MATHEMATICS EDUCATION THROUGH LESSON STUDY IN THE ASIA-PACIFIC REGION

CONFERENCE REPORT

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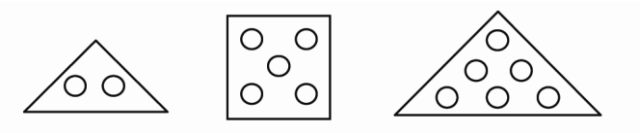
The conference took place from 16 to 20 August in Khon Kaen, a university city in the north-eastern part of Thailand, a province known as Isaan. It gathered a number of researchers from the APEC member countries, external observers and about 150 teachers and master students in mathematics education. Improving the quality of mathematics teaching is a big issue in Asia. The economic success of the four tigers, Japan, Singapore, South Korea and Taiwan inspires the less developed countries to catch up. Mathematics is seen as a leverage for raising the level of engineering and computer sciences and participating in the success of the four example countries. The participant of Singapore, Ban Yar Yeap, literally stated that the prime reason for him engaging in research in mathematics education is the shameless fact that it contributes to the economic success of his country. Also the availability of comparative international assessment results such as PISA and TIMSS, make the difference in performance of mathematics education between countries painfully clear. But even Singapore, ranking consistently at the top, seeks to improve its teaching methods. Singapore students are excellent in procedural methods and symbolical representations. Still, Ban Yar Yeap sees the need to improve upon the problem-solving skills and conceptual understanding of students.

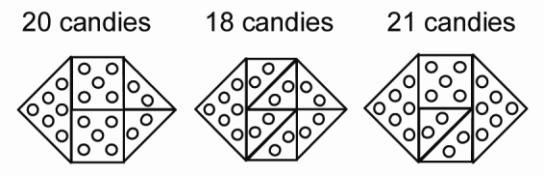
The conference is part of a joint project of research and human resource development of APEC with as main partners the Center for Research in Mathematics Education (CRME) of Khon Kaen University and the Center for Research on Cooperation International Development (CRIDED) of the University of Tsukuba, Japan. This year's theme is the development of mathematical thinking. The focus is on the observation and discussion of real-world class situations, called lesson study. The observation, recording and discussion of real-life lessons is a main tool in Japan to improve education. Several presentations discussed particular lessons with video, transcripts and even live classes. Having live lessons with a class of fifty Thai 5th grade students and a Japanese teacher before an audience of over 200 people is quite a feat. Translation of the Japanese to Thai and vice versa was done by project manager Maitree Inprasitha who is fluent in both. Translation to the English audience was provided through wireless headphones. Despite the obvious technical challenges and the cultural and language differences between teacher and students the lesson worked remarkably well. The Thai pupils responded wonderfully to the collaborative development of the tasks set by experienced and enthusiastic Japanese teacher. The lesson was consequently discussed by specialist as Alan Bishop and Kaye Stacy and from Australia and David Tall from the UK. Cultural differences in such settings not only lead to communication problems, they also provide excellent opportunities for studying the socio-cultural aspects of

mathematics education. With additional contributions from Vietnam, Indonesia, Malaysia, Brunei, Hong Kong, the Philippines, South-Africa, Chile and Peru, the event was truly intercultural and thus exposed cultural-dependent factors and values in mathematics teaching.

Recorded lessons from Japanese schools were discussed in separate workshops. One lesson for 2nd grade pupils was rather interesting from the point of view of switching between representations and early symbolic reasoning. Mathematical thinking depends very much on representations. Many mathematical problems, once formulated within an adequate representational form, allow for an easy solution. The representation determines the operations that are possible on structures it represents. But students often find it difficult to formulate problems in the right representation. Typical for mathematical thinking is the switching between different representation forms. This lesson is an excellent example of teaching such skills at a young age. Pupils were given an envelope of cards of triangular and square form with a number of dots on it, or candies, as they were told.



Then they were asked to assemble the cards in a predefined hexagonal shape and count the candies. Several configurations are possible and they can lead to a different total number of candies, as shown in three examples below:



Counting the total can be done by counting all the dots. However, the children switched instead to a symbolic representation in which the total is expressed as the sum of dots on each of the cards, as 6+6+2+2+5=21 in the third configuration. A symbolic representation is the a more adequate representation to add several numbers together without making counting errors. Very interesting was that two different kinds of symbolic representations were used and that these are facilitated by the geometrical configuration. One student spontaneously suggest to make the sum by parentheses as in (2x6)+(2x2)+5=21. Undoubtedly this was inspired by the geometrical configuration of 2 large triangles, 2 small triangles and one square. This illustrated quite nicely how the two representations are reinforcing each other and contributed to the completion of the task. It was impressive to see how 7-year old Japanese pupils handled symbolic representations with ease.

The use of the history of mathematics for mathematics education was only marginally discussed in this conference. One example was the teaching of Pythagorean theorem as adding numbers in two dimensions. The lack of further efforts along this line is unfortunate as the multi-cultural setting allows for many opportunities. In general, there is a growing interest in the Asian countries to reassess and revalue their native

mathematical heritages and put them to use for mathematics education. The Confucian-heritage countries have a rich tradition of ancient Chinese mathematical practice to draw from. In India there is a revival of Vedic arithmetical techniques as a basis for teaching the algorithms for operations on numbers. In Japan, traditional mathematics from the Edo period (1603-1868) was completely replaced by Western symbolic mathematics in a very short time span. Currently there is an increasing interest of going back to this *wasan* tradition for teaching elementary concepts of mathematics. This trend of drawing examples and techniques from the rich intellectual heritage of Asian cultures may be inspired by a revaluating their traditions and possibly nationalistic tendencies. However, when we see mathematics as a product of socio-cultural activities the use of culture-specific concepts and techniques makes sense.

The conference contributions can be downloaded from the Khon Kaen CRME website http://www.crme.net/. The lesson plan of the Japanese lesson discussed can be found at http://www.criced.tsukuba.ac.jp/math/apec/apec2007/lesson_plans/Takao_Seiyama.pdf.