International Association for the Evaluation of Educational Achievement



Maryellen Harmon
Teresa A. Smith
Michael O. Martin
Dana L. Kelly
Albert E. Beaton
Ina V.S. Mullis
Eugenio J. Gonzalez
Graham Orpwood

September 1997



TIMSS International Study Center Boston College Chestnut Hill, MA, USA

© 1997 International Association for the Evaluation of Educational Achievement (IEA).

Performance Assessment in IEA's Third International Mathematics and Science Study / by Maryellen Harmon, Teresa A. Smith, Michael O. Martin, Dana L. Kelly, Albert E. Beaton, Ina V.S. Mullis, Eugenio J. Gonzalez, and Graham Orpwood

Publisher: Center for the Study of Testing, Evaluation, and Educational Policy, Boston College.

Library of Congress Catalog Card Number: 97-69827

ISBN 1-889938-07-6

For more information about TIMSS contact:

TIMSS International Study Center

Center for the Study of Testing, Evaluation, and Educational Policy

Campion Hall

School of Education

Boston College

Chestnut Hill, MA 02167

United States

For information on ordering this report, write the above address or call +1-617-552-4521.

This report also is available on the World Wide Web:

http://www.csteep.bc.edu/timss

Funding for the international coordination of TIMSS is provided by the U.S. National Center for Education Statistics, the U.S. National Science Foundation, the IEA, and the Canadian government. Each participating country provides funding for the national implementation of TIMSS.

Boston College is an equal opportunity, affirmative action employer.

Printed and bound in the United States.

Contents

INTRODUCTION	
Table 1: Countries Included in the TIMSS International Performance Assessment Report	3
Table 2: Information About the Grades Tested	4
The Nature of Performance Assessment	5
Performance Assessment in TIMSS	7
The TIMSS Performance Assessment Tasks	8
Structure of the Performance Assessment Report	9
CHAPTER 1: STUDENT ACHIEVEMENT ON THE PERFORMANCE ASSESSMENT TASKS	11
Pulse	13
Figure 1.1: Pulse: Full-Task Example and Scoring Criteria – Eighth Grade	14
Figure 1.2: Pulse: Items and Scoring Criteria - Fourth Grade	
Table 1.1: Pulse Task: Average Percentage Score on Items – Eighth Grade	
Table 1.2: Pulse Task: Average Percentage Score on Items - Fourth Grade	19
Magnets	21
Figure 1.3: Magnets: Full-Task Example and Scoring Criteria – Eighth Grade	22
Figure 1.4: Magnets: Items and Scoring Criteria - Fourth Grade	25
Table 1.3: Magnets Task: Average Percentage Score on Items - Eighth Grade	26
Table 1.4: Magnets Task: Average Percentage Score on Items - Fourth Grade	27

Batteries	29
Figure 1.5: Batteries: Full-Task Example and Scoring Criteria – Eighth and Fourth Grades	30
Table 1.5: Batteries Task: Average Percentage Score on Items – Eighth Grade	32
Table 1.6: Batteries Task: Average Percentage Score on Items - Fourth Grade	33
Rubber Band	35
Figure 1.6: Rubber Band: Full-Task Example and Scoring Criteria – Eighth Grade	36
Figure 1.7: Rubber Band: Items and Scoring Criteria - Fourth Grade	39
Table 1.7: Rubber Band Task: Average Percentage Score on Items - Eighth Grade	41
Table 1.8: Rubber Band Task: Average Percentage Score on Items - Fourth Grade	42
Solutions	43
Figure 1.8: Solutions: Full-Task Example and Scoring Criteria - Eighth Grade	44
Table 1.9: Solutions Task: Average Percentage Score on Items - Eighth Grade	46
Containers	47
Figure 1.9: Containers: Full-Task Example and Scoring Criteria – Fourth Grade	48
Table 1.10: Containers Task: Average Percentage Score on Items - Fourth Grade	50
Shadows	51
Figure 1.10: Shadows: Full-Task Example and Scoring Criteria - Eighth Grade	52
Figure 1.11: Shadows: Items and Scoring Criteria - Fourth Grade	54
Table 1.11: Shadows Task: Average Percentage Score on Items - Eighth Grade	56
Table 1.12: Shadows Task: Average Percentage Score on Items - Fourth Grade	57

Plasticine	59
Figure 1.12: Plasticine: Full-Task Example and Scoring Criteria - Eighth Grade	60
Figure 1.13: Plasticine: Items and Scoring Criteria - Fourth Grade	63
Table 1.13: Plasticine Task: Average Percentage Score on Items - Eighth Grade	64
Table 1.14: Plasticine Task: Average Percentage Score on Items - Fourth Grade	65
Dice	67
Figure 1.14: Dice: Full-Task Example and Scoring Criteria – Eighth and Fourth Grades	68
Table 1.15: Dice Task: Average Percentage Score on Items - Eighth Grade	70
Table 1.16: Dice Task: Average Percentage Score on Items - Fourth Grade	71
Calculator	73
Figure 1.15: Calculator: Full-Task Example and Scoring Criteria - Eighth and Fourth Grades	74
Table 1.17: Calculator Task: Average Percentage Score on Items - Eighth Grade	76
Table 1.18: Calculator Task: Average Percentage Score on Items - Fourth Grade	77
Folding and Cutting	79
Figure 1.16: Folding and Cutting: Full-Task Example and Scoring Criteria - Eighth and Fourth Grades	80
Table 1.19: Folding and Cutting Task: Average Percentage Score on Items - Eighth Grade	82
Table 1.20: Folding and Cutting Task: Average Percentage Score on Items - Fourth Grade	83
Around the Bend	85
Figure 1.17: Around the Bend: Full-Task Example and Scoring Criteria - Eighth Grade	86
Figure 1.18: Around the Bend: Items and Scoring Criteria - Fourth Grade	89
Table 1.21: Around the Bend Task: Average Percentage Score on Items - Eighth Grade	91
Table 1.22: Around the Bend Task: Average Percentage Score on Items - Fourth Grade	92

Packaging	93
Figure 1.19: Packaging: Full-Task Example and Scoring Criteria – Eighth and Fourth Grades	94
Table 1.23: Packaging Task: Average Percentage Score on Items – Eighth Grade	96
Table 1.24: Packaging Task: Average Percentage Score on Items - Fourth Grade	97
Summary	98
CHAPTER 2: INTERNATIONAL STUDENT ACHIEVEMENT	99
Overall Differences in Student Achievement on the Performance Assessment	100
Table 2.1: Average Percentage Scores Overall and on Performance Assessment Tasks - Eighth Grade	102
Table 2.2: Average Percentage Scores Overall and on Performance Assessment Tasks - Fourth Grade	103
Table 2.3: Average Percentage Scores Overall and by Science and Mathematics Subject Areas - Eighth Grade	104
Table 2.4: Average Percentage Scores Overall and by Science and Mathematics Subject Areas - Fourth Grade	105
Gender Differences in Performance Assessment Achievement	107
Table 2.5: Gender Differences in Average Percentage Scores Overall and on Performance Assessment Tasks - Eighth Grade	108
Table 2.6: Gender Differences in Average Percentage Scores Overall and on Performance Assessment Tasks - Fourth Grade	110
CHAPTER 3: STUDENT ACHIEVEMENT IN PERFORMANCE EXPECTATION CATEGORIES	113
Performance Expectation Reporting Categories	114
Figure 3.1: Distribution of Performance Assessment Items Across Science and Mathematics Performance Expectation Reporting Categories	115
Science Performance Expectations	116
Table 3.1: Average Percentage Scores by Science Performance Expectation Categories - Eighth Grade	117
Table 3.2: Average Percentage Scores by Science Performance Expectation Categories - Fourth Grade	118

Mathematics Pertormance Expectations	119
Table 3.3: Average Percentage Scores by Mathematics Performance Expectation Categories - Eighth Grade	120
Table 3.4: Average Percentage Scores by Mathematics Performance Expectation Categories - Fourth Grade	121
Variation in Performance in Subcategories of Performance Expectations	122
Figure 3.2: Profiles of International Performance on Example Items That Require Scientific Problem Solving and Applying Concept Knowledge - Eighth Grade	123
Figure 3.3: Profiles of International Performance on Example Items That Require Using Scientific Procedures – Eighth Grade	124
Figure 3.4: Profiles of International Performance on Example Items That Require Scientific Investigating - Eighth Grade	125
Figure 3.5: Profiles of International Performance on Example Items That Require Performing Mathematical Procedures - Eighth Grade	127
Figure 3.6: Profiles of International Performance on Example Items That Require Problem Solving and Mathematical Reasoning - Eighth Grade	128
APPENDIX A: OVERVIEW OF TIMSS PROCEDURES FOR THE PERFORMANCE ASSESSMENT	A-1
History	A-2
The Components of TIMSS	A-3
Figure A.1: Countries Participating in Components of TIMSS Testing	A-5
Developing The TIMSS Performance Assessment Tasks	A-6
Table A.1: Description of Performance Assessment Tasks with Associated Content Knowledge Areas and Performance Expectations	A-7
Performance Assessment Design and Administration Procedures	A-10
Sample Implementation and Participation Rates	A-10
Table A.2: Coverage of TIMSS Target Population - Performance Assessment - Eighth Grade	A-12
Table A.3: Coverage of TIMSS Target Population - Performance Assessment - Fourth Grade	A-13
Table A.4: TIMSS School Sample Sizes - Performance Assessment - Eighth Grade	A-14
Table A.5: TIMSS Student Sample Sizes - Performance Assessment - Eighth Grade	A-15
Table A.6: TIMSS School Sample Sizes - Performance Assessment - Fourth Grade	A-1 <i>ć</i>

Table A.7: TIMSS Student Sample Sizes - Performance Assessment - Fourth Grade	A-17
Table A.8: TIMSS Participation Rates - Performance Assessment - Eighth Grade	A-18
Table A.9: TIMSS Participation Rates - Performance Assessment - Fourth Grade	A-19
Compliance with Sampling Guidelines	A-20
Figure A.2: Countries Grouped for Reporting of Performance Assessment Results According to Their Compliance with Guidelines for Sample Implementation and Participation Rates	A-21
Table A.10: Coverage of 13-Year-Old and 9-Year-Old Students	A-22
Scoring the Performance Assessment	A-23
Table A.11: TIMSS Inter-Coder Agreement for Performance Assessment – Eighth Grade	A-24
Table A.12: TIMSS Inter-Coder Agreement for Performance Assessment - Fourth Grade	A-25
Performance Assessment Test Reliability	A-26
Table A.13: Reliability Coefficients for the TIMSS Performance Assessment – Eighth and Fourth Grades	A-27
Data Processing	A-26
Data Analysis	A-28
Estimating Sampling Error	A-28
APPENDIX B: SELECTED PERFORMANCE ASSESSMENT RESULTS FOR HONG KONG AND ISRAEL	B-1
Table B.1: Hong Kong: Average Percentage Scores on Items by Task – Eighth Grade	B-2
Table B.2: Israel: Average Percentage Scores on Items by Task - Unweighted Data - Eighth Grade	B-4
Table B.3: Israel: Average Percentage Scores on Items by Task – Unweighted Data – Fourth Grade	B-6
APPENDIX C: ACKNOWLEDGMENTS	C-1