

IEA Research for Education

A Series of In-depth Analyses Based on Data
of the International Association for the Evaluation
of Educational Achievement (IEA)

Volume 5

Series Editors

Seamus Hegarty, University of Warwick, UK, and Chair of IEA Publications
and Editorial Committee

Leslie Rutkowski, Indiana University, USA

Editorial Board

John Ainley, Australian Council for Educational Research, Australia

Kadriye Ercikan, University of British Columbia, Canada

Eckhard Klieme, German Institute for International Educational Research
(DIPF), Germany

Rainer Lehmann, Humboldt University of Berlin, Germany

Fou-Lai Lin, National Taiwan Normal University, Chinese Taipei

Marlaine Lockheed, Princeton University, USA

Sarah Maughan, AlphaPlus Consultancy, UK

Carina Omoeva, FHI 360, USA

Elena Papanastasiou, University of Nicosia, Cyprus

Valena White Plisko, Independent Consultant, USA

Jonathan Plucker, John Hopkins University, USA

Fernando Reimers, Harvard Graduate School of Education, USA

David Rutkowski, Indiana University, USA

Jouni Välijärvi, University of Jyväskylä, Finland

Hans Wagemaker, Senior Advisor to IEA, New Zealand

The International Association for the Evaluation of Educational Achievement (IEA) is an independent nongovernmental nonprofit cooperative of national research institutions and governmental research agencies that originated in Hamburg, Germany, in 1958. For over 60 years, IEA has developed and conducted high-quality, large-scale comparative studies in education to support countries' efforts to engage in national strategies for educational monitoring and improvement.

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 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>

Markus Broer • Yifan Bai • Frank Fonseca

Socioeconomic Inequality and Educational Outcomes

Evidence from Twenty Years of TIMSS



Markus Broer
American Institutes for Research
Washington, DC, USA

Yifan Bai
American Institutes for Research
Washington, DC, USA

Frank Fonseca
American Institutes for Research
Washington, DC, USA



ISSN 2366-1631

ISSN 2366-164X (electronic)

IEA Research for Education

ISBN 978-3-030-11990-4

ISBN 978-3-030-11991-1 (eBook)

<https://doi.org/10.1007/978-3-030-11991-1>

© International Association for the Evaluation of Educational Achievement (IEA) 2019. This book is an open access publication.

Open Access This book is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this book are included in the book's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the book's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

This work is subject to copyright. All commercial rights are reserved by the author(s), whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Regarding these commercial rights a non-exclusive license has been granted to the publisher.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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. IEA studies, most notably TIMSS, PIRLS, ICCS, and ICILS, have set the benchmark for international comparative studies in education.

These well-established 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 represent an invaluable contribution to the corpus of educational research.

Nevertheless, 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 analyses and facilitates scholars and policymakers in conducting secondary analysis of the datasets. So IEA provides software such as the International Database Analyzer to encourage the analysis of their datasets, support numerous publications, including a peer-reviewed journal – *Large-Scale Assessment 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 these 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 fifth volume in the series is concerned with socioeconomic inequality and educational outcomes. Socioeconomic status is a key variable in social science research. It is especially important to the understanding of educational inequality and how best to address it. There is a substantial literature on the links between students' educational achievement and their family background. Despite this, challenges in measuring socioeconomic status and identifying its impact persist.

This book draws on data collected over 20 years in the IEA Trends in International Maths and Science Study (TIMSS) and scrutinizes student achievement levels in relation to their socioeconomic status. Besides achievement data, TIMSS has been collecting background information from students, teachers, and school principals. Using a modified version of the TIMSS home educational resources index, the authors have identified tentative patterns in the changes over time. Specifically, they have established which countries have seen greater educational inequality attributable to family background and which have seen a reduction. They also identify which countries have managed to increase the academic performance of disadvantaged students over the period and those which have not.

There are no easy answers to the challenges posed by the educational underachievement of students from disadvantaged backgrounds. It remains, however, one of the most significant issues facing societies and their education systems. While family background is a critical variable, the authors properly point out that macro-level factors such as gross national wealth per person, total expenditure on education, and degree of centralization of the education system all play a part. What this book does offer is a data-driven focus on the effects of socioeconomic status on educational outcomes and a methodology for deeper national investigation across the many cycles of TIMSS. Both researchers and policymakers will find it suggestive in terms of exploring national contexts more precisely and devising policy actions to ameliorate educational underachievement.

Future publications in the series will examine trends to evaluate the success of countries in strengthening teacher quality, and reducing educational inequality, and systematically investigate differences in use, perceptions, and capabilities in using computer technologies by student gender.

Seamus Hegarty
Leslie Rutkowski
Series editors

Contents

1 Socioeconomic Inequality and Educational Outcomes:	
An Introduction	1
References	5
2 A Review of the Literature on Socioeconomic Status and Educational Achievement	7
2.1 Socioeconomic Status and Related Constructs and Measures	8
2.2 Family SES and Student Achievement	9
2.3 Differences in Education Systems and Changes Over Time	11
2.3.1 Homogeneous Versus Heterogeneous	11
2.3.2 Centralized Versus Decentralized	13
References	15
3 Methodology: Constructing a Socioeconomic Index for TIMSS	
Trend Analyses	19
3.1 TIMSS Data and Sample Characteristics	20
3.2 Construction of a Proxy Measure for Socioeconomic Status	23
3.2.1 Components of the SES* Measure	25
3.2.2 Multiple Imputation of Missing Values	26
3.2.3 The SES* Index	26
3.2.4 Defining High- and Low-SES* Groups	27
3.3 Analytic Approach	30
3.3.1 Plausible Values and Imputed Datasets	30
3.3.2 Measuring Educational Inequality	31
3.3.3 Country-Level Indicators in the Educational Systems and the Macroeconomic Context	32
References	33

4 Socioeconomic Achievement Gaps: Trend Results for Education Systems	35
4.1 Overall Findings	35
4.1.1 Increasing SES* Achievement Gap	36
4.1.2 Decreasing SES* Achievement Gap	36
4.2 Education System Specific Findings	41
4.2.1 Australia	41
4.2.2 Hong Kong	44
4.2.3 Hungary	46
4.2.4 Islamic Republic of Iran	48
4.2.5 The Republic of Korea	50
4.2.6 Lithuania	52
4.2.7 New Zealand	54
4.2.8 Norway	56
4.2.9 Russian Federation	58
4.2.10 Singapore	61
4.2.11 Slovenia	63
4.2.12 Sweden	65
4.2.13 United States	67
References	69
5 Trends in Socioeconomic Achievement Gaps in the Macroeconomic Context: Discussion and Future Research	71
5.1 Summary of the Findings	72
5.2 Relating the Findings to Country-Level Indicators in the Educational Systems and the Macroeconomic Context	73
5.2.1 Tentative Pattern 1: Reductions in the Achievement Gap Tend to Accompany Improvements in Overall TIMSS Performance	73
5.2.2 Tentative Pattern 2: Education Systems That Observed Increases in Achievement Gaps Tend to be Decentralized	77
5.2.3 Tentative Pattern 3: Education Systems That Reduced Investment in Education Tended to Observe an Increased Mathematics Achievement Gap	77
5.3 Limitations of the Study and Recommendations for Future Research	78
5.4 What Have We Learned from Twenty Years of TIMSS Data?	79
References	80
Appendix Sensitivity Check	81
A.1 Index Sensitivity Check	81
A.2 Cut-off Sensitivity Check	82
References	83