YOUTH

Figures of importance

Speakers at the 14th International Congress on Mathematical Education put an emphasis on the training of teachers to be able to implement diverse curricula that inspire children and make the subject fun, **Cao Chen** reports in Shanghai.

China will enhance the quality of math teachers both in urban and rural areas, make study fun, and strengthen academic exchanges with the world for the development and progress of science, technology and civilizations, according to Weng Tiehui, vice-minister of education.

Learning math will deepen children's knowledge of basic science and help them explore possible relationships among abstractions, which will improve brain power for lifelong benefits, said Weng at the opening ceremony of the 14th International Congress on Mathematical Education held at East China Normal University in Shanghai on Monday.

"To inspire students' interest in math, we should make math classes fun, while avoiding repetitive, excessive training," she suggests.

"Mathematics is the common scientific language of the world, and mathematics education is a cause that requires the dedication of global practitioners. In addition, skilled teachers are at the heart of excellent math education," she adds.

Weng took Shanghai as an example. According to Weng, local teachers there have been engaging in teaching groups and research activities for personal professional development. Over 20,000 math teachers in primary and secondary schools from Shanghai and the United Kingdom have taken part in a China-UK math teacher program, jointly launched by both countries in 2014 to observe classes and share experiences. In 2018, a teacher education center was established in Shanghai, supported by UNESCO, aimed at fostering international teacher training exchanges.

"We're aware that the country still faces the challenge of inadequacy and inequality of education resources, and we will be dedicated to improving children's access to quality education in remote areas," says Weng, adding that a national training mechanism has been established to train around 618,000 math teachers in rural areas.

Weng expects that "experts participating in the congress will offer advice on the training of teachers in China and accelerate long-term global cooperation for the progress of science, technology and civilization".

The opening of the 14th International Congress on Mathematical Education at East China Normal University in Shanghai on Monday.
GAO ERQIANG / CHINA DAILY

Shanghai Party Secretary Li Qiang points out the crucial role of mathematics in driving the city's scientific and economic development.

"For instance, the development of artificial intelligence is mainly data-driven, which is inseparable from the work of mathematicians," Li says.

"The city will provide more solid support for the application of mathematical sciences and the development of related industries, especially integrated circuits, AI and biomedicine, for the city's digital transformation and a better life through innovation led by mathematics," he adds.

Cedric Villani, director of Institut Henri Poincare in France and 2010 recipient of the Fields Medal, the highest scientific award for mathematicians, stresses the role of mathematics as "an art as old as civilization" in his keynote speech.

"Mathematicians have always had a privileged role in society, as problem solvers, guardians of an art, deeply attached to values of intellectual freedom and the challenging of opinion," Villani says.

He also accentuates the most important characteristics of a mathematician — persistence, imagination and rigor — which would facilitate a successful career in the subject.

As the largest international conference on math education, the event, organized by the International Commission on Mathematical Instruction, will run through Sunday.

Over 2,200 experts and teachers in mathematics from 129 countries including the United States, France and Canada, will be present at the meeting or will join online, sharing insights on research and development in the field.

This is the first time the ICME has been held in China. Activities, such as plenary lectures and workshops, are available to participants, covering topics including challenges of math teaching amid the COVID-19 pandemic, math education for children under 7, and math textbooks for primary and secondary schools in China.

The opening ceremony also saw the awarding of three prizes recognizing outstanding achievement in mathematics education research and practice. Deborah Ball, professor of education at the University of Michigan in the US, and Tommy Dreyfus, professor Emeritus of Mathematics Education at Tel Aviv University, Israel, were the 2017 and 2019 laureates of the Felix Klein Award, respectively, for their lifetime achievements in math education.

The Hans Freudenthal Awards for 2017 and 2019 were respectively given to Terezinha Nunes, professor of educational studies at the University of Oxford in the United Kingdom, and Gert Schubring, a long-time member of the Institut fur Didaktik der Mathematik at Bielefeld University in Germany, for their innovative and highly influential programs of mathematical research.

The National Council of Teachers of Mathematics, based in the US, won the Emma Castelnuovo Award in 2020, in recognition of its achievements in supporting teachers in ensuring quality mathematics learning for students.

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Wang Jianpan, congress chair of ICME-14

The Chinese Mathematical Society has the pleasure of hosting the 14th International Congress on Mathematical Education in 2021 in China. The congress, held under the auspices of the International Commission on Mathematical Instruction, takes place at the East China Normal University in Shanghai, which has been both a powerful engine for China's economic and social development and the cradle of modern Chinese mathematics and mathematics education. It offers a perfect environment for a challenging congress. We invite participants from all over the world to come to Shanghai and make ICME-14 a rich experience for all.

The 14th International Congress on Mathematical Education

The largest international conference of its kind.

Over **2,200** experts and teachers in math education and research from **129** countries. The first time the ICME has been held in China.

Activities:

4	plenary lectures
3	plenary panel reports
4	survey team reports
5	reports by laureates of ICMI Awards
60	invited lectures
62	topic study groups
200	academic posters
15	discussion groups
27	workshops
4	national presentations

CHINA DAILY

A formula for education success in the suburbs

By CAO CHEN

Math education reform is a complex, long-term process requiring the persistence and effort of generations of experts, as well as the integration of theories from educational research and best practices from classroom experiences, a Shanghai math expert says.

Gu Lingyuan, who pioneered mathematical education reform in Shanghai in the 1970s and was the former vice-dean of the Shanghai Academy of Educational Sciences, made the remarks during an exclusive interview with China Daily regarding a speech about a math education experiment that he delivered at the 14th International Congress on Mathematical Education, the largest international conference of its kind. It is currently underway at East China Normal University and will run until Sunday.

"Education reform relies on the efforts of generations of experts from different disciplines, including math, education and psychology," Gu says.

"Ideas from front-line teachers who are familiar with students' academic, physiological and psychological characteristics are vital to enhance the efficiency of the reform as well."

Gu's insights are based on a math teaching experiment that he and his peers initiated in 1977 to improve students' academic performance in the subject in Qingpu district, an area too far away from the center of Shanghai to, at that time, have access to abundant and quality teaching resources and proper school management.

The experiment will conclude next year, according to Gu.

The national college entrance examination was resumed on the Chinese mainland in 1977, and Gu arranged a math test for all high school graduates in Qingpu to assess their abilities.

Although the test was on primary and middle school level math, student performance was shockingly disappointing, Gu says. Among the 4,373 people who took the test, over 23 percent received zero out of 100 marks. The average score was 11.

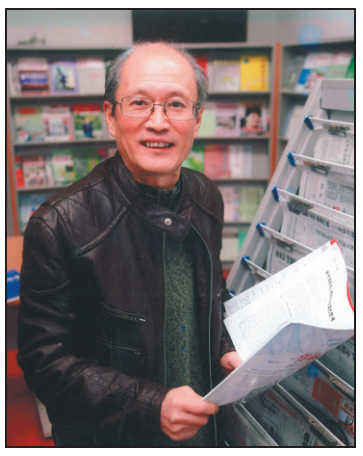
Supported by local education authorities, Gu formed a team of five to carry out the trial. The first three years were spent on investigating and researching teaching approaches, student performances and school management in Qingpu. They then explored suitable teaching methods for Shanghai students and applied the shortlisted methods to classes as an experiment.

Great progress was made after 10 years of reform, while Gu's team grew to include over 200 math teachers, researchers and other practitioners.

More than 85 percent of students in Qingpu scored over 60 out of 100 marks in the high school entrance examination in Shanghai in 1986, which was a surge of 69 percentage points from 1979. The Qingpu students' performance in high school math exams that year was also higher than the average of high school students in Shanghai at 68 percent.

Aside from academic performance, since 2008, Gu's team has also been engaged in cultivating students' creative and analytical abilities. The team has also adopted some elements of foreign math instruction into the local curriculum through teacher exchange programs, such as interactive techniques to make classes fun.

"This year, we'll summarize the experiment, results and achievements so far and publish a book on it for further promotion of the core accomplishment of the reform next year," Gu says.



Gu Lingyuan, former vice-dean of the Shanghai Academy of Educational Sciences.
PROVIDED TO CHINA DAILY

"It's a complex, long-term process requiring the persistence and effort of generations of experts and the integration of front-line practice and theories based on facts.

"A transformation of the roles of teachers and students is the essence of an educational reform. In the past, imparting knowledge used to be the only responsibility of teachers, but the student-teacher relationship evolved into teachers asking inspiring questions in a bid to lead students to study on their own. However, teachers are now more like tutors, seeking to enlighten students to learn, inquire and experience proactively," Gu says.

He adds that in the next phase, improving students' creativity and critical thinking ability in math study is a key challenge for mathematics education in China.

"It is not advisable to achieve high scores through excessive academic training. Diverse teaching and research activities are crucial for teachers to analyze the performance of students and themselves and accelerate their professional growth," Gu adds.

Finding balance in a numbers game

By CAO CHEN

Competition training is supplemental to in-class math education for primary and secondary school students in China, but further research and practice is still necessary to identify the role of competitions in popularizing the study among the public and selecting top talent, a math scholar says.

"Math contests could develop valuable skills students acquire beyond the formal academic settings," says Xiong Bin, director of the International Mathematical Olympiad Research Center at East China Normal University.

Xiong, also director of Shanghai Key Lab of Core Mathematics and Practice, will give a speech on Mathematical Olympiad education at the congress on Sunday. He has, so far, served as the leader of Chinese teams participating in the International Mathematical Olympiad (IMO) 10 times, seven of which, his team won the first group prize.

According to Xiong, math competitions at all levels, especially at the IMO in recent years, often include geometry problems, which help foster students' logical reasoning ability.

"Math contests also hone communication skills, exemplified when students present their mathematical ideas or problem-solving process to others, or evaluate solutions put forward by teachers and other students," Xiong says.

"Moreover, imaginative and critical thinking abilities are also enhanced when math problems students encounter in contests cannot be solved by textbook formulas or theorems."

Open-ended problems are an example. According to Xiong, math problems in the classroom normally have one correct answer. However, in high-level math competitions, open-ended problems that address higher order thinking goals are often posed and, usually, contestants' solutions are beyond the expectations of their teachers.

Xiong Bin, director of the International Mathematical Olympiad Research Center at East China Normal University.
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For instance, prizes have been awarded to more than 40 contestants of the IMO so far for providing better answers than the sample solutions.

"In the long run, training for math competitions cultivates potential mathematicians and scientists. Middle school teachers and students are also able to conduct research-based learning and academic exchanges through competitions," he says.

Mathematics competitions were introduced to China in 1956 when math contests were first held in middle schools in Beijing, Tianjin, Shanghai and Hubei province's Wuhan. Late Chinese mathematical research pioneer Hua Luogeng served as the chairman of the Beijing Municipal Competition Committee and presided over the designing of questions for contests. In 1985, for the first time, two domestic contestants representing China participated in the 26th IMO held in Finland.

Since then, decades of development in math competitions education in China has contributed to the establishment of a comprehensive training system for math competitions, covering diverse activities such as interest groups, regional and interprovincial math competitions and summer camps for students. Teacher training is also part of the system, through courses and teaching practices.

"The excessive popularization of math contests, however, has been controversial, as interest in math competitions is encouraged among more children at an early age. Hua's concern when the math competitions were introduced to the country over whether extracurricular math contests would impact the basic mathematics education or holistic education for students remains true today," Xiong says.

"In fact, many students have excelled in previous IMOs at an early age, and math competitions are designed for such gifted children. However, experts found some children may lose their problem-solving ability or even interest in the subject when they are in the upper grades," Xiong says.

"Opening math contests to all primary and middle school students is an option for popularizing math, but from the perspective of talent selection, contests are suitable for just a few students with an appetite to learn math at a high level and with a strong mathematical ability. It would be against the law of education to force all students to be devoted into training for high-level math competition," he adds.

Xiong also points out that stress may arise from unprecedented academic pressure, when in-class education is increasingly intertwined with math contest skills and knowledge, which requires "cooperation among teachers and experts in creating proper math problems for competition".