

# **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 1

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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 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>

R. Annemiek Punter · Cees A.W. Glas  
Martina R.M. Meelissen

# Psychometric Framework for Modeling Parental Involvement and Reading Literacy



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R. Annemiek Punter  
Department of OMD, Faculty of BMS  
University of Twente  
Enschede, Overijssel  
The Netherlands

Martina R.M. Meelissen  
Department of OMD, Faculty of BMS  
University of Twente  
Enschede, Overijssel  
The Netherlands

Cees A.W. Glas  
Department of OMD, Faculty of BMS  
University of Twente  
Enschede, Overijssel  
The Netherlands

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# Foreword

The mission of the International Association for the Evaluation of Educational Achievement (IEA) 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 the Trends in International Mathematics and Science Study (TIMSS), Progress in International Reading and Literacy Study (PIRLS), and International Civic and Citizenship Education Study (ICCS), 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 requires in-depth analysis of the global datasets. IEA has long championed such analysis, and facilitates scholars and policy makers 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 Assessment in Education*—dedicated to the science of large-scale assessments 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.

This new series of thematic reports represents a further effort by IEA to capitalize on our unique datasets, so as to provide powerful information for policy makers and researchers. Each report will focus on a specific topic and will be 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. The intention is to have 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 first report is based on secondary analysis of the Progress in International Reading Literacy Study (PIRLS) data, and aims to deepen understanding of the influence of home support for learning on student achievement. Conducted by researchers at the University of Twente, *Psychometric Framework for Modeling Parental Involvement and Reading Literacy* is a valuable addition to the growing research on the impact of parental involvement in education, exploring the relationship between aspects of parental involvement and student reading literacy across countries, while taking cultural differences into account. This report should make a significant contribution to a field where cross-cultural comparisons from a triangulated perspective are sparse.

Upcoming thematic reports will focus on the role of teachers and teaching in relationship to student outcomes, and on perceptions of school safety and the school environment for learning and their impact on student learning.

Seamus Hegarty

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# Executive Summary

## Research Objectives

Parental involvement is seen as one of the most malleable factors of the student's home situation, which makes it a relevant subject for schools, educational policies, and research. Though many studies have researched its role in student achievement, effects are not univocal. It is difficult to tell whether these inconsistent results are caused by differences between educational systems and cultural differences, or by the great variation in the methods used to assess student achievement and parental involvement across studies. Large-scale international assessment studies like the Progress in International Reading and Literacy Study (PIRLS) undertaken by the International Association for the Evaluation of Educational Achievement (IEA) therefore provide valuable data. However, a limiting factor may be the extent to which data from different countries can be compared, as cultural differences could influence the international validity of the indicators.

The purpose of this research was to develop a suitable psychometric framework for the assessment of the relation between parental involvement and reading literacy, using the PIRLS-2011 data for 41 countries as a case study. The framework included country-specific differences, both at the item and scale level, to gain insight into cultural differences in the parental involvement construct and its relation to student achievement in reading literacy. The project may thus also contribute to the issue of measurement invariance across cultures in large-scale assessment studies.

Three main research questions guided the project:

- Which dimensions of parental involvement can be discerned and to what extent is there empirical evidence that these dimensions are related to student attainment?
- To what extent are there any cultural differences (differences between countries) in the constructs that measure dimensions of parental involvement?

- To what extent are the different dimensions of parental involvement related to student achievement in reading literacy, taking into account student background characteristics and differences between countries?

## **Literature Review**

The introductory literature review (1) investigated the underlying dimensions of the parental involvement concept in current research literature and how these dimensions were related to educational outcomes; (2) explored which dimensions showed the most significant relationship with student attainment, and reading literacy in particular; and (3) determined whether cultural differences existed between countries in the perception of relationships between parental involvement and student achievement.

The review identified four key dimensions of parental involvement and provided a comprehensive analysis of existing studies on parental involvement and student achievement. Overall, the literature suggested that parental involvement had a positive influence on student achievement; however, when the key four dimensions characterizing parental involvement were considered separately, the results were less straightforward. None of the meta-studies in the literature addressed cultural differences in parental perceptions of parental involvement or how parents behaved towards their child's education as possible reasons for the diverse results.

## **Modeling Parental Involvement**

The psychometric framework aimed to identify and model cultural differential item functioning (CDIF) using five item response theory (IRT) models: the generalized partial credit model (GPCM), a GPCM with 10 % and 20 % country-specific parameters, a GPCM with random item parameters, and the bi-factor GPCM. These models were each applied to five components of parental involvement identified by the literature review and constructed from the PIRLS-2011 dataset.

All models clearly and consistently supported the identification of CDIF. However, the results obtained varied across models. This disagreement was because different aspects of model fit were assessed by the models; the method using residuals (i.e., the first four models) specifically targeted uniform CDIF, while the bi-factor GPCM specifically targeted nonuniform CDIF. Practitioners should not rely on one model and one approach to investigate CDIF, but diversify in their methods.

## Latent Multilevel Model

After modeling parental involvement including CDIF, its relation with reading literacy was investigated using a latent three-level regression model. The analyses confirmed that the control variables for gender and socioeconomic status (SES) were important predictors for reading literacy. Parental involvement in early literacy activities with their child had a small but positive influence on student achievement. Parental involvement in helping their child with homework in the current grade appeared to have a weak negative influence. The effect of other components was negligible.

A model with random slopes at the country level for the components “early literacy activities” and “helping with homework” was tested to establish whether their effects differed across countries. There were large differences in the impact across countries, especially for parental help with homework. There was a positive correlation between the country-level intercept slopes, indicating that the effect of helping with homework was less significant in low-achieving PIRLS countries than in high-achieving countries.

To establish the impact of CDIF, the analysis was replicated with the a posteriori estimates of the latent student parameters from all five IRT models. The resulting estimates were very close, and within one standard deviation from the estimates under the GPCM. Thus, CDIF did not appear to bias the inferences.

## Conclusions

The main purpose of this study was to assess whether there were cultural differences in the measurement of parental involvement in PIRLS and, if so, whether correction for these differences led to differing interpretations with regard to its relation with reading literacy. Although some of the constructed scales for parental involvement may require improvements to increase reliability, the PIRLS scales remain internationally valid. Analyzing the impact of CDIF on the estimates of country means and on the outcomes of latent regression analyses established that CDIF did not influence the results.

By providing a robust framework to identify and model cultural differences, this project contributes to the field of large-scale assessments in educational research by modeling the relationships between parental involvement and student learning over a large number of educational systems. Most importantly, the work confirms that there is a positive relationship between parents’ early literacy activities and students’ reading literacy, and conversely, a negative relationship between parental help with homework and students’ reading literacy.