih Cup" and "Lookeng Hua Cup" sponsored by schools and associations, are called with the "Olympic mathematics" divorcing from the textbooks with too much emphasis on the skills.

Training schools can be divided into two kinds of public and private. Public training schools only accept excellent students without any charge, and there are always a fixed number of trainees, *e.g.*, 10 or 20 for each class. By contrast, trainees in private training schools pay for it and there is no quota for the number of students. Not all public schools

are entitled to the chance to send contestants for the competition, only top students from celebrated schools are qualified to participate in it. Consequently, the private training organizations are thriving with a group of experienced and able coaches.

Now, not all top students in mathematics go to the training classes for the competition. most of top students in mathematics, who are not interested in the Olympic mathematics, However are forced by their parents to go there for further studies. The parents assume that as long as their children participate in the Olympic mathematics training, the children's academic performance will be improved. Based on the above ideas, therefore, whether children are willing or not, and regardless of their actual mathematics ability, parents force their children to receive the Olympic mathematics training.

By rights, mathematics competition is to cultivate students' interest in mathematics, finding their mathematical ability. If this work begins not ready, in junior make mathematics competition, haste makes waste most people will gradually lose problem-solving skills, even lose interest in mathematics. Middle school mathematics emphasizes logical, with the primary contest intelligence game have very difference. If not play well, and have great partiality, many students can not adapt to the middle school mathematics. But university mathematics differs from middle school mathematics; this is one reason why some IMO gold medal winners are unfit for mathematical study.

The Olympic mathematics competition has taken place in high school, and even in the middle of pupils. Only those who are interested in mathematics for the students to attend, even all students. Fan & Yang (2009) said, "So many children attend the Olympic mathematics class, go to the Olympic training mathematics school, join local and provincial Olympic mathematical contests, in doing so, it not only can cultivate student's mathematics attainment, but will also give students heavy burden of competitions and weariness, this brings the exam-oriented education consequences.

All these can be demonstrated by our investigation, which was carried out in the mathematics department's three classes of new students continuously in 2008 autumn.

We took the way of questionnaire survey, choosing at random 120 students from 12 different provinces or cities. We set such question: Have you ever participated in the Olympic mathematics training? The result shows that 52% of them say yes, only with different amount of training time.

They said that their purpose for the training was mainly to be well-equipped for the college entrance examination. Some participants who got a satisfactory result in the college entrance examination thought it was effective, but some others didn't. People vary in their views on this phenomenon. Some people think that students' intelligence can be developed in the training and thus the training school should keep on going (Shen, 2002; 2004). Yet some others hold the opposing opinion; they insist that mathematics training has tired the people and squandered resources, aggravated both the students' and their

guardian's pressure. The education administrative department should give warning to the training school. We, along with many other parents, agree on the latter.

However, every coin has two sides; we should correctly understand the Olympic mathematics education. There is no doubt that it can inspire the thinking of students, promote intellectual development for them. On the other hand, it also has many drawbacks. It puts too much emphasis on problem-solving skills, and doing a large number of difficult questions consumes a lot of time and strength; the development of other disciplines has been affected. Therefore, we can not simply treat the Olympic mathematics education as a good practice.

3. HISTORICAL REVIEW

In 1985, China sent out two contestants to participate in the 26th IMO competition the first time. The purpose of that was to be familiar with the situation and get some experience. As a result, we got a bronze medal. Formal participation[2] of Chinese team to the International Mathematical Olympiad started in 1986.

According to our statistics, China, from 1986 until 2008, won a total of 132 medals, including 101 gold medals.

At the same time, four top universities jointly sponsored the Olympic Mathematics Winter Camp, training the candidates for the coming year IMO. The winter camp participants were those who got the provincial championship in the national tournament for high schools (about 20 in total).

From 1991, the winter camp was renamed as the "Chinese Mathematics Olympics" (CMO), the CMO tests are similar to the IMO tests, which go in two periods of time (in two days), 3 problems each time(lasted 4.5 hours), 21 points for each problem, the total score of the two tests is 126 points. 20 top contestants are selected by the CMO to form the national training team. After a certain period of training, 6 of them are selected to participate in the next IMO. In 1986, the Chinese team got 4 gold medals in the 27th IMO and more gold medals in the later years (see Table 1).

Some 100,000 students are going to take part in the National High School Mathematics League each year, and produce a total of 1000–1200 the first prize. The 180 outstanding students are picked out from the league they have eligible to participate the "CMO National Middle School Mathematics Winter Camp" by organized the Chinese Mathematical Society. National Sports Team have 35 contestants every year, they come from the winter camp. National Team contestants, 6 every year, be selected from National Sports Team, representing their country to participate international competition.

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[2] Each participating country can send up to six contestants each IMO.

Table 1. The Chinese team's achievements in IMO

Date*	Gold medals	Silver medals	Bronze medal
1985	0	0	1
1986	3	1	1
1987	2	2	2
1988	2	4	0
1989	4	2	0
1990	5	1	0
1991	4	2	0
1992	6	0	0
1993	6	0	0
1994	3	3	0
1995	4	2	0
1996	3	2	1
1997	6	0	0
1999	4	2	0
2000	6	0	0
2001	6	0	0
2002	6	0	0
2003	5	1	0
2004	6	0	0
2005	5	1	0
2006	6	0	0
2007	4	2	0
2008	5	1	0
Total	101	26	5

* Note: In 1998, China has not participated in IMO.

From the above Table 1 we can see that in the past 23 years, the Chinese team's brilliant achievements have greatly encouraged the Chinese people's morale. The government highly rewards the winners not only monetarily, but also gives them the direct access to the top universities.[3]

According to our statistics, gold medal winners mainly come from Hubei, Beijing, Shanghai, Hunan, and Guangdong, in which the education level is much better than in other places. These provinces and cities value the "IMO" competition and they have

[3] The state's policy is that the gold medal winners of CMO or IMO can enter the domestic top universities, and are likely to receive full scholarships.

established the management mechanism, put in massive manpower resources and the financial support. The candidate students need to receive 3 years of strengthening training, then get through layer-upon-layer selections, the final contestants are very strength.

In China, the "IMO" is jointly sponsored by China Association for Science and Technology, the Ministry of Education and the National Natural Science Foundation. The teenagers department of the China Association for Science and Technology is in charge of the concrete work such as competition participation abroad and handles, jointly with some related nationwide specialized academic society, the job of candidate selection, training, and team formation.

4. OLYMPIC MATHEMATICS EDUCATION ANALYSIS

In China, Olympic mathematics education is often welcomed; people have a strong wish to the study. As long as the contestants can be winners, they will get certain benefits. For instance, "Lookeng Hua Cup" prize-winners are likely to be enrolled by the top junior middle schools; the national junior middle school league tournament's prize-winners will receive the top high school's acceptance, (usually earlier than high school entrance examination); the national high school league tournament's prize-holders can get the attention of college administrators, and the champion enjoys the prestige of being recommended for admission to some famous university. Based on the above situation, many parents require their children to receive Olympic mathematics education.

The Olympic mathematics contests are very challenging; they are conducive to the enhancement of the students' curiosity, to their interest in learning mathematics, and to their mobilization of learning enthusiasm and initiative. Olympic mathematics is the intellectual competition; it mainly aims at discovering and cultivating mathematically talented young people, fostering their exploring capacity, their overall quality and innovative spirit. However, we should know that the door of Olympic mathematics education is open only to the extraordinary intelligent students, not to all ones.

In the real sense, the parents do not understand their children. They do not know whether their children like mathematics or not. They based their subjective wishes on that as long as the children learn Olympic mathematics, the children may raise the mathematics level, improving their mathematical test performance.

However, the out-comings are not as what they imagine. Some of the children spend a lot of time learning mathematics, but their mathematics ability remains the same. Some others spend too much time learning mathematics but ignoring other subjects, affecting their overall ability. There are still some children even develop a psychological harm to mathematics due to overwork on mathematics problems.

Table 2. Chinese Gold Medalists in IMO

Name	Year (IMO)	Academic achieve, field	Affiliation
Jing, Qin	1986(27th)	Teacher	Harvard University
Gao, Xia	1987(28th)	Teacher	Peking University
He, Yuhong	1988(29th)	Professor, Mathematics	Georgia University
Chen, Xi	1988(29th)	Professor, Mathematics	Alberta University
Zha, Yuhan	1988(29th)	Researcher	Chinese Academy of Sci.
Luo, Huazhang	1989(30th)	Dr.	Software Co.
Yu, Yang	1989(30th)	Lecturer	Ohio University
Huo, Xiaoming	1989(30th)	Assistant Professor	Georgia
Tang, Ruoxi	1989(30th)	Dr. Statistics	
Yan, Huafei	1989(30th)	Professor	Texas A&M
Wang, Jianhua	1990(31st)	Dr. Mathematics	Software Co.
Wang, Song	1990(31st)	Professor, Mathematics	De Montfort University
Ku, Chao	1990(31st)	Dr. Mathematics	UIC
Luo, Wei	1991(32nd)	Dr. Mathematics	Zhejiang University
Zhang, Lizhao	1991(32nd)	Dr. Mathematics	
Wang, Shaoyu	1991(32nd)	Dr. Mathematics	Yale University
Yang, Baozhong	1992(33rd)	Dr. Finance	
He, Simai	1992(33rd)	Dr.	
Zhang, Yin	1992(33rd)	Dr. Computer Science	University of Texas
Yang, Ke	1993(34th)	Dr. Computer Science	Google Co.
Yuan, Hanhui	1993(34th)	Teacher	South Normal University
Zhang, Jian	1994(35th)	Dr. Mathematics	Moscow State University
Yao, Jiangang	1994(35th)	Dr. Mathematics	UC, Berkeley
Peng,Jianbo	1994(35th)	Dr. Computer Science	New York University
Xi, Chenhai	1994(35th)	Dr. Computer Science	University of Pittsburgh
Wang,Haidong	1994(35th)	Dr. Computer Science	Stanford University
Cheng, Chang	1995(36th)	Dr. Electronic Engineering	UC, Berkeley
Zhu, Chenchang	1995(36th)	Dr. Mathematics	UC, Berkeley
Lin, Yizhou	1995(36th)	Dr. Computer Science	UC, Los Angeles
Yao, Yijun	1995(36th)	Dr. Mathematics	Paris Polytechnic Univ.

What is more, some of prize winners do not like to study mathematics any more after entering university. Statistics shows that few gold medal winners choose to engage in mathematics research (see Table 2). China currently is a very large country with exam, because of too low honesty. In addition to test and competition, it is hard to imagine a more just and objective measures to select talents. And mathematics exam, which is to objective and fair and low cost, do not like doing the experiment requirement. Therefore,

as the criteria of selection of talent, China like to make mathematics competition is a reason.

Although Chinese contestants can often obtain the gold medal in the IMO, few of them have grown into mathematician. Statistics indicates that in the past 20 years, over 4000 students have obtained the provincial level (or above) reward. In the end, less than 20% specialize in studying mathematics. Nobody knows why (You, 2008).

China is a "big country with IMO gold medals," but we still have no stand on the podium of the Nobel Prize. There is a non-controversial fact that the Chinese college students' innovative ability is far poorer than their counterparts in developed countries, China's overall level of science and technology lags far behind that of developed countries. Faced with such a grim fact, how can we feel complacent with the title of "big country of gold medals"?

Professor Lo Yang (Chinese Academy of Sciences) said,

> "Now many people think our students obtained medals in the International Mathematical Olympiad get honor for China. But we also see behind these medals, our students in the International Mathematical Olympiad, through layer upon layer selection process exam, strengthen training in Winter Camp, and reduce other courses. "

This is not a heuristic centralized guidance, but more and more are on the training strategies. In this case, the position cannot explain our contestants' mathematical level above foreign contestants (Fan & Yang, 2009).

Professor Shing-Tung Yau (Harvard University /United States National Academy of Sciences) recruited a couple of Chinese students, including some "IMO" gold medalists who were regarded as mathematical genius in China.

None of them could get the professor's approval to start mathematics research until after a certain period of preparatory training.

Yau believed that Chinese domestic media sensationalized IMO, intensifying its attraction to the public. Some prestigious universities directly enroll the prize-winners. In fact, it is quite normal for some students to be able to solve slightly difficult mathematics problems, but the heated pursue and admiration of the society to the IMO champions bring into them too much self-satisfaction, they no longer assiduously keep going in the road to the realm of mathematics, they take "Olympic mathematics" as the final goal of studying mathematics. Yau (2006) said: "How can these small-problem-solvers become great mathematician?"

International Mathematical Olympiad is only a test of knowledge, a test of the contestants' ability. To be scientific researchers, we should learn how to think and how to research, not how to do a test. Therefore, it is time that we reflected on the honorary title of "Olympic mathematics gold medals country."

The key of mathematics education lies more in cultivating the interest of students and

their ability of independent thinking than in getting awards in the IMO.

ACKNOWLEDGMENTS

We are grateful to the referees for a careful reading of the paper, and for their comments and suggestions.

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