APEC Mathematics and Science Instruction

Purpose: Information
Submitted by: Russia
APEC Mathematics and Science Instruction

This priority identifies research-based strategies and potential future APEC projects to strengthen the skills necessary to succeed in the 21st-century workforce. Specifically, it focuses on skills related to content areas of mathematics and science education – academic subjects critical to establish the knowledge, skills, and values to meet the regional challenges of the Asia-Pacific and succeed in a dynamic technology driven workplace.

An overarching proposed project is to create a digital library of exceptional open-education resources (OER) initially in mathematics and then science. The digital library will be a one-stop shop featuring a problem bank of international mathematics items. The digital library will include content standards, teacher standards, lesson study and other instructional videos, key research articles and digital instructional materials. These resources are compiled from APEC member submissions and freely accessible across APEC.

Other proposed APEC projects will address strategies for providing effective access to math and science for all students, math and science applied to support 21st Century problem solving skills and coordination with other APEC work on math and science teacher preparation and development.

I. Background on the Topic

This theme showcases how the Education Network (EDNET) has been and will continue to respond to: the rapidly evolving, knowledge-based and globalized economy (the changing nature of work), creating demands for students to understand how to work with others (changing requirements for collaboration), while building their knowledge and skills to innovate (the changing nature of instruction).

APEC Ministers are aware that the economy is becoming increasingly international and increasingly knowledge and data driven. It was highlighted on the APEC Education
Ministers meeting in 2008 that “Mathematics and Science are essential to navigating the data-driven and technological world of the 21st century, no matter one’s occupation” (APECWIKI, 2008).

The global job market is changing rapidly, requiring workers to have a strong set of adaptable skills if they are to succeed. Students must learn how to learn while applying the knowledge of mathematics and science to real world problems. This is because tomorrow’s workplaces may look totally different than today’s and will use innovations that don’t even exist today. It is clear that schools across the region must change the way they teach students if students are to have the skills they need to cope in the new global environment.

For purposes of APEC in this thematic area, we are focusing on those 21st Century Skills integral to the need to know and be able to apply math and science within the new digital Economy. We also include understanding each other’s languages and cultures to support globalization and cooperation within the math and science area, for example to read international scientific articles.

- **Stimulating Learning in Math and Science.** Facility with mathematics and science is a key to success in a global economy driven by technological development and the use of information and data to solve problems as diverse as global warming, the need for alternative energy sources, and disaster risk. However, international comparison studies have found significantly different levels of achievement and practice in science and math education in the East and West. In general, the Asian educational systems seem to excel in producing students with a strong grasp of the content knowledge and include some of the highest scoring economies on the Third International Mathematics and Science Study (Mullis, et. al., 2008). The Western systems have other strengths; they are successful in helping students develop problem-solving skills and the ability to apply knowledge to real life situations to build 21st Century competencies. Indeed, many Western economies are among the most scientifically innovative in terms of such indicators as new scientific patents and Nobel prizes. The pressing issue is how to combine the best of both systems.

- **Learning Each Other’s Languages and Culture.** The ability to communicate across language barriers is essential to international trade and to building mutual understanding among interconnected global economies. All APEC members are faced with the issue of how to effectively prepare multi-lingual citizens who can appreciate the culture of and communicate with speakers of other languages. In many APEC member economies, second or third language learning has historically occupied an important place in the school curriculum. Because of the primacy of English in trade today and in mathematics and scientific journals, many APEC members from Eastern economies have further stressed English language education, extended this to the early elementary grades, and raised their expectations for proficiency. English speaking economies, on the other hand, find it hard to motivate their students to take a second language in high school and to find teachers qualified to teach a language other than English.
The recommendations moving forward build off of previous work conducted by APEC to build a body of knowledge to support improvements in mathematics and science education throughout the region.

II. Key Research

21st Century Analytic Framework

Math and science education is the content area that forms a common part of the education systems of APEC economies. That is why the first step in creating a common educational environment and to identify research that would guide developing this environment would be to understand Economies’ common goals of math and science education.

To inform the achievement of these goals, research in APEC Economies is highlighted in four areas: essential to producing students who know and are able to do mathematics and science (Exhibit 1):

Effective Teachers
- To increase the level of subject and pedagogic teacher preparation in science and math fields
- To increase the real and virtual mobility of APEC economies students to facilitate better coordination of the efforts of APEC organizations in the field of highly-qualified teachers preparation

Students Knowledgeable and Able in Math and Science
- To promote gradual buildup of math and science literacy among all students within an economies population and not just those who intended to go into math and science careers.
- To search for gifted students and stimulate their progress and self-actualization

Relevant Standards and Curriculum
- To provide students with an understanding of the importance of mathematical way of thinking and rational recognition of the world in the society as a base for future development
- To increase the share of curriculum devoted to the theory and application of probability and statistics as those parts of math that are the closest to the real world phenomena
- To increase motivation to studying math and science

21st Century Skills
With the above goals in mind – to shift towards developing education skills that are focused on solving the problems of the real world.

Exhibit 1: 21st Century Math and Science Goals

Teachers as Main Drivers of Achievement

As Barber and Mourshed (2007) discovered when studying the 25 worlds best performing school systems: the main school factor contributing to student learning at school is teacher quality. Despite the many different cultural and political contexts and challenges among the systems the researchers looked at, the study concluded that “high-performing school systems consistently do three things well:

- They get the right people to become teachers (the quality of an education system cannot exceed the quality of its teachers).
- They develop these people into effective instructors (the only way to improve outcomes is to improve instruction).
- They put in place systems and targeted support to ensure that every child is able to benefit from excellent instruction (the only way for the system to reach the highest performance is to raise the standard of every student).” (p. 13)

EDNET’s projects to improve math and science teachers have focused on effective teacher preparation and professional training. Recognizing the importance of mathematics and science competency for global competitiveness, EDNET is studying mathematics and science teacher preparation in APEC economies (Exhibit 2). The project involves examining economy teaching profiles, teacher standards, and teacher preparation programs and assessing future teachers. The products will identify best practices and develop new models for the improvement of teacher quality and corresponding student outcomes. This project involving leading universities in 6 APEC Economies (Australia: Monash University, China: East China Normal, New Zealand: Waikato University, Russia: Moscow Institute of Open Education, Singapore: National Institute of Education, Thailand: Koen Kaen University, USA: Columbia, Harvard and Pennsylvania).
With respect to improving current teachers through professional development, APEC work on Classroom Innovations through Lesson Study is widely acknowledged to have led to the understanding and dissemination of this Japanese approach (Exhibit 3). APEC members learn how lesson study works to improve teacher quality through peer and expert critiquing of teacher lessons. Led by Tsukuba University - Japan and Khon Kaen University – Thailand, the project has produced a Lesson Study Guide and videos of sample lessons in mathematics (Lesson Study on APEC Wiki). The project has moved forward toward applying math and science concept to the real-world problems and to contribute sustainable development. And it aims to provide students and teachers the necessary scientific and practical knowledge about disaster risks and related competencies, which was attached importance to in the APEC Education Ministers meeting in 2008. Electric materials for getting scientific knowledge of disaster will be developed for math classes in APEC economies through the lesson study approach.

Math and Science for All Students

All students need extensive exposure to math and science at both primary and secondary levels to succeed in the 21st Century digital Economy. This requires a change in education philosophy as often math and science courses are geared to those students who are most adept at math and science.

Two specific Economy examples of practices suited for at-risk students that would also typically help all students are:

- **Chinese math standards provide optional math choices on top of a common core compulsory program.** To respond to the need for all secondary students to have extensive exposure to math, the Chinese math standards (APEC Wiki) offer a flexible curriculum that recognizes students’ varying needs. Chinese standards provide a compulsory core of 5 components of fundamental secondary mathematics. The optional curriculum satisfies students’ special interests. For example, in Exhibit 4 below, you see an optional module on the left if for humanities/social studies and a second for science and technology majors.

- **Singapore’s visual representations of mathematical ideas.** Mathematics and science ideas may represent abstract concepts that many students have difficulty grasping in a meaningful way. Visual approaches give students a grounding of these ideas in reality. For example, the number line is a powerful way to visually represent such concepts as greater than and less than, negative numbers, fractions and decimals. The Singapore Math curriculum employs a concrete-to-pictorial-to-abstract approach to provide students visual scaffolding in understanding math concepts. Singapore’s Bar model method (Singapore Ministry of Education, 2009) (Exhibit 5) delivers “a pictorial model to represent the known and unknown quantities and their relationships in a problem,” to develop their mathematical problem-solving skills.
Part of assisting the special needs all students is helping the mathematically and science gifted students fully develop their special capacities.

- Japan's *Super Science High schools* (SSHs) have developed enriched curricula, teaching methods and materials on science and mathematics in *partnership with Japanese universities and research institutes* ([http://rikai.jst.go.jp/eng/e_about/e_sshs.php](http://rikai.jst.go.jp/eng/e_about/e_sshs.php)). Some SSHs also promote classroom teaching in English to prepare students for international activities.

- Russia's *Moscow State School 57th Math School* introduces university math students who may have a desire to teach to tutor gifted children in very small groups under supervision of mentor teacher (APEC Quality of Teacher Preparation project).

APEC’s work would examine these and other promising practices across APEC education systems for helping all children learn math and science.

### 21st Century Math and Science Standards

21st Century mathematics and science content standards address the need to expose students to a mathematical way of thinking, real-problem solving and adequate levels of probability and statistics. APEC has been an international leader in the compilation of math standards ([http://hrd.apec.org/index.php/Mathematics_Standards_in_APEC_Economies](http://hrd.apec.org/index.php/Mathematics_Standards_in_APEC_Economies)) and science standards ([http://hrd.apec.org/index.php/Science_Standards](http://hrd.apec.org/index.php/Science_Standards)) across APEC Economies. These standards identify what students need to know and be able to do at primary and secondary grades. And hence are critical to framing instruction and assessment.

APEC analyses (Achieve, 2009) have compared the standards to identify common topics and differences across standards at primary and secondary grades for math and science. Examples of findings with respect to the goals above:

Unlike most economies, New Zealand devotes a third of standards to statistics and probability at every grade span. New Zealand credits its relatively high ranking on PISA to its standards that emphasize statistical word problems.

- The newer math and science standards are shifting away from rote memorization and highly rigorous mathematical proofs to stressing students being able apply and solve *real-world applications of math and science concepts*. An example from the Chinese standards of introducing real-world applications even in grade 3.

As APEC educational systems evolve and update their standards, APEC members should also be able to share good practices in implementing the new standards to change teaching and learning.
Math and Science Problem-solving

Today, nearly every worker in the global economy needs to know how to apply scientific thinking to make “green” decisions that help to preserve the health of our natural systems and our citizens. Focusing on how to teach and assess scientific literacy that encompasses both knowledge and application may produce important benefits.

In a study designed to look at how well students were mastering scientific reasoning—the transferable ability to apply scientific thinking to a variety of situations—researchers from U.S. and Chinese universities compared the knowledge mastery and scientific reasoning ability of 5,760 students who were about to begin their university careers as science and engineering majors (Bao, et al., 2009). The students had experienced very different types of curricula in their K-12 years, with the Chinese students being exposed to more extensive content knowledge. The instruments designed to measure content knowledge reflected greater mastery by the Chinese students. Results on the instrument designed to measure scientific reasoning, however, were nearly identical across the two economies. This suggests that content-rich instruction is not sufficient to produce deep understanding and application of scientific reasoning. The researchers noted that blending inquiry-based learning with content instruction gives a more balanced approach that prepares students to use higher-order scientific reasoning to apply their knowledge.

The APEC WIKI contains a pilot collection of problems to demonstrate the feasibility of collecting and comparing mathematics problems on different math topics and grades. These data were used in a study, Measuring Up: How the Highest Performing U.S. State (Massachusetts) Compares to the Highest Performing economy (Hong Kong, China) (Leinwand & Ginsburg, 2009). Hong Kong, China grade 3 items were more likely to require students to: (1) construct a response than Massachusetts items; (2) were more likely to require more than low computational difficulty, compared with Massachusetts items; and (4) fall into the moderate or high cognitive complexity category compared with Massachusetts items.

The interesting results from the feasibility study suggest that EDNET should fully develop an open environment containing mathematics and science problems, assessments and possibly other resources.

III. New Directions and Recommendations

Proposed Project 1: Open Environment for Educational Collaboration of APEC Economies—An Initial Focus on an APEC Math Assessment Item Bank (See Appendix for Details). To enhance APEC economies’ cooperation in the area of education, EDNET will establish an open system for access to the educational resources, with the goal of evolving an open environment of math education resources in the APEC region. Such an environment would promote the level of teaching and of citizens’ math literacy and would also encourage popularization of math education.
In the course of future development, the system would:

- Initially develop an open bank of mathematical problems for tests, exams, and math progress monitoring that would be gradually expanded by APEC project participants. Each problem would include various attributes and descriptors, such as the age of the pupil, number of students that took this problem on the exam, and percentage of student shaving successfully passed the exam. The bank would also include Economy examples of full assessments, and contain all the tools for implementation and monitoring of the assessment.

- Expand the open education environment to include resources in the areas of natural science, cultures, and languages of APEC economies.

**Proposed Project 2: a Repository of Math and Science Content Standards and Implementation Strategies.** This project continues to maintain and update the repository of math and science standards across APEC Members on the APEC Wiki. Further, it collects best practices in effective outreach, professional training and implementation of new or significantly changed standards through case studies and sharing of materials.

**Proposed Project 3: Meeting the Math-Science Needs of All Students.** Hold a conference to share research-based strategies and practices for ensuring all students receive a sound foundation in math and science and that students with different math and science interests and abilities have adequate specialized developmental opportunities. Agenda would cover best practices for making math accessible to all (visual approaches to explaining abstract math concepts) and realizing the math talents of gifted students, especially girls.

**Proposed Project 4: Math and Science To Support 21st Century Problem-Solving Skills.** Project would examine strategies for teaching the application of mathematics and science ideas to real-world problem solving. A special focus would be on effective methods for teaching statistics and probability such as New Zealand’s emphasis on using the statistical inquiry cycle. Another focus would be Education for Sustainable Development whose concept is to integrate the current issues such as environment, poverty, human rights, peace and development, etc. into math and science curricula in order to foster human resources who can contribute to a sustainable future with regard to the environmental, economic and social aspects. The on-going Japan-Thailand project on disaster preparedness into math education could be one of the exemplar.

**Proposed Project 5: Focus on improving the quality of teacher preparation and professional training in math and science** (link to ongoing APEC Quality of Teacher Preparation Project: Math and Science).
Appendix

Project Details:

APEC Open Environment for Education Collaboration - Math Education

Background (environmental scan)

Math and science education is the common part of the education systems of APEC economies. That is why the first step in creating a common educational environment would be to understand the common goals of math and science education and to create a common approach in this educational area.

Creating a joint open data base of math problems and assessment methods could become the first main step in the process of progressive integration of different elements of school math education and mutual enrichment of educational systems of APEC economies. Such a database would be used by educational institutions for assessments (to compare pupils’ results with other economies), as problems for intellectual contests (Olympiads) and to form a “problem core” for teachers.

Some economies already have a positive experience when using an open bank of math problems. Russia, for example, has been using this system for 3 years to develop The Unified State Exam in math as well as to inform the professional community about requirements set for students’ preparation.

The Australian Government has initiatives to increase the pool of digital learning resources and assessment tools available domestically to teach math and science. Some of these resources and assessment tools would be able to be made available to other APEC economies through an APEC digital library of resources.

APEC agenda motivation

Creating a joint open data base of math problems will contribute to regional economic integration, cross-border education and systemic reform, as it will bring together the best experience from across the APEC region, facilitate interaction and cooperation between various institutions within APEC economies and promote student mobility. Currently, apart from direct mobility that is seen as relocation of students between the economies, there’s another type of mobility that is called “remote mobility” which is implemented through computer technologies and allows to plan and to carry out remote education.

An efficient system of interaction between APEC economies’ educational institutions is urgently needed. Creating an open bank of math problems and open procedures in evaluating individual progress of each student could be the step towards this system.

In any case, whichever interpenetration of educational systems we will face in the future, there’s a need for a solid base for mutual understanding at all levels. That is why
a well thought-out policy of language education is becoming more important and should become a part of the APEC project.

Key research

The data bank would be formed and the exchange of experience will start take place in a pilot project of APEC math quiz. Every school in APEC economy would be able to participate in the project (voluntarily). It is assumed, that the quiz will take place twice a year. Around a half of problems would be formed by an international committee. APEC economies would take turns to form the rest pool of problems. Another important element of the project would be constructing an environment for remote interaction and cooperation for teachers.

1. In the context of the APEC economies co-operation in the area of education, an open system for access to the educational resources and to indices of quality of math education, which are supposed to become a part of open environment of math education in the APEC region, is proposed to be formed. Forming such an environment in the APEC region would promote the level of teaching and population’s math literacy. It will also induce popularization of math education. In the course of future development the system will include recourses in the area of natural science, culture and languages of APEC economies.

Structure of the working group, which ensures the Open access to educational resources system operation

2. The system should include an open bank of mathematical problems for tests, exams and math progress monitoring and be gradually expanded by project participants. Each problem must include various attributes and descriptors, such as the age of the pupil, number of students that took this problem on the exam, percentage of students having successfully passed the exam. The bank would contain all the tools for implementation and monitoring of the assessment.
3. It is proposed to run an open pilot research on students’ math education progress in APEC economies in October 2012. The research would be based on the materials that are developed in collaboration with Russian Federation, United States of America and Thailand. It is proposed that any school submitting the application would be able to participate. The decision on participation in the research must be taken on a level of school headmaster provided that the economies’ government agrees. One of the main goals of this research is to examine the perspectives of collaboration and interaction and also to estimate the expected start results of the whole project.

The project would enable to study the dynamics of educational progress for every individual and will also provide the data for monitoring of the level of math education within one economy and the whole region. APEC economies may be interested in the proposed environment’s comparison studies (as an addition to PISA research and others) in order to enrich and modernize the education content providing increase in students’ mobility and the educational process management.
New directions and recommendations

According to the goals declared above, a set of measures is proposed to be implemented:

1. Research of common and individual problems that Economies face in the field of math and language education and looking into the optimal ways of collaboration
2. Creating a common educational space, that includes common bases of educational materials as much as common approach of realization of educational goals.
3. Selecting target groups of students that are motivated to achieve certain level of math and/or science education.
4. Developing a common procedure to evaluate the progress of each target group on each subject. These procedures must be based on modern mathematical methods and estimation theory.
5. Developing feedback mechanisms that will simplify decision-making process and make it possible to modify the educational space as a reaction to changes in it.
6. Creating a search engine that will facilitate the search and development of gifted students in APEC framework, that includes running Olympiads, supervise extracurricular activity, publishing popular and semi-popular literature for students as much as developing methodology of getting students involved in research in the field of mathematics
7. Creating a system of refresher training for teachers, that works according to unified standard in the APEC framework.

Creating and putting into operation the joint open bank of math problems would help to meet these points.

It is proposed to develop the joint open bank of math problems in several stages:

1. Creation of international project group. Its aims would be:
   - To define the target groups of individual and corporate users of the future system;
   - To define the properties and develop the structure of the database (including defining types and constructive elements of problems).
   - Developing means of database operating for each target group;
   - Developing technical requirements for the System.
   - Developing specifications for data input subsystems, and presenting results of assessment procedures.

2. Expertise and project adjustment based on the results.
3. Creating an international working group, whose aims are:
   - To create a database prototype;
   - To create a multilingual system program shell that facilitates various means of interaction between user and the database.
   - To develop means to regulate interaction between system components and users and system components and operational team of experts.
   - To developing technological documentation
4. Expertise, testing and modifying system prototype based on expertise results.

5. Creating and training an international operational team for methodological and technical support of the project.

6. Developing regulations on interaction between participating economies that include defining test procedures and their processing results with dates, periodicity and duration. Defining structure and content of the conducted research report.

7. Making the open bank of problems available on computers, laptops and e-books (alike the idea that came from Japan and Thailand on 34th Human Resources Development Group Meeting).

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**Teacher interaction environment**

The system that is about to be created should not be restrained to problem collection and storage, to carrying out the research. Another important thing is the informational subsystem that allows education administration institutions, teachers and all the concerned individuals to communicate and actively participate in system development. The subsystem can be implemented as a specialized web-site (or a group of web-sites) that contains the following components:

- on-line Information and methodological support for the project that gives the access to database of problems and various levels of test procedures;
- operational reports on implemented research with comments and recommendations from experts;
- on-line forum on professional teacher communication.
Further opportunities

1. Developing and introducing similar systems of educational resources access in other educational areas – in science, languages and cultures.

2. Developing teacher preparation programs and programs on working with gifted pupils based on the research results.

3. Gradual transition to unified educational space, that unites all the APEC economies’ education systems on a base of uniform understanding of math and science education goals, bearing in mind the regional and other participants’ features.

References


Lesson Study on APECWiki: http://hrd.apec.org/index.php/Lesson_Study.


Development of an Open Environment for Educational Collaboration of APEC Economies
Proposed by Russian Federation in collaboration with Korea, USA, Australia, Japan

Overview

WHAT
EDNET will establish an open environment for access to the educational resources and to evaluation and assessment methods of quality of math and science education

WHY
APEC region needs to evolve the environment that will
• promote the level of teaching and of citizens’ math literacy
• encourage popularization of math & science education.

HOW
The environment will include:
• an open bank of problems for tests, exams, and progress monitoring as well as evaluation procedures
• interaction and search mechanisms
Background of The Topic

APEC leaders are aware, that:

• Economy is becoming increasingly international and increasingly knowledge and data driven
• The global job market is changing rapidly, requiring workers to have a strong set of adaptable skills
• For students to succeed the schools must change the way they teach students

Math and science education is the invariant priority

The Project refers to the priority themes of APEC

The way Education Network (EDNET) has been and will continue to respond to the rapidly evolving, knowledge-based and globalized economy.
Relation to APEC Agenda

“Education must equip the workforce with relevant knowledge and skills for the new economy and society of the 21st century.”

21st Century Skills respond to the “new division of labor” in the 21st Century Economy:

• Technology is enhancing the value of people with higher-level competencies involving data analyses, interpretation, and problem solving.
• Multiple jobs and technological innovations are increasing the importance of broader occupational competencies.

Key Research

Since 2004 Math education has been a priority for the human resources development working group (HRDWG).

In the past few years a series of projects in the area of math&science education have been implemented.

i.e. The survey of Curriculum for Upper Secondary High School Mathematics/Science Teacher Preparation Programs.
CURRENT STATE
APEC as well as OECD economies are creating their data banks of testing and assessment materials.

WHY and WHAT WILL BE CHANGED?
1. The majority of these data banks are closed for general public (and even classified). That:
   • leads to misrepresentation of their purposes
   • generates low-quality materials that are obtained by copying or mimicking fragments of closed data outside of educational context
2. Evaluation and assessment materials and procedures that are used in APEC economies are quite different and, therefore are of mutual interest

Necessity to combine efforts of APEC economies in order to develop common approaches, mutual assistance and experience exchange

Beyond PISA and Domestic Exams

The goals of the Project
• To promote gradual buildup of math and science literacy among students and general population of the economies
• To increase motivation in the area of studying math and science
• To search for gifted students and stimulation their progress and self-actualization
• To increase the level of subject and pedagogic teacher preparation in science and math field
• To increase the mobility of APEC economies students

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Broad scale of actions of implementation

• Research of challenges that Economies face in the field of education and looking for the optimal ways of collaboration
• Creating a common environment, that includes bases of educational materials
• Determining target audiences having been motivated to achieve certain level of math and science competence.
• Developing a common procedure to evaluate the progress of each target audience.
• Developing feedback mechanisms
• Creating a search engine (incl. Olympiads, popular literature) research in the field of mathematics
• Creating a system of in-service training for teachers.

The First Step

Creating a joint open data base of math problems and assessment methods
Stages of System development

1. Creation of international project group. Its aims would be:
   - To define the target groups of users;
   - To develop the structure of the database.
   - To develop means of database operating for each target group;
   - To develop technical requirements for the System.
   - To develop specifications for data input subsystems, and presenting results of assessment procedures.
Further stages of System development

2. Expertise and project adjustment based on the results.
3. Creating an international working group, to develop:
   – a multilingual system shell that facilitates various means of interaction between user and the database.
   – models and interfaces of interaction technical documentation
4. Expertise, testing and modifying system prototype based on expertise results.
5. Creating and training an international operational team for methodological and technical support of the project.
6. Developing regulations on interaction between participating economies on procedures, processing results, dates, etc. Defining structure and content of the conducted research report.

Once the prototype of the collection of problems is formed...

To run a (low scale) open pilot research on students’ math education achievements in APEC economies in 2012/2013.

• Every school in APEC economy that submits an application would be able to participate in the project (voluntarily).
• The collection could also be used by educational institutions for:
  – assessments;
  – as problems for Olympiads;
  – to form a “problem core” for teachers;
Teacher interaction environment to provide:

- on-line Information and methodological support for the project that gives the access to database of problems and various levels of test procedures;
- operational reports on implemented research with comments and recommendations from experts;
- on-line forum on professional teacher communication.

Outcomes

The project would enable...

- to study the dynamics of educational progress for every individual
- to provide the data for monitoring of the level of math education within one economy and the whole region
- to enrich and modernize the education content providing increase in students' mobility and the educational process management.
Further opportunities

1. Developing and introducing similar systems of educational resources access in other educational areas – in science, languages and cultures.
2. Developing teacher preparation programs and programs on working with gifted pupils based on the research results.
3. Gradual transition to unified educational space, that unites all the APEC economies’ education systems on a base of uniform understanding of math and science education goals, bearing in mind the regional and other participants’ features.

Thank you for your attention!