

Executive Summary

MAIN MESSAGES

Teaching and learning practices vary widely across educational systems and across schools within systems.

Teaching and learning strategies are an important area of educational policy and practice. An international perspective on these issues informs students, parents, teachers, policy makers and other stakeholders about the most common patterns in their system, how these compare to other countries, and how these practices vary across schools within these systems. When examining these issues, it is important to inform students, parents, teachers, policy makers and other stakeholders about the most common patterns in their systems and how teaching and learning practices vary from school to school within these systems. An international perspective can also add important insight on how countries' education systems compare to one another. This report offers that kind of insight particularly for the countries involved in the PISA 2003 cycle. The analysis of how teaching and learning practices are linked to student performance is, however, more limited, given the international cross-sectional nature of surveys, such as PISA, and the need for very fine and detailed data for the analysis of these issues.

Teaching and learning strategies are complex processes that interact with one another, suggesting that in-depth, context-specific analyses are necessary to fully understand each strategy's role in enhancing student performance.

With a few interesting exceptions, most teaching and learning strategies do not have a direct, robust and consistent relationship with student performance across countries. The relationship between the strategies and performance tends to be moderated by other factors such as student attitudes and background, suggesting that these issues cannot be analysed separately.

Disciplinary climate is the main teaching-related variable that shows a robust and consistent association with better performance, both at the individual and school levels.

Across most countries, a strong disciplinary climate is consistently and robustly associated with better performance. The analysis shows that beyond the individual level, policies targeted to improve the disciplinary climate at the school level also yield positive effects. Determining how to address schools and individuals facing a challenging disciplinary climate should therefore be a priority for further in-depth, policy oriented studies.

Student background continues to be among the main determinants of performance, even after adjusting for teaching and learning strategies, which suggests that these processes only play a limited moderating role for disadvantaged students.

A combined analysis of teaching and learning strategies with student background and other antecedents shows that different practices, even if they vary a lot, do not significantly moderate the effect of socio-economic background. There is little evidence that teaching and learning strategies play a significant role in reducing the effect of socio-economic background on student performance.

Student attitudes, such as confidence with or anxiety towards mathematics, play a mediating role with respect to some teaching and learning strategies, and maintain their strong association with student performance even after adjusting for these strategies.

The relationship between student performance and many of the teaching and learning strategies, in particular, meta-cognitive strategies, is mediated by student attitudes. A potential area of further research, these mediating effects may explain the lack of evidence for a direct relationship between performance and these strategies, in particular, meta-cognitive strategies or student preferences for a cooperative or a competitive environment. It is, however, hard to evaluate how much of this research can be accomplished with international, cross-sectional studies such as PISA.

OVERVIEW OF THE REPORT'S APPROACH

This thematic report presents new evidence on teaching and learning strategies for mathematics that emerges from the PISA 2003 assessment and complements the results discussed in other PISA reports (*e.g.* OECD, 2004, 2005). The report's analysis clarifies understanding of the following: the differences across countries between teaching and learning practices, which allow countries to benchmark practices; the extent to which teaching and learning practices vary from school to school within each country; and the extent to which individual aspects of teaching and learning are associated with better or worse performance in mathematics.

The report will be useful for education policy makers and other stakeholders and concerned with the study of teaching and learning. It will also prove insightful for academic researchers wanting to identify research questions for follow-up studies. This report may thus help stimulate a new round of research designed to gather more detailed information on teaching and learning strategies. Recent examples include the OECD Teaching and Learning International Survey (TALIS) (OECD, 2009), which takes a large step in this direction, as well as the upcoming PISA 2012, which will again focus on mathematics and be another opportunity to build on the methodology and results presented in this report. In addition, this report may be of interest to teacher educators and officials within national and local educational authorities who are responsible for the professional development of teachers, programmes, and school boards and parent advisory bodies.

The report first surveys the theory and measurement of teaching and learning strategies. Teaching strategies refer to a broad range of processes, from the way in which classrooms are organised and resources are used to the daily activities engaged in by teachers and students to facilitate learning. Student learning strategies refer to cognitive and meta-cognitive processes employed by students as they attempt to learn new topics. In PISA, teaching and learning strategies are measured using a variety of questionnaire items, which in turn are combined and scaled to yield a number of composite or index variables representing broad constructs. Examples of these constructs include disciplinary climate, teacher-student relations, memorisation strategies and time spent on various learning activities. In PISA 2003 these measures were specifically geared towards the learning of mathematics. The TALIS survey extends the analysis of these strategies, their relationship to each other and their links to teacher beliefs. Further analysis on the effects of these strategies on student learning, particularly in reading and science, will be possible in later PISA surveys.

Most of the results presented in this report are based on separate analyses for each country. The within-country results are then combined to allow for comparisons across a range of countries. The

report follows a two-stage analytical approach. The first stage involves a comparative analysis of mathematics teaching and learning in order to describe how mathematics is taught in different countries. The report then examines variations across schools within countries and, on the basis of these analyses, presents a broad profile of commonalities and differences in mathematics teaching and learning strategies. While limited in their ability to provide explanations for differences in teaching methodology, the results can inform policy makers in individual countries how their situation might relate to or differ from that of other countries in terms of consistency or variety among schools.

The second stage of the analysis utilises a comprehensive two-level, student and school, prediction model of the factors influencing mathematics achievement. Here the primary emphasis is on the teaching and learning strategy variables. The analysis adjusts for a number of antecedents, which are introduced into in stages before entering the teaching and learning variables. This approach allows the predictive power of the model to be determined as groups of variables are inserted. The basis of the final reporting of the effects of each of the main variables is the full model. This approach offers a more complete picture of the real world of teaching and learning, compared to that provided by the intermediate models, and may be of more interest from a policy perspective. The report then examines mediating effects, in part by the use of bivariate analysis, to compare effects using the full model versus each variable independently.

ORGANISATION OF THIS REPORT

Chapter 2 depicts a complex and widely varying picture of mathematics instruction, both within and across participating countries. It examines the characteristics of students, schools and countries in terms of various teaching and learning strategies, as well as the distribution of these characteristics. The chapter notes observed associations between various aspects of teaching and learning strategies and mathematics performance, as well as the extent to which these associations correlate with higher student achievement.

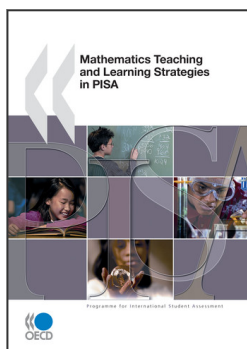
Chapter 3 examines how selected features of teaching and learning affect performance in mathematics after other characteristics of students and schools are taken into account. The features measured cover the antecedents to learning, the effects of teaching and learning, and teaching strategies. The analysis divides the total variation in students' performance in mathematics into "between-student" and "between-school" components. The chapter presents results for each country separately. In addition to examining the observed association between various factors and performance, and the unique effects of these factors once other factors have been accounted for, the chapter discusses the interactions between the different measures.

Chapter 4 summarises the report's main results, identifies relevant educational policy and practice issues, and examines the extent to which the available results respond to these issues. The chapter also considers the design of PISA in light of the interpretation issues encountered in this study. It seems that the use of teaching and learning strategies does not significantly mitigate the disadvantaged social backgrounds of some students. PISA shows that teaching and learning factors are related to mathematics achievement, but this relationship is not necessarily bi-directional or of similar magnitude across all the countries and economies studied. Country differences stand out for many of these variables, a finding which suggests that effects may be best interpreted within countries or clusters of countries with similar cultural backgrounds or school systems.

Chapter 5 concludes this report and summarises the main policy insights that can be drawn from the evidence presented in the previous chapters.

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