

TIMSS 2007 International Mathematics Report

Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades

Michael O. Martin

Ina V.S. Mullis

Pierre Foy

In collaboration with

John F. Olson

Corinna Preuschoff

Ebru Erberber

Alka Arora

Joseph Galia



Copyright © 2008 International Association for the Evaluation of Educational Achievement (IEA)

Published December 2008, Revised August 2009

TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades

Ina V.S. Mullis, Michael O. Martin, Pierre Foy in collaboration with John F. Olson, Corinna Preuschoff, Ebru Erberber, Alka Arora, Joseph Galia

Publisher: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College

Library of Congress Catalog Card Number: 2008902434

ISBN: 1-889938-48-3

For more information about timss contact:

TIMSS & PIRLS International Study Center

Lynch School of Education

Boston College

Chestnut Hill, MA 02467

United States

tel: +1-617-552-1600

fax: +1-617-552-1203

e-mail: timss@bc.edu

http://timssandpirls.bc.edu

Boston College is an equal opportunity, affirmative action employer.

Printed and bound in the United States.



Contents

Foreword	1
Executive	e Summary
Introduc	tion
What Is TIMSS	5714
Which Countr	ies Participated in TIMSS 2007?
Exhibit 1	Countries Participating in TIMSS 2007
Exhibit 2	Countries Participating in TIMSS 1995 Through 2007
Exhibit 3	Selected Characteristics of TIMSS 2007 Countries
What Was the	Nature of the TIMSS 2007 Mathematics Test?
How Was Info	rmation Collected About the Contexts for Learning Mathematics? 25
Who Conduct	s TIMSS?
Chapter	1
Internationa	al Student Achievement in Mathematics
How Do Coun	tries Differ in Mathematics Achievement?
Exhibit 1.1	TIMSS 2007 Distribution of Mathematics Achievement
Exhibit 1.2	TIMSS 2007 Multiple Comparisons of Average Mathematics Achievement 36
How Has Matl	hematics Achievement Changed Since 1995, 1999, and 2003?43
Exhibit 1.3	Trends in Mathematics Achievement – 1995 Through 2007
Trends Across	Grades: Fourth to Eighth Grade Cohort Analysis
Exhibit 1.4	Cohort Comparison: 2003 Fourth Grade Students in Eighth Grade in 2007 55
What Are the	Gender Differences in Mathematics Achievement?
Exhibit 1.5	TIMSS 2007 Average Mathematics Achievement by Gender
Exhibit 1.6	Trends in Average Mathematics Achievement by Gender – 1995 Through 2007 60

Chapter 2	2
	at the TIMSS 2007 International Benchmarks
for Mathema	tics Achievement
	tries Compare with the TIMSS 2007 International Benchmarks as Achievement?
Exhibit 2.1	TIMSS 2007 International Benchmarks of Mathematics Achievement
Exhibit 2.2	Percentages of Students Reaching the TIMSS 2007 International Benchmarks of Mathematics Achievement
Exhibit 2.3	Trends in Percentages of Students Reaching the TIMSS 2007 International Benchmarks of Mathematics Achievement
Fourth Grade:	Achievement at the Advanced International Benchmark
Exhibit 2.4	Description of the TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement
Exhibit 2.5	TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 1
Exhibit 2.6	TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 2
Fourth Grade:	Achievement at the High International Benchmark
Exhibit 2.7	Description of the TIMSS 2007 High International Benchmark (550) of Mathematics Achievement
Exhibit 2.8	TIMSS 2007 High International Benchmark (550) of Mathematics Achievement – Example Item 3
Exhibit 2.9	TIMSS 2007 High International Benchmark (550) of Mathematics Achievement – Example Item 4
Fourth Grade:	Achievement at the Intermediate International Benchmark
Exhibit 2.10	Description of the TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement
	TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 5
	TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 6
Exhibit 2.13	TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 7
Fourth Grade:	Achievement at the Low International Benchmark
Exhibit 2.14	Description of the TIMSS 2007 Low International Benchmark (400) of Mathematics Achievement
Exhibit 2.15	TIMSS 2007 Low International Benchmark (400) of Mathematics Achievement – Example Item 8
Eighth Grade:	Achievement at the Advanced International Benchmark
Exhibit 2.16	Description of the TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement
Exhibit 2.17	TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 1
Exhibit 2.18	TIMSS 2007 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 2



Eighth Grade:	Achievement at the High International Benchmark				
Exhibit 2.19	Description of the TIMSS 2007 High International Benchmark (550) of Mathematics Achievement				
Exhibit 2.20	TIMSS 2007 High International Benchmark (550) of Mathematics Achievement – Example Item 3				
Exhibit 2.21	TIMSS 2007 High International Benchmark (550) of Mathematics Achievement – Example Item 4				
Eighth Grade:	Achievement at the Intermediate International Benchmark				
	Description of the TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement				
Exhibit 2.23	TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 5				
Exhibit 2.24	TIMSS 2007 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 6				
Eighth Grade:	Achievement at the Low International Benchmark				
	Description of the TIMSS 2007 Low International Benchmark (400)				
LAIIIDIL 2.23	of Mathematics Achievement				
Exhibit 2.26	TIMSS 2007 Low International Benchmark (400) of Mathematics Achievement – Example Item 7				
Exhibit 2.27	TIMSS 2007 Low International Benchmark (400)				
Chapter 3	of Mathematics Achievement – Example Item 8				
_	of Mathematics Achievement – Example Item 8				
Average Achi How Does Ach	B				
Average Achi How Does Ach and Cognitive	B				
Average Achi How Does Ach and Cognitive Exhibit 3.1	3				
How Does Ach and Cognitive Exhibit 3.1 In Which Math	B				
How Does Ach and Cognitive Exhibit 3.1 In Which Math	3				
How Does Ach and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2	B				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2	Sevement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the G and Cognitive Exhibit 3.3	B				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Cand Cognitive Exhibit 3.3 Chapter 4	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Cand Cognitive Exhibit 3.3 Chapter 4 Students' Back	Sevement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Cand Cognitive Exhibit 3.3 Chapter 4 Students' Back	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Country Exhibit 3.3 Chapter 4 Students' Back What Education	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Cand Cognitive Exhibit 3.3 Chapter 4 Students' Back What Education Exhibit 4.1	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the Cand Cognitive Exhibit 3.3 Chapter 4 Students' Back What Education Exhibit 4.1 Exhibit 4.2	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				
How Does Achi and Cognitive Exhibit 3.1 In Which Math Strong or Wea Exhibit 3.2 What Are the G and Cognitive Exhibit 3.3 Chapter 4 Students' Bac What Education Exhibit 4.1 Exhibit 4.2 Exhibit 4.3	Revement in the Mathematics Content and Cognitive Domains sievement Differ Across the TIMSS 2007 Mathematics Content Domains?				



	Fheir Out-of-school Time Do Students Spend on Homework During ek?					
Exhibit 4.7	Index of Time Students Spend Doing Mathematics Homework (TMH) in a Normal School Week					
What Are Stud	lents' Attitudes Toward Mathematics?					
Exhibit 4.8	Index of Students' Positive Affect Toward Mathematics (PATM) with Trends 175					
Exhibit 4.9	Index of Students' Valuing Mathematics (SVM) with Trends					
Exhibit 4.10	Exhibit 4.10 Index of Students' Self–Confidence in Learning Mathematics (SCM) with Trends					
Exhibit 4.11	Index of Students' Self-Confidence in Learning Mathematics (SCM) by Gender 184					
Chapter 5	5					
The Mathem	atics Curriculum					
How Much Ins	tructional Time Is Spent on Mathematics?					
Exhibit 5.1	Weekly Intended and Implemented Instructional Time for Mathematics					
	with Trends					
Exhibit 5.2	Yearly Hours of Implemented Instructional Time for Mathematics with Trends 194					
Exhibit 5.3	Percentage of Time in Mathematics Class Devoted to TIMSS Content Domains During the School Year					
Are the TIMSS	Mathematics Topics Included in the Intended Curriculum Taught in School?198					
Exhibit 5.4	Summary of TIMSS Mathematics Topics in the Intended Curriculum 200 decided as the contract of the Contract					
Exhibit 5.5	Summary of Students Taught the TIMSS Mathematics Topics					
	Which TIMSS Mathematics Topics Are in the Intended and Implemented					
Curriculum? .						
Exhibit 5.6	Intended and Taught TIMSS Number Topics					
Exhibit 5.7	Intended and Taught TIMSS Geometric Shapes and Measures Topics					
Exhibit 5.8	Intended and Taught TIMSS Data Display Topics					
-	Which TIMSS Mathematics Topics Are in the Intended and Implemented					
Exhibit 5.9	Intended and Taught TIMSS Number Topics					
	Intended and Taught TIMSS Algebra Topics					
	Intended and Taught TIMSS Geometry Topics					
Chapter 6	$5 \dots \dots$					
Teachers of N	<i>Mathematics</i>					
What Are the	Background Characteristics of Mathematics Teachers?					
Exhibit 6.1	Mathematics Teachers' Gender, Age, and Number of Years Teaching with Trends 244					
What Education	on and Training Do Teachers Have for Teaching Mathematics?					
Exhibit 6.2	Highest Educational Level of Mathematics Teachers					
Exhibit 6.3	Teachers' Educational Emphasis on Mathematics and Teaching					
Exhibit 6.4	Teachers' Participation in Professional Development in Mathematics					
Fyhihit 6 5	Frequency of Collaboration Among Mathematics Teachers with Trends 255					



How Well Prep	pared Do Teachers Feel They Are to Teach Mathematics?				
Exhibit 6.6	Summary of Students Whose Teachers Feel "Very Well" Prepared to Teach the TIMSS Mathematics Topics				
Exhibit 6.7	•				
Chapter 7	7				
Classroom C	haracteristics and Instruction				
How Do the Cl	haracteristics of Mathematics Classrooms Impact Instruction?				
Exhibit 7.1	Class Size for Mathematics Instruction with Trends				
Exhibit 7.2	Achievement and Class Size for Mathematics Instruction				
Exhibit 7.3	Index of Teachers' Reports on Teaching Mathematics Classes with Few or No Limitations on Instruction Due to Student Factors (MCFL)				
What Activitie	s Do Students Do in Their Mathematics Lessons?				
Exhibit 7.4	Students' Reports on Mathematics Content-related Emphasis in Classroom Activities				
Exhibit 7.5	Teachers' Reports on Mathematics Content-related Emphasis in Students'				
Exhibit 7.6	Classroom Activities				
Exhibit 7.7	Teachers' Reports on Learning Activities in Mathematics Lessons				
What Instructi	onal Strategies Are Used in Mathematics Classes?				
Exhibit 7.8	Textbook Use in Teaching Mathematics with Trends				
Exhibit 7.9	Percentage of Time in Mathematics Lessons Students Spend on Various Activities in a Typical Week				
How Are Calcu	ılators and Computers Used?				
Exhibit 7.10	Calculator Use in Mathematics Class with Trends				
Exhibit 7.11	Computer Use in Mathematics Class with Trends				
What is the Ro	sle of Homework?				
	Index of Teachers' Emphasis on Mathematics Homework (EMH) with Trends 304 $$				
	Use of Mathematics Homework				
Exhibit 7.14	Types of Mathematics Homework with Trends				
What Types of	Assessments Are Used in Mathematics Classes?				
Exhibit 7.15	Emphasis on Sources to Monitor Students' Progress in Mathematics 309				
	Frequency of Teachers Giving Mathematics Tests with Trends				
Exhibit 7.17	Item Formats Used by Teachers in Mathematics Tests or Examinations with Trends				
Exhibit 7.18	Types of Questions on Mathematics Tests				
Chapter 8	3				
School Conte	exts for Mathematics Learning and Instruction				
What Are the	Characteristics of the Schools' Student Population?				
Exhibit 8.1	Principals' Reports on the Percentages of Students in Their Schools Coming from Economically Disadvantaged Homes with Trends				
Exhibit 8.2	Principals' Reports on the Percentages of Students Having the Language of the Test as Their Native Language with Trends				
Exhibit 8.3	Index of Good Attendance at School (GAS)328				
Exhibit 8.4	High Index of Good Attendance at School (GAS) with Trends				



What Is the Ro	ole of the School Principal?	
Exhibit 8.5	Principals' Time Spent on Various School-related Activities with Trends 334	
Do Schools En	courage Home Involvement?	
Exhibit 8.6	Schools' Encouragement of Parental Involvement	
What School R	Resources Are Available to Support School Learning?	
Exhibit 8.7	Index of Availability of School Resources for Mathematics Instruction (ASRMI)	
Exhibit 8.8	High Index of Availability of School Resources for Mathematics Instruction (ASRMI) with Trends	
Exhibit 8.9	Index of Teachers' Adequate Working Conditions (TAWC)	
Exhibit 8.10	Schools' Reports on Teachers' Mathematics and Science Professional Development in the Past 2 Years	
What Are the I	Perceptions of School Climate?	
Exhibit 8.11	Index of Principals' Perception of School Climate (PPSC) with Trends	
Exhibit 8.12	Index of Mathematics Teachers' Perception of School Climate (TPSC) with Trends 360 $$	
How Safe and	Orderly Are Schools?	
	Index of Mathematics Teachers' Perception of Safety in School (TPSS) with Trends 364	
Exhibit 8.14	Index of Students' Perception of Being Safe in School (SPBSS) with Trends 366	
1.1	x A	
11	Documentation	
	athematics Framework	
Exhibit A.1	Overview of TIMSS 2007 Mathematics Framework	
Number of Ite	ms by Mathematics Content and Cognitive Domains	
Exhibit A.2	Distribution of Mathematics Items by Content Domain and Cognitive Domain 374 $$	
Grades and Ag	ges Assessed	
Exhibit A.3	Information About the Grades and Ages of Students Tested in TIMSS 2007 $\ldots378$	
Sample Imple	mentation and Participation Rates	
Exhibit A.4	Coverage of TIMSS 2007 Target Population	
Exhibit A.5	School Sample Sizes	
Exhibit A.6	Student Sample Sizes	
Exhibit A.7	Participation Rates (Weighted)	
Exhibit A.8	Trends in Student Populations	
Translation an	d Layout Verification	
Survey Operat	tions for Data Collection	
Scoring the Co	onstructed-response Items	
Test Reliability		
Scaling the Ac	hievement Data	
Exhibit A.9 Average Percent Correct in the Mathematics Content and Cognitive Domains 405		
Ceala Anchari		
Scale Alichorn	ng Analysis	



Appendix	x B
Multiple Con	nparisons of Average Achievement in Mathematics Content And
Cognitive Do	
Exhibit B.1	Multiple Comparisons of Average Achievement in Number
Exhibit B.2	Multiple Comparisons of Average Achievement in Geometric Shapes
Exhibit B.3	and Measures
Exhibit B.4	Multiple Comparisons of Average Achievement in Knowing
Exhibit B.5	Multiple Comparisons of Average Achievement in Applying
Exhibit B.6	Multiple Comparisons of Average Achievement in Reasoning
Exhibit B.7	Multiple Comparisons of Average Achievement in Number
Exhibit B.8	Multiple Comparisons of Average Achievement in Algebra426
Exhibit B.9	Multiple Comparisons of Average Achievement in Geometry
Exhibit B.10	Multiple Comparisons of Average Achievement in Data and Chance $\ \dots \ \dots \ 30$
Exhibit B.11	Multiple Comparisons of Average Achievement in Knowing
Exhibit B.12	Multiple Comparisons of Average Achievement in Applying
Exhibit B.13	Multiple Comparisons of Average Achievement in Reasoning
Appendix	x C
	riculum Matching Analysis: Mathematics
Exhibit C.1	Average Percent Correct for Test–Curriculum Matching Analysis – Mathematics 444
Exhibit C.1	Standard Errors for the Test–Curriculum Matching Analysis – Mathematics
EXHIBIT C.2	Standard Errors for the rest–Curriculum Matching Analysis – Mathematics 446
1 1	x D
Percentiles a	nd Standard Deviations of Mathematics Achievement
Exhibit D.1	Percentiles of Achievement in Mathematics
Exhibit D.2	Standard Deviations of Achievement in Mathematics
Appendix	x E
* *	Mathematics Achievement
Exhibit E.1	
A A	x F
Organization	ns and Individuals Responsible for TIMSS 2007

