

IEA Research for Education

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IEA continues to promote capacity building and knowledge sharing to foster innovation and quality in education, proudly uniting more than 60 member institutions, with studies conducted in more than 100 countries worldwide.

IEA's comprehensive data provide an unparalleled longitudinal resource for researchers, and this series of in-depth peer-reviewed thematic reports can be used to shed light on critical questions concerning educational policies and educational research. The goal is to encourage international dialogue focusing on policy matters and technical evaluation procedures. The resulting debate integrates powerful conceptual frameworks, comprehensive datasets, and rigorous analysis, thus enhancing understanding of diverse education systems worldwide.

More information about this series at <http://www.springer.com/series/14293>

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Motivational Profiles in TIMSS Mathematics

Exploring Student Clusters Across Countries
and Time



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Foreword

IEA's mission is to enhance knowledge about education systems worldwide, and to provide high-quality data that will support education reform and lead to better teaching and learning in schools. In pursuit of this aim, it conducts, and reports on, major studies of student achievement in literacy, mathematics, science, citizenship, and digital literacy. These studies, most notably TIMSS, PIRLS, ICCS, and ICILS, are well established and have set the benchmark for international comparative studies in education.

The studies have generated vast datasets encompassing student achievement, disaggregated in a variety of ways, along with a wealth of contextual information which contains considerable explanatory power. The numerous reports that have emerged from them are a valuable contribution to the corpus of educational research.

Valuable though these detailed reports are, IEA's goal of supporting education reform needs something more: deep understanding of education systems and the many factors that bear on student learning advances through in-depth analysis of the global datasets. IEA has long championed such analysis and facilitates scholars and policymakers in conducting secondary analysis of our datasets. So, we provide software such as the International Database Analyzer to encourage the analysis of our datasets, support numerous publications including a peer-reviewed journal—*Large-scale Assessments in Education*—dedicated to the science of large-scale assessment and publishing articles that draw on large-scale assessment databases, and organize a biennial international research conference to nurture exchanges between researchers working with IEA data.

The **IEA Research for Education** series represents a further effort by IEA to capitalize on our unique datasets, so as to provide powerful information for policymakers and researchers. Each report focuses on a specific topic and is produced by a dedicated team of leading scholars on the theme in question. Teams are selected on the basis of an open call for tenders; there are two such calls a year. Tenders are subject to a thorough review process, as are the reports produced. (Full details are available on the IEA website.)

This seventh volume in the series is concerned with student motivation for learning mathematics. Student achievement in school depends on many school- and home-based factors, but also on individual motivation. Research into the motivational correlates of learning is not new, and it is clear that there is a positive relationship between motivation and learning. However, the links are generally found to be weak, and are imperfectly understood.

This study has taken the novel approach of focusing on students rather than motivation variables and, by identifying clusters of students with distinctive profiles in terms of these variables, sheds light on how motivation patterns relate differentially to achievement.

For analysis purposes the authors construe motivation in terms of three elements: enjoyment of, confidence in, and perceived value of mathematics (measures of each of these can be derived from the TIMSS background questionnaires). Cluster analysis across 12 education systems that took part at both grades four and eight in the TIMSS cycles of 1995, 2007, and 2015 identified a number of student clusters that remained stable across grades, over time, and across different systems. As might be expected, students scoring highly in all motivation elements also had high mathematics achievement levels. Critically, however, this study also delineates those clusters where the different elements of motivation went in contrary directions and provides a nuanced identification of the value of building student confidence in their mathematical abilities. Consistent patterns across grades, time, and systems show that confidence is a more important predictor of achievement than either enjoyment or perceived value.

Besides being a valuable addition to the literature on motivation and student learning, this report highlights the central importance of reinforcing students' competence in mathematics as a central construct toward building confidence. While it helps if students enjoy mathematics and appreciate its significance, in the absence of a well-founded confidence in mathematics, these factors have a weaker association with achievement.

Future publications in this series will include an in-depth investigation into the nature and extent of students' misconceptions and misunderstandings related to core concepts in mathematics and physics across grades four, eight, and 12, and a comprehensive analysis of gender differences in grade eight students' use and understanding of computer technologies.

Seamus Hegarty
Leslie Rutkowski
Series editors

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Contents

1	Introduction to Motivational Profiles in TIMSS Mathematics	1
1.1	Motivation in Mathematics in Studies of Educational Achievement	1
1.2	A Person-Centered Approach to the Study of Motivation in TIMSS Mathematics	4
1.3	Potential to Expand the Current State of Research	5
1.4	Overview of This Book	5
	References	6
2	The Relationship of Motivation with Achievement in Mathematics	9
2.1	Introduction to Student Motivation	9
2.2	Theoretical Approaches to the Study of Motivation	11
2.2.1	Self-determination Theory	11
2.2.2	Expectancy-Value Theory	12
2.2.3	Self-efficacy Theory	13
2.2.4	Self-concept	13
2.2.5	Achievement Goal Theory	14
2.3	Measures of Motivation in TIMSS	14
2.4	The Relationship Between Motivation and Achievement	15
2.5	Self-reported Ratings of Motivation Across Education Systems	16
2.6	Self-reported Ratings of Motivation Across Ages	17
2.7	Another Approach to Studying the Motivation–Achievement Relationship	18
	References	19

3	Methodology: Cluster Analysis of Motivation Variables in the TIMSS Data	25
3.1	TIMSS Sampling	25
3.2	Jurisdictions Included in This Study	26
3.3	Instrumentation	28
3.3.1	Motivation Measures in the TIMSS 2015 Administration	29
3.3.2	Motivation Measures in the TIMSS 2007 Administration	29
3.3.3	Motivation Measures in the 1995 Administration	32
3.4	Other Variables Included in the Study	34
3.4.1	TIMSS Achievement Score Estimation	34
3.4.2	Other Variables of Interest	35
3.5	Analysis Technique	36
	References	39
4	Cluster Analysis Results for TIMSS 2015 Mathematics Motivation by Grade and Jurisdiction	41
4.1	Introducing the Person-Centered Approach	41
4.2	Cluster Analysis Results for the TIMSS 2015 Administration at Grade Four by Jurisdiction	42
4.2.1	Australia	42
4.2.2	Canada-Ontario	43
4.2.3	Canada-Quebec	45
4.2.4	England	46
4.2.5	Hong Kong	46
4.2.6	Hungary	48
4.2.7	Iran	49
4.2.8	Japan	50
4.2.9	Norway	51
4.2.10	Singapore	52
4.2.11	Slovenia	52
4.2.12	USA	54
4.3	Cluster Analysis Results for the TIMSS 2015 Administration at Grade Eight by Jurisdiction	55
4.3.1	Australia	56
4.3.2	Canada-Ontario	57
4.3.3	Canada-Quebec	59
4.3.4	England	59
4.3.5	Hong Kong	61
4.3.6	Hungary	61
4.3.7	Iran	63
4.3.8	Japan	65

4.3.9	Norway	66
4.3.10	Singapore	67
4.3.11	Slovenia	69
4.3.12	USA	70
5	Cluster Analysis Findings Over 20 Years of TIMSS	73
5.1	Summary of Cluster Analysis Results for Grade Four Samples	73
5.1.1	The TIMSS 1995 Administration	74
5.1.2	The TIMSS 2007 Administration	75
5.1.3	The TIMSS 2015 Administration	75
5.2	Summary of Cluster Analysis Results for Grade Eight Samples	76
5.2.1	The TIMSS 1995 Administration	76
5.2.2	The TIMSS 2007 Administration	77
5.2.3	The TIMSS 2015 Administration	78
5.3	Twenty-Year Patterns in TIMSS by Country and Grade	79
6	Insights from Motivational Profiles in TIMSS Mathematics	85
6.1	Examining the Role of Motivation in Educational Achievement	85
6.2	Clusters of Students Using Motivation Variables: A Person-Centered Approach	87
6.3	Motivation Clusters and Achievement	88
6.4	Motivation Clusters, and Student and Family Characteristics	89
6.5	Methodological Concerns	92
6.6	Concluding Remarks	93
	References	94
	Appendix A: IBM SPSS Code for the Two-Step Cluster Analysis	97
	Appendix B: TIMSS 1995 and 2007 Boxplots by Cluster for Each Jurisdiction	99
	Appendix C: TIMSS 1995 and 2007 Descriptive Statistics by Cluster for Each Jurisdiction	125