



**Asia-Pacific  
Economic Cooperation**

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**2011/SOM1/HRDWG/032rev1**

Agenda Item: EDNET 7.6

**Completion Report - HRD 01/2009A APEC 21st  
Century Mathematics and Science Education for All:  
Strengthening Developing Economies and the  
Gender Equity Through Standards, Assessments  
and Teachers**

Purpose: Information

Submitted by: United States



**33<sup>rd</sup> Human Resources Development  
Working Group Meeting  
Washington, D.C., United States  
7-11 March 2011**

# Project Completion Report

Please submit through your APEC Secretariat Program Director within 2 months of project completion.

## SECTION A: Project profile

<b>Project number &amp; title :</b>	HRD 01/2009A - APEC 21st Century Mathematics and Science Education for All: Strengthening Developing Economies and the Gender Equity through Standards, Assessments and Teachers		
<b>Time period covered in report:</b>	2009- December 2010	<b>Date submitted:</b>	January 20 2010
<b>Committee / WG / Fora:</b>	Human Resources Development Working Group		
<b>Project Overseer Name / Organization / Economy:</b>	Brian Fu, US Department of Education, USA		

## SECTION B: Project report and reflection

***Briefly answer each of the questions below. Section B should be a maximum of 2-3 pages, inclusive of the questions and tables provided.***

**1. Project description: In 3-4 sentences, describe the project and its main objectives.**

The main goals of this project were to share exemplary practices in mathematics education from around the APEC region and develop technical assistance from these promising practices to help developing economies in APEC to effectively replicate these practices based on their individual contexts.

**2. Meeting your objectives: Describe how the project went, with reference to the objectives laid out in your project proposal. Include any major changes to your project as proposed and any problems or obstacles that you encountered and how you overcame them.**

The ultimate goal of the conference was to develop a series of resources, recommendations, and action plans for the APEC Education Network based on the presentations and discussions held during the conference. In order to address issues and concerns for improving mathematics teaching and learning, the project overseers and the conference chairs identified five major topics in mathematics education. Based on these topics, the 4-day conference was organized around five major topics and was designed for intensive discussion on each topic among not only the speakers and discussants but also including the active participants who were nominated by the each APEC member economy. The following are the five plenary sessions based on the five major topics that were identified by the conference organizers:

1. Standards plenary session
2. Curriculum plenary session
3. Teacher plenary session
4. Assessment plenary session
5. Interventions plenary session

Each plenary session began with presentations from selected monograph writers followed by break-out sessions, which provided the participants an opportunity to engage in discussion with the presenters and other active participants. Next, the whole group reconvened for panel discussions, which included all presenters of the plenary session and the discussants who represented the audience members of the resources from this project. 17 distinguished presenters and 5 discussants from 12 economies participated in the conference.

**3. Project evaluation: Describe how you evaluated the project and provide some details on the results of the evaluation (e.g. participant evaluation, peer review of publication, measurement of indicators, statistics demonstrating use of outputs etc.).**

The project evaluation was primarily carried out through a survey questionnaire for conference participants. The evaluation showed that most participants indicated that the selected topics and discussions were helpful.

4. **Key findings:** Describe one or two examples of important findings arising from the project (e.g. results from surveys or case studies, insights provided by participants or experts, policy recommendations, roadblocks to progress on an issue etc.).

Discussions at the project conference highlighted the importance of international benchmarking in all aspects of mathematics education from the development of standards, assessments, textbooks and other materials to improvements in teacher training and evaluation. Indeed, APEC economies share many common challenges. Concrete examples of promising practices were presented and documented by this project. Highlights of these promising practices include using progressions to develop mathematics standards, using formative assessment in the classroom, and implementing strategic teacher recruitment, training, and evaluation systems.

5. **Next steps:** Describe any follow-up steps or projects that you recommend. Have you already planned or begun these? What role could APEC play in any follow-up?

The project overseers have already started a follow-up project, HRD 01/2009S. HRD 01/2009s responds directly to the recommendations made from the completed conference in Thailand. The key deliverables of HRD 01/2009S include:

- Online toolkits describing promising practices in mathematics education with tips on how to replicate these programs and practices with special emphasis on travel eligible APEC Economies
- Technical assistance in the form of webinars provided to help APEC travel-eligible Economies further understand the content in the online toolkits
- Online learning modules for teaching data and statistics. While the project overseers were hoping to establish more linkages with other organizations, we plan to establish more relationships in the implementation of the follow-up project.

6. **Feedback for the Secretariat:** Do you have any suggestions for more effective management of projects in the future? Any assessment of consultants, experts or participants that you would like to share? *(The Secretariat collates and examines feedback to identify trends for ongoing evaluation of our project management and/or communications systems.)*

7. **Participant information:** Please provide details, where applicable. Insert rows as needed.

Economy	# male	# female	Details
Australia	2		
China	3		
Hong Kong, China	1		
Indonesia		2	
Japan	2		
Malaysia		3	
Mexico		1	
New Zealand	1	1	
Peru	1	1	
Philippines		3	
Singapore	1	2	
Thailand	over 30	over 30	
United States	6	6	
Viet Nam	3		
Other:			

8. **Outputs:** Please provide details, where applicable. Change headings or insert rows as needed.

	# planned	# actual	Details
# of workshops / events	1	1	The project event was held in March 2010 in Thailand
# of publications distributed	2	2	Available on the APEC publications database
# of CDs distributed	0	0	
# of websites created	1	1	Project materials available: <a href="#">here</a>
Other:			

### SECTION C: Budget

Attach a detailed breakdown of the APEC- provided project budget, including:

- **Planned costs** (using most recently approved budget figures)
- **Actual expenditures**
- **Variance notes:** An explanation of any budget line under- or over-spent by 20% or more.

### SECTION D: Appendices or additions

Please attach any of the following. This information will help us better understand your project, support overseers of similar projects and plan for future projects.

- ✓ List of **participants**, with contact details
- ✓ Links to any relevant **websites or online material** (e.g. reports, resources created)

<b>FOR APEC SECRETARIAT USE ONLY</b> APEC comments: Were APEC project guidelines followed? Could the project have been managed more effectively or easily by the PO?

**Attachment:**

**Website address for more project information**

[http://hrd.apec.org/index.php/APEC Conference on Replicating Exemplary Practices in Mathematics Education](http://hrd.apec.org/index.php/APEC_Conference_on_Replicating_Exemplary_Practices_in_Mathematics_Education)

# Best Practices in Mathematics Education

Developing Mathematics Curriculum and Content Standards



APEC Technical Assistance & Training Facility (APEC TATF)

APEC Project HRD 01/2009A - 21<sup>st</sup> Century Mathematics Education for All in the APEC Region



## Why take an international perspective?

- Provides a broader perspective for analyzing performance and practices
- Compares practices with those of the highest performers
- Identifies each other's underlying assumptions and approaches
- Creates a world laboratory for new ideas

## Learning from others

- There is more than one way to do things.
- As a foreign language strengthens our understanding of our native language, so can international comparisons strengthen our understanding of our mathematics program.
- There are reasons other economies do better.
- In answering “How is it done elsewhere?” we can learn how to change what we do here.

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## Three toolkits drawn from the March, 2010 APEC Conference

- Mathematics curriculum and standards
- Developing effective teachers of mathematics
- High quality mathematics assessments

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## Mathematics curriculum and standards

This toolkit draws from a range of APEC economies to provide ideas and examples of

- The purpose of content standards
- Organizing mathematics standards
- Characteristics of high-quality mathematics standards
- Resources for international benchmarking of mathematics standards

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## Developing effective teachers of mathematics

To ensure effective teachers, governments and schools must

1. Attract and recruit high-caliber students into education
2. Provide rigorous preservice preparation
3. Provide effective mentoring and support
4. Provide meaningful professional development
5. Provide career paths and incentives to retain effective teachers.

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## **High Quality Mathematics Assessments and Assessment Systems**

This toolkit draws from a range of APEC economies to provide ideas and examples about:

- the critical role of assessment
- a balanced assessment system
- high quality assessment tasks
- formative assessment practices

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## **Curriculum and Standards excerpt**

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### 3. Characteristics of high-quality standards

An analysis of the mathematics content standards followed in the highest-performing APEC economies finds six characteristics of effective standards.

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### Early learning

High-quality standards for early learning of mathematics concentrate on numbers, measurement, and geometry, with a limited focus on data analysis, and no attention to algebra until later grades.

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## Topic sequencing

A second characteristic of high-quality standards is that mathematical topics are sequenced within strands to support in-depth and efficient development of mathematical understanding that follows a logical development of mathematical knowledge.

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## Sequencing within topics

Third, high-quality standards *sequence mathematical competencies within a topic* across grades according to mathematically logical learning progressions.

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## Learning progressions

A learning progression is a sequence of successively more complex ways of reasoning. The progression from novice learner to competent learner to expert begins with the acquisition of relevant experiences, principles, concepts, facts, and skills and moves to the accumulation and organization of knowledge in a specific domain and finally to expertise *after extensive experience and practice*.

(National Assessment Governing Board, 2008)

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## Alignment of content order among topics

Fourth, ordering content for one topic is often aligned to reinforce the content of another topic for the same or prior grades.

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## Processes incorporated with content

Fifth, high-quality standards incorporate mathematical processes or practices as well as content.

Mathematical processes:

- Problem solving
- Reasoning and proof
- Communicating mathematically
- Making connections
- Using multiple representations

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## Good standards use examples

Sixth, high-quality standards include representative examples.

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## Resources for international benchmarking of mathematics standards

- APEC Wiki:  
[http://hrd.apecwiki.org/index.php/Mathematics\\_Standards\\_in\\_APEC\\_Economies](http://hrd.apecwiki.org/index.php/Mathematics_Standards_in_APEC_Economies)
- US Common Core State Standards  
<http://corestandards.org>
- Composite Standards:  
<http://www.air.org/files/MathStandards.pdf>

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## Effective Teachers excerpt

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### 3. Mentor and support teachers

APEC economies with effective teaching forces have built mentoring and support into their system of **appraisal** and **feedback, rating** and **rewarding** in a clear system of professional growth.

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### In Japan

- Level 1: Teachers can tell students important basic ideas of mathematics such as facts, concepts, and procedures.
- Level 2: Teachers can explain the meanings of and reasons behind the basic ideas of mathematics.
- Level 3: Teachers can give students opportunities to understand basic ideas and support their learning so that students become independent learners.

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## In Japan

A Level 1 teacher would present the problem and show the steps for solving it.

A Level 2 teacher would show the steps and explain why those steps are correct and useful.

A Level 3 teacher would present students with the same problem, providing structure and guiding the conversation, so that students arrive at a new understanding as a result of their own efforts in solving it.

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## 5. Provide career paths and incentives

APEC economies with effective teaching forces provide clear career paths and a range of incentives to encourage teachers to stay in teaching and to continue to grow.

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## In China

### Teaching hierarchy in Chinese cities:

- A new teacher remains a trainee for 3 years.
- A second-rank teacher (for those who qualify) may teach independently.
- A first-rank teacher must write articles.

### In Beijing or Shanghai: teach/mentor by:

- Master or senior teacher (2%)
- Leading or special teacher (0.4%)
- Super rank (*te ji jiao shi*) (0.15%) through contests

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## Singapore's GROW Package

- Expansion of Part-Time Teaching Scheme
- Greater Support for Part-Time Teaching
- Enhancements to No-Pay Leave

- Enhanced Senior Specialist Track
- Further Re-employment Opportunities
- Future Leaders Programme



- Professional Development Packages
- Greater Support for Postgraduate Studies
- More In-service Upgrading Opportunities for Non-Graduate Teachers

- New Education Scheme of Service (2008)
- Revision to CONNECT Plan
- Additional Outstanding Contribution Awards

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## Assessment excerpt

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## 4. Formative Assessment Practices

Assessment *for* learning to make instructional decisions and monitor student progress – that is formative assessment.

Assessment *of* learning to evaluate students' achievement and overall program effectiveness – that is summative assessment.

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## Definitions

We use the general term *assessment* to refer to all those activities undertaken by teachers – and by their students in assessing themselves – that provide information to be used as feedback to modify teaching and learning activities. Such assessment becomes *formative assessment* when the evidence is actually used to adapt the teaching to meet student needs.

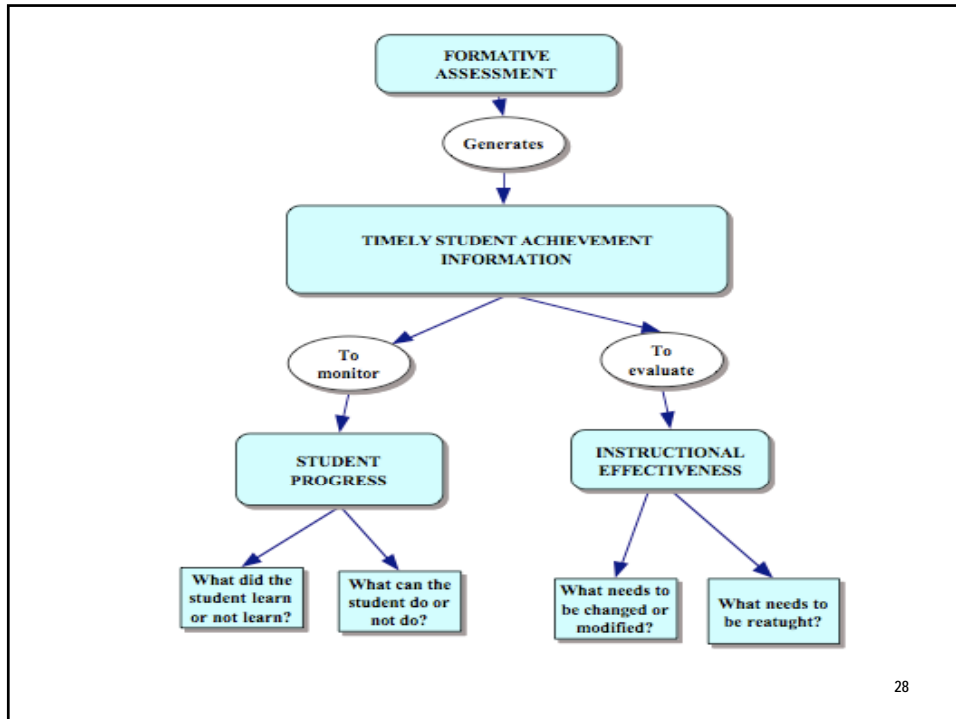
- Black and Wiliam

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## The Research

- Innovations that include strengthening the practice of formative assessment produce significant and often substantial learning gains.
- Improved formative assessment helps low achievers more than other students and so reduces the range of achievement while raising achievement overall.

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## Characteristics of Classroom-Based Formative Assessment

- Involves short cycle very frequent (daily assessment);
- Takes a variety of forms and involve a range of techniques including projects, discussion, questions, quizzes;
- Provides enough detail to suggest next steps;
- Followed by appropriate feedback and instructional adjustments;
- Involves students in self and peer assessment.

## Conclusion for Standards

Developing standards is the first step in a long improvement process. Strong, effective standards must be developed to guide the rest of the process.

The high-quality mathematics standards discussed here provide a benchmark for all countries.

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## Conclusion for Teachers

Research has found that teachers account for more of the variance in student performance than any other school factor.

The practices and policies that support the training, development and support of teachers of mathematics discussed in this toolkit provide an important international benchmark for ensuring high quality teachers of mathematics in all APEC economies.

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## Conclusion for Assessment

Whether we like it or not, what is taught and what is tested are intimately related. No serious possibility exists for creating tests that will not eventually influence what is taught and how it is taught in schools.

Meaning:

- You get what you assess;
- You do not get what you do not assess; and
- Therefore, build assessments toward which we want to teach.

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## Coming soon to the APEC wiki

**Thank you!**

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