National Presentation of Japan

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Japan was honored to be invited to make an ICME-13 national presentation. Japan's National Presentation consisted of a 90-minute National Presentation session and a 5-day Japan Booth. These were organized by the Japan Society of Mathematical Education (JSME) with the help of other organizations. In the National Presentation session, first, a brief history of Japanese mathematics education and the next curriculum were described. Second, Japanese mathematics traditional problems were demonstrated actively using sets of interesting and unique problems involving wasan and origami. Third, two major impacts of TIMSS and PISA on Japanese mathematics education were described. Finally, key factors embedded in the Japanese model of Lesson Study were clarified based on the IMPULS project. At the Japan booth, Japanese mathematics textbooks, curricula, and books were displayed, and 11 posters explaining interesting and unique problems were distributed.

Chapter 1 Structure of Presentation Session

Japan's National Presentation session took place on Saturday, July 30, 2016, from 16:30–18:00. Approximately 120 people attended. The structure of presentation session was as follows:

1. Opening address
(Toshiakira Fujii, President of the Japan Society of Mathematical Education)
2. Japanese education systems, Japanese mathematics textbooks, and next curriculum
(Hanako Senuma, Toshikazu Ikeda)

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3. Active demonstrations; Let's give it a try! Interesting and unique Japanese mathematical problems involving *wasan* and *origami*
(Members of the liaison section of the Japan Society of Mathematical Education: Masakazu Okazaki, Shinya Itoh, Nagisa Nakawa, Akihiko Saeki, and Kensuke Koizumi)
4. Impact of international mathematics achievement tests (TIMSS and PISA) on Japanese mathematics education
(Keiko Hino)
5. Japanese Lesson Study
(Toshiakira Fujii)
6. Closing address
(Masataka Koyama, Vice-President of the Japan Academic Society of Mathematics Education).

Summary of Lectures and Demonstrations in National Presentation Session

Japanese Education Systems and Japanese Mathematics Textbooks and Other Information

Presenter: Hanako Senuma, Tamagawa University, Japan

Summary: The presentation was divided into five parts. The first part discussed the role of the JSME, established in 1919, and the liaison section of JSME, established in 1982. The second part discussed features of Japanese mathematics education from the results of SIMS and TIMSS 1995, 1999 international studies. The third part discussed characteristics of mathematics educational systems and textbooks based on the results of the International Comparison of Mathematics Textbooks in 11 Countries (Nagasaki, 2009). Fourth was a brief history of the Japanese educational system and snapshots of international seminar/conferences held in Tokyo: the United States-Japan seminar on mathematical education in 1971, the ICMI-JSME regional conference in 1983, and the ICME 9 in 2000. Finally, photos of Japan booth were shown and thanks were addressed to all who came to the booth and presentation.

Next Curriculum

Presenter: Toshikazu Ikeda, Yokohama National University, Japan

Summary: The next curriculum will be introduced in 2020 in elementary school, in 2021 in junior high school, and in 2022 in senior high school. Generic skills will be focused on for all subjects and three principles (basic knowledge and skills, mathematical thinking and representation, and meaning and willingness to study)

will be set to organize the curriculum. In mathematics, one of the main issues has been how to describe mathematics thinking based on development stages from elementary school to senior high school. In terms of mathematical activity, two types of mathematization will be described as a slogan.

Let's Give It a Try! Japanese Traditional Geometric Tasks: Family Crest Clipping and Origami Crane

Presenter: Masakazu Okazaki, Okayama University, Japan

Summary: The presenter introduced family crest clipping and origami cranes as Japanese traditional geometric tasks (The Association of Mathematical Instruction, 1994). Both tasks include the activities of imagining the completed figure, drawing its design on paper, and checking the geometric relations between the design and the completed figure by folding and unfolding the paper. We believe that these activities contribute to enhancing students' higher-level geometric thinking while enjoying the activity.

Let's Give It a Try! Making Patterns with Triangular Pieces

Presenter: Shinya Itoh, Kanazawa University, Japan

Summary: The presenter introduced a mathematical task from a figure drawn on the cover of a green textbook called *Jinjo Shogaku Sanjutsu* that was edited before World War Two by Naomichi Shiono. He advocated the development of *suri shisoh*, which is an independent-minded approach to cultivating students' ability to independently observe and interpret everyday phenomena mathematically. The task was the final of the textbook for Grade 6, dealing with patterns involving triangular pieces. It involved students determining the sum of areas of figures consisting of smaller triangles arranged in a particular way. The presenter introduced it with *origami* windmills.

Let's Give It a Try! Rearrange a Regular Pentagon

Presenter: Nagisa Nakawa, Tokyo Future University, Japan

Summary: The presenter introduced a mathematical task from a green textbook for Grade 2 published in 1938. This series of textbooks was innovative at that time, stimulating children's scientific and mathematical thinking, and it has also influenced current mathematics education in Japan. The task was to cut a regular pentagon into four parts and rearrange the four pieces of paper to make up figures

such as a rectangle, a parallelogram, and two types of trapezoids. The audience used the actual material and solved it during the presentation.

Let's Give It a Try! Tachiawase

Presenter: Akihiko Saeki, Naruto University of Education, Japan

Summary: The presenter introduced two mathematical problems, *tachiawase*, from *wasan*. *Wasan*, a mathematics native to Japan, was established in the beginning of the Edo period. *Tashiawase* involves making a different geometrical figure by dividing the original geometrical figure into several parts and recombining them. The first problem presented was from Masashige Yamada (1657) involving making a square by dividing a rectangular woolen cloth into two parts and recombining them. The second problem, from Genjyun Nakane (1743), was making a square by dividing two different sizes of squares into three parts and recombining them. The people of the Edo period learned the Pythagorean theorem through *tachiawase*. At the end of presentation, the presenter illustrated that the logo of ICME-13 was constructed using the Pythagorean theorem.

Let's Give It a Try! Sashigane: Japanese Traditional Ruler

Presenter: Kensuke Koizumi, Takasaki University of Health and Welfare, Japan

Summary: The presenter introduced the Japanese traditional ruler called the *sashigane*. The main topic in this presentation was how to use the *sashigane* and how to make use of it in real world. The *sashigane* is a rectangular ruler that includes several scales used by carpenters. For example, it has a *kakume* scale, whose unit is the square root of 2 mm. Carpenters can easily determine the size of a square that can be obtained from a log using *kakume*. For this reason, it is indispensable for carpenters and is said to be one of the carpenters' three treasures.

Impact of International Mathematics Achievement Tests (TIMSS and PISA) on Japanese Mathematics Education

Presenter: Keiko Hino, Utsunomiya University, Japan

Summary: The two major impacts of TIMSS and PISA on Japanese mathematics education were described (Ginshima & Matsubara, 2012; Nagasaki & Senuma, 2002). The first was the introduction of “mathematical activity” as a core of curriculum design. In the current objectives of mathematics education, “mathematical activity” is placed at the head of the statement. In this presentation, examples of

mathematical activities were given using examples of textbook problems. The second was the implementation of the National Assessment of Academic Ability. Two types of problems are used for this assessment. One type of problem is oriented towards “knowledge” and the other is oriented towards “application.” The aim of this test is not only assessing the status quo of students but also giving feedback to schools and teachers. In the presentation, an example of the idea of conducting mathematics lessons using a problem item from the assessment was shown.

Japanese Lesson Study

Presenter: Toshiakira Fujii, Tokyo Gakugei University, Japan

Summary: Lesson Study is an approach to teacher professional development that differs sharply from the professional development practices common in other countries. While the history of Lesson Study in Japan spans more than a century, for Japanese educators, Lesson Study is like air, part of everyday school life. Educators outside Japan, however, having had to learn about Lesson Study less naturally, may sometimes fail to grasp some important aspects of Lesson Study (Fujii, 2016). This presentation tried to clarify key factors embedded in the Japanese model of Lesson Study based on my experience with the IMPULS project (International Math Teacher Professionalization Using Lesson Study) (Fig. 1).

Japan Booth

Japanese mathematics textbooks, curricula, and books were displayed and posters explaining *wasan* and *origami* were distributed from July 25–30, 2016. The Japan booth was mainly conducted by members of the liaison section of the Japan Society of Mathematical Education: Hanako Senuma, Toshikazu Ikeda, Takuya Baba,

Fig. 1 After Japan National Presentation

Akihiko Saeki, Masakazu Okazaki, Shinya Itoh, Takashi Kawakami, Tetsushi Kawasaki, Kensuke Koizumi, Kosuke Mineno, and Nagisa Nakawa, with the help of Satoru Sakanashi and graduate students from Yokohama National University, etc. (Figs. 2 and 3).

Big Four Mathematics Education Organizations in Japan

- The Japan Society of Mathematical Education (JSME; <http://www.sme.or.jp/>)
- The Japan Academic Society of Mathematics Education (JASME; <https://www.jasme.jp/>)
- Mathematical Education Society of Japan (<http://mes-j.or.jp/>)
- The Association of Mathematical Instruction (1994) (AMI; <http://www.ne.jp/asahi/math.edu/ami/>).

Fig. 2 Mathematics textbooks and posters

Fig. 3 Welcome to the Japan booth!

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