

IEA's TIMSS 2003 International Report on Achievement in the Mathematics Cognitive Domains

Findings from a Developmental Project



© 2005 International Association for the Evaluation of Educational Achievement (IEA)

TIMSS 2003 International Mathematics Report / by Ina V.S. Mullis, Michael O. Martin, Pierre Foy.

Publisher:

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

Library of Congress Catalog Card Number: 2005900696

ISBN: 1-889938-38-6

For more information about TIMSS contact:

TIMSS & PIRLS International Study Center Lynch School of Education Manresa House Boston College Chestnut Hill, MA 02467

United States

tel: +1-617-552-1600 fax: +1-617-552-1203 E-mail: timss@bc.edu

URL: timss.bc.edu

Boston College is an equal opportunity, affirmative action employer. Printed and bound in the United States.

Contents

3 Chapter 1

The Developmental Project to Report TIMSS 2003 Mathematics Achievement in Cognitive Domains

- 3 Overview of TIMSS
- 3 The TIMSS 2003 Assessment Frameworks and International Reports
- 5 History of the Developmental Project
- 6 Mapping the TIMSS 2003 Mathematics Items to Cognitive Domains
- 9 The Scaling Methodology
- 10 Summary of Overall Mathematics Achievement Nationally and by Gender for the TIMSS 2003 Countries
 - 12 Exhibit 1.1 Distribution of Mathematics Achievement Overall and by Gender

15 Chapter 2

Mathematics Achievement in the Cognitive Domains at the Fourth and Eighth Grades

- 15 Knowing Facts, Procedures, and Concepts
 - 18 Exhibit 2.1 Distribution of Mathematics Achievement for Knowing Cognitive Domain
 - 20 Exhibit 2.2 Multiple Comparisons of Average Mathematics Achievement for Knowing Cognitive Domain
- 23 Applying Knowledge and Conceptual Understanding
 - 24 Exhibit 2.3 Distribution of Mathematics Achievement for Applying Cognitive Domain
 - 26 Exhibit 2.4 Multiple Comparisons of Average Mathematics Achievement for Applying Cognitive Domain
- 29 Reasoning
 - 30 Exhibit 2.5 Distribution of Mathematics Achievement for Reasoning Cognitive Domain
 - 32 Exhibit 2.6 Multiple Comparisons of Average Mathematics Achievement for Reasoning Cognitive Domain
- 36 Overview Across Domains

Contents

41 C	hapter	3
------	--------	---

Achievement by Gender in the Mathematics Cognitive Domains at the Fourth and Eighth Grades

- 42 Gender Differences in the Knowing Cognitive Domain
 - 43 Exhibit 3.1 Average Mathematics Achievement by Gender for Knowing Cognitive Domain
- 45 Gender Differences in the Applying Cognitive Domain
 - 46 Exhibit 3.2 Average Mathematics Achievement by Gender for Applying Cognitive Domain
- 48 Gender Differences in the Reasoning Cognitive Domain
 - 49 Exhibit 3.3 Average Mathematics Achievement by Gender for Reasoning Cognitive Domain

53 Chapter 4

Country by Country Profiles of Achievement in the Mathematics Cognitive Domains

- 53 Profiles of Achievement
- 54 Relative Strengths and Weaknesses in the Knowing Domain
 - 55 Exhibit 4.1 Profiles of Within-Country Relative Performance in Mathematics Cognitive Domains
- 60 Relative Strengths and Weaknesses in the Applying Domain
- 60 Relative Strengths and Weaknesses in the Reasoning Domain
- 61 International Achievement Across the Cognitive Domains
- 63 References
- 65 Appendix A

Mathematics Cognitive Domains Framework: TIMSS 2003 Developmental Project Fourth and Eighth Grades

- 65 Knowing Facts, Procedures, and Concepts
- 67 Applying Knowledge and Understanding
- 69 Reasoning

73 Appendix B

Overview of Procedures TIMSS 2003 Developmental Project

- 73 Process for Establishing the Mathematics Cognitive Domains for Scaling and Reporting
- 75 Characteristics of Items Within Cognitive Domains
 - 76 Exhibit B.1 Characteristics of Items Within Cognitive Domains
- 79 Constructing Achievement Scales in the Mathematics Cognitive Domains
- 80 Item Calibration
- 81 Evaluating the Fit of the IRT Models
- 81 Generating IRT Proficiency Scores
- 82 Reliability
 - 83 Exhibit B.2 Reliabilities of Overall Mathematics and Cognitive Domains
- 85 Correlations
 - 86 Exhibit B.3 Correlations of Mathematics Cognitive Domains with Overall Mathematics
 - 88 Exhibit B.4 Correlations of Mathematics Cognitive Domains

93 Appendix C

Coverage of TIMSS 2003 Target Populations and Participation Rates

- 94 Exhibit C.1 Coverage of TIMSS 2003 Target Populations
- 96 Exhibit C.2 Participation Rates (Weighted)

99 Appendix D

Percentiles and Standard Deviations of Mathematics Achievement in the Cognitive Domains

- 100 Exhibit D.1 Percentiles of Achievement in Knowing Cognitive Domain
- 102 Exhibit D.2 Percentiles of Achievement in Applying Cognitive Domain
- 104 Exhibit D.3 Percentiles of Achievement in Reasoning Cognitive Domain
- 106 Exhibit D.4 Standard Deviations of Achievement in Knowing Cognitive Domain
- 108 Exhibit D.5 Standard Deviations of Achievement in Applying Cognitive Domain
- 110 Exhibit D.6 Standard Deviations of Achievement in Reasoning Cognitive Domain