APEC Lesson Study Projects in Mathematics, Science and Emergency Preparedness Education proposed from Thailand and Japan

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Table of Content

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1. Overview and Background in relation to the Purpose of the Projects

This report includes the eight Lesson-Study Projects (LSPs) proposed by Thailand and Japan starting in 2006 and extending to 2014. It focuses on the subjects of mathematics, science, and emergency preparedness. Beginning at the elementary school level, mathematics literacy are fundamental subjects for economic development as they represent the major language in every economy. Science is also necessary because it is the base for engineering and technology which also use mathematics as their language. Due to this necessity, they have been recognized as basic skills in a knowledge based society in the 21st century. Mathematics usually receive the largest amount of teaching time from kindergarten or elementary school through high school as well as mother language and English as the second language. Even though East Asia typically performs well, mathematics is known as a difficult subject. The LSP's begun with a focus on mathematics and included science when they shifted to Emergency Preparedness Education. Next, the background of the LSPs will be explained followed by an overview of the LSPs.

1-1. Background

There are two main regional and global backgrounds for LSPs.

In the APEC (2004, 2008, 2012) and UNESCO (2000) documents, universal mathematics and science literacy have been recognized as necessary in order to establish better quality of life and economic growth within a globalized, knowledge based society. While the UNESCO documents highlight supporting minimum literacy such as Numeracy, the APEC documents are more directed towards economic growth and the welfare of APEC economies.

The documents such as the Darwin Declaration of APEC Energy Ministers (2007), the establishment of the APEC Emergency Preparedness Working Group (2010) and the Decade of the Education for Sustainable Development by UNESCO (2005) indicate the urgent themes for the preparation and innovation in education for risk management regarding global warming and unavoidable natural disasters. They are the emergency tasks which can only be solved by global and regional collaboration. While the UNESCO document refers to world issues for establishing comprehensive long term educational efforts for involving under achieved economies, APEC documents are more directed towards the economic development.

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1-2. Overview of LSPs

Out of these two major pushes, LSPs have been extended as follows.

1-2-1. First Stage for LSPs: "Establishment of Lesson Study activity in each economy"

As for the economic growth for every economy, mathematics has been regarded as the priority area for innovation in education by the APEC HRDWG (Human Resource Development Working Group) Educational Network under the Joint statements from the Education Ministerial Meetings in Santiago (2004), Peru (2008) and Korea (2012). Under the demands agreed to in Santiago (2004), the 2006 project was submitted to APEC HRDWG Education Network in 2005.

1-2-1-1. The year 2006 LSP: Pilot study

Under the demands of APEC, LSPs for Mathematics Education launched in 2006 with the pilot project 'A collaborative study on innovations for teaching and learning mathematics in different cultures among the APEC Member Economies (2005). Firstly, the pilot project reviewed the various existing classroom studies in the APEC economies, such as the extant action research, the TIMSS (Third International Mathematics and Science Study) Videotape Classroom Study (Stigler, Gonzalez, Kawanaka, Knoll, and Serrano, 1999) and Japanese meaning of lesson study. From the reports such as the US Department of Education [2000], the Japanese Lesson Study methodology for improvement of education was recommended based on the academic research trends from 1990's. During the discussion in the first meeting in 2006, lesson study was recognized as the best method to produce the best practice for teaching as well as being an autonomous improvement system in education controlled by the teachers themselves. Thus, it was concluded to choose the lesson study methodology for the methodology of the LSPs to produce innovative approaches for mathematics classrooms.

1-2-1-2. The year 2007 and 2008 LSPs: Establishment of the network with visible approach.

Based on this pilot project, five years planned projects (2007-11) were proposed to the Education Network for Innovation of Mathematics Teaching. APEC funded the projects for 2007 and 2008. The study topic of the 2007 LSP was to develop an innovative method for teaching to develop children who think mathematically in the classroom. The study topic of the 2008 LSP was to develop an innovative method for teaching for mathematical communications. The 2007 and 2008 projects produced several good practices for the model teaching-approaches in visible with videos by leading economies such as Japan, Thailand, and Singapore. However many economies' still struggled to implement the lesson study because it was first experience for them

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and some economies changed delegates every year. Thus, one task taken up by the LSPs was to establish consistency for the sustainable development of lesson study activities in every economy. Continuity was needed for learning each other and selecting the model approach within reach was the task for every economy at that time.

Through the first three years(2006-2008), APEC funded LSPs to establish the APEC lesson study networks (see Chapter 2) in order to share the innovative teaching methods for mathematics teaching as for the possible goals in each economy.

1-2-1-3. The influence of the year 2006, 2007 and 2008 projects.

One of the important features of lesson study is that it is a methodology that allows for innovation to develop better practice in classroom by teachers. It is suitable for each classroom and school level activity and it is not limited to the subject of mathematics. As a result, LSPs influenced teacher education methods for other subjects in APEC economies and established national level activities in some economies.

For example, through the evaluation of the projects at every HRDWG meeting, LSPs helped establish the lesson study movements in APEC economies to other priority subjects, such as Science and English. For example, Chinese Taipei established the highly successful Lesson Study Project for English as a Second Language under the HRDWG Education Network (See APEC HRDWG Wiki site).

1-3. Second Stage for Lesson Study Projects: Efforts for Specified Topics

Under the changing priorities in general in relation to the emergent events for the Lehman Crisis and Trans-Pacific Partnership (TPP), the projects in 2009 did not receive the APEC central funds despite the fact that the 2009 project was recommended by HRDWG to Budget and Management Committee (BMC). Subsequently, the projects 2010 and 2011 were funded through self-funds.

Even if the project established the lesson study networks to an early stage, many economies are still at the start line in terms of innovations. For example, many economies faced the difficult problem of improving teaching despite being engaged in lesson study. Despite the implementation difficulties, open ended tasks for assessments in the year 2010 project and the textbooks for problem solving teaching approach for the year 2011 project have been proposed as model approaches in innovation within reach and every economy trying to implements those two approaches. Beginning in the year 2011, the LSPs began to use dbookPro for producing e-textbooks for the classroom.

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Due to these efforts, the lesson study network began to produce comprehensive materials, textbooks, and assessment tasks. The number of participating economies was nineteen at this stage.

1-4. Third stage for Lesson Study Projects: Emergency Preparedness Education Projects

Strong earthquakes struck Indonesia (2004), Chile (2010) and Japan (2011) and many more economies were affected by the corresponding Tsunami. Thailand (2011) and the Philippines (2012) had huge floods and avalanches filled with debris. Chile (2013), Peru (2013), Mexico (2013), and Indonesia (2013) had concurrent volcanic eruptions. Russia (2010), the USA (2013) and Australia (2013) had forest or bush fires. Many people, including children, lost their lives or their economic base for life. Due to these problems, emergency preparedness is recognized as APEC's second general priority.

On this demand, the 2012, 2013, and 2014 LSPs were funded by APEC Emergency Preparedness funds. The theme was to produce model textbooks for general economics and mathematics through the studying of the sciences of natural disasters. The projects produced sample e-textbooks for each economy. The 2012 project focused on earthquakes and tsunami. The 2013 project focused on floods and typhoons. The concept note of the 2014 project is just approved at the BMC meeting on September,2013. .

The third stage of LSPs is the project for Emergency Preparedness Education. The LSPs receive participants from both mathematics and science. Scientists specifically in the area of earth science have been contributing to the projects. The number of participating economies is sixteen in the 2013 project because earthquakes and tsunami are not emergent issues in some economies. The APEC funded a travel grant for 11 economies and 6 speakers: thus at most, 17 economies are capable of earning an APEC grant. Other travels are supported by self-grants. Japan and Thailand tried to increase the number of scientists to three times the number in past LSPs. Due to the increased participation and numbers of scientists, the third stage established the LSPs for Mathematics, Science and Emergency Preparedness Education Projects.

Through LSPs, the number of total participants in every planning meeting held in Japan from APEC economies (not including those from Japan) has increased from 30 in 2006 to 130 in 2013. This indicates that the projects are well supported by the self-funds in every economy.

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2. Involved Personnel and Organizations

In 2006, Thailand's Ministry of Education and Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) proposed the LSPs with the support of a number of economies. Khon Kaen University, Thailand, and the University of Tsukuba, Japan, have been managing the project and supporting the self-funds under the support of their governments.

2-1. Designing Procedure of LSPs

In the LSPs, project overseers established the collaboration policy for lesson study including the difference of genders for asking teaches in both genders to work together. They do not distinguish between the participants and speakers for engagement of LSPs, even if their invitation status are based on the APEC regulation, because everyone is considered to be contributors for classroom innovation in each economy—all of them have the same duty to develop products such as videos and e-textbooks. At the same time, they invited world-known researchers to serve as advisors who did not always attend the meetings and did not have the obligation to produce the products. Based on this flat organizational structure under the policy of lesson study, all specialists usually proposed the innovative ideas for the next year's project proposals in the planning and report meeting.

The only exceptional case is the pilot project in 2006 which was proposed by Thailand and Japan in 2005. For this project, all specialists and the world-known researchers discussed the best approaches for the innovation of classroom teaching for the APEC economies. The lesson study method was selected and a flat organizational structure was established in order to propose and discuss the future mathematics education in APEC economies with each other. The planning of the five year projects' ideas for proposing the APEC HRDWG Education Network beginning with the 2007 project was also discussed at the pilot project. Before the 2008 project, the project overseers succeeded in establishing the lesson study network in mathematics.

In the case of Stage 2, the policy of selection of the project itself changed in the middle of the five year projects. For completing the five year proposed projects, the self-fund projects were proposed with the same policy as before.

In the case of Stage 3, both proposing economies experienced huge disasters and expressions of sympathy for each other went around in the network. All specialists recognized the importance of the APEC ministers' established priorities. On this status,

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the emergency preparedness education projects were proposed to the specialists in the lesson study network. Based on the agreement, the projects were proposed.

2-2. Personnel and Organizations: Why National Level Teacher Education Institutions are involved in.

Lesson study is a kind of cultural practice by teachers for innovation of their classroom instruction. Through the lesson study methodology, LSPs establish the lesson study community itself for autonomous and sustainable developments. Lesson study communities are usually constructed by teachers, specialists such as supervisors, teacher trainers and researchers for supervising, and administrators such as principals and officers of educational boards for funding and directing. One of the driving forces of lesson study communities is the study topic which is necessary for the community. The community usually select the sharable study topic. The role of the LSPs is providing the study topic, based on the APEC minister's demands, to stimulate the cultural practices.

Because of this, LSPs worked with the national-level leading teacher-education organizations under the government as well as directly with each government's key personnel because those organizations usually work with teachers and support national level teacher training and curriculum development. It is also a good opportunity for teacher trainers and researchers who are working inside of organizations but rarely have the chance to visit school and see how teachers actually work. This is partly due to teacher education belonging to the higher education ministry in some countries and researchers and teacher trainers needing permission from the educational ministry.

LSPs include the practical shifting of research trends established by the ministers for the improvement of teaching. In the lesson study, the researchers are contributors to the enculturation of teachers' community. He/she works for improvement beyond solely being an observer who uses the observations for his/her own research. From these objectives, key organizations in each economy works with classroom teachers on the implementation of curriculum beyond just distributing it per the regulations.

On these demands, managing institutions made an effort to establish the APEC Lesson Study network within the first three years. Following is the key organization of the network.

<u>Proposed Governments</u>:

Ministry of Education (Thailand)

Ministry of Education, Culture, Sports, Science and Technology (Japan).

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Managing Institutions:

Khon Kaen University (Thailand) and The University of Tsukuba (Japan)

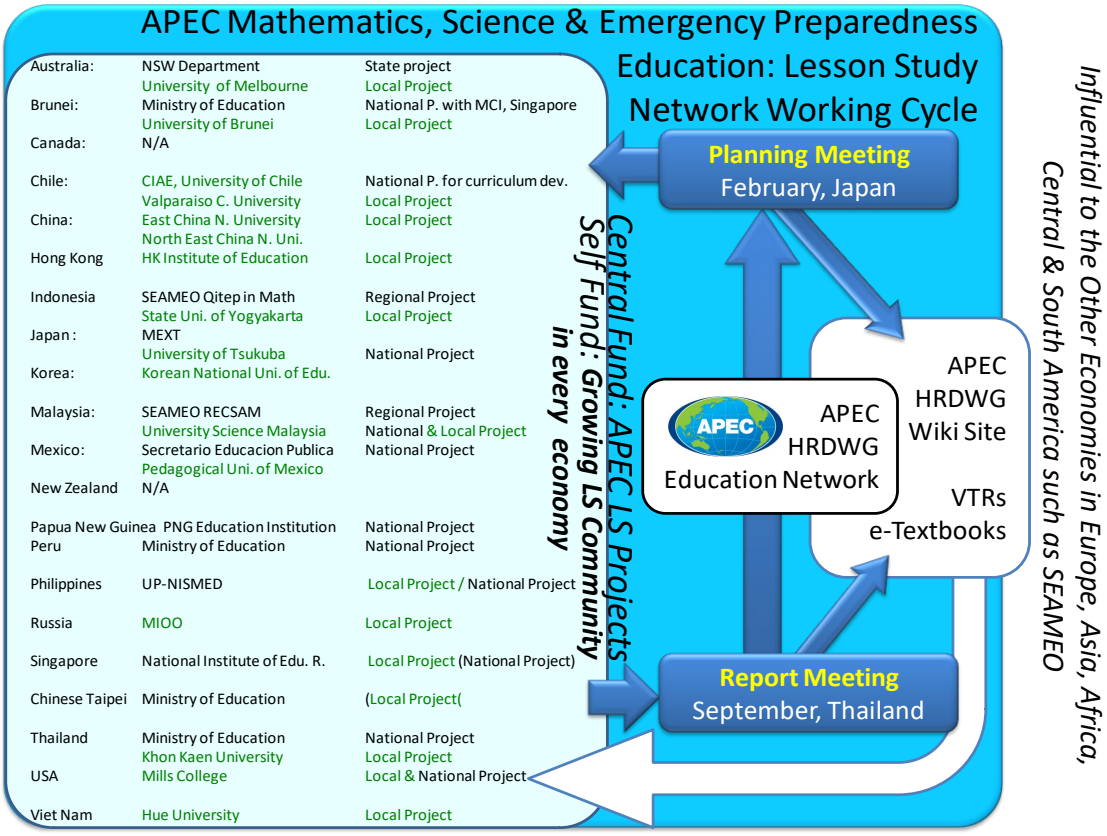
Governmental organizations:

SEP (Mexico); Dept. of Education, government of NSW (Australia); Ministry of Education (Brunei Darussalam); Ministry of Education (Peru); SEAMEO RECSAM (Malaysia); SEAMEO QITEP (Indonesia); UP-NISMED (Philippines); Ministry of Education (Chinese Taipei); IPST (Thailand)

Teacher education institutions:

MIOO (Russia); East China Normal University and North East China Normal University (China); Hong Kong Institute of Education (Hong Kong); Korean National University of Education (Korea); Valparaiso Catholic University (Chile)

The LSPs established the following structure for the lesson study network in mathematics:



*Project names are the case of the year 2013.

LSPs are on a yearly cycle of Plan, Do and See under HRDWG Education Network.

Due to the flat structure under the lesson study policy, newcomers can be specialists from the project side if they agreed to engage in the projects in their

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economies. However, newcomers usually come with the APEC funded specialists because every participating institution sets the grant for pushing the lesson study as well as newly recommended APEC funded specialists from the government.

At the same time, in the self-funded projects in every economy there are a number of collaborative works which are done by the bilateral arrangements between or among economies. This also provides evidence that the network is working well and stimulating every economy's lesson study project under the policy.

2-3. Expected roles of institutions

APEC funds are only to support planning and reporting meetings. Implementation of the lesson study itself is done by specialists in each economy's participating institutions and organizations. Each specialist is expected to establish the project through self-funding in each economy. The self-fund is usually a grant to the institutions and from the organizations such as the Ministry of Education. The lesson study products, such as videos and e-textbooks, are produced based on it. For setting the project in each economy, specialists have to write the grant paper for the next year as well as project overseers (POs don't allow to use the APEC grant for themselves under APEC regulation. They apply the grant from MEXT, Japan and MOE, Thailand for their working every time). Out of this necessity, the project overseers usually discuss the future plan of LSPs with specialists and specialists views are usually enclosed in the project proposals.

In the planning and reporting meeting on the APEC funded part, the keynote speakers are usually recommended from the deeply related institutions in the LSPs cycle beyond the proposed economies. For example, the year 2013 keynote speakers were recommended from the Philippines because it was the Philippines which met the strongest floods and typhoons. The 2014 keynote speakers will be recommended from Russia, Australia and Indonesia because the theme is fire and eruption.

3. Methodology, Procedure and Tools for Implementation

As stated above, Lesson Study is the methodology for the LSPs. It is applied yearly and produces several e-contents for supporting Lesson Study Community such as e-textbook and videos.

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3-1. Lesson Study as for Methodology

Lesson Study, which originated in Japan in 1873 and spread through USA in 1990s (Stigler et al,1999), is a cultural activity for teachers aimed at improvement and innovation of their teaching for children, led by the teachers.

It was strongly recommended by research in the USA because it is done for improvement and innovation of education autonomously by teachers and functions well in Japan. Through the introduction of the lesson study, the role of teacher educators has changed from lecturers/modulator who knows the established theory to co-workers with fellow teachers for the establishment of professional knowledge, self-confidence, and as teachers for children. Because it is done autonomously, professional development of teachers and curriculum development for children are usually done as a part of teacher's life. The autonomous feature of lesson study is far from the traditional teacher training program which usually begins with employing a consultant and sets the lectures in holydays of teachers which are not usually contented with teaching content for tomorrow. For sharing the information such as revision of curriculum, lecture style workshop is normal however lesson study push the challenge for the better implementation of curriculum.

In lesson study, teachers work together on planning the class, sharing their practice and classrooms with others, and reflecting on the class for further feedback. Lesson study is usually prepared for the study topic which is necessary for innovation as well as meeting the objective of the class, which is usually fixed. However, in the case of the USA and other economies, the introduction of lesson study is itself the study topic because there is no cultural practice like in Japan. For example, Catharine Lewis, a leading researcher of lesson study in U.S., gave lectures at the Planning meeting in Tokyo for the year 2006 and explained the meaningfulness of the LSPs as follows:

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A U.S. teacher said, "Before Lesson Study, we had talked about multiple intelligences, constructivism and so on, but never talked about the contents of teaching. In the Lesson Study project, we began to talk about the subject matter, why we teach it, how we teach it and what students learn from the lesson"

A U.S. teacher said, "I developed the eyes (teacher's perspective) to look at students and subject matters "Kodomo wo miru me". Now, I am well aware of my responsibility for my lesson. In the lesson study with other teachers, I preferred the more challenging lessons such as with Open-ended problems. When I found that students can challenge such difficult problems, I recognized self-confidence in my lessons"

Thus, lesson study has two types of study topics. The first study topic is developing sustainable lesson study communities for the improvement of teaching and innovation around teaching content. The second study topic is the real topic of study in the reform issues.

In this manner, in the first stage of LSPs, the project set the study topic to establish the lesson study network itself as well as each year's tasks such as mathematical thinking and communication. Then, LSPs focused on the tasks and, at the third stage, the LSPs have been working on the tasks of emergency preparedness education stemming from the prime ministers' demands. The first and second stages of the LSPs tried to establish lesson study communities in mathematics. In the third stage, lesson studies have been used for the methodology for improvement as the LSPs begins to work in the community beyond just the topic of mathematics.

3-2. Implementation Process: PDCA (plan-do-check-act) cycle

The LSPs are done on a yearly schedule in the three/four phases; Planning, Implementing, Summarizing and Finalizing (Evaluating), and Adopting (Fourth phase is a part of next year's project, not necessary included in the yearly schedule).

Phase 1: Planning

From January (or December in the previous year) to March in the same year.

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Goal of Phase 1: Sharing past outcomes for newcomers and setting the theme of the lesson study for producing the model/innovative approaches and knowing the product of the year from the sample products proposed by the specialists.

December or January: Preparation of the planning meeting. Send the announcements to each ministry through the HRDWG Education Network.

February: Planning meeting for sharing the theme of the lesson study (supported by the APEC and Self funds in proposed economy) in Tokyo, Japan

March: Uploading the products of the planning meeting for sharing the expected outcome at the website on the University of Tsukuba, Japan.

Phase 2: Implementing

From March to August in the same year

Goal of Phase 2: Produce materials such as video and e-textbooks for each economy utilizing the self-fund in each economy according to the lesson study.

Participating institutions and governmental organization support lesson study activities and developing e-textbooks under the support of each economy. Localization will be done based on the episode and problem situations in each economy.

Phase 3: Summarizing and Finalizing

September-December in the same year.

Goal of Phase 3: Developing the recommended materials on the web for improvement of teaching.

September: Reporting meeting in Khon Kaen, Thailand, is done for improvement of products from each economy.

November: Each economy finalizes its products based on the recommendation of the reporting meeting. Khon Kaen University uploads the conclusion of the reporting meeting on the website.

December: University of Tsukuba finalizes all contributions from each economy on their website.

Phase 4: Adopting

In the next year, finalized products will be uploaded on the APEC HRD Wiki site after the HRDWG meeting. Each teacher training institutions engages the lesson study for implementation in their program.

3-3. Selecting process of Specialists for Implementations

In the LSPs, specialists engage in the key role of producing the materials from the lesson study in their economy's own lesson study project. On these grounds,

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project overseers set the requirements of the specialist and keynote speakers in the call for specialists.

In the case of the 2014 project, the following conditions for specialists who will be invited through the grant of APEC are described in the full proposal:

Condition 1: The specialists must be influential to the mathematics curriculum (including textbooks) from primary to secondary school.
Condition 2: The specialists must be influential to teacher education.
Condition 3: The specialists can lead the lesson study from primary to secondary school.
Condition 4: The specialists can develop the booklet from the lesson study.
Condition 5: When the specialists are recommended from economies, the economies must guarantee to implement their lesson study projects under their participating institutions in each economy.
Condition 6: The specialist works or collaborates with the participating institutions in each economy.

Specialists are recommended from each economy at the first announcement—if not, the project overseers recommend from an individual from the Lesson Study Network. In this case, the specialist who is recommended from the Lesson Study Network has to contact his/her ministry expressing that he/she must work for the economy.

For bridging between the HRDWG and the EPWG, the project meeting invites speakers who are specialized in the following subjects in the case of the year 2014:

Keynote Speaker 1: The specialist of disaster science in evacuation
Keynote Speaker 2: The mechanism of bush fires
Keynote Speaker 3: The mechanism of volcanic eruptions
Keynote Speaker 4: The influence of volcanic eruptions
Keynote Speaker A: Mathematical problem solving and modeling from elementary to secondary
Keynote Speaker B: Statistical problem solving from elementary to secondary
Keynote Speaker C: How to develop e-textbooks using dbookPro

4. Success Factors

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There are several success factors as follows.

4-1. The project selected the inevitable subjects: mathematics and emergency preparedness education.

Mathematics is the major literacy subject from elementary level to secondary level. There are huge numbers of teachers for mathematics. Mathematics is the most necessary subject for sustainable development of economies. There are number of articles which explain how economic growth is related to mathematics achievement. Mathematics represents the most important subject for 21st century knowledge and skills. Because of this reason, it is the lesson study in each economy and the main component of the project which should be funded by the self-fund: this is well supported by each economy or organization.

4.2 Lesson Study Methodology is appropriate for themes and excellence.

Lesson study was recommended for improvement of teacher education from the US department of education (2000). When the first project was established, APEC economies already had the mindset to introduce it due to US influence. Otherwise, lesson study was only a cultural practice in Japan (since 1873, established by the host institution, the University of Tsukuba for introducing European style of education on the context of improvement by themselves).

The following are the answers of each specialist (math-educator) from each economy to a series of questions about the influence of the LSPs in their economy (All items are answered in the context of mathematics education. The survey is done through e-mail in August, 2013.):

Q1-5. Lesson Study project is influential because it improved the methods of in-service teacher education.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	Mean
8	4	2	1	3.3

Q1-8. Because it enhanced the mathematics education research for teachers and classrooms.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	Mean
7	6	2	1	3.2

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Q1-9. Because it produced good practice and influenced teachers.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	Mean
9	4	2	1	3.3

4-3. Project are managed by a Raising Economy and a Matured Economy

Japan, an advanced and matured economy, usually shows excellent lesson study examples for changing mindsets and meeting innovative goals for specialists in every economy. A raising economy such as Thailand shows the possible innovation within reach for under achieving economies.

4-4. The LSPs are managed by the Lesson Study Policies:

Policy 1) Everyone (teacher or researcher) is a challenger. He/She has the ownership of the challenges. Open classroom is functioning for leaning from each other. It is innovation for teaching with the objective of developing children.

Policy 2) Instead of action research lead by the researchers, lesson studies recommend that researchers learn from the good practice of teachers and work together with teachers on the real responses from children. It establishes a flat structured community for innovation. Teachers respect each other through the reflection of their practices.

Under the policies, the projects never distinguish between participants, speakers, and others, even if the gender issue is considered. All of them are regarded as specialists and everyone has ownership in the meeting. For example, the reporting meeting, the summarizing and recommendation session, which are the most important sessions in the meetings, are usually managed by the specialists who are not coming from the original proposing economies of Thailand and Japan because the objective is to produce products for all economies.

4-5. Every specialist from economy has ownership under lesson study policies.

The main phase is Phase 2, which is managed by the self-funds. Every specialist proposes their innovation based on their challenges in Phase 2 at the Phase 3 and 1. They also propose new ideas for the project from their practice. Every specialist lead the innovation on his/her economy's setting.

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4-6. Every specialist well supported by the self-fund from the ministry or institution.

Because the lesson study is the newest development methodology recommended by US government and LSPs are the project under APEC with mathematics and science as the most necessary subjects, specialists can work under the support of government and their belonging institutions.

4-7. The products such as video and e-textbooks produced by every economy are visible and distributed through the web.

From the beginning of the first project, it was proposed to make end product visible on the web. E-textbooks lead the efforts recently begun in each economy. The projects used the e-textbook editor dbookPro which is distributed freely. Through the use of e-textbooks, teachers are also able to use dbookPro to make their own edits to the e-textbook.

5. Best Practices

The projects developed a number of videos and e-textbooks. They are visible on the APEC HRDWG wiki site and the project site. Especially because of the influence of the LSPs, the HRDWG wiki site itself was established as the lesson study site for all economies, which was not limited to mathematics:

Produced Videos:

http://www.criced.tsukuba.ac.jp/math/apec/

http://hrd.apec.org/index.php/Lesson_Study

Produced e-Textbooks:

http://math-info.criced.tsukuba.ac.jp/museum/dbook_site/#e

Those products on the web represent the results of the good practices of LSPs.

If the product of every project is within the obligation on the proposal document for APEC funding, every project should be recognized working well. To be recognized as the best practices, here, LSPs re-define the best practice by how the project worked influential beyond obligations and limitations of APEC funding. It means that if the APEC project included several further practices which show that the project is well influenced into economies, it will be the factors for Best practices. Actually, Phase 2 of LSP usually done by each self fund in every economy. On this meaning, there are a number of local best practices. Here, we would like to show the same points such as the collaboration among economies:

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5-1. Best Practices for Networking by the self-funds in economies

The following lists shows how each organization and institution are synchronized with APEC project through their self-funds in 2012: *(see on the next page)*

Descriptions about on going corresponding project for the APEC project in each economy

The answers are for the 2012 (or related year)
(The Information about under representing economies for this project is also added by the project overseer in the branch)

Economy	Name of the Project in English	Summary in a few sentences	List or number of publications (in any language)	Number of workshops	Number of participating teachers	Your rolls in the project	Funding source: the grant coming from	Any suggestions for our future project
Australia	Building Teacher Capacity	Jointly funded by the State government and involving several universities and ACER	3	12	100	Leader and advisor	Government and university	No suggestions
(Burunei: Elementary Teacher education project with lesson study is running with support of MCI, singapore. In the year 2012, no participation to the project)								
(Canada is not participating this project)								
(China: There are huge number of the projects in relation to the lesson study such as Open-ended Approach. In the year 2012, no participation to the project)								
Chile	1) Post tittle for Primary Teachers in Service 2) Public Open Lessons	1) More than 17 universities participated during several years offering 800 hours course. Our University PUCV is participating during 5 year. Lesson Study is a key point which determines the final work of teachers. 2) For several years, more than 5 five principal cities offers Open lesson to teachers. 3) Annual meeting of Lesson Study, in which participate several educators.	1) Estrella, S., Olfos, R. y Morales, S. (2014). What Can We Learn from Natural Disasters to Prevent Loss of Life in the Future?. En Lessons Learned from Across the World, Pre-Kindergarten-Grade 8, National Council of Teachers of Mathematics. DC:NCTM. Estrella, S. y Olfos, R. (2013). Cómo un profesor de primaria en Chile mejora la enseñanza de la Estadi stica en el contexto de un grupo de Estudio de Clases. En Educación Estadística en América Latina: Tendencias y Perspectivas, Audy Salcedo, Editor. Universidad Central de Venezuela: Venezuela. Olfos, R., Estrella, S. y Del Sol, C. (2011). "¡Sí, es posible!: Un caso de enseñanza de la Matemática". En Mejoramiento Escolar en Acción, editores J. Campos, C. Montecinos y A. González, CIAE-PUCV, ISBN 978-956-345-542-7, pp. 81-102.	More than 15	Since 100 to 900 teachers each	Usually as Researcher	Ministry of Education of Chile	Saving life is very important. Change the traditional approach in text books is important too. The use of Dbook should give teachers opportunities to contribute with proper design in modification of usual lesson. Equity is important too. Society is very complex now and there are several clever young people that is not participant in the Economy Progress. We need to look for them. Every people should be part of our society. We have to understand that environment is important, and we should change the idea of "consumes" because our children will need water, trees, and so on.
Hong Kong	Mathematics Thinking in lesson	To teach mathematics exploration and thinking through different domains in mathematics.	7 papers (from 2006 onwards)	2 (2012-13)	30 (2012-13)	Content providers and consultant	From schools	No suggestions
Indonesia	Course on Developing Lesson Study for Mathematics Teachers.	This course is conducted by SEAMEO QITEP in Mathematics for around 14 mathematics teachers from Indonesia and 10 mathematics teachers from SEAMEO member countries.	10 books concerning Lesson Study for Course participants.	2	Per year, around 14 mathematics teachers from Indonesia and 10 mathematics teachers from SEAMEO member countries.	Facilitators.	From the Government of the Republic of Indonesia.	I suggest that dBook from CRICED - University of Tsukuba can be used freely by every economy.
Japan	Challenges of Mathematics Education for Diiersters	It is the self fund part of the APEC project.	50 books	2	10,000	Organizers	JSPS	Emargence prepardness educaion changed the mind for applying mathematics. Developing the content for emargency prepardness should be
Korea	NA/ We have several classroom research projects. Each project propose various methodology..							
Malaysia	Teacher Quality Education: Professional learning Communities	Started in 2011 and involved 289 schools nationwide. Still continuing as a project under the National Key Result Area, Government transformation Program	Lesson Study: Pembelajaran Melalui Amalan Kolaboratif Guru. [Lesson study: Learning through collaborative teacher practice]	12	1132 (Information for Year 2011 only)	Advisor/ subject matter expert	Ministry of Education	This is a very significant project. It has helped to disseminate ideas about the implementation of Lesson Study which is a very practical innovation to improve education.
Mexico	Teacher Education College Project	Teacher training program for mathematics education at elementary	13	5	1500	Organizers	Ministry of Education	
(New Zealand is not participating this project)								
Papua New Guinea	EQITV project	Improvement of quality for teaching through TV teachers	30	20	2000	Advisor/ subject matter expert	Ministry of Education	No suggestions
Perú	Articulate the plan of emergency preparedness in the area of mathematics and sciencein the provinces of Callao and Moquegua	Collaborated with teachers from three schools in the preparation of Lesson Study and continual review of their math classes that developed the skills required on Tsunami situation. Lesson session was performed and elaborated a document for dissemination and knowledge of other schools in the province of Callao. This document has used to Dissemination and awareness teachers in province of Moquegua.	One	Two	30	Tutor	No suggestions	It is very difficult to implement the project directly from the Ministry, as it has very political and administrative tasks. It is best implemented through projects with private organizations, institutes or universities that are in charge of in-service teacher training. For my part I worked the project by myself introducing the project and asking for engage institutions to providing work with them to implement the project.
Philippines	Collaborative Lesson Research and Development (CLRD) Project	This project involves all the academic groups of UP NISMED (Elementary School Mathematics, High School Mathematics, Elementary School Science, High School Earth and Environmental Science, High School Biology, High School Chemistry, High School Physics) and the Audio-visual Group. The staff of these groups work with teachers of different grade levels in the CLRD schools. They promote teaching mathematics through problem solving and teaching science through inquiry using lesson study.	UP NISMED will come up with Lesson Study Book 1: Planning Together, Learning Together (2013) (in press). There are 15 chapters in this book.	16	Approximately 500 teachers have participated in these workshops which were conducted by different staff of UP NISMED.	I am the overall coordinator of CLRD and the overall coordinator and editor of Lesson Study Book 1.	UP NISMED Trust Fund.	No suggestions
Russia	Perspectives of developing math education for everyday life needs (in-service training course for teachers from Yakutia).	The project is orienting teachers to plan and discuss classes in statistics and probability for junior school students including disaster preventing topics to be concerned as applying of statistical methods. The project is a part of yearly teachers seminar in Yakutsk and Moscow.	1	3	Near 100 in three year	The overseer and manager of the project.	Self-funded (partially institute for the development of Education of Yakutia).	No suggestions
Singapore	(1) Project Evergreen (2) Project Junyuan (3) Project PCF	In each of the projects, schools are provided with guidance in doing lesson study. In (3) we collected data as it is a research project. We go through the stages in lesson study cycle to introduce schools to lesson study.	1 online journal MOE Singapore 1 monograph 1 research report	Each lesson study team met with me about five times to complete one cycle. (1) 3 teams (2) 4 teams (3) 2 teams + 5 teams to start in September)	(1) 15 (2) 20 (3) 10 (plus another 25 in September)	(1) And (2) Facilitator (2) Facilitator and Principal Investigator	(1) and (2) school funds for professional development (3) Ministry of Community Development, Youth and Sports	It is too technical for specialist to to be involved in the technical aspect of the e-textbooks. Usually we supply the content and people who are knowledgeable in e-textbooks produce a technical superior e-textbook. With our limited expertise we might get an e-textbook which is more like a paper textbook in the e-book platform. This does not harness the role of technology.
(Chinese Tipei: There are the lesson study project such as the Establishment of Learning Commuites with school leaders. In the year 2012, no participation to the project))								
Thailand	Research on Using Lesson Study and Open Approach to Improve Classroom Quality based on Sustainable Development (and other 6 projects)	It is the self fund part of the APEC project.	24	50	10000	Director	National Research Council (and other organizations)	Lesson Study methodology can be spread through mathematics and Elementary School teachers spread it to other Rsubjects. The effective reform of teacher education is pnly possible with the reform of content of teaching itself. .
USA	Using Lesson Study to Develop Mathematical Thinking.	Introduced teachers to LS and worked with them over the course of a year.	2	10	8 teachers	Project director	School-supported	No suggestions
Viet Nam	Integrating dynamic models with lesson study focus on mathematical thinking to enhance the professional development of teachers.	This is a national key project supported by the Ministry of Education, Vietnam under the project number: B2008-DDH 03-41TD.	8	4	50	Leader	Ministry of Education, Vietnam	No suggestions

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The list indicates that each specialist gets the grant for their contribution in each economy. This shows that Phase 2 support by every economy is the main part of the project activity and that the APEC grants, which support Phase 1 and 3, are stimulating activity in every economy.

The followings is the answers for questionnaires from the specialists in the economies regarding the influence of the APEC LSPs.

1-1. In your economy, APEC lesson study project is influential.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
7	4	4	1	3.0

1-2. Because it established the local lesson study projects.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
6	7	2	1	3.1

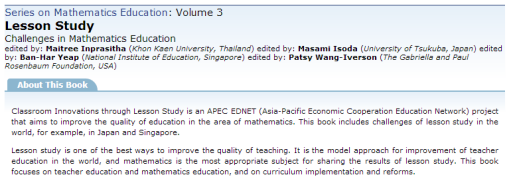
**Non-existence of local lesson study project means only existing the national project.*

Looking at the average viewpoint, most of people recognize that the lesson study project is ongoing in each economy.

The followings evidences 5-1-1 and 5-1-2 are further achievements under the network with self-funds beyond the expected outcomes of LSPs on the project proposals.

5-1-1. Best Practices with all collaboration of Lesson Study Network

Based on every effort, the LSPs have been publishing the APEC lesson study series in English for worldwide reference.



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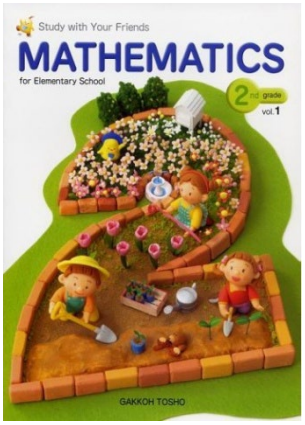
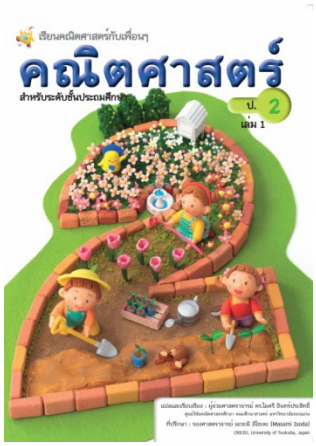
5-1-2. Best Practices with collaboration between/among economies

On the LSPs, specialists discussed the content deeply for lesson study in Phase 2 at the preparation meeting in Phase 1 and the report meeting in Phase 3. They usually compared textbooks with each other in order to produce the best practice. In the project meetings, there were usually higher officials participating who search for innovative ideas to improve teaching practice. As a consequence, Japanese Mathematics Textbooks were adopted into the Thailand project and the Mexican project from the English edition. Singaporean Mathematics Textbooks were adopted into the Brunei Project and the Chilean Project from the English edition.

Best Practice (1): Following is the sample pictures of textbooks (11 volumes) for elementary level from Japanese to English and English to Thai:





みんなと学ぶ小学校算数（Japanese）

↓

Study with your friends : mathematics for elementary school

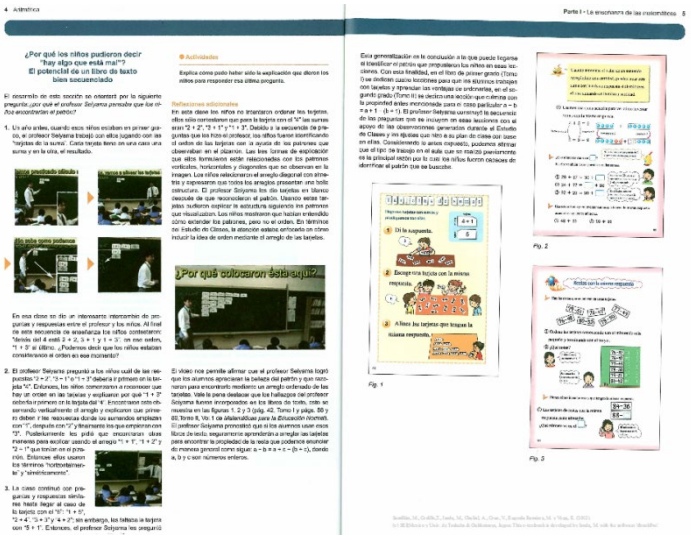
↓

เรียนคณิตศาสตร์กับเพื่อนๆ　คณิตศาสตร์

สำหรับระดับชั้นประถมศึกษา ชั้นประถมศึกษาปีที่

The 30 project schools with 300 teachers and 5 teacher education universities are using these textbooks for innovation.

Best Practice (2): Following are sample pictures of the textbooks (13 volumes) for all Mexican teachers colleges (450 schools x 160 students) with collaboration among Mexico, Chile, and Japan. The translations into Spanish were first done by the Chileans and finalized by the Ministry of Education, Mexico. The Ministry of Education, Mexico officially selected and published it for Teachers College Textbooks via Pearson



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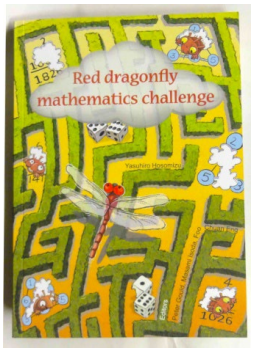
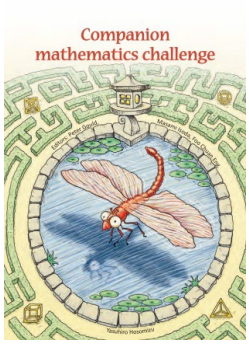
which is the largest textbook publisher in Latin America. It is currently referred to by the projects in Peru and Chile. Non-APEC economies such as Brazil are now also using it for their lesson study projects.

Best Practice (3): The Ministry of Education, Brunei, compared the Singapore and Japanese Textbooks and created the teacher education project which includes a lesson study with the Singapore specialist.





Best Practice (4): The project by the state government of New South Wales, Australia, implements the lesson study by videos, published two teacher training materials, and two e-books from the government with the collaboration of Japan and Thailand. All school teachers in NSW are allowed to use these materials for free. The ministry of Education, Papua New Guinea and the University of Chile are developing their edition, too.

Best Practice (5): Valparaiso University, Chile, which has the only PhD program for mathematics education in Chile published the four books for lesson study with the collaboration of Japan and distributed it, along with videos, freely via their website. Those books are used as references for teacher educations.

Best Practice (6): Every self-funded project in an economy established its own website or uploaded their contents, via such methods as youtube for sharing ideas for lesson study activities. Two examples are:
http://www.qitepinmath.org/?id=eng3jGmABYTE

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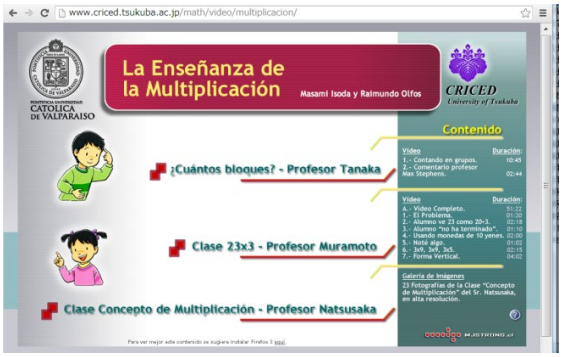
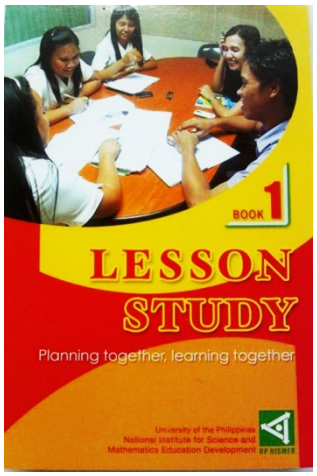
http://www.youtube.com/watch?v=rxWZxepY5m4
(Most of the related videos on this YouTube list are related projects in the given economy)

Like those example on the web, every self-funded project in every economy on the lesson study network produced or influenced the production of a number of lesson study videos and training programs. It means that APEC self-funded LSPs are functioning well for stimulating activates in every economy, producing materials for innovations.



http://www.criced.tsukuba.ac.jp/math/apec/others/

Best Practice (7): Singapore supported textbooks in Spanish for Chile.



5-1-3. Best Practices in economies

Many participating institutions such as RECSAM (Malaysia), Qitep in Math (Indonesia) and UP-NISMED (Philippines) published Lesson Study guidebooks or booklet for teachers.

5-2. Best Practices as the models for teachers' cultural activities who ensure the better quality of education in APEC economies

Many of the APEC funded projects are planned and set at one meeting regarding the topic, such as curriculum reform issues. APEC funded projects usually have to challenge for getting influential participants beyond the limitation of the APEC grant. On this context, there is difficulty to be influential for teachers directly even if they are key components for innovation in education. Thus, several APEC projects usually face the problem of securing sustainable development on the topics beyond the original participants of the meeting--even if the meeting produces the best images in educational reform for the future.

In 2006 and 2007, the lesson study project was evaluated well in all education network projects and influenced other economies' project proposals for the sustainable development of the project because it has the framework of PDCA (Plan, Do, Check and Act) for the sustainable development of project with visible products. In 2008, lesson study is also proposed in the priority areas of English as a Second

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language in Chinese Taipei. Lesson study communities have been growing beyond mathematics and science in relation to the Emergency Preparedness Education.

Before the LSPs, there was no custom to upload videos of the classroom by teachers. Through the LAPs' several websites and the HRDWG wiki site, the lesson study models are distributed by the web. On YouTube, currently, there are a number of similar lesson study videos which can be freely seen which could be seen as being directly influenced by the official sites. Those videos on the web illustrate that LSPs has been influential to develop the culture of lesson study by teachers.

5-3. Best Practices as the model of multi-year projects in HRDWG

Especially in mathematics and science, there are no multi-year projects. LSPs are the first project for mathematics which has the project cycle. At the HRDWG meeting 2008, Lead Shepherd, Dr. Alan Ginsberg proposed the importance of the multi-year and visible project for consistency using the example of the LSPs. In all multi-year projects, the features of LSPs are as follows;

a) It will use the PDCA cycle for the planning meeting, lesson study, and the reporting meeting even if every year changes the theme.
b) It is trying to reach teachers even if the projects are managed by the specialists.
c) Managed by the network institutions and organizations supported by the participating economies even if it is proposed from Thailand and Japan.
d) Visible products such as videos and e-textbooks are produced.

5-4. Best Practices for producing visible and user-revisable content such as Videos and e-Textbooks for sharing in APEC economies: In relation to ICT Education and APEC HRDWG wiki site.

It is necessary for every project to share the outcome of the project in APEC economies. Visibility, which was quoted by the Lead Shepherd in the 2008 HRDWG meeting, has been the keyword of the LSPs since the first announcement of the first project in 2006. HRDWG setup the APEC HRDWG wiki site. Under this policy, LSPs have been producing the website and e-contents for sharing outcomes. The first stage of LSPs focused on video materials. Beginning in the second stage of the project, LSPs included the e-textbook as a component. In the third stage, LSPs focused on e-textbooks as the major products for Emergency Preparedness Education.

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Following are the questions for the specialists in relation to e-textbooks:

Q5-1. On the APEC project, you newly learned what the e-textbook is.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
13	1	3	0	3.6

Q5-2. On the APEC project, you newly learned how to develop e-textbook.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
11	2	3	0	3.5

Q5-3. Your economy has a plan to shift to the e-textbook.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
5	3	5	2	2.7

Q5-4. The APEC project has also influenced your economy to develop e-textbooks .

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
4	6	3	3	2.7

ICT education itself is also necessary in this knowledge based society and has been enhanced through the HRDWG education network as well as through mathematics and science.

In the second stage, LSPs have been distributing the freeware dbookPro, developed by the University of Tsukuba, which enables every teacher to produce e-textbooks using general software, such as Microsoft Word, to develop sharable content on the web. dbookPro is a simple software for teachers for producing e-textbook: e-textbooks will be produced from a Microsoft Word file to dbookPro, by drag and drop only. For the visible product, the project also pushes the active use of ICT in classrooms. Without teachers being able to produce content or use content produced by others, teachers cannot use ICT in education. Experiencing the production of e-textbooks in mathematics from elementary to secondary level is the best opportunity for trying to introduce ICT into education. This is because mathematics,

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which has the largest population of teachers, as well as language, and is the one of the major subjects to use ICT in education.

Currently, every self-funded project in each economy is using dbookPro to produce e-textbooks for teachers. They can revise content by themselves. LSPs are, thus, influencing innovative ICT education as well as innovation of mathematics, science and emergency preparedness education.

5-6. Best Practices as for Mathematics and Emergency Preparedness Education as for the Priority Areas on HRDWG and APEC with bridging the different APEC Fora

Mathematics is the basic subject for science, engineering and social science. There are a number of research studies which demonstrate the correlations between economic success and achievement in mathematics. The APEC HRDWG Education network has been pushing mathematics and science education as the priority areas for collaboration in APEC because it is the core competency for economic development, as well as language, for each economy.

Emergency Preparedness Education is also a hot issue because of climate change and economic growth. Most of the economies' GDPs are growing every year at a rate of more than 4%. In order to keep growing, every economy considers how to avoid risks which would inhibit growth. Thus, Emergency Preparedness Working Group (EPWG) became a working group in 2010. Bridging between Fora has been enhanced by the prime ministers. The LSPs are the first project in HRDWG for Emergency Preparedness Education which bridge HRDWG with EPWG. The following are the answers given by specialist in each economy.

Q2-1. In your economy, Emergency Preparedness Education is a necessary topic in every school.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
10	2	1	3	3.2

Q2-2. It is enhanced in the Ministry of Education documents.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
8	3	2	3	3.0

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Q2-3. Could you specify the class or activity in every school for teaching it?

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
3	3	4	4	2.3

2-4. Is it taught within the academic subjects or the out of the academic subjects?

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
4	4	0	6	2.4

2-5. Do teachers have the opportunity to learn Emergency Preparedness Education?

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
2	3	7	4	2.2

The results imply that even if Emergency Preparedness Education is expected to be taught there is no clear time for teaching it in the school curriculum. Mathematics is the subject which should be taught almost every day from elementary to secondary level as well as language and on this reason, thus, it is the best subject to teach the scientific concepts for risk management.

6. Strengths and Weakness/ Transferability

6-1. Strengths

Strengths are already described. If we enhance the unique points, the following strengths are only for LSPs.

6-1-1. Lesson study network in Mathematics Education under HRDWG Education Network

LSPs established the network for HRDWG Education Network for Mathematics Education.

6-1-2. Producing free re-producible e-textbook on the web.

As long as there is an indication in the reference, the e-textbook can be revised. The software to produce e-textbook is free.

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6-2.Weakness

Weakness is usually contrasted from strengthens points.

6-2-1. LSP Network is open for everyone however office working staffs and researchers have to change their mindsets to work with teachers depending on economies

Based on the policy of lesson study, the LSP Network established a flat culture in education. There are economies where government officials are changed with every election within their hierarchy from top to bottom. There are other economies where researchers are not expected to learn from teachers. In some economies, researchers have only observed teachers and experienced the classroom when they were children themselves. In this context, there are severe obstacles to the improvement of education because their images of education are only based on their childhood experiences. They do not have any experience to work towards educational innovation together with teachers. Therefore, they find it difficult to explain the innovation in a way that is understandable to teachers. The LSP Network can be really meaningful in this situation, however, they have to change their mind set from just addressing teachers to working with teachers in the production of better education, step by step.

This means that the flat culture itself is a potential obstacle for researchers who would like to work in their closed offices as they have to change their mindset to be public servants for an open society, with teachers as well as government official in their Ministry of Education. The LSP Network still needs to enlarge the community to include the people who are still only working in offices.

6-2-2. LSP Network is trying to produce the activity to integrate both top down and bottom up approaches for educational innovation however need the years for integration.

Lesson study is not only an approach for the curriculum implementation but also for curriculum development and revision. It produce curriculum for the participating economies. To synchronize these two approaches, it may take decades because it includes the establishment of the communities and evaluation of the curriculum itself, as well as the implementation of curriculum.

If the time is given, it will establish better curriculum and better practice. However there are economies where educational policy changes every election and there is a need to revise the curriculum without the appropriate time for the evaluation of implementations. From this situation, the lesson study cannot easily synchronize the revision of curriculum for the economy.

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The following are answers by the specialists to a question regarding curriculum development due to LSPs:

Q1-7. Because it improved the methods of curriculum development in general such as the economy level.

4:Strongly Y.	3:Yes	2:No	1:Strongly N.	2.5:Mean
3	6	3	4	2.5

Specialists are engaging in the lesson study with teachers and producing local curriculum for the project. However, there are people who feel difficulty in adopting their products into the curriculum. The economies which find difficulty in using the lesson study methodology are usually producing their new curriculum via comparison with other economies and their current curriculum because of the limited amount of time to revise their curriculum. In the case of those economies, lesson study is limited for curriculum implementation and revision of local curriculum such as school district, and does not work for the revision of national curriculum.

6-2-3. Limitation of re-producing contents

In the project, the copyright of videos and textbooks belong to the authors even though the authors have to allow the free distribution of them on the web. For example, student's pictures are allowed for authors to use and distribute through the web however there are limitations regarding changing the pictures of students. The content of e-textbooks can be reproduced by the indication of it in the reference, indicating the original authors. However pictures, especially student pictures, are still necessary to consider on a case by case basis even if most of them are allowed to use by free.

Acknowledgments

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