TIMSS and PIRLS 2011 Encyclopedias

Education Policy and Curriculum in Mathematics, Science, and Reading

Ina V.S. Mullis and Michael O. Martin

Executive Directors
TIMSS & PIRLS International Study Center
Boston College

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Encyclopedia Overview

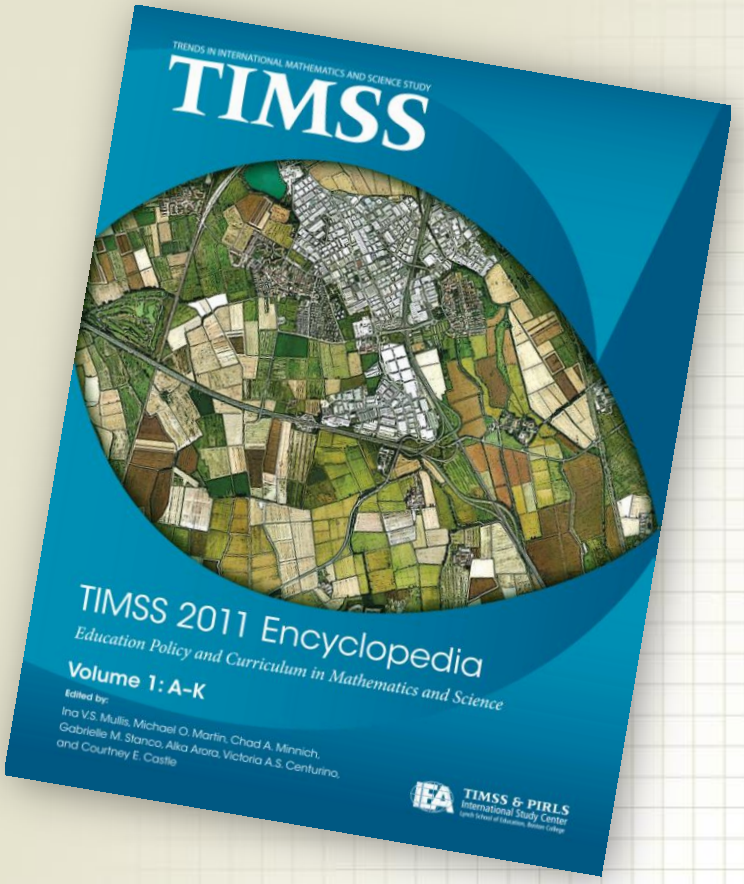
- Impressive compendium of what is taught and how it is taught around the world
- TIMSS in mathematics and science
- PIRLS in reading
- Qualitative complement to the quantitative International Results reports

Importance of Country Contexts

- Each TIMSS 2011 and PIRLS 2011 country prepared a chapter
- Countries very different
- Educational systems reflect these differences
- Encyclopedias increase understanding of the variation in educational policies

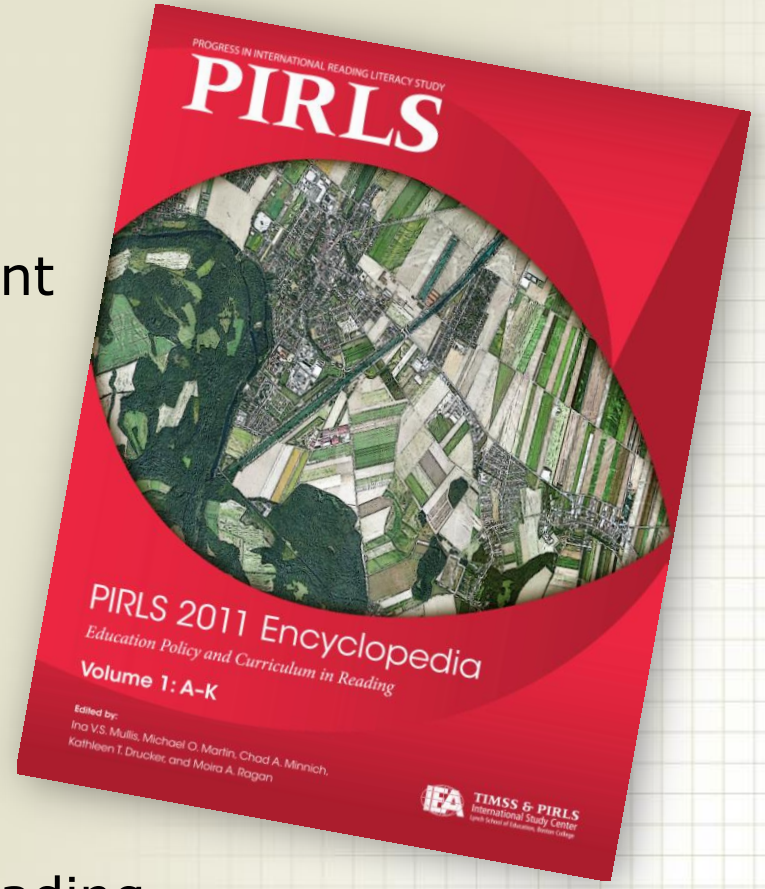
TIMSS 2011 Encyclopedia: Grades 4 and 8

- 69 individual country chapters
  - Overview of education systems
  - Mathematics curriculum
  - Science curriculum
  - Instruction in mathematics and science
  - Teachers and teacher education
  - Monitoring student progress in mathematics and science
  - Impact of TIMSS



PIRLS 2011 Encyclopedia: Grade 4

- 56 individual country chapters
  - Language and literacy environment
  - Overview of education systems
  - Language/reading curriculum
  - Reading instruction
  - Students with reading difficulties
  - Teachers and teacher education
  - Monitoring student progress in reading
  - Impact of PIRLS



Significance of Encyclopedia Chapters

- Important contextual information about each country
- Chapters taken together provide a view of education worldwide
  - Concise description
  - From country's own viewpoint
  - Important and indispensable resource for policy and research in comparative education

Curriculum Questionnaire

- Chapters supported with information provided by Curriculum Questionnaire
  - Schooling policies (age of entry, promotion)
  - Preprimary education
  - Intended curriculum (content prescribed, topics covered, cognitive skills emphasized, policies about instruction)
  - Teacher education
  - Examinations with consequences

Demographic Context of TIMSS and PIRLS Countries

- Demographic facts and figures collected primarily from *World Development Indicators 2011*
- Illustrates the diversity of the TIMSS and PIRLS countries
  - Population size and geographic area
  - Economic development
  - School enrollment

School Entry Policies in TIMSS and PIRLS Countries

- Children begin primary school between ages 5 and 7
- Calendar year
  - Begin the calendar year of your 6th birthday or 7th birthday
- School year
  - Begin when school starts (typically September 1st) as long as you are 6 or 7 by then
- Decision of children entering school a matter of parental discretion in many countries

Preprimary Education Important in TIMSS and PIRLS Countries

- Preprimary education important in preparing students for primary school
- Preprimary education was available in all countries
- Mandatory for one year in 8 PIRLS countries and 10 TIMSS countries
- Many countries reported nearly all children attended even though voluntary

Preprimary Curriculum in TIMSS and PIRLS Countries

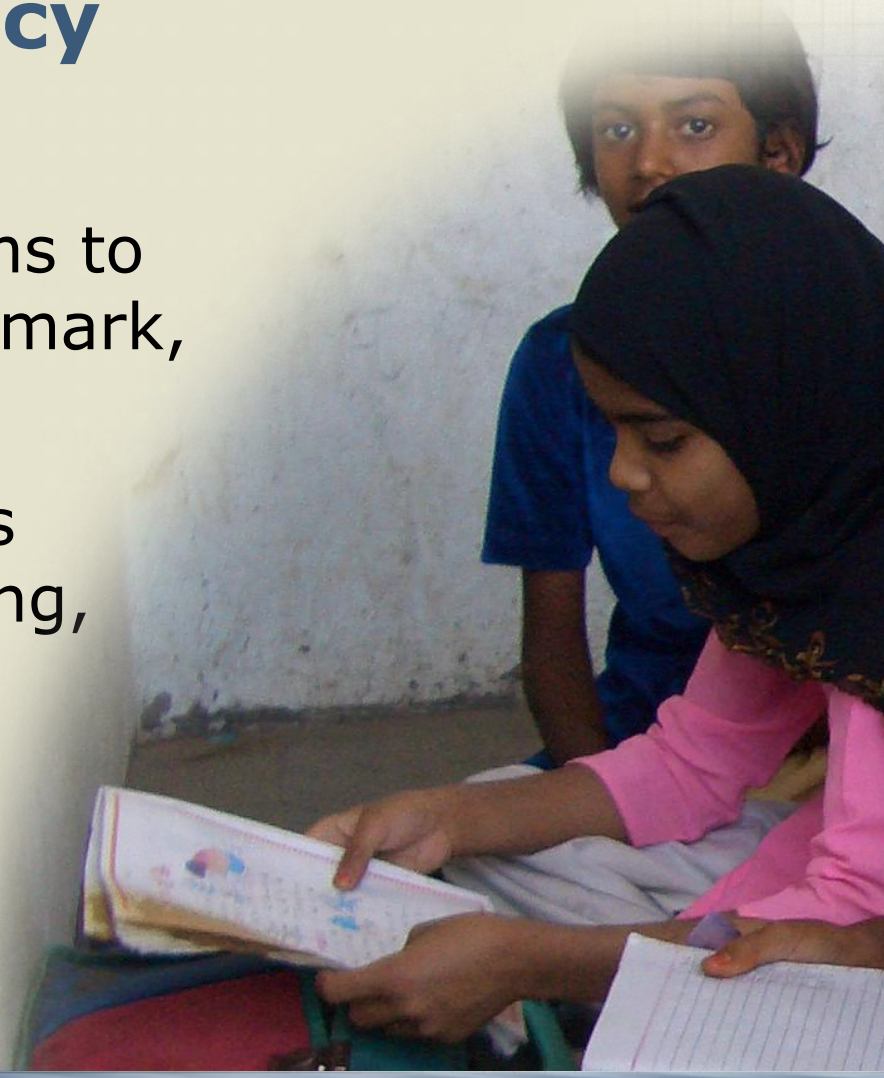
- Most countries had a preprimary curriculum
- Curriculum typically included
  - Language, reading, and writing skills
  - Mathematics (e.g., counting, learning shapes)
  - Science (e.g., nature study, weather)
- Variation, but reading instruction often begins in preprimary grades

Considerable Language Diversity

- Historical cultural regions, indigenous groups, more recent immigration
- Challenge of instruction in multiple languages, with South Africa having 11 home languages
- Teaching the language of instruction as a second language

PIRLS
High Levels of Literacy Fundamental

- Ambitious national programs to improve literacy (e.g., Denmark, Hong Kong, Portugal)
- Numerous initiatives across countries to promote reading, some in partnership with libraries



Language/Reading Most Comprehensive Subject in Primary School

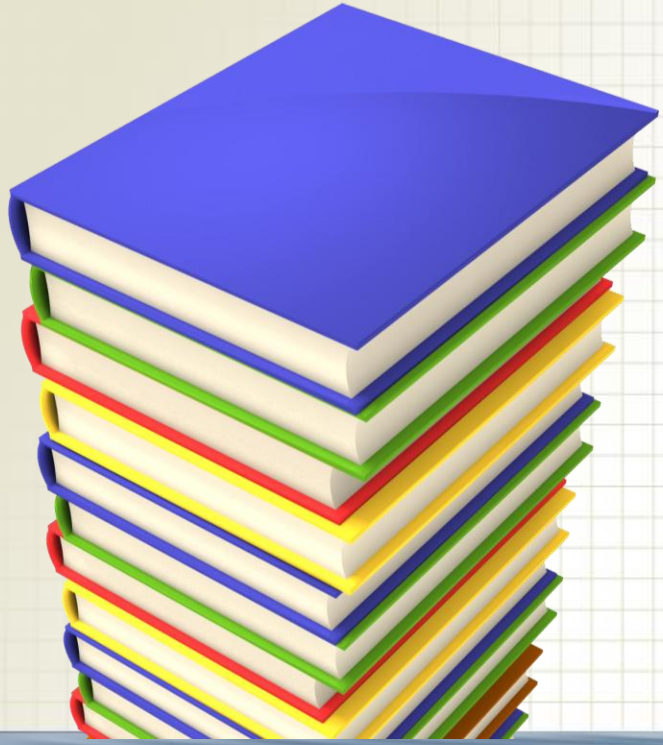
- Nearly all countries had a national language/reading curriculum
- Majority introduced their curriculum since 2000, although about half under revision
- Most countries devoted around 20-30 percent of instructional time to language/reading

Language/Reading Curriculum Goals

- Central goal – fourth grade students read with comprehension
- Most curricula emphasized reading across a broad range of text types and for different purposes
- Most curricula included an explicit focus on reading comprehension skills and strategies, from identifying main ideas to a variety of higher-order strategies (e.g., evaluating, making connections)
- About one-third of the curricula encouraged students to develop positive attitudes, read for pleasure, read to develop personal identity

Materials for Reading Instruction

- Textbooks still primary resource for about three-fourths of students
- Three-fourths of countries described reading instructional materials beyond textbooks and reading series
  - For example, computer programs, audiotapes, newspapers, magazines
- Some technology use, but reading teachers may still prefer books (e.g., Denmark)



Reading Teachers

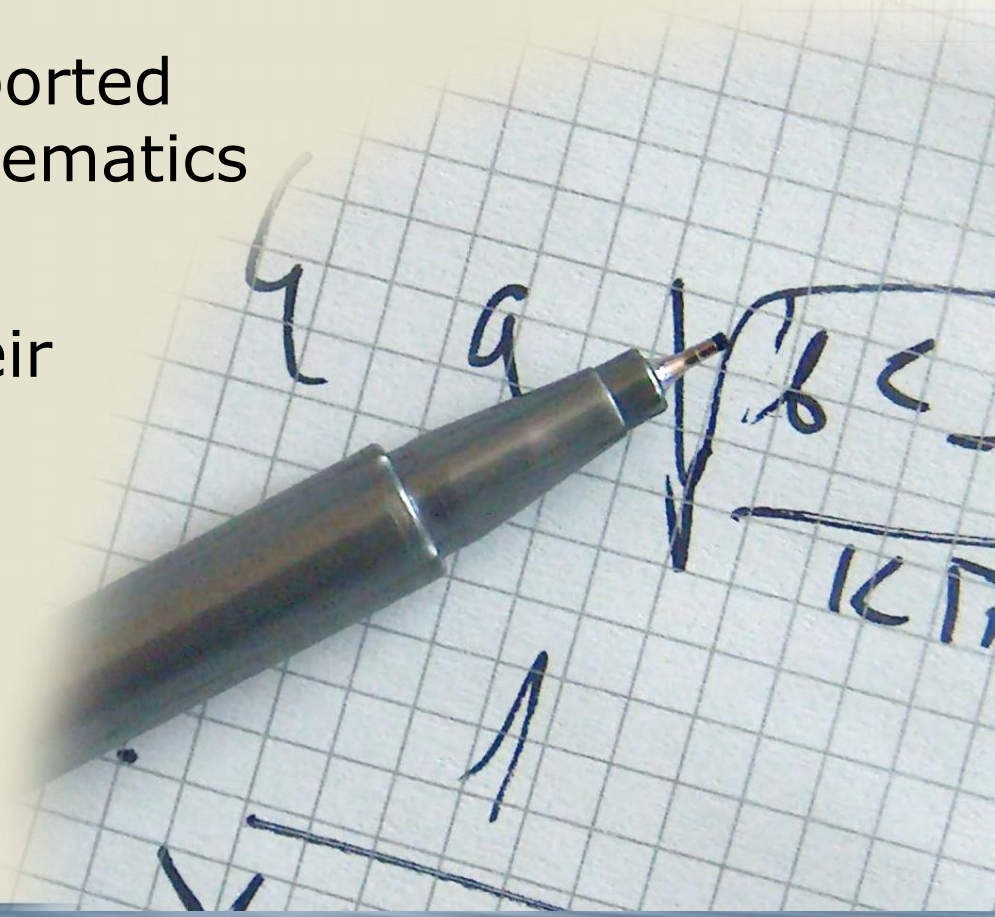
- Primary school teachers responsible for all basic subjects
- Bachelor's degree in primary education
- Most not required to have training in reading instruction *per se* – Sweden an exception
- Professional development varied and did not necessarily include reading

Monitoring Student Progress in Reading

- About one-third reported national assessments in the primary grades
- Some school-based standardized testing
- Classroom assessments
- Policies/procedures for reporting to parents

TIMSS
Mathematics and Science Curricula at Fourth and Eighth Grades

- Nearly all countries reported having a national mathematics and science curriculum
- Majority introduced their curriculum since 2000, although about half under revision



Instructional Time for Mathematics and Science

Mathematics

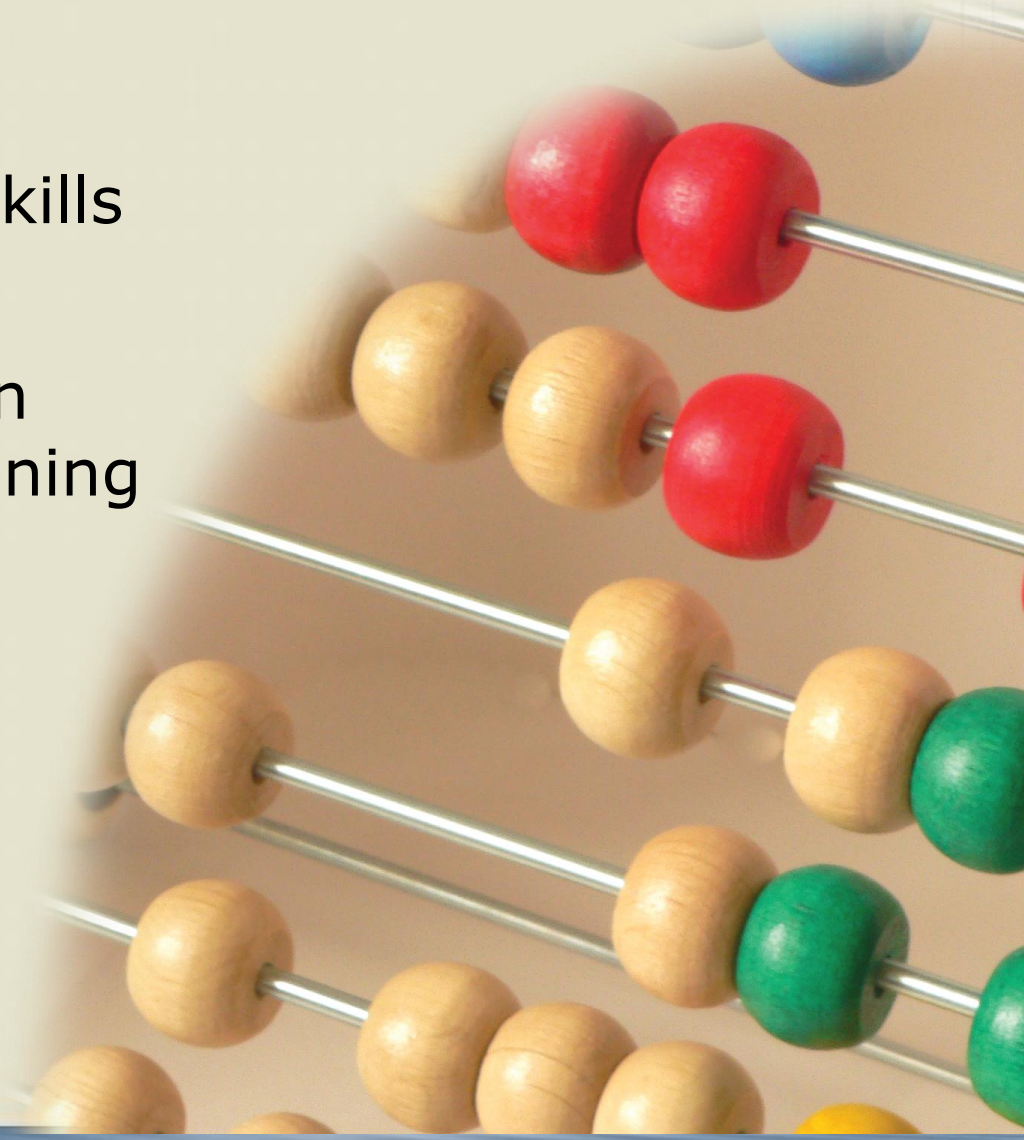
- Most countries devoted around 10-20 percent of instructional time to mathematics at Grades 4 and 8

Science

- Most countries devoted somewhat less instructional time to science in Grade 4 than Grade 8
  - 5-10 percent of time in Grade 4
  - 10-20 percent of time in Grade 8

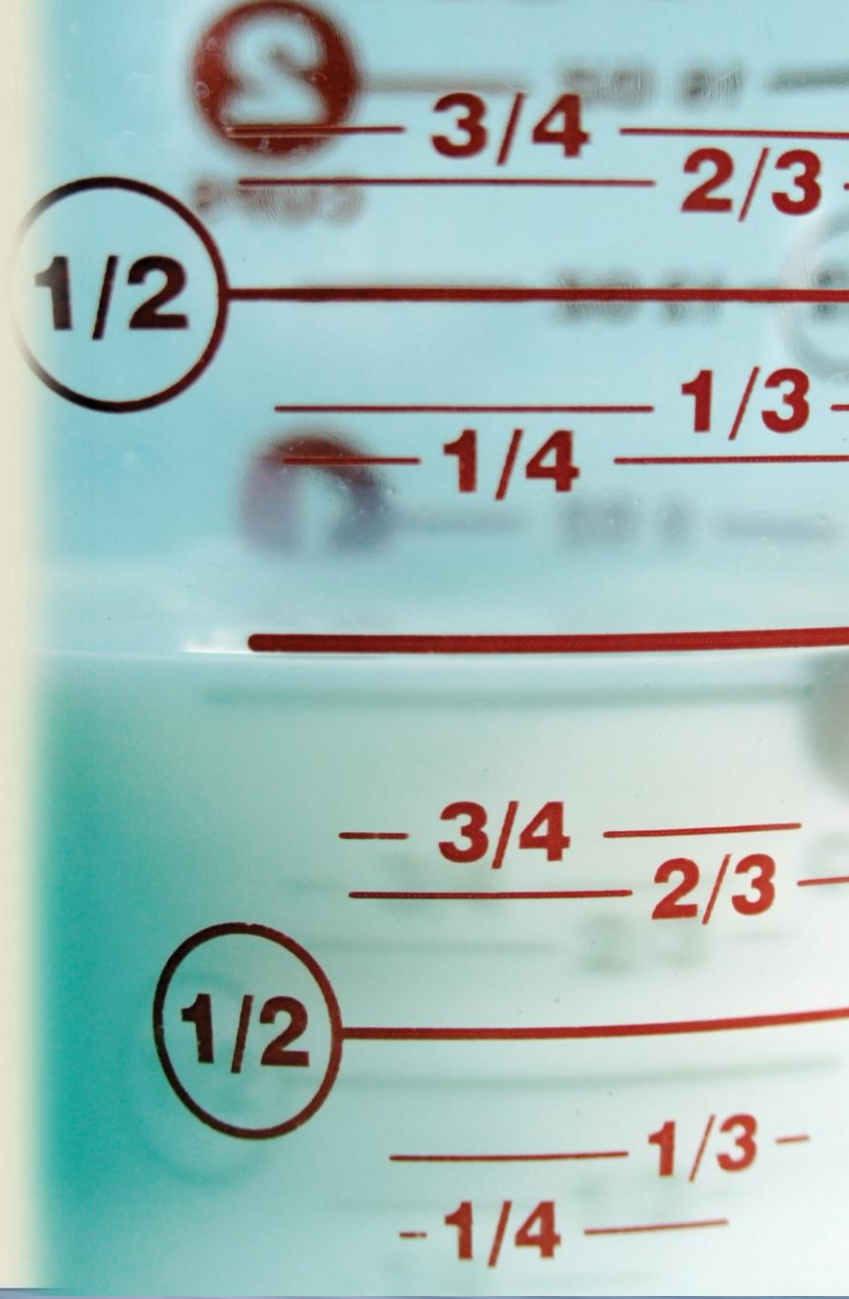
Fourth Grade Mathematics Curricula

- All emphasize basic skills "a lot"
- Range of emphasis on application and reasoning
- Eighth grade – less emphasis on basic skills



Number Topics

- Majority of curricula at fourth grade – all include operations with whole numbers and two-thirds include fractions and decimals
- Eighth grade – about half integers and irrational numbers, also ratios and proportions as well as exponents



Algebra Content

- Coverage of algebra content varied greatly across countries
  - About one-third included algebra at fourth grade, including simple linear equations
  - Most countries introduced algebra in the form of symbols and variables by sixth or seventh grades
  - By eighth grade, most countries teach simple linear equations
  - About 1/3 of countries have completed simultaneous linear equations and few have actually taught quadratic equations

Problem-Solving in the Mathematics Curriculum at the Fourth and Eighth Grades

- About 80 percent of mathematics curricula explicitly discussed higher-order thinking/critical reasoning/problem-solving skills
- Half of the countries had problem-solving as a **major** focus or important goal in the curriculum

Science Curriculum

- Many primary level science curricula focused on life sciences (e.g., environmental studies, living things, human health) instead of physical sciences
- At Grade 8, science instruction follows two different paths
  - Most teach science as an integrated subject (synergy across topics)
  - 16 countries teach science as separate subjects (e.g., in-depth focus on biology, chemistry, physics, and earth science)

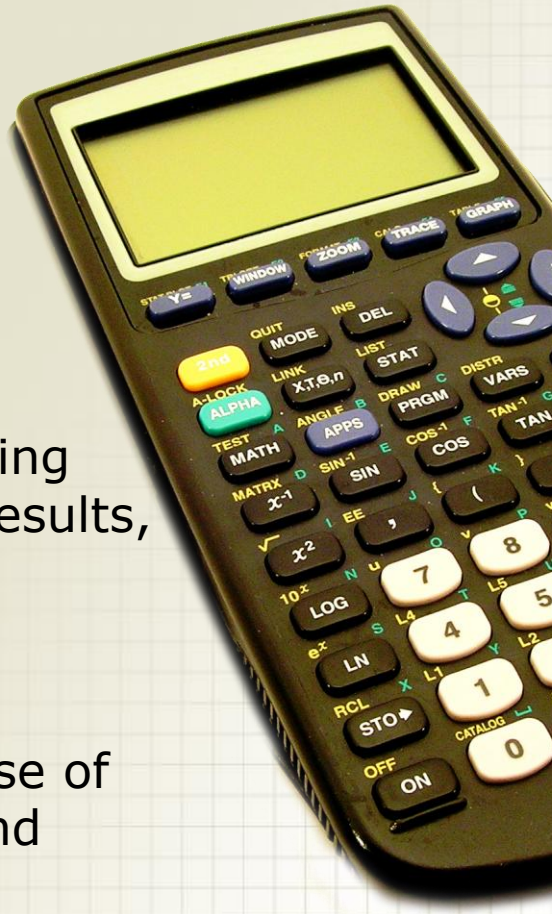
Scientific Inquiry in the Science Curriculum at the Fourth and Eighth Grades

- The majority of countries had science curricula emphasizing scientific inquiry, particularly as a skill to be taught within science content areas
  - About two-thirds of countries described emphasizing investigations or promoting the scientific process through instruction as a major focus
  - About two-thirds of countries mentioned that schools are equipped with laboratories or science materials for conducting experiments

Information and Communication Technology for Mathematics and Science Instruction

- About one-third of the countries described how computer use or ICT was encouraged in the mathematics or science curriculum
- Part of a push toward increased use of technology overall in schools
  - More than half of the countries described having Internet-connected computers, networks, or other computer software or hardware for student and teacher use
  - Some countries described teacher education programs aimed at helping teachers integrate ICT into instruction

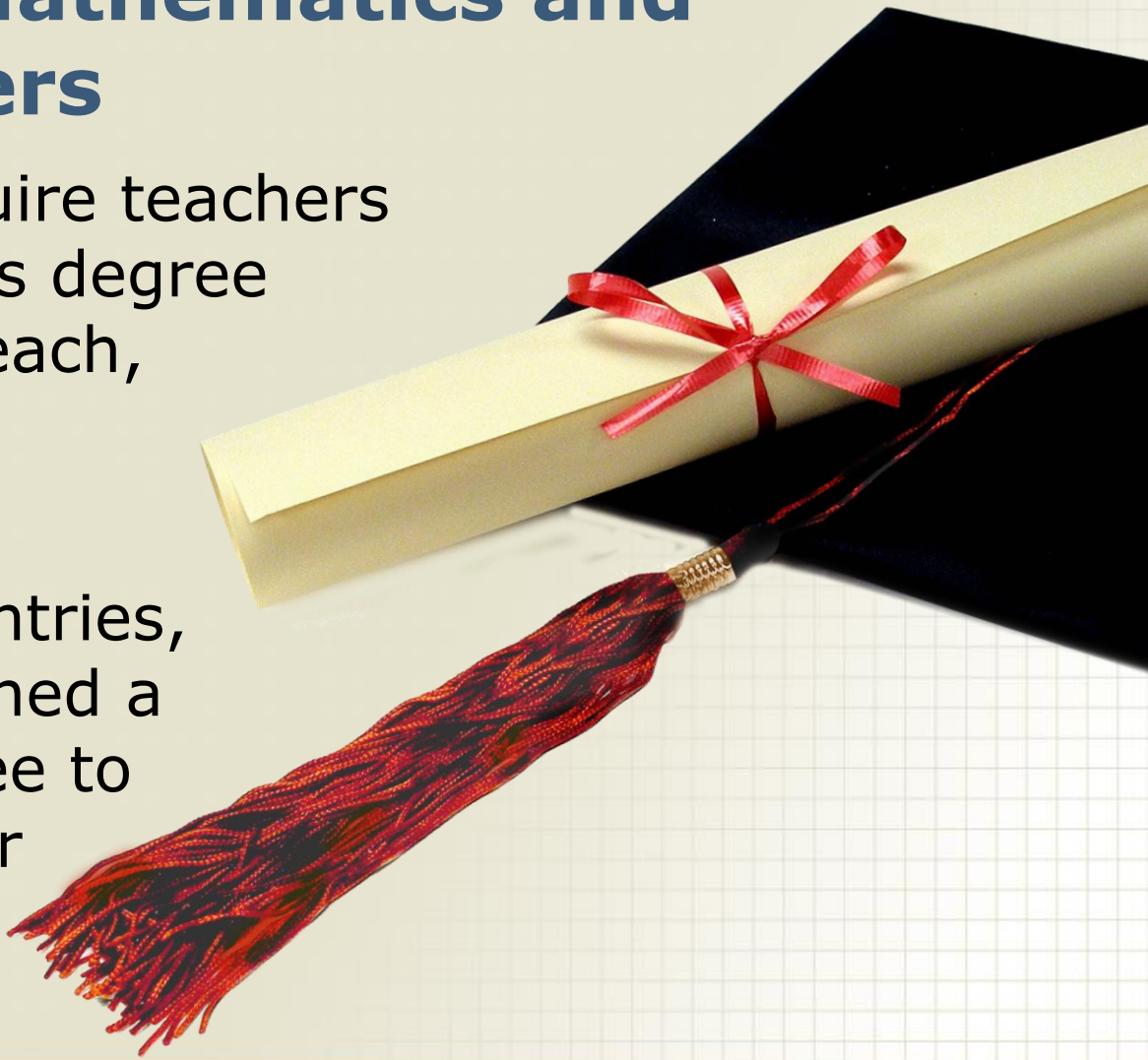
Policies About Calculator and Computer Use in Mathematics and Science



- Calculator Use
  - More countries had policies allowing the use of calculators in Grade 8 compared to Grade 4
  - Used for exploring number patterns, constructing concepts, trying different methods, checking results, complicated calculations
- Computer Use
  - Most countries had some policy to guide the use of computers as resource tools in the teaching and learning of mathematics and science
  - Used for exploration, visualization, simulation, and researching information

Teacher Education for Fourth and Eighth Grade Mathematics and Science Teachers

- Most countries require teachers to have a bachelor's degree to be qualified to teach, often a bachelor's in education
- In one-third of countries, teachers also obtained a postgraduate degree to teach, especially for teaching secondary education



Specialist Teachers in Mathematics and Science

- Nearly all countries had specialized teachers (extra coursework in mathematics and science or a subject-specific degree) for mathematics and science in some grades
  - A small number had specialized teachers beginning in primary grades (Grades 1-4)
  - About one-third had specialized teachers beginning in upper primary (Grades 5-6)
  - About half of the countries had specialized teachers beginning in lower secondary (Grades 7-8)

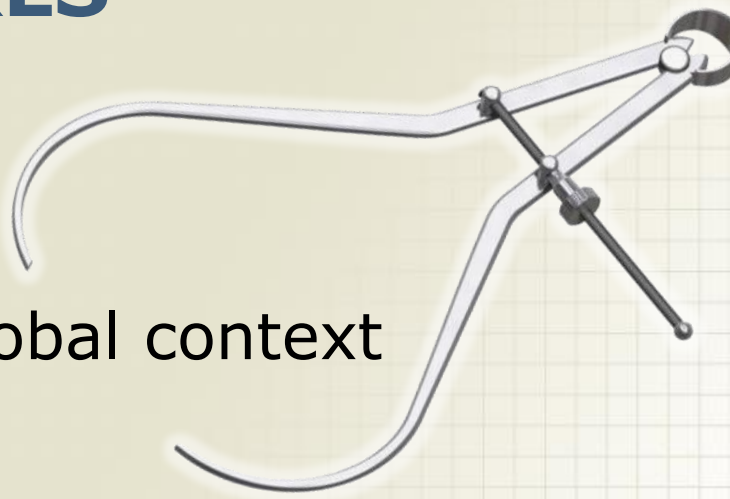
Increased Requirements to Be a Teacher

- Since 2000, one-third have increased requirements, especially at primary level
- Some added an additional year (e.g., diploma to bachelor's degree)
- Some require a master's degree
- Examination requirements
- Increased training and professional development

Mathematics and Science Examinations with Consequences for Students' Futures

- Many countries used examinations during primary and secondary school as a method for making decisions about individual students
- Often served as a "gateway" to further education
  - About half of the countries reported requiring examinations for graduation or certificate of completion
  - About half of the countries reported that an examination is used to determine qualification for entry into the next stage of education
  - Some countries reported requiring examinations for grade promotion

Uses of TIMSS and PIRLS



Primary use

System-level monitoring in a global context to inform policy

- Compare achievement to other countries
- Compare achievement over time
- Considered together with other information as available

Policy Implementation

Implement reforms, if

- Achievement low in relation to other countries
- Achievement low in relation to own expectations
- Trends declining
- Weakness in particular area(s)
- Equity issue for region or ethnic group

Use next cycle to monitor effects of reform

Curriculum Reform

- Curriculum the foundation – natural starting point for reform
- Almost all TIMSS and PIRLS countries engaged in some type of curriculum reform
- Contributions of TIMSS and PIRLS
  - Assessment results
  - Assessment Frameworks
  - Encyclopedia descriptions

Areas of Curriculum Reform

Mathematics

- Problem solving/reasoning
- Earlier advanced content (e.g., algebra)

Science

- Inquiry, cognitive domains
- Science in primary school

Reading

- More time for student reading
- Informational texts in primary curriculum

Teacher Professional Development

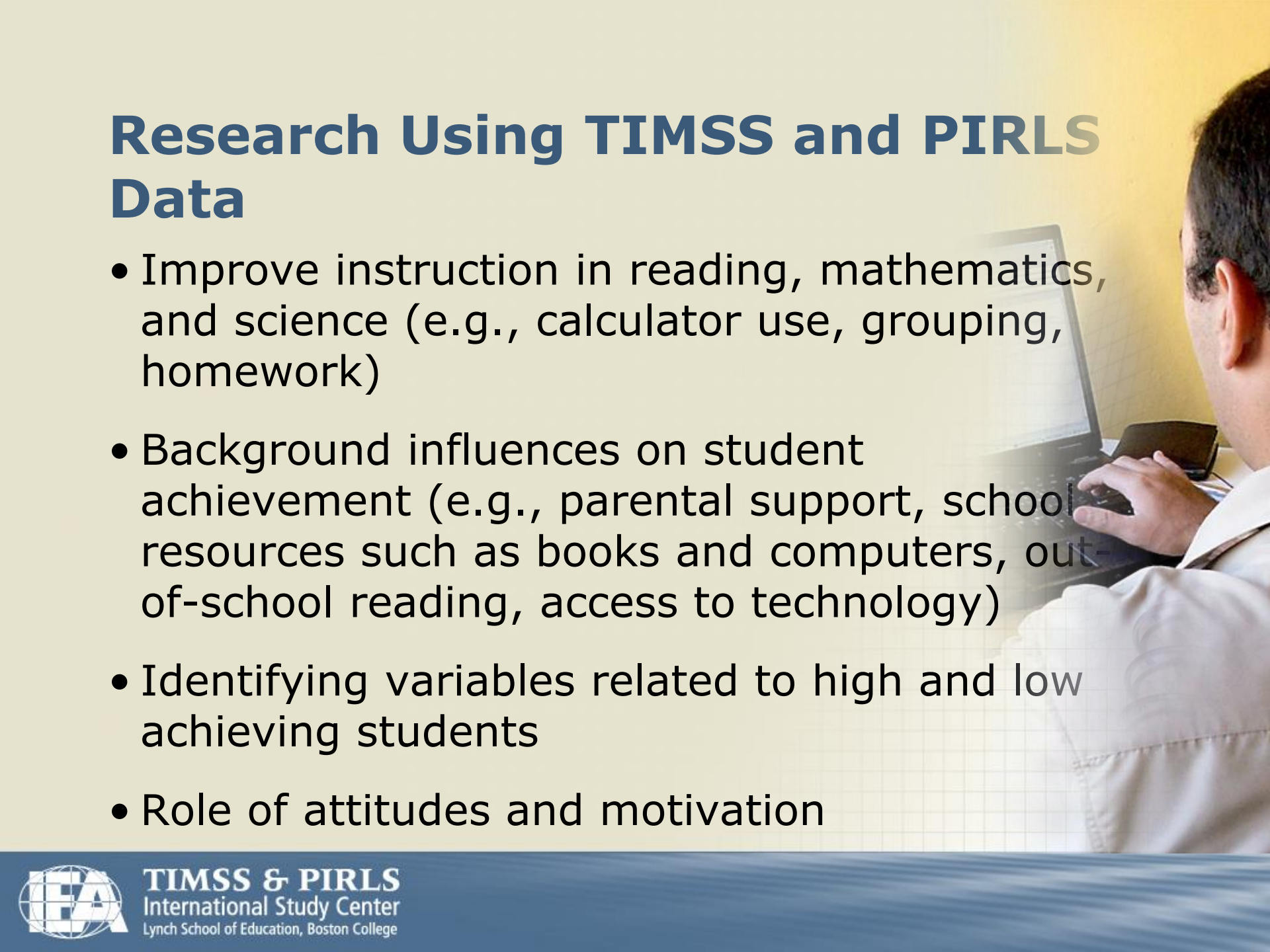
- Workshops to familiarize teachers with TIMSS and PIRLS assessment results
- Widespread dissemination, discussion, and training using released items
- Revision of teachers' guides to include TIMSS and PIRLS topics
- Professional development to strengthen particular areas (e.g., numeracy, comprehension strategies)
- Targeted funding to improve teaching – literacy, mathematics, science, and technology

Improving Equity among Regions and Ethnic Groups

- Australia – Aboriginal, Torres Strait Island, disadvantaged youth
- Italy – improve school quality in four regions
- New Zealand – Maori and Pasifika students
- Slovenia – large regional differences
- South Africa – disadvantaged communities

Research Using TIMSS and PIRLS Data

- Improve instruction in reading, mathematics, and science (e.g., calculator use, grouping, homework)
- Background influences on student achievement (e.g., parental support, school resources such as books and computers, out-of-school reading, access to technology)
- Identifying variables related to high and low achieving students
- Role of attitudes and motivation



Encouraging and Supporting Research Using TIMSS and PIRLS Data

- Government supported research institutions (e.g., Norway's National Center for Reading Education and Research)
- Ministry sponsored funding programs for research using TIMSS and PIRLS data (e.g., Chinese Taipei's National Science Council's annual call for proposals)
- Numerous dissertations based on TIMSS and PIRLS data (e.g., Hong Kong SAR, Iran)

Growth in Assessment

- More national assessments (e.g., Armenia, Macedonia, Romania)
- Using TIMSS and PIRLS approaches to improve national assessments (e.g., Ireland, Serbia)
- Learning how to construct assessment items using TIMSS released items (e.g., Botswana, Ghana, Oman)
- Making TIMSS and PIRLS released items available on a special website (Romania)

Assessment Competence

- Hungary graduated hundreds of teachers from two-year university programs in assessment and evaluation
- Italy spreading an evaluation culture in primary and secondary schools
- Two Moscow universities opened new graduate programs in educational measurement
- Morocco's Ministry of National Education launched a program to nurture a culture of assessment in mathematics and science
- Establishing a culture of assessment is a goal of Qatar's Supreme Education Council

Summary of Uses

- System-level monitoring in a global context to improve educational goals and achievement
- Basis for curriculum reform and implementation
- Supports teacher professional development
- Enables research and data analysis to improve teaching and learning
- Encourages assessment and evidenced-based decision making to implement educational reform and improvement

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