Theory and Perspective of Mathematics Learning and Teaching from the Asian Regions

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Report

The DG has prepared a questionnaire to collect data of teachers' practise in China, Taiwan, Hong Kong, and Korea. The results, together with the literature search in theory and practice in mathematics education was prepared into a booklet of 90 pages for discussion during the ICME-12. There were two sessions of discussion during the ICME-12 and the following is a report of work and discussion of the DG during the ICME-12.

The Chinese Framework and Theories in Mathematics Education

Two practices in China dated back to the 13 century. One is the technique of using analogy by Yang Hui (楊輝) in 1275, which work on two problems which shared the same structure and one can apply the method of the first question to solve the second problems. Another technique is the using of more than one solution to tackle the same problem by Li Zhi (李治, 1248) when he investigates cases of circles inscribed in a right angle triangle.

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Approaches in Understanding and Learning Mathematics in Taiwan

Fou-Lai Lin (National Taiwan Normal University) suggested that the components of being a good teacher include (1) Vary methods, (2) "Skillfully waits to be questioned" and "Hear the questions", (3) Teach students "how to learn", and (4) Know the reasons why teaching is successful or failed. And conjecturing approach is the principle of teaching mathematics.

Different Approaches in Understanding and Learning Mathematics in China

We know that the models and approaches developed in Mainland China these years include:

1. "Four Basic" model (structure approach and heuristic approach)
2. Problem solving model (structure approach)
3. Trial Teaching and Learning approach (heuristic approach),
4. GX experiment and model, (through correspondence, induction and deduction)
5. Teaching through variation approach (structure approach),
6. Demonstration, imitation and practise approach (structure approach) and
7. Dialectic approach for abstraction and internalization (structure approach).

The Characteristics of Chinese Mathematics Education and Four Basics Model

Zhang Dian-zhou (Eastern China Normal University) proposed the 5 aspects of characteristics in China Mathematics Education:

1. good lesson introduction of new topics,
2. technique of interaction among teachers and students in large classes,
3. teaching of mathematical thinking with variation method,
4. variation in teaching and exercises, and
5. fluency in practice-for-sophistication.

Zhang also proposed "Four Basics" model in mathematics teaching. The model has three dimensions and these three dimensions intertwined with each other in the process of learning.

Dimension 1: the accumulation of Basic Mathematics Knowledge (relational and procedural).

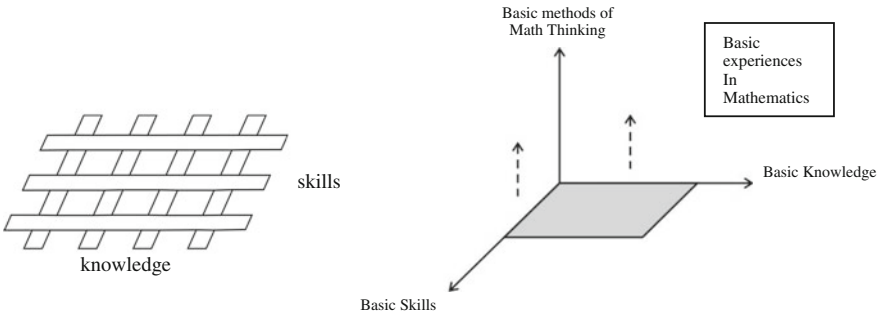

Fig. 1 Dimensional representation of the foundations of mathematics module

Dimension 2: the development of Basic skills (mathematical skill and skills to known procedure).

Dimension 3: the process of Basic Mathematical Thinking (application, formation of method of Mathematical Thinking, and develop new method).

The Basic Experiences in mathematical activities form as glue to connect the three-dimensional module (Fig. 1).

The Korean Framework and Theories in Mathematics Education

A survey conducted by Chung in Korea found that the most important thing that teachers considered in teaching and learning mathematics are (1) understanding 'concepts', (2) 'principles', and (3) 'process'. In Korea, teacher's role is described as "Goon Sa Boo Il Che" (君師父一體), that means King, Teacher and Father are the same one. These circumstances can be explained by culture tradition under Confucian Heritage Culture (CHC) in Korea. Though passive learning in traditional classroom is changing into more active learning in recent reformed classroom. But the zealous of learning under CHC culture still the core of the classroom in Korea.

Kyung Hwa Lee of the Seoul National University indicated that: "Good" Mathematics Teaching and "Good" Teachers usually means typical Korean math teacher have the orchestration of lessons based on the following four areas (a) Systematic instruction, (b) Coherent explanation, (c) Complete practice, and (d) Efficient imprinting.

The Japanese Framework and Theories in Mathematics Education

Masami Isoda (University of Tsukuba) indicated that there are a few traditions in the Japanese teaching of mathematics. The first one is the Japanese Problem Solving Approach for Learning by/for students. The second one is Problematic Situation explained by the Contradiction between Conceptual and Procedural Knowledge Originated from Mathematics Curriculum. And the third one is learning how to develop mathematics.

The aims of the traditions are achieved through the following teaching approaches in classroom:

1. Categorizing students' ideas from Meaning and Procedure.
2. Explaining Contradiction by Meaning/Conceptual and Procedural Framework
3. Procedurization of meaning,