First Announcement

Third APEC-Tsukuba International Conference
Innovation of Classroom Teaching and Learning through Lesson Study
-Focusing on Mathematical Communication-

Dec. 9-14 (15), 2007
Tokyo and Kanazawa (and Kyoto), Japan

At the third APEC Education Ministerial Meeting held on 29-30 April 2004 in Santiago, the ministers defined the four priority areas for future network activities. “Stimulating Learning in Mathematics and Science” is one of the four priority area. Based on this priority, APEC HRDWG approved this project, ‘Innovation of Classroom Teaching and Leaning through Lesson Study’.

Lesson Study is a world known school based action research for both professional development and curriculum development, and an essential strategy to improve the quality of education in economies. As well as previous projects APEC HRD 03/2006, 02/2007, FY 2008 project has four phases: First phase is aimed to share the ideas and the planning of Lesson Study for each economy in Japan. Second phase is aimed to engage in Lesson Study for developing models in each economy. Third phase is aimed to report the results of Lesson Study and share the models in Thailand. Fourth phase is aimed to adapt the model in each economy.

As for FY 2008 APEC project, first phase is planed as APEC-Tsukuba International Conference (III) at **December 9-14 (15), 2007**. This announcement includes the call for specialists from economies, the discussion documents of the conference in order to push challenges for the improvements of education in APEC economies, and conference schedule and venue.

Call for Specialists from member economies

The project and the meetings are planned for improving the quality of education in APEC economies. The project itself has been carried out by the specialists from member economies who participated in the past meetings: Tokyo in January 2006 and Khon Kaen in June 2006 for APEC HRD 03/2006 project, and Tokyo-Sapporo in December 2006 and Khon Kaen in August 2007 for APEC HRD 02/2007 project. The project is still ongoing in each economy at this moment by each specialist (Please look at Appendix B).

In past meetings, it also opens for new delegates who are recommended by each economy. In the case of economies recommending new specialists, please consider the following specialist's criteria for developing the products of the project.

Specialist;

- is working in the Ministry of Education for curriculum development or collaboratively working with the Ministry of Education in academic institutions including universities for teacher education,
- has experience of research in mathematics classroom at compulsory education level,
- will engage in Lesson Study for FY 2008 project and develop teacher education program in each economy in the project, and,
- will present his/her reports at both meetings in Japan in December, 2007 and Thailand in August, 2008.

Please inform us the specialists who are recommended by the economies using the format (Appendix A) attached on the last pages of this document not later than October 26, 2007.

For sharing the welfare to improve the quality of education through the Lesson Study, it is very welcome the member economies will support travel grants for a number of delegates. Based on the APEC policy, the travel cost of one specialist from each APEC eligible member economy (Chile, China, Indonesia, Malaysia, Mexico, Papua New Guinea, Peru, Philippines, Russia, Thailand, and Vietnam) should be supported by APEC grant. Economies which can dispatch by the self-grant is recommended to use self-grants for their participations however the organizing committee will consider the ways to support if possible. The ways of support will be estimated after the specialist nomination in October 26, 2007 (See page 5). If the number of delegates is larger than the limitation of the grant, the priority will be decided by the APEC policy.

Contribution, Report and Publication

Specialists are required to submit their paper not later than November 30, 2007 on the PME format. For specialists, you are expecting to write paper with respect to the following key questions using examples to illustrate your ideas (Further explanation will be seen Appendix C). Keynote Speakers are required to submit their paper and ppt file not later than November 26, 2007 for preparing simultaneous translation.

As well as past meetings in Japan, the purpose of this session is to share key ideas and the planning of Lesson Study project in each economy. Before the meeting, specialists will have to read each other's papers. All the papers will be compiled into the progress report of the APEC HRD project with CD or DVD and distributed through the project website and APEC Knowledge Bank by US government. APEC Knowledge Bank also

supports the Wiki pilot study for this Lesson Study project. Based on our outcome of the year 2008 project, next year, we will ask the contributors to rewrite the papers for the publication of the teacher education book.

Key Questions for Focusing on Mathematical Communication

1. Why do we focus on mathematical communication?

On your national curriculum document (including the general document of whole curriculum), how does it enhance communication or mathematical communication for students?

2. What are your components of mathematical communication to develop?

When you consider the classroom communication, what kinds of components you want to integrate on the words of communication for developing mathematical thinking?

3. What kinds of approach will you prefer to develop the communication in classroom?

What is your model teaching approach (or your teaching strategy) to enhance classroom communication in mathematics?

Further explanation will be seen on Appendix C

Program of the Conference in Japan

As well as our past years, we will share the key ideas through keynote lectures and panel discussion, and share the key methods of Lesson Study at the open symposium. Further elaborate and develop challenging plan for the Lesson Study for Phase II will be held during the specialists' session.

Dec. 8. 2007 Arrival (Tokyo)

15:00- Program meeting: Discussion about Wiki project.

18:00- Meeting in Japan Side

20:00- Explanation of the whole schedule for all specialists and keynote speakers

Dec. 9. First day: Open Symposium. -Representation and Communication-

9:00 Opening Ceremony

9:20 Explanation about the APEC Project

9:30 Tadao Nakahara

President, Japan Society of Mathematical Education/Pan-Pacific University

Constructing mathematical ideas through representation

-Significance of communication

10:20 Kozo Tsubota

Elementary School attached to the University of Tsukuba

Developing the comprehensive classroom with Problematic Situation

11:30 Koeno Gravemeijer

Freudenthal Institute, Netherland

Designing mathematical activities by representation: Emergent modeling

12:50 Lunch Break

13:50 Lesson Study: Kozo Tsubota, 6th grade

14:50 Panel Discussion and Group Discussion about the lesson

17:30 Resume

18:00 Reception

Dec. 10. Second day: Open symposium. –Communication, Argumentation and Reflection

9:00 Wiki Project Report

9:10 Hiroshi Nemoto

Former Chief Inspector/ Ibaraki University

Developing mathematical thinking through reflective experience

10:00 Hiroshi Tanaka

Elementary School attached to the University of Tsukuba

Developing children's communication and representation

11:00 Guershon Harel

University of California, USA

Explanation, Argumentation and Proof

12:20 Lunch Break

13:30 Lesson Study: Kozo Tsubota

14:30 Panel Discussion and Working Group

17:00 Resume

(17:30 Book Project session)

Dec. 11. Move to Kanazawa: Short excursion of Kenroku-en (Park)

Dec. 12. Specialist session at Kanazawa University about Representation

Morning session: Lesson Study meeting

Mayumi Hashimoto / Elementary School Attached to Kanazawa University

Afternoon session: Teaching strategies to develop the ability of representation

(Night session for Book Project)

Dec. 13. Specialist session at Kanazawa University about Argumentation

Morning session: Lesson Study meeting

Toshiharu Matsubara

Junior Secondary School Attached to Kanazawa University

Afternoon session: Teaching strategies to develop the ability of discussion

Night session: developing the plan of Lesson Study in each economy

Dec. 14. Specialist session: Planning to challenge

Morning session: Planning to challenge for Phase II

Closing Session at noon

Additional Session of the Conference (Kyoto Excursion)

Dec. 14 Afternoon: move to Kyoto
Dec. 15. Excursion in Kyoto and additional planning (at night move to Narita if necessary)
Dec. 16. Departure (from Kansai airport or Narita airport)

Important Information for Participants at APEC-Tsukuba Conference

First Announcement will be sent:

October 5, 2007
Contact URL: http://www.criced.tsukuba.ac.jp/math/apec

Deadline of the nomination of specialists from member economies:

October 26, 2007
Contact address: apec@criced.tsukuba.ac.jp

Invitation letter, Information of Trip and Second Announcement will be sent from

October 31, 2007
Contact address: apec@criced.tsukuba.ac.jp
Contact URL: http://www.criced.tsukuba.ac.jp/math/apec

Deadline of the submission of paper:

Keynote Speakers: November 26, 2007
Specialists: November 30, 2007
Contact address: apec@criced.tsukuba.ac.jp

All Papers for Discussion and Final Announcement will be on the website:

December 3, 2007
Contact URL (to be announced to specialists)

Arrival day of Participants

December 8

References:

APEC:
http://www.apec.org/
Knowledge Bank for APEC HRDWG Education Network:
http://www.apecknowledgebank.org/knowledgebank/index.cfm?action=dsp_body
APEC HRDWG Lesson Study Project official site (will be renewal in November):
http://www.criced.tsukuba.ac.jp/math/apec
Latest information of the Lesson Study project in FY 2007:
http://ednet.kku.ac.th/dataheadnewsdetail.php?headnews_ID=5

List of Correspondence of the Conference

Conference Host:	University of Tsukuba Kanazawa University
Organized by	Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Khon Kaen University (Thailand)
Supported by	Japan International Cooperation Agency (JICA) Japan Society of Mathematical Education (JSME) Japan Society of Science Education (JSSE)

Organizing Committee

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Kanazawa University, Japan

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HATTORI, Katunori, Professor, Naruto University of Education
OHARA, Yutaka, Associate Professor, Ritsumaikan University
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Appendix A

Specialists from the Economy

Please fill and sent it back from the economy to 'apec@criced.tsukuba.ac.jp'

* Specialists will be already worked at past meeting (see Appendix 2), or new persons who are recommended by the economy.

**The specialist written on 1) will be recommended to use the APEC project grant or the Japanese grant from the economy side and will be expected as a delegate from economy.

***There is no limitation of the number of specialists who are recommended by each economy.

1)

Names (First Middle Last)			
Title		Economy	
Affiliation (Institution)			
e-mail			
Tel/Fax			

2)

Names (First Middle Last)			
Title		Economy	
Affiliation (Institution)			
e-mail			
Tel/Fax			

3)

Names (First Middle Last)			
Title		Economy	
Affiliation (Institution)			
e-mail			
Tel/Fax			

Appendix B

Specialists (Experts) working in the project

A number of specialists from the following economies have been participating and giving much contribution for developing product of this project in each year:

Australia, Brunei Darussalam, Chile, China, Hong Kong, Chinese Taipei, Indonesia, Japan, Korea, Malaysia, Mexico, Peru, Philippines, Singapore, Thailand, United States, Vietnam

The project is making efforts of getting more participation from all economies using grant from APEC, Japan and Thailand and we welcome more new participants from economies preferably with self-funding for each economy's welfare on the policy of APEC.

The project has been ongoing in each economy by the participated specialists. Major working on this project is going through the Lesson Study activity for developing model teaching approach with teachers by specialists in each economy. The meeting at Tokyo-Kanazawa is just aimed for the Lesson Study planning in each economy. And the meeting at Thailand is aimed for the reflection of the Lesson Study product in each economy. Thus, the specialists nominated from each economy are the key persons for acquiring fruitful product for each economy and they are working for improvement of the quality of education in each economy and developing the model approaches for economies.

The following specialists expressed to work in their Lesson Study for preparing the FY 2008 project and currently developing products.

Australia	Peter Gould , Max Stephens,		Mexico	Marcela Santillan
Brunei Darussalam	Madihah Khalid		Peru	Monica Miyagui
Chile	Mag. Francisco Cerda Bonomo		Philippines	Soledad Ulep
Hong Kong	Cheng Chun Chor Litwin		Singapore	Yeap Ban Har
Indonesia	Marsigit		Thailand	Inprasitha, Maitree Loipha, Suladda
Japan	Masami Isoda, Shizumi Shizumi, Kazuyoshi Okubo.		United States	Akihiko Takahashi, Patsy Wang-Iverson, Makoto Yoshida
Korea	Inchul Jung		Vietnam	Tran Vui
Malaysia	Lim Chap Sam			

All keynote speakers, Catherine Lewis (US), Alan Bishop (Australia), Kaye Stacey (Australia), Fou Lai Lin (Chinese Taipei), Frederick Leung (Hong Kong), Kyungmee Park (Korea) and so on, have been supporting the project. From the world, David Tall (UK), Abraham Arcavi (Israel) and others supporting the project by self-grants.

Appendix C

Key Questions for Focusing on Mathematical Communication

Lesson study is a well known method to improve quality of education and has been functioning for professional development and curriculum development. Through the Conference in Japan, specialists share the ideas and the plan of Lesson Study for Second Phase in each economy. The following key questions are posed for developing model of teaching approaches in each economy for APEC welfare.

Why do we focus on mathematical communication?

In this knowledge based society, a kind of knowledge could be shared on the website. Plenty of useful information and resources that allow interactions within society could be uploaded if necessary from the web. Nevertheless once information is introduced onto the internet, nobody has control over it anymore. Computer technology is embedded in the environment and innovation is a current key word for sustainable development of globalization.

In making use of information, the competency of thinking symbolized by the keywords such as critical, collaborative, developmental, creative, and mathematical, and the sense of values such as innovative and sustainable, is essential to be developed by teachers. It induces that we should change our teaching from product-based teaching approach such as lecturing skills and knowledge to process-based teaching approach represented by the communication in the classroom.

In the society, higher order mathematical concept itself is embodied in the thinkable representation (Tall, 2006) on the computer but it is still necessary to think mathematically (Stacy, 2006) on the situation with mathematical concept. Thus, we focused on the development of mathematical thinking in the project year 2007. When we think about these keywords as well as mathematical thinking, we know that to develop classroom communication is important because to develop thinking ability is explained by internalizing communication from inter subjective communication to inner subjective one. Based on this principle, critical thinkers will be developed through the reflective experiences of critical discussion. As a kind of competency, critical thinkers could be developed in other subjects or fields, not only in mathematics. Math educators recognize that such kind of narrow meaning of mathematics is the result of ready made, product based, or chalk and talk approach of school mathematics. Here, we, math

educators, let people know that if we know the essential meaning of mathematics, mathematics is the most necessary subject to develop the essential way of communication. Mathematics is the most appropriate subject to develop the communications because both mathematical way of communication and mathematical thinking is a necessary for tomorrow's better life.

One could view mathematics as a kind of second language which will not be acquired without studying it in school. For the sustainable development on various meaning of globalization, the ability to challenge the problem which does not have only one answer and trying to find best solutions through collaboration beyond each economy is important. This is the problem solving approach itself in mathematics education (Takahashi, 2006; Okubo, 2006.). Mathematical communication is an important key idea not only for improving mathematics but also for developing necessary ability for sustainable development on the knowledge based society. From these views, we focus on mathematical communication.

On your national curriculum document (including the general document of whole curriculum beyond mathematics), how does it enhance communication or mathematical communication for students? Even if the word of communication is not mentioned, it is important to consider why it is not mentioned.

What are your components of mathematical communication to develop?

Mathematical communication is a kind of communication. Greek origin of the word *'communication' is related with community*. Communication is based on community and it development is deeply related with cultural development or enculturation (Bishop, A., 1988) in community. The usage of word 'communication' is not only restricted to use within human community. The word includes the meaning of interactive process and uses metaphorically such as scientists communicate with nature through observation and experimentations. Mathematical communication is the communication on mathematics. When we consider the meaning of mathematical communication, history of mathematics gives us essential features of it. Followings are some features of mathematical communication from history.

Firstly, mathematical communication has the dialectic feature in mathematical development. Dialectic feature of mathematical communication is now known as historically most important feature of mathematics itself. As Savor described, the origin of indirect proof is the dialectic which is known by Pythagoreans or school of Plato. The condition to enter the Academia of Plato School was mathematics. Indeed, many examples of dialectics given by Plato or Socrates are mathematics and those are

currently an important historical text which we can know what Pythagorean's school was. Hegel's dialectic, thesis, antithesis and synthesis, as known as the logic of heuristics was clearly referred Ancients Greek. Imre Lakatos proposed a feature of mathematics by proof and refutation was recognized as a Hegelian.

Secondly, mathematical communication has the features of *mathematical way of explanation for sharing ideas and understanding.* In the upper grades, this is formalized to *proof*, as a special way of explanation and rhetoric, but even if we learned proof we keep using *various ways of explanation* as well as proof in mathematical communication. Depending on Szabo, A. (1978), the *indirect proof* in mathematics is internalized communication of *dialectic* between people such as 'if your saying is true, then…'. For sharing ideas, we use various ways of explanation such as inductive, analogical and didactical. In any case, it is necessary to understand other ideas to share the communication ground. For understanding the content, we use examples to support those reasoning.

Thirdly, mathematical communication has the feature to use mathematical representation which is developed for mathematics. At the area of ancient Greek, mathematical representation is geometric representation and Greek language itself. Geometric representation has the restriction of dimensions and Descartes overcame the restriction through developing the translation rule between geometry and algebra. Analytic geometry and calculus developed functional representation on the coordinates and statistical graphs have developed through the data representation. At the area of computer, knowledge based society is supported by these representation. Indeed, binary notation system represents the electric functioning of computer and Boolean algebra is necessary for logic circuit.

Fourthly, mathematical communication has the feature of both competitive and sympathetic attitudes. These attitudes are well known on historical communication between mathematicians such as between Archimedes and Eratosthenes, Pascal and other mathematicians, and so on. For sharing and refutation of other's ideas, we should know others perspectives and let others understand our own ideas clearly. There is fantasy that everyone can solve the problem if we can teach heuristics. The history tells us that even if the problems are posed to each other in the process of competition and many people are exploring, they were solved by one or few. The others were trying to follow with exultation and enjoining to engage in going beyond. Understanding other's ideas with sympathetic attitude and trying to go beyond others with competitive attitudes are both essential for mathematical activity. We can easily observe both attitudes in the process of communication (Isoda, M., McCrae, B., Stacey, K., 2006).

Lastly, mathematical communication has influenced by language and it is deeply depending on culture. There are economies where mathematics is taught by second language or in multi-language classroom (Lim, C., 2007). In these economies, there is much difficulty to study mathematics and to engage in mathematical communication. At the same time, mathematics itself is a language for sharing mathematical ideas. Mathematics is a possible language enabling us to share ideas beyond different cultures and languages. On the other hands, mathematical communication is deeply related to classroom culture. Mathematics classroom culture is the base of communication and improvement of mathematical communication cultivate culture of classroom for the mutual understanding of mathematics and classroom community.

When we consider communication from these features, we easily understand that we can not focus on only communication in our reference. For example, in PISA (2003), there is the competency about communication but at the same time, the argumentation is also related.

- *Argumentation:* this involves knowing what mathematical proofs are and how they differ from other kinds of mathematical reasoning; following and assessing chains of mathematical arguments of different types; possessing a feel for heuristics ("What can or cannot happen, and why?"); and creating and expressing mathematical arguments.
- *Communication:* this involves expressing oneself, in a variety of ways, on matters with a mathematical content, in oral as well as in written form, and understanding others' written or oral statements about such matters.

In Standards by NCTM, 'Representation' and 'Proof and Reasoning' are also process standards as well as 'communication'.

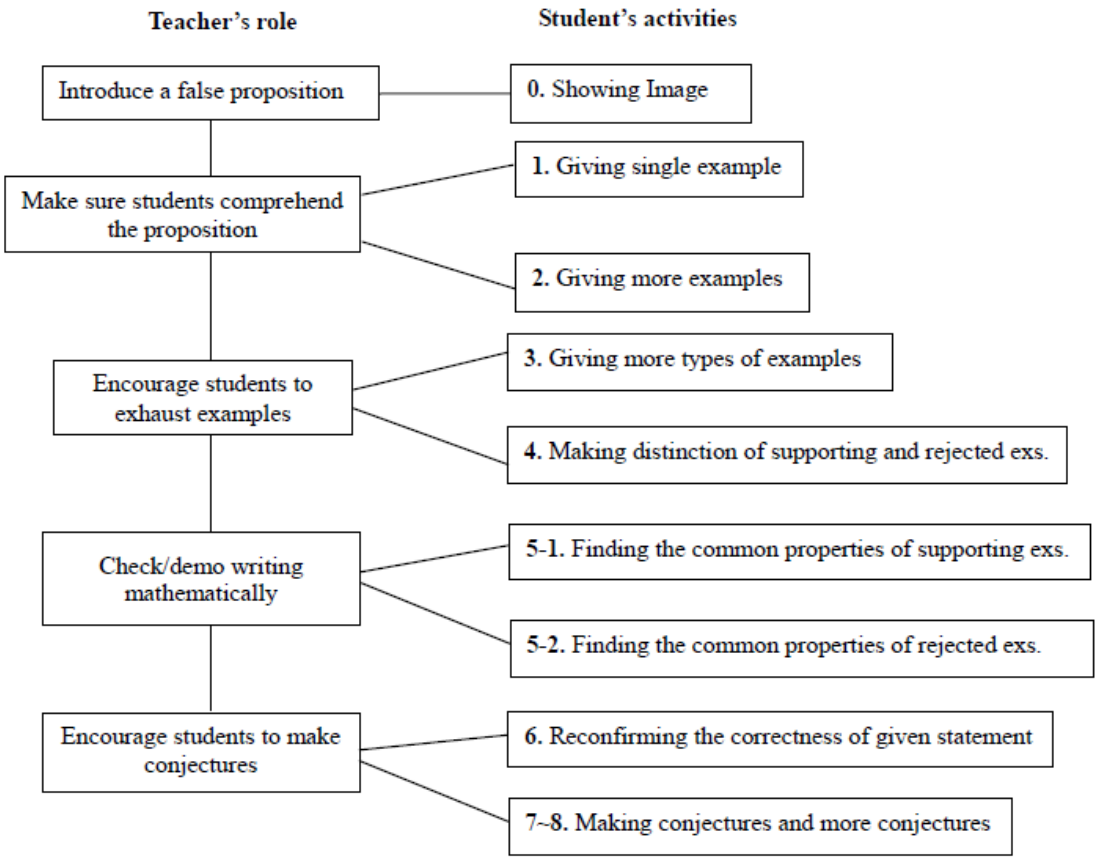
When we consider these features of communication, we recognize that if we focus on the word 'communication', we also focus on all processes of mathematics thinking. Thus, *when you consider the classroom communication, what kinds of components you want to integrate on the words of communication for developing the mathematical thinking?*

What kinds of approach will you prefer to develop the communication in classroom?

The above-mentioned features of communication are also the nature of mathematical activity. If we focus on the communication, we can improve the process of teaching with mathematical activity for developing mathematical thinking. There are a number of researches analyzing or surveying classroom but there are a limited number of researches which propose the challenges of improvement itself. As Wiliam, D. (2003)

proposed, we prefer hermeneutic-practical approach against analyzing approach of lesson. The Lesson Study is hermeneutic-practical approach and it is managed by teachers. Normally, a teacher poses the problem and conducts communication in classroom. From teachers' perspective for challenging to improve their lesson, we will focus on communication from the view point of planning the lesson and managing the lesson.

On our APEC project, there are several model approaches for the challenges in classroom through the Lesson Study for developing classroom mathematical communication. One of the model approaches for improving classroom communication was proposed by Lin, F. (2006). He illustrated his approach as follows.



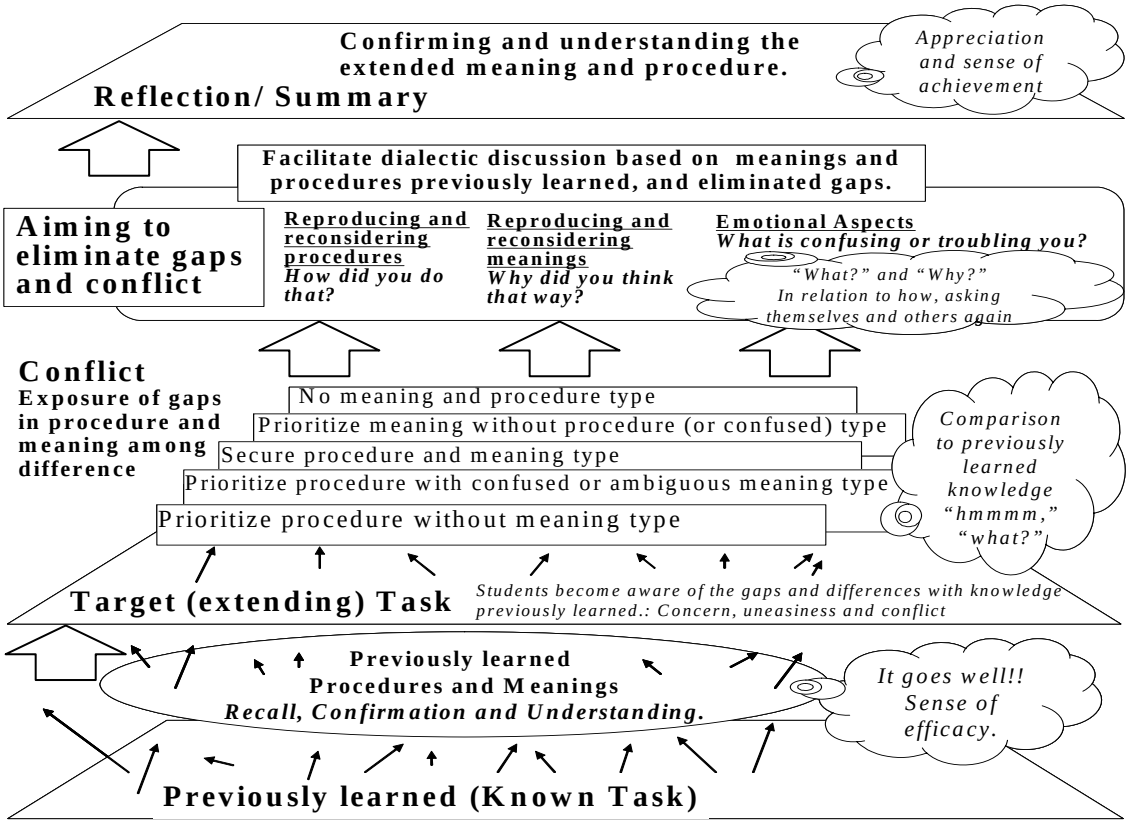
In other models, the problem solving approaches are illustrated by Takahashi, A. (2007), Okubo, K. (2007) and so on. Following picture in the next page is one of problem solving approach by Isoda, M. (2006, 2007).

Through the approach, he proposed sequential problem posing (task sequence) with teaching strategies for dialectic discussion to construct mathematics in classroom as follows.

What if A's idea is correct?

Facilitating awareness through application of tasks in different situations and examples

Both strategies also could be seen on the approach by Lin.



Problem solving approach is also illustrated by Inprasitha, M. (2006) as Open Approach. He introduced Open Approach by incorporating in Lesson Study. In developing lesson plan, he suggests using open-ended problem for putting mathematical activity into the lesson. He also suggests changing the classroom culture through open approach. In the approach, communication among students in classroom is richly generated. The results revealed a new classroom culture which is contrasted to the traditional mathematics classroom where drilling computational skills were emphasized. Additionally, He explained the effect of Open Approach lesson study that it is not only cultivating classroom culture but also gradually changing traditional school culture among teachers and students.

We believe that there are a number of model approaches to improve the way of communication in mathematics classroom. Indeed, those approaches are just examples from the past APEC conferences. The feature of those models is that the model is used

for developing teaching practice including ways of communication, and not developed for analytic survey itself. And as for APEC Human Resource Development project, we will develop model approaches for the teaching to improve classroom communication. *What is your model for teaching approach (or your teaching strategy) to enhance classroom communication in mathematics?*

For the Lesson Study at Second Phase

The plan of FY2008 project is followings: First phase is aimed to share the ideas and the planning of Lesson Study for each economy at this conference in December 9-14, **2007**. Second phase from January, 2008 to August, 2008 is aimed to engage in Lesson Study for developing models in each economy. Third phase in August 2008 is aimed to report the results of Lesson Study and share the models in Thailand. Fourth phase in August 2008 to December 2008 is aimed to adapt the model in each economy.

The plan of Lesson Study will be set in this conference. Tentatively, we are considering following activities in each economy based on experience and current activities on the project.

1) Working with teachers to develop lesson plans for lesson study,
2) Conducting the cycle of lesson study including research lessons and post-lesson discussions with a group of teachers,
3) Documenting the entire process by video taping, and
4) Developing a report for Thailand meeting with an edited video of the research lesson and the post-lesson discussion with English subtitle.

The products from economies will be sited on the APEC knowledge bank and used for the Wiki project as a branch of this project for influencing the model for improving quality of education with the support of US government.

Specialists and keynote speakers will also discuss these points and develop their plan in this conference.