REPORT ON ATTENDING
THE APEC-TSUKUBA INTERNATIONAL CONFERENCE V
INNOVATION OF CLASSROOM TEACHING AND LEARNING THROUGH LESSON STUDY
FOCUSING ON MATHEMATICS TEXTBOOKS, E-TEXTBOOKS AND EDUCATIONAL TOOLS
TOKYO AND TSUKUBA, JAPAN
15 – 21 FEBRUARY, 2011

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Rational

The Asia-Pacific Economic Cooperation (APEC) forum is the premier economic organization in the Asia-Pacific region. Established in 1989 by 12 economies, including the United States, APEC fosters growth and prosperity by facilitating economic cooperation and expanding trade and investment throughout the region.

APEC-HRDWG (Human Resources Development Working Group) Lesson Study Project Website (www.criced.tsukuba.ac.jp) states that since 2006, 19 APEC member economies have been participating in the APEC-HRDWG Mathematics Lesson Study project proposed by Japan and Thailand. It has great influence on the establishment of Lesson Study Movements in other subjects such as Science and English as for the second language.

Theme of APEC_Tsukuba International Conference V, 2011, is innovation of teaching approaches with computer. The conference is focused on textbooks and educational tools in mathematics, especially e-textbooks as for newest tools in teaching mathematics. The targets of the conference are as follows.

Q1. How do we use our textbook in our country? Sharing the methods of teaching and learning with textbooks and knowing theories on curriculums and textbooks.
Q2. How can we use our textbook meaningfully? Elaborating the model approaches in using textbooks to develop mathematical thinking and communication.
Q3. How do we use blackboards and projectors in our country? Sharing the various ways in utilize the traditional equipments in classroom such as blackboards as well as projectors and computers.

Q4. How can we improve our teaching approaches for teachers? Knowing the innovative tools to develop e-textbooks and sharing the methods of teaching.

Although the conference is focused on mathematics education, these topics are meaningful for other subjects, educational technology and ICT education on the context of lesson study. As well as previous Conference, this meeting includes keynote lectures, short presentations, discussions and workshops. Communication and discussions among the economies are the major parts of this conference. The specialists on the APEC project participated on discussion about Q1-Q4. The Conference was hosted by the Center for Research on International Cooperation in Educational Development (CRICED), University of Tsukuba. with the General Chair was Prof. Masami Isoda (APEC Project Overseer), and the APEC Project Co-Overseer was Ass. Prof. Dr. Maitree Inprasitha (Khon Kaen University Thailand).

In addition, this international level conference was attended by prominent mathematics educators from 5 continents, except Africa, such as Max Stevens and Peter Gould (from Australia), Catherine Lewis (from USA), Ivan Vysotsky (from Rusia, Europe), and Simizu Shizumi (from Japan, Asia). Due to the importance of the meeting and conference to the QITEP in Mathematics; therefore the delegation of QITEP in Mathematics was participated in that activity as part of benchmark activity of the SEAMEO QITEP in Mathematics.

Objectives

There are four main objectives of this benchmark activity as follow.

1. To learn and benchmark about mathematics education in general and specifically on the lesson study (plan, do, see) in enhancing the professional competencies of mathematics teachers.
2. To learn and benchmark about how do the countries of member of APEC economies manage the use of blackboard, textbook and e-textbook during the teaching and learning of mathematics.
3. To learn and benchmark about how to conduct and manage an international level seminar.
4. To learn and benchmark about the system in working together among international level of mathematics educators.

Activities

15th February	Yogyakarta – Jakarta – Tokyo
16th February	Good morning Tokyo. Arrive in R & B Hotel; got information from the committee of the conference or seminar.
	Morning and Afternoon Session Editorial Meeting for the Mathematics Textbooks at Gakko Tosho. Four participants from SEAMEO QITEP in Mathematics participated on that meeting (Prof Subanar Ph.D; Dr Ida Karnasih; Puji Iryanti, M.Sc.Ed, dan Fadjar Shadiq, M.App.Sc). The meeting was aimed to evaluate the mathematics textbook which are translated from Japanese to English.

Evening Session
Attended the SEAMEO-Tsukuba Business Meeting at Meikei Kaikan.

Japanese students were learning to think and to reason

17th February

Morning Session
The participants visited Elementary School, University of Tsukuba and participated on the World Largest Lesson Study Meeting Mathematics Classes by:

- Takao Seiyama: "How much does chocolate weight? The area of geometrical shapes".
- Yasuhiro Hosomizu: "The expression of proportionality."

Afternoon Session
The participants attended the greetings and explanation of schedule from Masami & Maitree at Attached School of Ochanomizu University.

General Session 1: Workshop by Prof. Hiroyuki Ninomiya (Q4): "How to utilize blackboards and notebooks for developing representation (BANSHO)".

Specialists Session 2: Three Working Groups (Q1 & Q2): "How do our teachers use our textbook?" The participants showed the newest-textbook sample page and explain how mathematics teachers use it. The presentation time was 10 minutes each and exchanged ideas. The representatives of each group presented the content and discussed it for meaningful using of textbooks.

18th February

Morning Session, at Junior High School, University of Tsukuba in relation to Q2 & Q4: "Challenges of Lesson Study using computers and projectors for 9th graders." Presenters: Masami Isoda and Yeap Ban Har.

Afternoon Session, at Attached Primary School of Ochanomizu University. Masami Isoda presented "How to develop e-textbooks."

General Session 1: Workshop by Masami Isoda (Q2) with title: "Theory of teaching and curriculum for Lesson Study."
Specialists Session 2: Three Working Groups (Q3&Q4): "How can we integrate technology, e-textbooks and classroom equipments for everyday teaching?" Each participant showed the use of sample of ICT and explained how to use it. The representatives of each group presented the content and discussed the presentation for improving mathematics teaching.

Evening Session: Move to Tsukuba

19th February

Morning Session

The Opening Ceremony of the conference with the opening address: "Japanese New Textbook and How We Use It?" by Shimizu Shizumi (President of Japan Society of Mathematical Education) and continued with Photo session.

Keynote 1: "Lesson Study in Progress" by Catherine Lewis (Mills College, CA, USA)

Keynote 2: "Curriculum, Textbook and Classroom Equipment" by Peter Gould (Inspector, NSW Department of Education and Training, Australia)

Evening Session
Panel 1: "How can we use better our textbook?"
Chair: Max Stephens (University of Melbourne, Australia)

Speakers: Kwang Ho Lee (Korea); Cheng Chun Chor Litwin (Hongkong); and Ali Hamdani HM Diah (Brunei)
Commentators: Hiroki Ninomiya (Saitama University) and Peter Gold (Inspector, NSW Department of Education and Training, Australia).

Panel 2: "Current Status and Efforts for Using ICT in Case of SEAMEO Centers."
Chair: Bunyamin Maftuh
Speakers: Puji Iryanti (QITEP in Mathematics); Prof Ismunandar, PhD (QITEP in Science); Dr Leong Chee Kin (RECSAM); and the representative of SEAMEO RETRAC (Vietnam)

20th February 20 Morning Session

Panel 3: "How can we innovate our classroom?"
Chair: Cheng Chun Chor Litwin (Hong Kong)
Speakers: Ivan Vysotsky (Rusia); Dr. Maitree Inprasitha (Khon Kaen University Thailand); Chap Sam Lims (Singapore); and Dr Rohani Ahmad Tarmizi (Malaysia)
Commentators; Prof Takuya Baba (Japan) and Catherine Lewis (Mills College, CA, USA)

Keynote 3: "Proposal Address from Project Side" by Maitree Inprasitha: "Progress in the case of Thailand." Masami Isoda: "Proposal for Next Project."

Afternoon Session
The participant climbed up nad experiencing the hot spring of Mt. Tsukuba.
Closing Ceremony

21st February Arigato Gosaimasu Prof Masami Isoda sensei. Sayonara Tokyo and Tsukuba. Tokyo – Jakarta – Yogyakarta.

The Results of the Benchmarking

1. As mention earlier, the Editorial Meeting for the Mathematics Textbooks at Gakko Tosho has been participated by four participants from SEAMEO QITEP in Mathematics (Prof Subanar Ph.D; Dr Ida Karnasih; Puji Iryanti, M.Sc.Ed, dan Fadjar Shadiq, M.App.Sc). The results of the meeting among others are as follow.

- The textbooks were very well designed.
- Colorful and user friendly.

- Lots of real life pictures or illustration to help children to learn mathematics meaningfully or with understanding.
- The activities in the textbooks are started with problem in order to help children to think.
- Lots of challenging problems to help children to think, to reason and to solve problems.

2. The entire participants of the SEAMEO-Tsukuba Business Meeting such as: SEAMEO Secretariat (Bangkok); BIOTROP (Indonesia); QITEP in Mathematics (Indonesia); QITEP in Science (Indonesia); RECSAM (Malaysia); and RETRAC (Vietnam) stated the importance of and the main role played by CRICED, University of Tsukuba in helping and working together with every SEAMEO Centre. Therefore, they also asked the continuous effort in maintaining this collaboration. Prof Bunyamin Maftuh (SEAMES) stated that CRICED, University of Tsukuba has been noted as the newest affiliate member of SEAMEO but this institution is very active in doing collaboration with SEAMEO member countries.

3. The participants have visited Elementary School, University of Tsukuba and participated on the World Largest Lesson Study Meeting Mathematics Classes.

PLAN → DO

Takao Seiyama lesson was "How much does chocolate weight? The area of geometrical shapes," and the open lesson by Yasuhiro Hosomizu ("The expression of proportionality"). The Takao Seiyama's and Yasuhiro Hosomizu's Lesson Plan can be seen and learnt respectively from Appendices A and B. The results are as follow.

- The students were very active and enthusiastic to learn mathematics.
- One lesson was started with reminding students with the checking of the preexisting or prior knowledge of the students.
- In conducting the lesson study, a mathematics teacher usually decides the theme of his or her lesson study. The examples of the theme as follow.

o To improve representational and thinking skills through "Representation, Reading and Calculation of expressions." (Yasuhiro Hosomizu's Research Lesson Theme)

o To communicate mathematics by writing and reading through application problem of the area of circle. (Takahiro Seiyama's Research Lesson Theme)

o How can we develop students' ability to apply geometric proof for problem solving in the real world? (Masami Isoda's Research Lesson Theme)

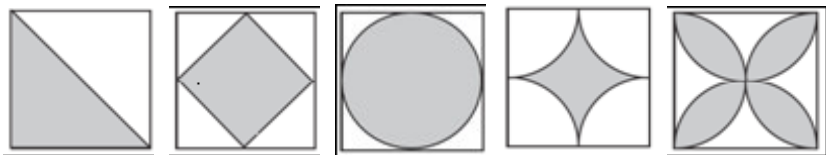
o What is the role of technology in student's mathematics learning at junior high schools? (Yeap Ban Har's Research Lesson Theme)

- Those themes were very important for mathematics teachers in designing the lesson. The issues of the written theme are the newest issues and the current trends of the teaching and learning of mathematics. The examples the issues are: representational and thinking skills; representation, reading and calculation; writing and reading communication, application problem; geometric proof and problem solving in the real world; the role of technology. We can conclude that the focal point of the implementation of lesson study were to change the teaching and learning mathematics in Japan to be more students centered and on the implementation of the newest issues and current trends in the teaching and learning of mathematics. In other words, the point is the change of the teaching and learning of mathematics and not only on the collaboration among teachers itself.

- The two lessons were started with problems as follow.

The weight of chocolate packed in a square box is 400g. 

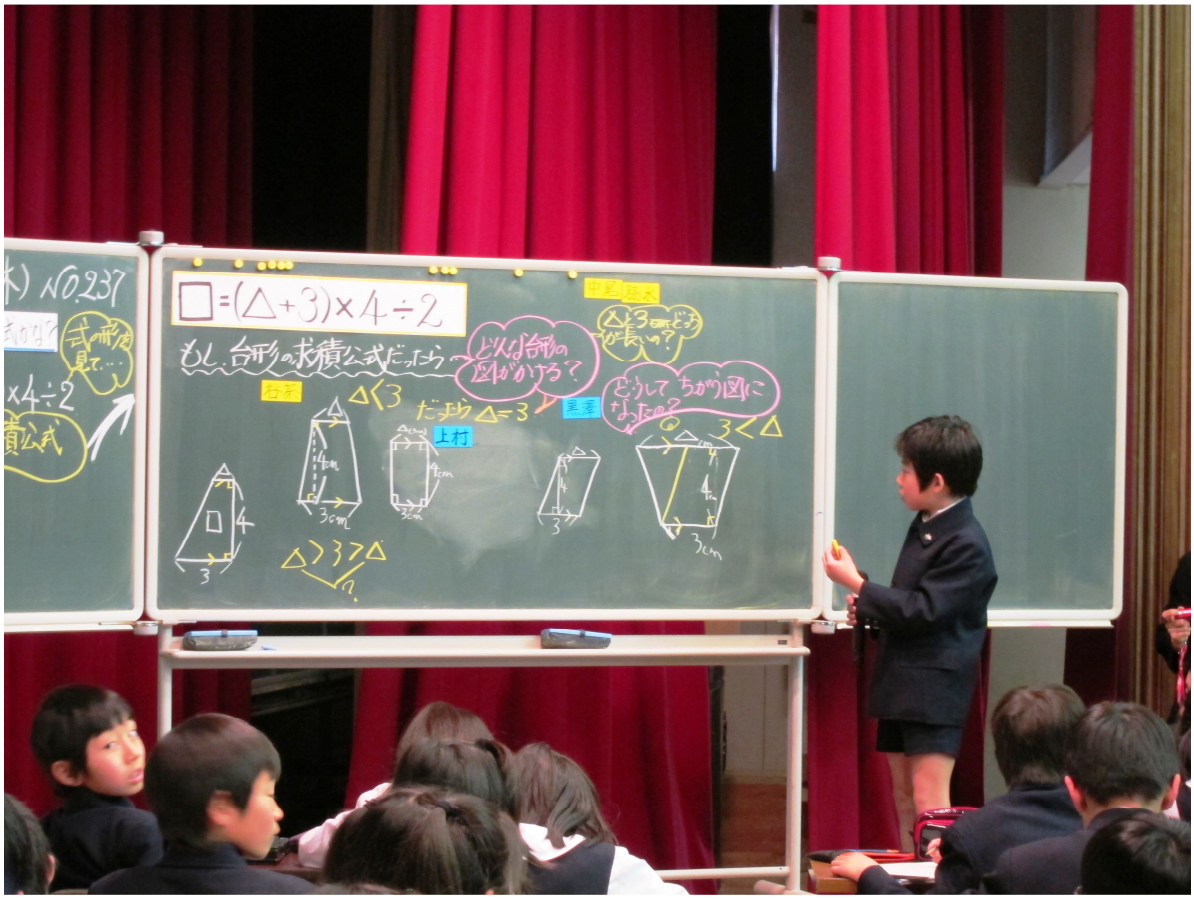
How much does it weigh which is packed in like following way?"



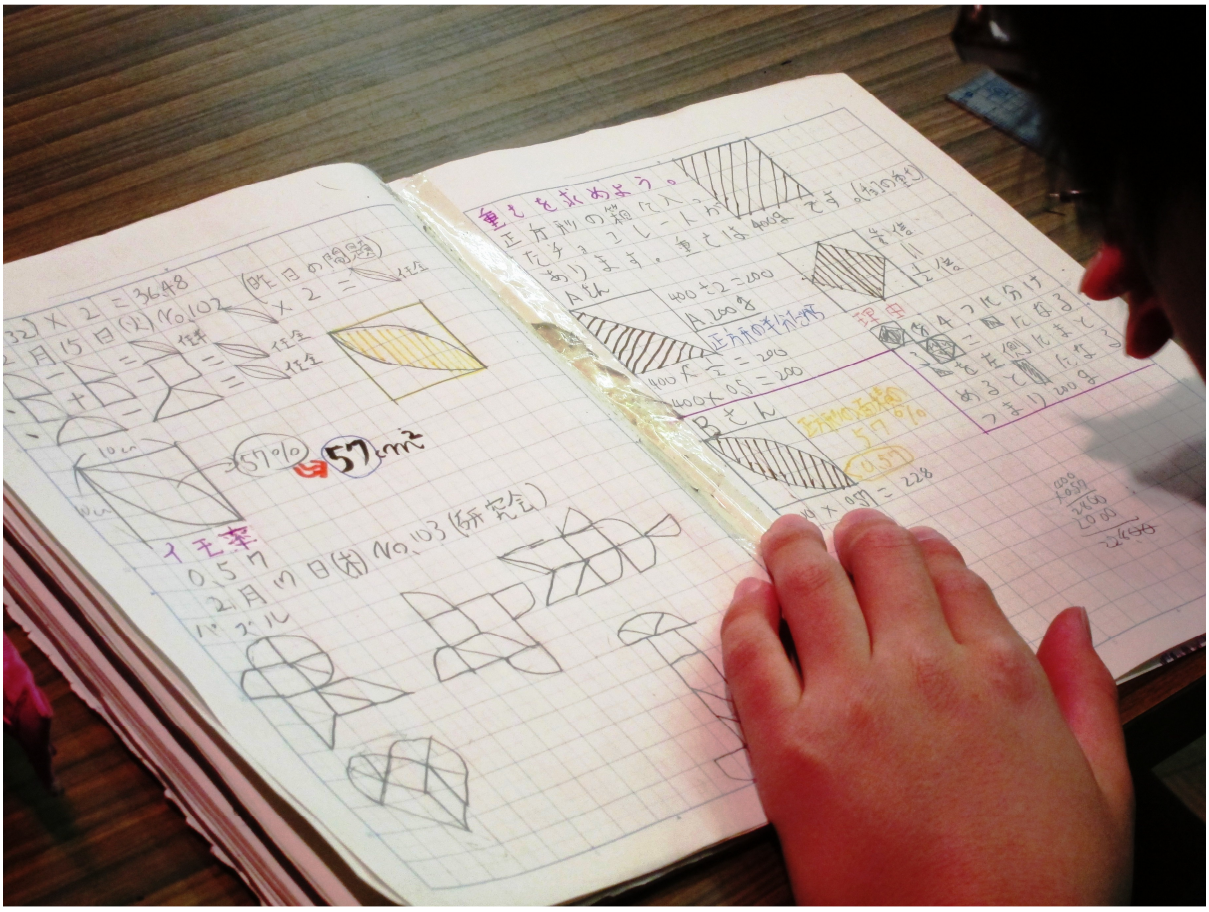
$$\square = (\triangle + 3) \times 4 \div 2$$

Let's think examples of this formula.

- Based on those two problems, students were guided to 'learn meaningfully' or 'learn with understanding', actively building new knowledge from experience and prior knowledge. On the first lesson, based on the knowledge of the area of a square, students were guided to find the area of those other five geometrical shapes. In addition, based on those two problems, both teachers tried to help their students to learn to think, to solve problem, to communicate and to reason mathematically. In other words, teachers gave opportunity to student to think and to reason and not only to memorize. I saw exactly that the students learnt mathematics enthusiastically and the learning process was very joyful to the students.



- During the learning process, students were facilitated by the teacher to think and to communicate by asking high order thinking skills. Examples of questions asked by teachers are as follow.
    - How …?
    - Is any body can explain why?
    - If you ….
    - What happen if ….
    - What was interesting of the results?
    - Why …?
- The last two pictures above show us that blackboards were used effectively and colorful. The blackboards were used to help students to take note.
- We also learn that the problems, the examples, and the use of blackboard have been carefully selected and chosen. The problem was neither too easy nor too difficult. In addition, alternatives of various students' answers have been anticipated by the teachers. Therefore, we can learn from Japanese Mathematics Teachers that they planned the lesson carefully and operationally.

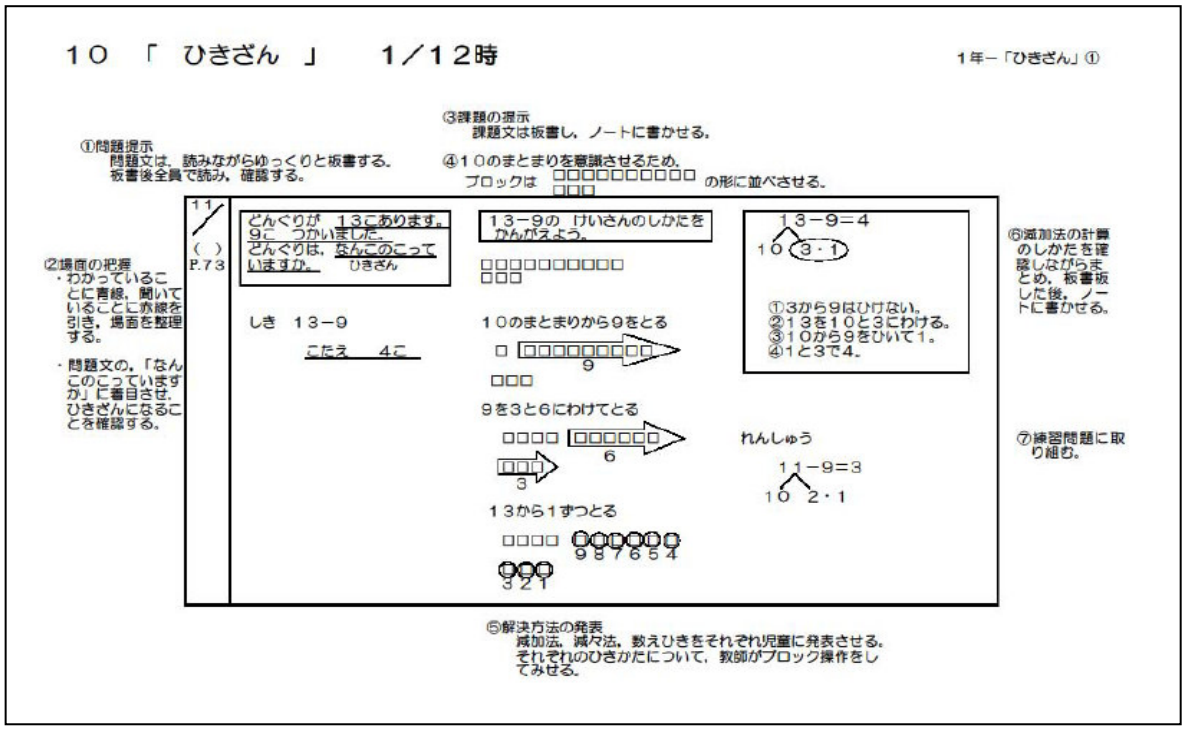


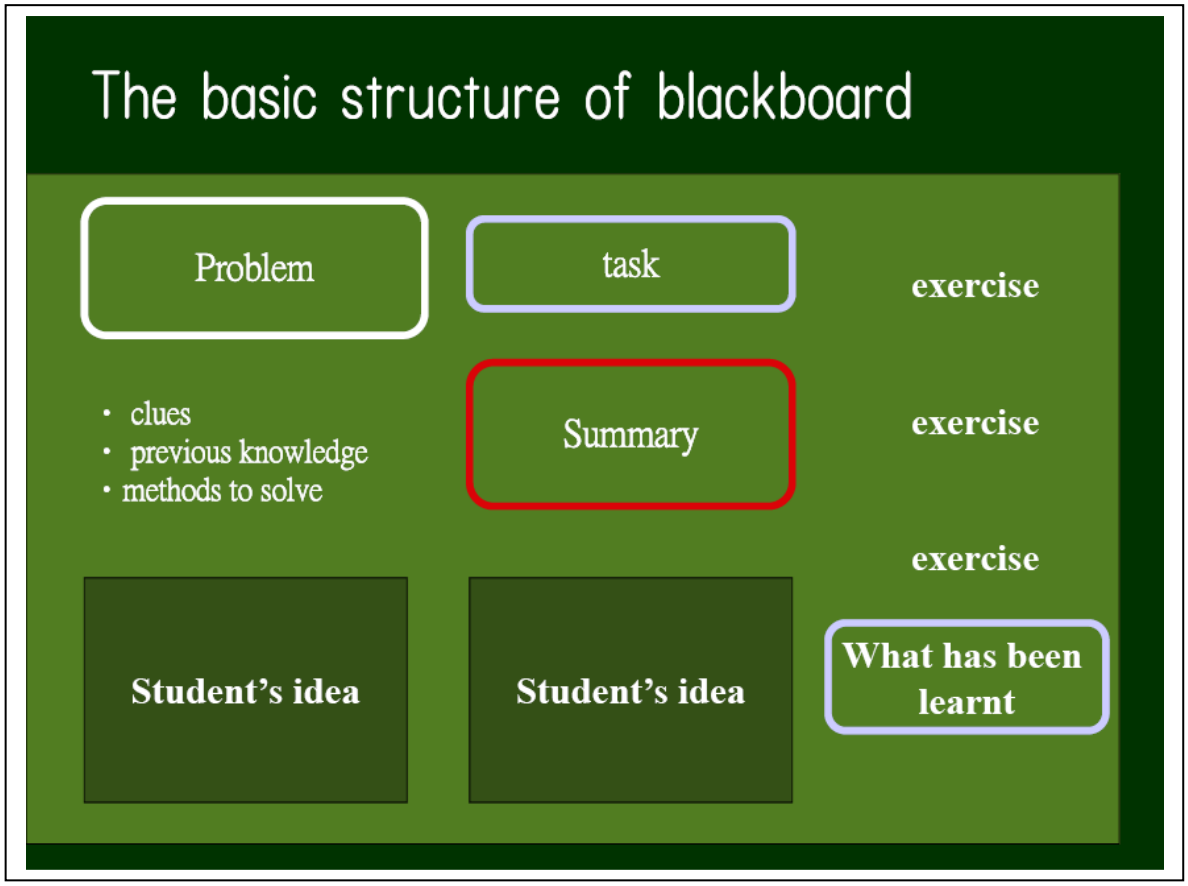
- Japanese teachers (during the 'do' or 'open class' session) usually continually gather information about their students through questions, interviews, writing tasks, and other means. Then they can make appropriate decisions about such matters as reviewing material, re-teaching a difficult concept, or providing something more or different for students who are struggling or need enrichment.

4. The main results from the General Session 1: Workshop by Prof. Hiroyuki Ninomiya of (Q4): "How to utilize blackboards and notebooks for developing representation (BANSHO)" are as follow.

- The term BANSHO consists of two Japanese words 'ban' and 'sho'. The meaning of 'ban' and 'sho' respectively are 'blackboard' and 'write/draw/ post'. Therefore, the meaning of 'BANSHO' is the product, the results of teacher and student interaction in the form of writing, drawing, or posting.
- The 'plan – do – see' steps in lesson study were also used and implemented in using the blackboard. In Japan, a teacher has to plan or design the use of the blackboard which consists of: (1) problem should be solved; (2) the task; (3) comments from students or teacher, such as: clues, previous

knowledge, methods to solve problem; (4) student's idea; and (5) summary. An example of the plan of the teacher is as follows.





- After finishing the lesson, as a reflective practioner; a teacher sometimes was asked by the principal to take a photograph of the use of the blackboard as part of the 'see' step on the lesson study process. It is clear that the 'plan → do → see' steps in lesson study can be implemented to enhance the quality of mathematics teachers in Japan and Indonesia.

5. Specialists Session 2: Three Working Groups (Q1 & Q2) discussed about "How do our teachers use our textbook?" The participants agreed about the importance role of the textbooks in the teaching and learning process. The good and well designed textbook can help students to learn mathematics with understanding or meaningfully, with colorful pictures to motivate students, and with various kinds of problems to help students to learn to think. The good and well designed textbooks are usually started with problems (realistic or contextual) in which students can learn the new concept from that problem.

6. The results of attending two open lessons at Junior High School, University of Tsukuba with two presenters (Masami Isoda and Yeap Ban Har) on 18th February morning are similar to the results of the other two open lessons at Elementary Schools as has been described on point 3 above. The

Masami Isoda's lesson plan and Yeap Ban Har's lesson plan can be viewed and studied respectively on Appendices C and D.

7. Afternoon Session, at Attached Primary School of Ochanomizu University. Masami Isoda talked about 'dbook'. The 'dbook' is a tool for developing digital textbooks. In other word, digital textbooks can be created by importing existing textbooks as image files. Furthermore, interactive drawing tools can be embedded in the digital textbooks. The textbook data together with the drawing tools can be used interactively in classrooms

8. General Session 1: Workshop by Masami Isoda (Q2) with title: "Theory of teaching and curriculum for Lesson Study." Isoda sensei proposed the Japanese Problem Solving Approach to be used during the Lesson Study activities. This approach will develop student's learning by and for themselves. In other words, this approach will help students to do the same things without teachers' help at the next time. Teachers will teach students 'how to learn'. Through the problem solving approach, students can develop mathematical ideas, Mathematical thinking and Mathematical values. Teachers are hoped to teach pattern through the ordering (teaching the process). Therefore, the Japanese students can find the pattern (the outcomes) by themselves. This approach comprises four phases: (1) Problem (or Task) Posing; (2) Solving; (3) Presentation and Comparison; and (4) Reflection.

9. The results of Specialists Session 2: "How can we integrate technology, e-textbooks and classroom equipments for everyday teaching?" are as follow.

- Implications of using ICT are: (1) blackboard space becomes smaller with the introduction of technology; (2) blackboard is considered as out-of date but means of communication; (3) some schools use tablet as an interactive board; and (4) for mathematics lesson, blackboard is important to record of what is happening during the teaching and learning of mathematics.
- Questions can be raised or suggestions can be discussed are as follow.
    - The need to rethinking about the use of blackboard.
    - What is the future route ahead of mathematics teaching? Whether is drill and practice or more mathematical thinking? How to integrate or to use ICT to help?
    - Does ICT diminish or enhance the development of mathematical language or assist in communication of mathematical meaning?
    - Teachers should be cautious because ICT is always driven by commercial benefit rather than educational/mathematical benefit!
    - ICT as another resource of learning – need to be evaluated its uses from a mathematical educational perspective and treat it as the same way as other learning resources evaluated as part of planning of lesson study.

10. The opening address of the conference opening ceremony was by Shimizu Shizumi (President of Japan Society of Mathematical Education). The address title was: "Japanese New Textbook and How We Use It?" He talked about: (1) Mathematical Activities in the New COS (Course of Study) and (2) Mathematical Activities in the Text books. The main points were as follow.

- Mathematical activities are defined as various activities related to mathematics where pupils engage willingly and purposefully. Source: "Elementary School Teaching Guide for the Japanese COS: Mathematics (Grade 1-6) (2008)" and "Lower Secondary School Teaching Guide for the Japanese COS: (Grade 1-3) (2008)"
- In The Elementary School, through mathematical activities, to help pupils acquire basic and fundamental knowledge and skills regarding numbers, quantities and geometrical figures, to foster their ability to think and express with good perspective and logically on matters of everyday life, to help pupils find pleasure in mathematical activities and appreciate the value of mathematical approaches, and to foster an attitude to willingly make use of mathematics in their daily lives as well as in their learning.
- Mathematical activities as methods mean through mathematical activities.
- Mathematical activities as aims mean if pupils engage willingly and purposefully in the following activities: (1) to acquire basic and fundamental knowledge and skills regarding numbers, quantities and geometrical figures, (2) to foster by themselves ability to think and express with good perspective and logically on matters of everyday life, (3) to find pleasure in mathematical activities and appreciate the value of mathematical approaches, (4) foster an attitude to willingly make use of mathematics in their daily lives as well as in their learning.
- In the new strands of 'Mathematical Activities', the following typical and important activities are introduced: (1) activities for creating mathematics, (2) activities for using mathematics, and (3) activities for communicating mathematics.
- Activities for creating mathematics mean the activities for discovering and extending properties of numbers and geometrical figures based on previously learned mathematics. Activities for using mathematics mean the activities for applying mathematics in the situations of everyday life and society. Activities for communicating mathematics mean the activities for communicating and explaining ideas clearly and logically, and refining them by using mathematical representations.
- The statement about Mathematical Activities affect on the Text books and will improve the classroom activities and affect also to some changes in new Textbooks for 2011.
- As an example, to get the sum of the angles of a quadrangle, using the sum of the angles in a triangle; the steps of lesson could be as follows.
    - Teacher poses a problem for inquiry to their students.
    - Students do inquiry for themselves.
    - Students represent, refine and share ideas.

    - Summary by teachers that the sum of the angles of a triangle is 180° and the sum of the angles of a quadrangle is 360°.
    - Teacher extent by generalizing and posing new problem.
    - Representing summary of the lesson according to pupils' notebooks.
- Summary of lessons that the sum of the angles of a triangle is 180° and the sum of the angles of a quadrangle is 360° are very important. However those two summaries are only mathematical facts. Other valuable results in this lesson should be summarized. For example:
    - Understanding of the roles and limitations of inductive approach using manipulation, measurement or experimentation. Measuring the sum of the angles for this quadrangle, either using a protractor or by gathering all the angles in one vertex seems to give 360º. But we have to check it for other quadrangles as well.
    - Understanding how to explain by using deductive reasoning. To get the sum of the angles of a quadrangle, we can divide it into two triangles at a diagonal. The sum of the angles in each triangle is 180º, and 180º x 2 = 360º, therefore, the sum of the angles in the quadrangle is 360º.
    - Understanding of the roles of deductive reasoning. Using this way of reasoning, we can explain for all quadrangles that the sum of the angles is the same and its value is 360º and understand mathematical facts exactly and relations between new facts or procedures and previously learned precisely.
    - Understanding of how to pose new problems or how to make conjectures for oneself. We get new problems or conjectures from inquiry of the sum of a quadrangle by plausible reasoning, i.e. induction and analogy. To explain ideas clearly and logically is one of the important mathematical problem to be solved
    - Understanding exactly of facts found out. The sum of the angles of a quadrangle is the same in any quadrangle, and its value is 360°.
- The guidelines of "Elementary School Teaching Guide for the Japanese Course of Study Mathematics (Grade 1-6) With the English Translation on The Opposite Page," can be learnt from Appendix G.

11. The results of Keynote 1: "Lesson Study in Progress" by Catherine Lewis (Mills College, CA, USA) is as follows.

- Normally, there are 3 steps of lesson study which are: Plan → Do → See. However, Catherine Lewis proposed four steps of lesson study which are as follows.
    - STUDY. Teachers consider long term goals for student learning and development or study the curriculum and the standards.
    - PLAN. Teachers select or revise research lesson, do task, anticipate student responses, plan data collection and lesson
    - DO RESEARCH LESSON. Teachers conduct research lesson, collect data

    - REFLECT. Teachers share data, ask and answer this question: "What was learned about student learning, lesson design, this content? What are implications for this lesson and instruction more broadly?"
- Part of the LS process is kyouzai kenkyuu, careful study of the teaching materials focused on both the mathematics and the pedagogy. We noticed that the textbooks US teachers used to support kyozai kenkyuu in lesson study may not be rich. So we focused on gathering materials to support lesson study; not developing them from scratch, but repurposing existing materials.
- Some Dramatic Differences between U.S & Japanese Texts.
    - Earlier Introduction of fractions in US
    - More representations in US (15) than Japan (4)
    - Linear measurement were used in Japan, while circle area (and many others) were used in US
- Teachers' Reflections stated: "That the way American schools have traditionally taught fractions is by using circles, pies, pizzas, etc. I have never heard of introducing fractions through linear measurement. The idea of starting with a unit (e.g., meter) and having students explore fractions in this manner is very interesting and new for me. This lesson helped broaden my own understanding of fractions by seeing them as parts of a whole and numbers."

12. The results of Keynote 2: "Curriculum, Textbook and Classroom Equipment" by Peter Gould (Inspector, NSW Department of Education and Training, Australia) with title: "Electronic mathematics textbooks: old wine in new skins?" were as follow.

- The use and nature of mathematics textbooks varies significantly between countries. In many countries, the use of mathematics textbooks is an expectation of teaching. In other countries, use of mathematics textbooks is optional, and thought to be a practice of less experienced or less confident teachers.
- The design of mathematics textbooks is influenced by its intended use by teacher and student. Textbook or workbook? How a mathematics textbook is used can relate to who owns the textbook. One way to think about mathematics textbooks is as a series of screens.
- Looking at screens and looking through screens can be very different experiences. Surface observations - as a representation of a mathematical object and deep observations - referring directly to the mathematics
- The Challenge of the use of ICT in the teaching and learning of mathematics.
    - The Challenge 1: Animation is not a substitute for interaction.
    - The Challenge 2: Recording mathematics should be as natural as possible but need not be a requirement of a mathematics e-text.

    - The Challenge 3: The interactivity and experimentation possible with computers should enable digital mathematics textbooks to make effective use of the diagrammatic method.
    - The Challenge 4: Students should always attempt a new type of mathematics problem with a familiar representational tool.
- Digital mathematics textbooks provide new opportunities to support learners.
- The capacity to interact with mathematical representations in mathematics textbooks poses several design challenges.
- In particular, development of a digital mathematics textbook needs to support mathematical representation.
- Mr Peter Gould's paper with title: "Electronic Mathematics Textbooks: Old Wine in New Skins?" can be learnt from Appendix E.

13. The results of Panel 1: "How can we use better our textbook?" Chaired by Max Stephens (University of Melbourne, Australia) are as follow.

- Arrange the content sequence according to the strength and interest of students.
- Pay attention on topics that can bring in discussion and interaction among students.
- Use a thinking approach in teaching and learning of mathematics concepts.
- Design tasks for investigations after the learning of concepts

14. The results of Panel 2: "Current Status and Efforts for Using ICT in Case of SEAMEO Centers" Chaired by Bunyamin Maftuh (SEAMES) are as follow.

- Southeast Asian Ministers of Education Organization (SEAMEO) was established on 30 November 1965 as a chartered international organization.
- SEAMEO Purpose is to promote cooperation among Southeast Asian nations through education, science and culture
- In the 21st century the world has changed so fundamentally ignited by rapid development of ICT. Rapid development of ICT encouraged people to have ICT literacy, information and media literacy. The fundamental changes in the 21st century will change the roles of learning and education in day-to-day living.
- The 21st Century Skills are:
    - Critical thinking and problem solving
    - Communication and collaboration
    - Creativity and innovation
    - Information literacy, media literacy, ICT literacy
    - Flexibility and adaptability
    - Initiative and self-direction
    - Social and cross-cultural interaction

    - Productivity and accountability
    - Leadership and responsibility
- SEAMEO Secretariat and SEAMEO VOCTECH conducted a preliminary survey on the status of ICT integration in education in the 11 SEAMEO Member Countries.
- The 10 ICT in Education Dimensions used as framework of the study were: (1) National ICT in education vision; (2) National ICT in education plans and policies; (3) Complementary national ICT and education policies; (4) ICT infrastructure and resources in schools; (5) Professional development for teachers and school leaders; (6) Community/partnerships; (7) ICT in the national curriculum; (8) Teaching and learning pedagogies; (9) Assessment; and (10) Evaluation and research.
- UNESCO's model of ICT Development in Education for classifying the stage of development used for the preliminary survey on the status of ICT integration in education in the 11 SEAMEO Member Countries and the results were as follow.
    - Emerging - comprises 4 Countries: Cambodia, Lao PDR, Myanmar, and Timor Leste which have just started their ICT in education journey; Emerging Group
    - Applying - comprises 0 Countries which have developed a new understanding of the contribution of ICT to learning;
    - Infusing - comprises 4 Countries: Indonesia, the Philippines, Thailand and Vietnam which have integrated ICT into existing teaching, learning and administrative practices and policies; and
    - Transforming - comprises 3 Countries: Brunei, Malaysia, and Singapore which have used ICT to support new ways of teaching, learning and administration.
- Ms Puji Iryanti from SEAMEO QITEP in Mathematics presented a paper with title: "The Use of Information and Communication Technology (ICT) in the Teaching and Learning of Mathematics in Indonesia and SEAMEO QITEP in Mathematics," which can be learnt from Appendix F.

15. The results of Panel 3: "How can we innovate our classroom?" were as follow.

- Maitree Inprasitha stated that a lesson can be stated as a traditional approach if the teacher transmits contents from teacher to students by demonstrating, describing, lecturing, or other transmitting ways.
- Maitree Inprasitha's answer to the question: "How do you use blackboards and projectors in your country?" were by sharing the various ways of utilizing traditional equipments in classroom such as blackboards as well as projectors and computers.
- The teaching approach usually be used in Thailand was as follows.
    - 1.Posing open-ended problem
    - 2. Students 'Self Learning'
    - 3. Whole Class Discussion

    - 4. Summary through Connection
- The answer to the question: "How can we innovate our teaching approaches for teachers?" was: "Knowing the innovative tools to develop e-textbooks and sharing the methods of teaching."
- At once it became clear that computer educational means may be divided into groups in natural way.
    - Electronic textbooks and reference books with hyperlinks, perhaps supplied with animation and demonstration models.
    - Tools for computer modeling and animation.
    - The interactive training software.
- In Russia in many regions were created the *Educational Software Centers* which have had mission to make examination and distribution of educational computer means, preparation of teachers for using them.
- Computer technologies require the prepared school teachers. The best software and hardware are not able to substitute for independent work of a student, permanent training, repetition of the same cogitative figures and hooks. Efficiency of learning is being defined mainly by readiness and motivation of students for learning. We must not also restrict students in their choice how to express thoughts.
- Not the computer but the science dictates rules. It is bad to create an object imagination deformed by computer realization. When interactive software is being developed the designers must adhere to a rule "screen follows science tradition"
- Understanding limits of computer learning. Warn honestly parents and teachers. The modern technology should not deprive a student of possibility and necessity to write, draw, speak, learn verses by heart. That trains and develops his memory, abilities for speaking and operating by hands.
- Rohani Ahmad Tarmizi and her groups answered the question: "How Can We Innovate Our Teaching Approaches In Teaching Mathematics?" as follows.
    - Improve the quality of Teacher Education Training and School Delivery System
    - Change the role of the teacher (from restricted professional to extended professional, from curriculum implementer to reflective practitioner, from purveyor of information to facilitator of thinking, and from focus on mathematics to focus on students)
    - Experiential Learning (emphasize on experience – students' experience and continuing process of learning; some experiential methods: problem-based learning, case studies, role play, simulations, internships, project-based, inquiry-based, experiments, explorations)
    - Innovations in pedagogy (1. Teachers are now expected to model and foster in their students a wide range of skills; critical thinking; self-regulated learning; knowledge of self and others and lifelong learning. 2. University teacher educators must re-evaluate their curricula and

emphasize more on realistic pedagogical skills. 3. These skills should be based on the philosophy of inquiry and actively learning and process approach.

16. Finally, Kwangho Lee (Korea National University of Education) invited the participants to attend the ICME Meeting (International Commission on Mathematics Education) in Korea. Inprasitha also invited the participants to attend the APEC-Tsukuba International Conference VI in Thailand.

Conclusions

1. The 'PLAN → DO → SEE' steps in lesson study or 'STUDY → PLAN → DO RESEARCH LESSON → REFLECT' in term of Catherine Lewis were used and implemented in every aspect of teaching and learning of mathematics; such as in using the blackboard, in designing textbooks, in assessing students, or in writing lesson plan. Therefore, the Lesson study (LS) processes in Japan have successfully changed the teaching and learning of mathematics processes to be more students centered. In addition, the LS have successfully changed the teaching and learning processes to start the process with problem (can be 'realistic problem' or 'contextual problem'). In other words, the focus of the teaching and learning processes in Japan was on problem solving. So, the first conclusion was the 'PLAN → DO → SEE' steps in lesson study should be implemented consistently. Every step is very important and should be implemented consistently also. The LS emphasize in Japanese culture was not only *on the collaboration* between mathematics teachers and mathematics education experts, but more importantly, the emphasize was on how to change the process of teaching and learning mathematics in class such that mathematics could *be more easily understood* by every students and in how to help to think, to reason, and to communicate mathematically which can be categorized as high order thinking skills (HOTS).

2. As mentioned by Shimizu Shizumi (President of Japan Society of Mathematical Education) on point 10 of the results above that mathematical activities as aims mean if pupils engage willingly and purposefully in the following activities: (1) to acquire basic and fundamental knowledge and skills regarding numbers, quantities and geometrical figures, (2) to foster by themselves ability to think and express with good perspective and logically on matters of everyday life, (3) to find pleasure in mathematical activities and appreciate the value of mathematical approaches, (4) foster an attitude to willingly make use of mathematics in their daily lives as well as in their learning. In Indonesia, Ministry of National Education, MONE (2006) states that the aims of mathematics teaching and learning are to help learners to be competent in areas: (1) mathematical knowledge; (2) reasoning (both inductive and deductive reasoning); (3) problem solving; (4) communicating; and (5) good attitude toward mathematics. If we compare those four aims of teaching and

learning mathematics in Japan with five aims in Indonesia; than it is clear that there are only minor differences between those two. In other words, the aims of mathematics teaching and learning in Japan and in Indonesia are similar. However, with the use of LS consistently in Japan, those aims can be implemented in the textbooks, in the teaching and learning process, and in assessment process. The second conclusion, the aims of mathematics teaching and learning in Japan and in Indonesia are similar.

3. The Japanese mathematics teachers have successfully implemented those aims in the teaching and learning process of mathematics. In Japan, mathematics teachers were supported by well designed textbooks and assessment. In curriculum theories, the Japanese mathematics teachers have implemented three aspect of curriculum successfully: (1) the curriculum contents (what do students should know?), (2) the delivery system (what should teachers do to help students to learn?), and (3) the assessment system (how do teachers know weather the students already learn or not?). The first aspect has been stated on the curriculum; the second and third aspect about delivery system and assessment system has been well designed and well prepared which supported by university or other institution expert. The third conclusion was, each aspect of those three aspects (contents, delivery system, and assessment system) should be taken into account in helping students to learn mathematics meaningfully and successfully.

4. The use of ICT in the teaching and learning of mathematics can not be denied by every educators and teachers. Computer technologies require the prepared school teachers. However, the efficiency of learning is being defined mainly by readiness and motivation of students for learning. We must not also restrict students in their choice how to express thoughts. Therefore, the fourth conclusion was, the ICT should be used to help learner to think and to learn meaningfully. Students should construct their knowledge by themselves. Teachers, textbooks, and ICT can only help students on constructing their knowledge by themselves.

5. The meeting was conducted successfully. The success of the meeting was based on the spirit of working together among them to learn and to share ideas.

The Recommendation

1. LS may be implemented in Indonesia and in SEAMEO member countries in order to enhance the *quality of teaching and learning mathematics* in primary and secondary schools. In order to assure that the LS can change the teaching and learning of mathematics that the each aspect of 'PLAN → DO → SEE' steps in lesson study or 'STUDY → PLAN → DO RESEARCH LESSON → REFLECT' in term of Catherine Lewis should be implemented consistently.

The LS emphasize should not only *on the collaboration* between mathematics teachers and mathematics education experts, but more importantly, the emphasize was on how to change the process of teaching and learning mathematics in class such that mathematics could *be more easily understood* by every students and in how to help to think, to reason, and to communicate mathematically which can be categorized as high order thinking skills (HOTS). However, there are several things should be taken into account in implementing LS, among them are as follow.

- The LS emphasize is not only on the collaboration between mathematics teachers and mathematics education experts; but should be on how to change the process of teaching and learning mathematics in such a way to be more easily understood by every students.
- The LS emphasize should be also aimed at learning mathematics, e.g. to help students to be competent in mathematics content knowledge, reasoning (inductive and deductive), problem solving, communications, and positive attitudes toward mathematics.
- The culture of Indonesian teachers (such as, some of them are seemingly 'shy' and 'quiet' in discussing or in arguing about their teaching plan); which could be constrained in using LS as an alternative or strategy in developing the professionalism of mathematics teachers. My question is, based on Japanese experience, what kind of culture, belief systems or behaviors are needed in implementing the LS? In your experience, how to change (modified) the culture, belief systems or behaviors to be more easily adapted in implementing the LS successfully?
- In planning the lesson; mathematics teachers, mathematics educators, and experts also need high quality resource materials (such as mathematics text books, example of lesson plan, materials from website/blog, periodicals, films, or VCD). Therefore the library of CEDEMTEP or *PPPPTK Matematika* and SEAMEO QITEP in Mathematics should be improved with the high quality text books, periodicals, films, or VCD.

2. As mentioned earlier, the aims of mathematics learning for students in Japan and in Indonesia are quiet similar. However, in reality, with the use of LS consistently in Japan, those aims can be implemented in textbooks, in teaching and learning process, and in assessment process. Mathematics teachers and Mathematics educators in Indonesia should learn from Japanese mathematics teachers and educators and should work hard in implementing the five aims of the teaching and learning mathematics can happen in Indonesian mathematics classes.

During the PLAN step, teacher should be encouraged to design about:

- Theme of the lesson study which was related to the newest issues or current trends of mathematics education.
- Started problems (can be contextual or realistic problems; or mathematical problems; and usually are open ended problems).
- Anticipated students' answers.

- Key questions.
- Other low level questions to help students.
- The use of time.
- The use of blackboard, textbooks, …

During the DO step, teachers should be encouraged to do activities as follow.

- Observe their students work.
- Ask questions and interview students in order to find their difficulties.
- Record the teaching and learning processes.
- Take pictures of the use of blackboard during the teaching and learning processes.

The 'see' steps can only happen if mathematics teachers eager to 'learn' from their students' difficulty. During the SEE step, teachers should be encouraged to ask and answer these sample questions.

- Why did some students have difficulties to do …?
- How can we help them?
- What kinds of change should be done to help students to learn mathematics more easily and more meaningfully?
- What kinds of change should be done to help students to learn to think, to reason, to solve problem, and to communicate mathematically?

As a reflective practitioner, with the 'PLAN → DO → SEE' steps in lesson study, mathematics teacher can be helped to enhance their professionalism as an experienced mathematics teacher.

3. Indonesian mathematics teachers should be supported by well designed textbooks and assessment especially they should be supported by well designed textbooks. In Japan, mathematics textbooks are already started with the problem (can be contextual or realistic problems; or mathematical problems; and usually are open ended problems) while in Indonesia, it is vey difficult to find mathematics textbooks which are already started with the problem (can be contextual or realistic problems; or mathematical problems; and usually are open ended problems). In addition, the examination problems such as the typical TIMMS and PISA problems should be introduced and asked to Indonesian students. With the support of well designed textbooks and assessment system the more students centered learning processes can happen in Indonesian classes. The CEDEMTEP (Center for Development and Empowerment of Mathematics Teachers and Education Personnel) or *PPPPTK Matematika* and SEAMEO QITEP in Mathematics, *Yogyakarta, Indonesia* should help Indonesian mathematics teachers with well designed models,

4. The ICT should be used to help learner to think and to learn meaningfully. Students should construct their knowledge by themselves. Teachers, textbooks, and ICT can only help or facilitate students on constructing their knowledge by themselves. Therefore, the CEDEMTEP or *PPPPTK Matematika* and SEAMEO QITEP in Mathematics should continue

their effort in helping Indonesian mathematics teachers and students with well designed computer programme.

5. The success of the APEC-Tsukuba International Conference V: "Innovation of Classroom Teaching and Learning through Lesson Study" was based on the spirit of working together among them to learn and to share ideas. Therefore the program of CEDEMTEP or *PPPPTK Matematika* and SEAMEO QITEP in Mathematics should be based on the spirit of working together among SEAMEO member countries to learn together and to share among them.

APPENDICES

A. Takao Seiyama's Lesson Plan ("The expression of proportionality.")
B. Yasuhiro Hosomizu's Lesson Plan ("The expression of proportionality.")
C. Masami Isoda's Lesson Plan ("Exploring Linkages with Geometry.")
D. Yeap Ban Har's lesson plan ("Exploring Polygons on Electronic Geoboard.")
E. Peter Gould's Paper ("Electronic Mathematics Textbooks: Old Wine in New Skins?")
F. Puji Iryanti's Paper ("The Use of Information and Communication Technology (ICT) in the Teaching and Learning of Mathematics in Indonesia and SEAMEO QITEP in Mathematics.")
G. Guidelines: "Elementary School Teaching Guide for the Japanese Course of Study Mathematics (Grade 1-6) with the English translation on the opposite page.")