



02 The Famous Professor of Mathematics - Terry Wood An open speech on the world's newest development of mathematics education

On the 4th and 5th of July 2007, University of Macau hosted the "The World's Newest Development of Mathematics Education" workshop and experience sharing meeting, with the assistance from Education and Youth Affairs Bureau and Mathematics Educational Society of Macau. The purpose of this workshop and experience sharing meeting was to share the successful experiences on America's mathematics course and teaching reform, broadening the international views on mathematics education of Macau mathematics teacher and course developer, and allowing them to understand well the newest development trend of the world's mathematics education.

The speaker, Terry Wood, Professor of Mathematics at Purdue University, is a famous mathematics educational scholar. She specializes in mathematics education and has participated in course reform of mathematics and professional development of mathematics teachers in America. She also has undertaken research on mathematics courses and teachings in Australia, Germany, Holland, New Zealand and the UK, etc. Professor Wood is now teaching in the Course and Educational Department of Purdue University in America. From the year 1964 up to now, she has been teaching in universities, secondary and elementary schools. She compiled and published numerous books relating to mathematics education. She has over and over published articles in international mathematics periodicals.

In the morning of 4th July, Professor Wood gave a lecture in the STDM Auditorium, University of Macau International Library. The lecture was called "Effective Teaching on Mathematics: an international angle of view". In this lecture, she shared her experiences with scholars and teachers on American mathematics education. Including:

1) Changes on mathematics teaching principles

Professor Wood pointed out that changes of American's ways of mathematics teaching was originated from the development of student's learning theories. How the students were learning? Where did their knowledge come from? These were the important elements which influenced teacher's teaching. At present, the teaching of mathematics in class in America emphasized that it was built on students' mathematics concepts and the formation of relationship between different concepts. Based on this principle, we should minimize the unnecessary steps of calculation in mathematics teaching, and we should put more emphasis on organizing student's mathematics knowledge and concepts.

2) New technique on teacher's teaching

Professor Wood pointed out that in the past teachers in America emphasized the acquiring of correct knowledge by students. Therefore, they had over participated in student's learning in classroom. Teachers provided standard answers to students immediately before students had enough time to build up their own thinking. As a result, it was the general case that knowledge was transferred to students directly. Following the development of student's learning theories, teachings should emphasize on the building up of student's independent concepts; therefore,

teachers should create a new class environment in their class teaching, allowing students to communicate their constructive conceptions with teachers and schoolmates. This kind of class environment enables students to explain on their own ideas and understandings; in this environment, teachers should question: "How do you get this result?" "Why do you do in this way?" "Where do you know from to do in this way?" etc. Through this open environment, students were able to distinguish each mathematics concept, thinking and procedure step by step. It promoted their independent thinking and ways of solving problems.

3) Suggestions from NCTM

At the same time, Professor Wood introduced some suggestions on mathematics teaching in America from NCTM (National Council of Teachers of Mathematics):

- Broaden contents of fundamental learning (for example, to include some beginning steps of algebra reasoning in arithmetic in primary school);
- Enhance the use of computer;





- Enhance mathematics concepts, and relationship between different concepts, reduce some steps in mathematics calculations;
- Allow students to use and apply their mathematics knowledge from what they have learnt.

When Professor Wood exchanged ideas with local mathematics teachers, she introduced the present situation of America mathematics education, the changes on mathematics teaching in class and the newest development trend of mathematics program idea. Meanwhile, she gave her ideas about America's experience in mathematics program and teaching:

- Course materials and textbooks must complement program reform. In America, program reform started from textbooks;
- Program reform needed to complement teaching methods;
- Before the year 1989, in America, mathematics course of primary schools concentrated on the numerical calculation in arithmetic. In secondary schools, mathematics symbols were mainly replaced by algebra. For this reason, the modes of course-design were set out according to the course standards. Course contents started from easy to difficult; then deepened and broadened from elementary level to higher level gradually. Besides, different levels of modules, chapters and sections for different classes were the main body of teachings. It was organized with a spiral design and some of the contents, which were not well-understood when students were in lower class, were deepened in the related subject learning when they were in higher class. Thus, course knowledge was better learned. For this reason, this kind of course teaching mode tended to lead directly to lectures from teachers directly according to the already decided orders to control the learning course of students.
- But following the development of students learning theories, mathematics course should move towards such individual abilities of students as independent exploring, solving problems, communicating and reasoning. Therefore, a new program was forming in America, which was called "standards based curricula". Course design included the following important points:
 - Use elaborated mathematics design assignments to unfold mathematics concepts;
 - Students on their own initiative learned by exploring concepts and deduced mathematics concepts according to their own reasoning and thinking;
 - After students understood concepts, teachers then joined to give explanation and eventually built up mathematics procedures or symbols according to new concepts;
 - According to students' acquired knowledge, impel meanings on new knowledge;
 - Courses were designed on a modular basis, every module revealed a big mathematics idea and various concepts for discussion.

- From our research, we found out that there was no distinct difference in the solving techniques of students who underwent the above two different mathematics courses.
- But students, who received new mathematics course, were more superior on their thinking, reasoning and understanding of concepts in tests.
- Therefore, in future, mathematics educational work should emphasize the development of ability of students to figure out mathematics concept. Those works related to arithmetical calculations, procedures and standard forms should be reduced appropriately.
- Besides, questions raised to the students should invoke thinking and discussion and should not be too easy.
- Every country and geographical regions had its own cultural background and social needs. Therefore, study program should fit in with the country or region's social needs and cultural characteristics in order to achieve the highest efficiency.

Professor Wood also pointed out that according to the opinion from NCTM, the content of mathematics teaching should include five areas which were arithmetic, algebra, measurement, geometry and data analysis and probability.

Professor Wood showed positively on future course reform and development direction in Macau. She believed that Macau's course reform was changing from knowledge structure of regular course to learning power structure of students. This was the new trend of course development.

Lastly, Professor Wood also pointed out that in the meantime of course reform, conditions on teacher, teaching resources were specially important and very crucial. Therefore, she suggested to provide newest teaching methods for front line teachers when they were trained and to build up a textbook system to ensure the smooth advancement of program reform.

Lam Vai lam Lok Weng Fai
(Technician of Education and Youth Affairs Bureau)

Excerpted from "Teacher's Magazine" 19th Issue, Dec. 2007

