Programme for International Student Assessment

Iberoamerica in PISA 2006

Regional Report

GIP
Grupo Iberoamericano de PISA
(Iberoamerican PISA Group)

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Published in Spanish by Santillana Educación S. L. under the title "Iberoamérica en PISA 2006".
Published in Portuguese by Editora Moderna S. L. under the title "Os países ibero-americanos no PISA 2006".

Published by agreement with the OECD and GIP.

General coordination: Inés Calzada Gutiérrez.
Editor: Alberto Martín Baró.

Design & Arts director: José Crespo

Cover design: Javier Tejeda

Design development: José Luis García, Raúl de Andrés

Technical director: Ángel García Encinar

Technical coordinator: Marisa Valbuena
Layout: Luis González Prieto
Correction: Gerardo Zoilo, Juan David Latorre

ISBN: 978-84-680-0037-4
CP: 301979

THE IBEROAMERICAN PISA GROUP

When the Programme for International Student Assessment (PISA) was first implemented in 2000, this was with the participation of three Iberoamerican OECD member countries, Spain, Mexico and Portugal, as well as Brazil. Gradually, other countries entered the programme and by 2005 eight Iberoamerican countries were preparing their involvement in the implementation of PISA 2006. Two European countries, Spain and Portugal, were involved, together with six from Latin America: Argentina, Brazil, Chile, Colombia, Mexico and Uruguay.

In addition to their similar cultural backgrounds, these countries also shared a generally limited experience in the field of learning assessment through standardised, large-scale instruments. However, from the mid-20th century onwards, this had become standard practice in some OECD member countries, especially the English-speaking ones.

As a result, the participation of the countries that had implemented PISA in 2000 and 2003 had been quite limited. They had not been involved in preparing the studies, nor had they produced items or questions for the tests and questionnaires that were given to students and school principals. Before 2005, Spain and Mexico had not used PISA results to undertake their own analyses, which would have provided educational authorities with valuable input to develop policies leading to a sustained improvement in the quality of education.

The Iberoamerican representatives on the PISA Governing Board proposed a collaborative effort to meet all PISA requirements, while also achieving its high quality standards. At the same time, this process enabled technical capacities to be developed more rapidly and efficiently than would have been the case if each national group had been working alone. The so-called Iberoamerican PISA group (GIP) was created, initially made up of the eight countries mentioned above. Other Iberoamerican countries will join in the future.

Today the GIP is a group that draws on shared reflection and teamwork to address the scientific and technical challenges of making effective assessment available to all its members. It seeks to contribute in such a way as to stimulate public debate, and improve PISA and evaluation as basic tools for acquiring information and improving education in Iberoamerica and, more generally, in PISA member countries.

Contents

Introduction

The aim of the Programme for International Student Assessment (PISA) is to obtain comparative information on the results achieved by 15 to 16-year-old students in the participating countries. It deals with three areas to which great importance is attached within educational systems, as will be explained more fully in Chapter 1. Through the controlled application of identical standardised instruments, those responsible for the design of educational policies obtain information that goes beyond the number of students in the educational system, or its resources. They can also find out the degree to which the students achieve, or fail to achieve, satisfactory levels in reading, mathematics and science. All these competencies will be vital to them in later life.

This explains why PISA has attracted a great deal of interest, not only within the Organisation for Economic Co-operation and Development (OECD), but also among a growing number of other countries, including some Iberoamerican ones. Four countries from the region participated in its initial implementation in 2000: the three OECD member countries, Spain, Mexico and Portugal, together with Brazil. In PISA Plus, the special implementation of 2001-2002, Argentina, Chile and Peru were also involved. These three countries did not participate in 2003, but Uruguay did, along with Brazil, Spain, Mexico and Portugal. In the implementation of 2006, Argentina and Chile again participated, while Colombia did so for the first time. Thus, in 2005 eight Iberoamerican countries were preparing their involvement in the implementation of PISA 2006: two European countries, Spain and Portugal, and six from Latin America: Argentina, Brazil, Chile, Colombia, Mexico and Uruguay.

In addition to their similar cultural backgrounds, these countries also shared a generally limited experience in the field of learning assessment through standardised, large-scale instruments. However, from the mid-20th century onwards, this had become standard practice in some OECD member countries, especially the English-speaking ones.

Consequently, the participation of the countries that implemented PISA in 2000 and 2003 was quite limited. They were not involved in preparing the studies, nor did they produce items or questions for the tests and questionnaires that were given to students and school principals. In Spain there were fuller surveys of some Autonomous Communities, while Mexico obtained similar information from the federal states. However, before 2005 Spain and Mexico had not used PISA results to undertake their own analyses, which would have provided educational authorities with valuable input to develop policies leading to a sustained improvement in the quality of education. Those responsible for PISA in each country, especially those participating for the first time, also encountered considerable difficulties in handling the varied and detailed practical tasks necessary for the implementation of these types of instruments, involving surveys of thousands of students, while ensuring the accuracy and validity of their results.

As a consequence, the Iberoamerican representatives on the PISA Governing Board proposed a collaborative effort, by which those with more experience would help those with less. This would enable all countries to meet PISA requirements, while also achieving its high quality standards. At the same time, this process enabled technical capacities to be developed more rapidly and efficiently than would have been the case if each national group had been working alone. The so-called Iberoamerican PISA group (GIP) was created, initially made up of the eight countries mentioned above. In 2008, they were joined by the representatives of Panama, Peru and the Dominican Republic, which will participate in the implementation of PISA 2009.

This collective effort helped to solve problems as they emerged. It also consolidated the practice, started in 2001, of making joint translations of the original versions of PISA documents and guidelines, which were translated from English and French into Spanish and Portuguese. After the implementation of 2006, national

groups provided each other with mutual assistance in the challenging task of coding answers to open-ended questions, and sifting information so as to establish a technically valid framework for processing it.

After each implementation of PISA, the main results are presented in an OECD report that is published at the end of the following year. Each country can also make its own report, and the exchange of information between GIP countries facilitated the preparation of national reports on PISA 2006. Furthermore, there were numerous meetings and training workshops, supported by the OECD Secretariat, for training members of the PISA teams from GIP countries.

Since early 2007, the GIP countries have initiated a new stage in their co-operation, which has involved the preparation of reading item units for PISA 2009. This phase began with a training workshop given by experts from the consortium responsible for PISA development. Over a period of several months, those responsible for each GIP country were in close contact with each other, exchanging the units that each country had developed, and providing ideas and feedback. These units were then forwarded to the international consortium.

As a result of this work, the 2009 tests will be the first to include units of items developed in Iberoamerica. GIP influence also led to the inclusion of optional units, characterised by their reduced difficulty. These do not lower the level of tests, nor do they undermine comparisons with previous implementations. However, they provide a greater degree of accuracy in establishing the competencies of young people who have not reached the lowest levels of performance, as measured by the instruments hitherto used. When students are beneath this level, we know what they cannot do, but not what they are capable of doing.

This study represents yet another stage in this collective effort, which has involved the preparation of a report on the results of PISA 2006 in the eight Iberoamerican countries that participated in this cycle. It also covers ten Autonomous Communities in Spain, seven federal states in Mexico, and five states in Brazil. In June 2007 it was agreed by the GIP that work would be carried out in 2008 on a document which would be ready for publication by the end of the year. This publication is the result. We present it now to everyone who is involved in PISA, and especially to all those who are concerned about the quality of the educational systems in our countries, and strive to improve them.

The work was carried out within a framework approved at a meeting held in January 2008. One or more members took on overall responsibility for a particular chapter, while the others fully participated. Within this framework, it was agreed that Chapter 4 would be an analysis of the ways in which the results obtained by the students of distinct countries and regions were linked to factors related to their educational or social environments. In view of this subject's great complexity, it was decided that an outside consultant would work on it, employing advanced statistical techniques. Dr. Douglas Willms, of the University of New Brunswick, Canada, was invited to participate in view of his long-standing expertise in this field.

This is therefore a collective study, prepared by the members of the assessment groups of the GIP countries. The different chapters were co-ordinated by the following people:

Introduction and Chapter 1. Spain, Mexico and Uruguay: Enrique Roca, Felipe Martínez Rizo and Andrés Peri.

Chapter 2. Spain and Uruguay: Enrique Roca and Andrés Peri.

Chapter 3. Argentina, Brazil and Spain: Antonio Gutiérrez, Sheyla Carvalho and Enrique Roca.

Chapter 4. Mexico and Chile: Felipe Martínez Rizo and Leonor Cariola. Douglas Willms is the author of the main text. The GIP representatives were responsible for the sections in which the results for each country are discussed, as well as those on the Autonomous Communities of Spain and the regions of Brazil and Mexico.

Chapter 5. Spain and Chile: Enrique Roca and Leonor Cariola.

Chapter 6. Chile, Colombia, Spain and Mexico: Leonor Cariola, Luís Piñeiros, Enrique Roca and Felipe Martínez Rizo.

The following members of the GIP assessment teams collaborated in the research, writing and revision of this work:

Argentina: Antonio Gutiérrez, Graciela Baruzzi, Marta Kisilevsky and Patricia Scorzo.

Brazil: Sheyla Carvalho Lira, Lígia Maria Vettorato Trevisan and Pedro Henrique de Moura Araújo.

Chile: Leonor Cariola, Claudia Matus, Ema Lagos and Gabriela Cares.

Colombia: Margarita Peña and Luís Piñeros.

Spain: Enrique Roca, Rosario Sánchez, Lidia Ayllon, Marco A. García, María José García de la Barrera, Iria Pérez, Cristina Romero, Silvia Vargas and Manuela Varilla.

Mexico: Felipe Martínez Rizo, María Antonieta Díaz, Damián Canales Sánchez and Gustavo Flores Vázquez.

Portugal: Carlos Pinto-Ferreira, Anabela Serrão and Luísa Belo.

Uruguay: Andrés Peri, María Sánchez, Gabriel Chouhy and Laura Noboa.

The authors of this Introduction were responsible for the co-ordination of the report and its general conclusions. We offer it to its readers with pride and satisfaction.

Enrique Roca
Director of the Spanish
Evaluation Institute

Felipe Martínez Rizo
General Director of the National
Institute for the Evaluation of Education
in Mexico until November 2008

Foreword

The world is rapidly becoming a different place, and the challenges to individuals and societies posed by globalisation and modernisation are widely acknowledged. Increasingly diverse and interconnected populations, rapid technological change in the workplace and in everyday life, and the instantaneous availability of vast amounts of information represent but a few of these new demands. In this globalised world, individuals and countries that invest intelligently in education benefit socially and economically from that choice, and increasingly so. Among the OECD countries with the largest expansion of their skill base over the last decades most have still seen rising earnings differentials, suggesting that an increase in knowledge workers does not lead to a decrease in their pay as is the case for low-skilled workers.

The other player in the globalisation process is innovation and technological development, but this too depends on education, not just because tomorrow's knowledge workers and innovators require high levels of education, but also because a highly-educated workforce is a pre-requisite for adopting and absorbing new technologies and increasing productivity. Together, skills and technology have flattened the world such that all work that can be digitised, automated or outsourced can now be done by the most effective and competitive individuals, enterprises or countries, wherever they are. All of this has led to a growing productivity gap between those who are well educated and those individuals – and nations – who struggle with the transition to the knowledge economy.

Not surprisingly therefore, parents, those who teach and run education systems as well as the general public everywhere are calling for better information on how well their schools prepare students for life. Many countries already monitor students' learning nationally in order to provide answers to this question. Comparative international assessments can extend and enrich the national picture by providing a larger context within which to interpret national performance. They can show what is possible in education in terms of the levels of quality and equity achieved in the best performing education systems. They can assist with gauging the pace of educational progress and help reviewing the reality of educational delivery at the frontline. Last but not least, they allow education systems to look at themselves through the lenses of the policies planned, implemented and achieved elsewhere so as to inform national efforts to help students to learn better, teachers to teach better, and schools to become more effective.

In response to the emerging need for cross-nationally comparable evidence on student performance, the Organisation for Economic Co-operation and Development (OECD) launched the Programme for International Student Assessment (PISA) in 1997. PISA represents a commitment by the countries taking part in the assessments to monitor the outcomes of education systems in terms of student achievement on a regular basis and within an internationally agreed common framework. PISA aims to provide countries with a basis for policy dialogue and for collaboration in defining and implementing educational goals, in innovative ways that reflect judgements about the skills that are relevant to adult life. The interest among countries in PISA has grown rapidly, with participation rising from 31 countries in the 2000 assessment to now 72 countries in the PISA 2009 round, which comprises roughly 90 per cent of the world economy.

The results from successive PISA assessments have shown wide differences in the quality of learning outcomes across countries, significant variation in the relative performance of schools as well as important differences among countries in the impact which social background has on learning outcomes. For some countries, the results have been disappointing, showing that their 15-year-olds' performance lags behind that of other countries, sometimes by the equivalent of several school years and sometimes despite high investments in education. The OECD has produced numerous reports to analyse and contextualise the find

ings from PISA and most countries taking part in the assessment have produced their own national analyses. The report from the *Grupo Iberoamericano de PISA* adds an important new dimension to such analysis, in scrutinising how the Iberoamerican countries fare against each other within the global context provided by the PISA assessment.

This perspective is important, as it accounts for some of the linguistic, social and cultural features that make international comparisons difficult. This perspective also makes comparisons more challenging for public policy, as it takes away some of the excuses often used to dismiss international comparisons, namely, that they compare countries that cannot really be compared. The authors should be commended for their evidence-based approach, that allows to evaluate lessons that might be learned from other education systems, without rejecting experiences developed and applied in other countries, as policymakers and practitioners alike so often do, following the principle that they would not take the prescription for a medicine if they had not themselves been chosen to take part in its clinical trial. At the same time, the report does not fall into the trap of trying to copy and paste other educational systems or experiences, but rather seeks to develop an understanding for the differences and some of the key factors that might explain those differences.

Is it fair to compare education systems operating under very different socio-economic conditions? As Chapter 2 of the report shows, many of the countries in the *Grupo Iberoamericano de PISA* are disadvantaged when comparing aspects such as their level of economic development, school enrolment or parental attainment with the OECD average. Despite this, the *Grupo Iberoamericano de PISA* has taken up the challenge of comparisons, recognising that, in the same way as students from rich and poor families in their countries will need to compete in the same labour-market the day on which they leave school, their countries now compete in an increasingly global marketplace in which the yardstick for success is no longer improvement by national standards but increasingly the performance demonstrated by the best performing education systems. So even if the comparisons are not fair in terms of comparing countries starting out from different conditions, they are highly relevant. Equally relevant, the report shows that resources really only provide a modest part of the explanation for the performance gap of the countries making up the *Grupo Iberoamericano de PISA*. Put plainly, the report shows more clearly than any comparative study before that the educational challenges in much of the Ibero American world are not limited to poor kids in poor regions, but indeed extend to most kids in most regions.

Are the competencies captured by PISA those that matter most? And how does what is measured by the global PISA assessment relate to what is taught in a local school in the countries of the *Grupo Iberoamericano de PISA*? It is quite clear that the shift in PISA, away from using multiple-choice tests to assess whether students can reproduce what they were taught, towards assessing to what extent they can extrapolate from what they have learned and transfer and apply their knowledge in novel contexts, departs from the prevalence of a content-driven approach to curriculum and assessment in the Iberoamerican countries.

At the same time, much of the current research suggests that the demand for competencies by modern societies is changing rapidly. A look at changing skill requirements in modern labour-markets illustrates this clearly: Particularly in the OECD's most flexible labour markets, it is now routine cognitive skills, no longer manual skills, that are seeing the sharpest decline in demand; it is thus those middle-class white-collar jobs that build on the application of routine knowledge, that are most at threat today. The reason is that the skills that are easiest to teach, and that are easiest to test, namely those skills that involve the mastery of subject matter content, are also the skills that are easiest to digitise, automate and offshore. Because such tasks can be accomplished by following a set of rules, they are prime candidates for computerisation. Furthermore, rules-based tasks are also easier to offshore to foreign producers than other kinds of work: when a task can be reduced to rules – i.e. a standard operating procedure – the process needs to be explained only once, so the process of communicating with foreign producers is much simpler than the case of non-rules based tasks where each piece of work is a special case.

But the issues go well beyond the economic dimension of competencies. For many spheres of life, OECD's research underlines the increasing importance of interpersonal dimensions of competencies, such as the capacity of students to relate well to others, to manage and resolve conflicts, or to respect and appreciate different values, beliefs or cultures. Similarly, intrapersonal dimensions of competencies are becoming more relevant as individuals need to have the capacity to find and constantly adjust their right place in an increasingly complex world, manage their lives in meaningful and responsible way, and be able to recognise rights and limitations, those of themselves and others. All this underlines the importance of a broader notion of competence.

All this being said, it should be underlined that PISA's goal is not to create a single measuring rod and common denominator against which to benchmark national educational goals. Quite on the contrary, its aim is to create a multi-dimensional space in which countries can see and reflect on their relative strengths and weaknesses. It remains the responsibility of national experts and authorities in the *Grupo Iberoamericano de PISA* to examine what dimensions of PISA are covered and uncovered in their own schools, then to decide on whether the uncovered ones should or should not be taught. PISA is a powerful instrument to help raise important questions about national curricula. When a country discovers that their students are unable to do things that students in other countries can do, knowing whether this better success was because students in other countries learnt those things in school or out of school is only a secondary issue. The crucial one is: do *our* students need these things too, to be able to survive in our modern society? If the answer is yes, then it will be wise to have a serious look at the curriculum - to improve it in case these things are covered but not learnt, or to include them if they are not covered.

As a whole, the report reveals significant challenges which the Iberoamerican countries face in reaching high student performance standards across the entire population of 15-year-old children. It is unlikely that these challenges can be adequately addressed by incrementally stretching 19^{th} century school systems with 20^{th} century teachers to teach 21^{st} century students. In this world, where virtually everyone will have to acquire high-level skills, the task is to transform great sorting engines, that worked well when schools could afford to give everyone the same treatment in order to distinguish those who are more talented from those who are less so, into mass-customised learning systems that identify and develop the extraordinary talents of ordinary students. This is about creating a "knowledge rich" evidence-based education system, in which school leaders and teachers act as a professional community and have the authority to act, the necessary information to do so wisely, and access to effective support systems to assist them in implementing change.

Of course, everywhere education is already a knowledge industry in the sense that it is concerned with the transmission of knowledge; but in many countries education is still far from becoming a knowledge industry in the sense that *its own practices* are being transformed by knowledge about the efficacy of *its own practices*. In many other fields, people enter their professional lives expecting their practice to be transformed by research, that is not yet the case in education. There is, of course, a large body of research about learning but much of it is unrelated to the kind of real-life learning that is the focus of formal education. Even that which is, has an insufficient impact when practitioners work in isolation and build their practice on folk wisdom about what works. Central prescription of what teachers should do, which the report shows still dominates Iberoamerican schools, will not transform teachers' practices in the way that professional engagement, in the search for evidence of what makes a difference, can transform them.

The road from the comfortable, introverted, input-focussed, and evidence-light approach in education towards a demanding, outward-looking, results-focussed, evidence-informed approach is steep. But addressing the challenges will become ever-more important as the world has become indifferent to tradition and past reputations, unforgiving to frailty and ignorant to custom or practice. Success will go to those individuals and countries which are swift to adapt, slow to complain and open to change. The task for policy makers in the Iberoamerican countries will be to ensure that their country rises to the challenges.

The OECD stands ready to assist the Iberoamerican countries in this strive and some of the instruments it has developed together with non-OECD countries, in particular the in-depth reviews of education policies have proven to be strong assets in supporting reforms and in stimulating national and regional policy dialogue and co-operation.

Andreas Schleicher

1

The PISA Study

MAIN CHARACTERISTICS OF THE STUDY AND PARTICIPATING COUNTRIES

The OECD began the PISA project in 1997 in order to provide data on the educational performance of 15-year-old students. The initial intention was that these results would complement the range of educational indicators that had been published by the OECD since 1992. However, PISA has now grown above all into a commitment by governments to investigate how the changing pattern of results in educational systems reflects the achievements of their students. It also seeks to provide the groundwork for political dialogue and co-operation in defining and adopting educational objectives, and competencies that are applicable to adult life.

Moreover, the OECD, in co-operation with all the countries involved in PISA, has initiated a rigorous large-scale programme, which draws on the sound technical support of an international consortium of institutions with wide-ranging experience in educational evaluation and research. The Australian Council for Educational Research (ACER) heads this international consortium. The other partners are the National Institute for Educational Measurement (Citogroep, from the Netherlands), the National Institute for Educational Policy Research (NIER, Japan), the Educational Testing Service (ETS, USA), and WESTAT, a US company. Supervision, co-ordination and project management are the responsibility of the Secretariat (reporting to the Indicators and Analysis Division), which co-ordinates work, launches the overall project and controls its implementation; the PISA Governing Board, which establishes operational guidelines at its biannual meetings and makes the relevant decisions; and the National Project Managers, leading teams from within each country.

PISA assesses the knowledge and skills acquired by students up to the age of 15. The assessment of students at this age, rather than at a given level, has been very useful for the purpose of comparing results from very different educational systems. The study focuses on reading, mathematical and scientific literacy. These three key competencies are assessed in each PISA cycle, which takes place every three years. This makes it possible to establish a trend analysis showing how student results in the three competencies change over time. But on each occasion, one domain is dealt with in more detail, using broader testing, and a longer period of assessment. It may be stressed that the international report uses the term *competency* (mathematical, scientific and reading literacy) with a broad meaning, including several distinct processes, types of content and, in some cases, attitudes. However, in science the term *competency* also refers to the scientific processes, which form part of basic scientific practice: identifying scientific issues, explaining phenomena scientifically, and using scientific evidence. The concept is used with both meanings in this report, particularly in Chapter 3, where we try to be more exact in the use of the term to describe processes. We hope that this clarification will avoid any possible confusion, and as with the PISA reports of the OECD, it is important to take into account the context in which it is used in each case.

The idea of carrying out assessment of the key competencies, instead of the purely cognitive aspects of the different curricular areas, became more widespread from the 1990s onwards. *Learning: The Treasure Within* (UNESCO, 1996), was a report produced by the UNESCO International Commission on Education for the 21st century, chaired by Jacques Delors. This argued that four pillars could be considered to be essential in education: learning to know (the mastery of learning tools); learning to do (skill training in order to be effective citizens); learning to be (the fullest possible human development); and learning to live together (forming part of collaborative projects). The report also stressed the value and importance of individuals' emotional development, and discussed how learning processes could be steered in this direction.

The DeSeCo project of the OECD developed the overall frame of reference for the concept of key competencies, which PISA has adopted. Both the European Union and non-EU countries have also taken up the acquisition of key competencies, which has been introduced into their curricula. These countries include Spain, Portugal and France, which have followed the recommendations of the European Parliament and the Council of Europe on key competencies for lifelong learning (EU, 2006). These identify key competencies as being those that all individuals require for their personal fulfilment, as well as for social and civic participation and employability. The approach finally adopted by PISA member countries is related to the capacity of students to extrapolate from what they have learned, and apply their knowledge in new situations and contexts. It is not a question of assessing what the students are expected to have learned, but how successfully they can go beyond their learning experience, and apply their knowledge and skills in new contexts (OECD, 2007).

The teams of international experts and institutions which co-operate with PISA have developed a frame of reference for each competency, and for assessment objectives (OECD, 2006). This sets out the sample populations, exercises, scope of competencies, learning contexts and school environments, as well as the analyses and reports which emerge from the study.

The study is carried out with a representative sample of 15-year-old students from each participating country, federal state or community. The international sampling specifications require a minimum of 4,500 students and 150 schools in each country, or 50 schools per state, region or community. The sampling can be proportional to a given number of strata, and the sampling programme of each country requires the prior agreement of the International Consortium.

PISA includes different types of information. The students do paper-and-pencil tests, which last for approximately two and a half hours. From 2009 onwards, there will be an additional, optional test in electronic format. These tests combine multiple-choice and open-ended questions, organised in units based on a written text or a graph showing a real life situation. The assessment instruments specify the required percentages for each type of answer. A matrix format is used to ensure that all relevant aspects of each competency are properly covered, while each exercise is designed to be the right length for students. Consequently, sets of booklets were designed for students with different clusters of items that appear at the beginning and end, and in the middle of each booklet.

PISA has also designed survey questionnaires that obtain information from students, school principals and, optionally, the students' families. PISA also takes into account other factors related to educational performance, such as the students' attitudes and commitment, and the characteristics and resources of schools.

The results of PISA 2006 are examined in Chapter 3 of this report. As we will point out there, PISA seeks to establish a type of measurement, which provides a framework for international comparisons and trend analysis. The results measuring student performance have been calculated using Item Response Theory. They are shown on scales that use the average for OECD countries and invariants in PISA cycles. All PISA scales use an average score of 500 for OECD countries, with a standard deviation of 100.

In order to establish the educational significance of the spread of scores produced in PISA, these are grouped by proficiency level. Each performance level is accompanied by a description of the competencies and capacities generally shown by the students who achieve the range of scores corresponding to that level. The proficiency levels, which are discussed in Chapter 3, are as follows:

Table 1.1

Proficiency levels

Reading (2000)		Mathematics (2003)		Science (2006)	
Levels	**Lower level**	**Levels**	**Lower level**	**Levels**	**Lower level**
< 1	–	< 1	–	< 1	–
1	334.8	1	357.8	1	334.9
2	407.5	2	420.1	2	409.5
3	480.2	3	482.4	3	484.1
4	552.9	4	544.7	4	558.7
5	625.6	5	607.0	5	633.3
		6	669.3	6	707.9

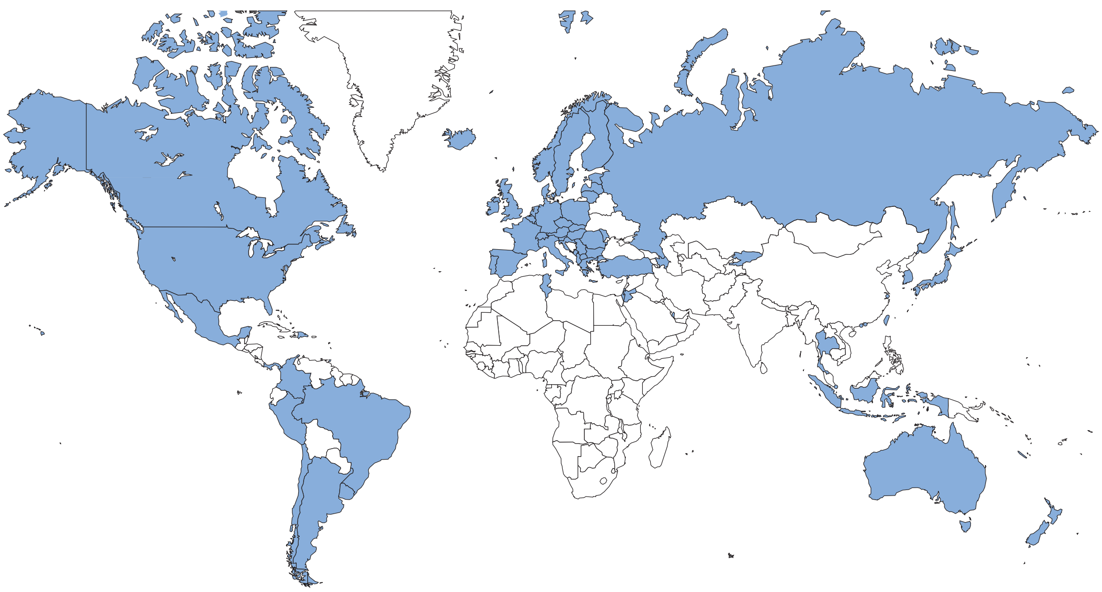
Source: PISA 2006.

The PISA study also collects important contextual information provided by students and school principals. This information, together with the results of the performance tests, sheds an interesting comparative light on the characteristic features of educational systems in the member countries. In addition, PISA breaks down information and results according to gender, academic record and the students' personal background, as well as the type of school, its management and its degree of autonomy.

The co-operative leadership and organisation of PISA involved the participation of 32 countries in 2000, 41 in 2003, 57 in 2006, and 64 in 2009. Moreover, 19 other countries are involved in a special implementation of PISA in 2010. The complete list of member countries in 2006 is shown in Graph 1.1, and in Table 1.2.

Graph 1.1

Countries participating in PISA 2009



To sum up, the main goal of PISA is to assess student performance in such a way as to clarify the functioning of distinct educational systems. It also establishes the key competencies that have been achieved by 15-year-old students, and enables comparisons to be drawn between the results for participating countries, federal states, regions and Autonomous Communities.

These are the main advantages of participating in this study for all countries involved, including the Iberoamerican ones. We may stress the usefulness of international performance comparisons for Iberoamerica because they permit data for the whole region to be interpreted in the light of the results from other, very different, parts of the world. Nevertheless, as this report demonstrates, the characteristics and situation of Latin American countries and their educational systems are such that they require an additional effort of contextualisation and cross-referencing. At the same time, the range of PISA countries is helpful in providing a broader framework.

THE GIP REPORT AND THE COMPARABILITY OF RESULTS BETWEEN COUNTRIES

The Iberoamerican PISA Group (GIP) was founded in 2005 in order to facilitate co-operation, reflection and mutual assistance between the Iberoamerican countries participating in PISA. The goal was to improve their contributions to technical decision-making, provide input into educational policies, and participate fully in PISA scientific work. It also sought to influence PISA's decision-making and overall planning in the light of the region's priorities, educational issues and conditions.

One of the greatest strengths of the GIP Report is that it enables comparisons to be made between the results obtained by member countries and regions, irrespective of their population size, curriculum, or other basic features of their educational systems. The GIP Report specifically attempts to offer a comparative analysis of the results from the Iberoamerican countries involved in PISA 2006.

A comparative dimension is inherent to all scientific research. Sartori and Morlino (1994) argue that comparisons make it possible to extend the evaluation criteria of a given theory or hypothesis, identify the conditions in which propositions are verified, and be aware of possible exceptions which may arise in specific contexts. The research with the greatest capacity for comparability is that which compares similar operations, results and processes between countries, using analogous procedures and data (Carnoy, 2006).

In establishing a comparative framework, the essential issue in the field of education is to establish a set of factors, which are likely to lead to given results. It is often debated whether the benchmarks for measuring educational performance should give higher priority to the quality of education, or the degree of social equity. Nevertheless, experience shows that the countries which have the best academic results are also those which have the highest levels of equity. It is therefore essential to take both aspects into consideration together.

The choice of a group of countries for comparative purposes may reflect cultural similarities, their historical background, or broadly comparable social, economic or political contexts. Another factor may be how interests converge when educational policy in the different countries is being evaluated. To a considerable extent, the configuration of the GIP responds to these criteria. In any case, the amount of comparable international information currently available means that it is also possible to refer to other types of experience for comparative purposes (and hence the inclusion of some non-GIP countries).

For this Report, the GIP member countries decided to adopt the following comparative framework:

- **GIP countries:** Argentina, Brazil, Chile, Colombia, Mexico, Portugal, Spain and Uruguay. These are compared with partner, or reference, countries.

- **Reference countries:** Finland, Canada, the United States, France, Greece, Italy, Japan, Korea, Kirghizstan, Qatar, and OECD averages.
- **Brazilian, Spanish and Mexican regions**, which are compared with OECD averages, and those of their respective countries.

Later chapters do not refer to the overall results from the group of countries participating in PISA 2006. The following table therefore summarises all their results in science, mathematics and reading.

Table 1.2

Countries participating in PISA 2006 and their range of results

Science			Mathematics			Reading		
	Average	S.E.		Average	S.E.		Average	S.E.
Finland	563	(2.0)	China Taipei	549	(4.1)	Korea	556	(3.8)
Hong Kong-China	542	(2.5)	Finland	548	(2.3)	Finland	547	(2.1)
Canada	534	(2.0)	Hong Kong-China	547	(2.7)	Hong Kong-China	536	(2.4)
China Taipei	532	(3.6)	Korea	547	(3.8)	Canada	527	(2.4)
Estonia	531	(2.5)	Holland	531	(2.6)	New Zealand	521	(3.0)
Japan	531	(3.4)	Switzerland	530	(3.2)	Ireland	517	(3.5)
New Zealand	530	(2.7)	Canada	527	(2.0)	Australia	513	(2.1)
Australia	527	(2.3)	Macao-China	525	(1.3)	Liechtenstein	510	(3.9)
Holland	525	(2.7)	Liechtenstein	525	(4.2)	Poland	508	(2.8)
Liechtenstein	522	(4.1)	Japan	523	(3.3)	Sweden	507	(3.4)
Korea	522	(3.4)	New Zealand	522	(2.4)	Holland	507	(2.9)
Slovenia	519	(1.1)	Belgium	520	(3.0)	Belgium	501	(3.0)
Germany	516	(3.8)	Australia	520	(2.2)	Estonia	501	(2.9)
United Kingdom	515	(2.3)	Estonia	515	(2.7)	Switzerland	499	(3.1)
Czech Republic	513	(3.5)	Denmark	513	(2.6)	Japan	498	(3.6)
Switzerland	512	(3.2)	Czech Republic	510	(3.6)	China Taipei	496	(3.4)
Macao-China	511	(1.1)	Iceland	506	(1.8)	United Kingdom	495	(2.3)
Austria	511	(3.9)	Austria	505	(3.7)	Germany	495	(4.4)
Belgium	510	(2.5)	Slovenia	504	(1.0)	Denmark	494	(3.2)
Ireland	508	(3.2)	Germany	504	(3.9)	Slovenia	494	(1.0)
Hungary	504	(2.7)	Sweden	502	(2.4)	Macao-China	492	(1.1)
Sweden	503	(2.4)	Ireland	501	(2.8)	Austria	490	(4.1)
Poland	498	(2.3)	France	496	(3.2)	France	488	(4.1)
Denmark	496	(3.1)	United Kingdom	495	(2.1)	Iceland	484	(1.9)
France	495	(3.4)	Poland	495	(2.4)	Norway	484	(3.2)
Croatia	493	(2.4)	Slovakia	492	(2.8)	Czech Republic	483	(4.2)
Iceland	491	(1.6)	Hungary	491	(2.9)	Hungary	482	(3.3)
Latvia	490	(3.0)	Luxembourg	490	(1.1)	Latvia	479	(3.7)
U.S.A.	489	(4.2)	Norway	490	(2.6)	Luxembourg	479	(1.3)

Science			Mathematics			Reading		
	Average	S.E.		Average	S.E.		Average	S.E.
Slovakia	488	(2.6)	Lithuania	486	(2.9)	Croatia	477	(2.8)
Spain	488	(2.6)	Latvia	486	(3.0)	Portugal	472	(3.6)
Lithuania	488	(2.8)	Spain	480	(2.3)	Lithuania	470	(3.0)
Norway	487	(3.1)	Azerbaijan	476	(2.3)	Italy	469	(2.4)
Luxembourg	486	(1.1)	Russia	476	(3.9)	Slovakia	466	(3.1)
Russia	479	(3.7)	U.S.A.	474	(4.0)	Spain	461	(2.2)
Italy	475	(2.0)	Croatia	467	(2.4)	Greece	460	(4.0)
Portugal	474	(3.0)	Portugal	466	(3.1)	Turkey	447	(4.2)
Greece	473	(3.2)	Italy	462	(2.3)	Chile	442	(5.0)
Israel	454	(3.7)	Greece	459	(3.0)	Russia	440	(4.3)
Chile	438	(4.3)	Israel	442	(4.3)	Israel	439	(4.6)
Serbia	436	(3.0)	Serbia	435	(3.5)	Thailand	417	(2.6)
Bulgaria	434	(6.1)	Uruguay	427	(2.6)	Uruguay	413	(3.4)
Uruguay	428	(2.7)	Turkey	424	(4.9)	Mexico	410	(3.1)
Turkey	424	(3.8)	Thailand	417	(2.3)	Bulgaria	402	(6.9)
Jordan	422	(2.8)	Rumania	415	(4.2)	Serbia	401	(3.5)
Thailand	421	(2.1)	Bulgaria	413	(6.1)	Jordan	401	(3.3)
Rumania	418	(4.2)	Chile	411	(4.6)	Rumania	396	(4.7)
Montenegro	412	(1.1)	Mexico	406	(2.9)	Indonesia	393	(5.9)
Mexico	410	(2.7)	Montenegro	399	(1.4)	Brazil	393	(3.7)
Indonesia	393	(5.7)	Indonesia	391	(5.6)	Montenegro	392	(1.2)
Argentina	391	(6.1)	Jordan	384	(3.3)	Colombia	385	(5.1)
Brazil	390	(2.8)	Argentina	381	(6.2)	Tunisia	380	(4.0)
Colombia	388	(3.4)	Colombia	370	(3.8)	Argentina	374	(7.2)
Tunisia	386	(3.0)	Brazil	370	(2.9)	Azerbaijan	353	(3.1)
Azerbaijan	382	(2.8)	Tunisia	365	(4.0)	Qatar	312	(1.2)
Qatar	349	(0.9)	Qatar	318	(1.0)	Kirghizstan	285	(3.5)
Kirghizstan	322	(2.9)	Kirghizstan	311	(3.4)			
OECD Average	***500***	***(0.5)***	***OECD Average***	***498***	***(0.5)***	***OECD Average***	***492***	***(0.6)***
OECD Total	***491***	***(1.2)***	***OECD Total***	***484***	***(1.2)***	***OECD Total***	***484***	***(1.0)***

Source: PISA 2006.

A key aspect of the co-operation between GIP members is the scientific and technical capacity of the teams responsible for carrying out the studies in each country. The preparation of this report was an excellent way to promote co-operation between the Iberoamerican countries. It has given all those in positions of responsibility within PISA who worked on it the opportunity to deepen their understanding of the report, and learn about the educational realities of GIP countries and their regions.

2

Education and the national contexts of the Iberoamerican countries in PISA

INTRODUCTION

This chapter provides a brief review of certain essential features of the educational systems and the level of economic and social development in each country. Its point of departure is that the welfare and development of each country cannot be separated from the capacity of different educational systems to achieve equitable and high quality levels of learning.

The following analysis takes four key aspects into account. Firstly, it examines a group of indicators that sum up population characteristics, and the level and type of economic and social development in the countries under review. Secondly, information is provided on the degree of investment in education, using various types of measurement. Then, several educational indicators are analysed by level, showing differential levels of cover in the educational systems of these countries. Finally, the effectiveness of these systems is compared, using indicators of results and educational performance. The aim is to relate learning achievement to different national contexts.

From the outset, it should be stressed that great inequality is the most salient characteristic of Latin America in general, as well as the Iberoamerican countries participating in PISA. It is reflected in social and educational indicators that reveal significant differences both between different countries, and quite often within countries. This inequality needs to be addressed when we turn to the four aspects mentioned above. It underpins the complexity of the analyses required to compare and elucidate economic, social and educational realities, while it also clarifies educational results and the factors that have shaped them, or might help to improve them. In view of this diversity, the following pages can only claim to shed a very modest light on a complex picture, but they nevertheless highlight the most significant indicators in national educational contexts.

Most of the indicators used here come from the international organisations that have prepared them, and provide data for GIP countries based on similar criteria. This is the case of the figures provided by the UNESCO Institute for Statistics and the World Bank. Nevertheless, there was sometimes a significant discrepancy between international data and official statistics provided by the different countries, and where this occurred it was decided to follow official national statistical data. This has been indicated in the corresponding notes.

POPULATION

The GIP has eight members, which is a small proportion of all Iberoamerican countries. However, in demographic terms, the 453 million inhabitants of these eight countries correspond to approximately 75 % of the population of Iberoamerica. This total represents roughly 25 % of the population of PISA countries. As was pointed out above, there are significant differences in population size between GIP countries. Brazil has a population of 187 million inhabitants, and Mexico 104 million, while at the other extreme, Portugal has less than 11 million inhabitants, and Uruguay a population of just over three million.

The first demographic indicator that needs to be taken into account is the extent of urbanisation. This represents a key aspect for assessing educational achievement, and proposing improvements. Several studies have shown that scattered settlement patterns in rural areas, along with the nature of the rural population's access to basic goods and services and its participation in productive work, call for special educational programmes which allow for acceptable levels of quality and equity.

The distinction between urban and rural populations is generally made on the basis of population size.

Table 2.1
Total population of GIP countries and of countries participating in the study (2006)

	In thousands
Argentina	39,134
Brazil	187,228
Chile	16,433
Colombia	43,405
Spain	44,121
Mexico	104,221
Portugal	10,589
Uruguay	3,314
Korea	48,418
U.S.A.	299,398
Finland	5,266
Qatar	821
GIP countries	452,695
PISA countries	1,993,323
Latin America and the Caribbean	556,145
Iberoamerica	610,856

Source: World Bank. Health, Nutrition and Population (HNP) Statistics.
Data for Colombia: DANE, Projection of the National Population Census 2005.
Data for Brazil: IBGE/PNAD 2006.

However, other factors may vary significantly: the distance to larger urban centres, the availability of efficient means of communication and transport, the provision of services such as electricity and telecommunications, and so on. It is clear that the conditions of rural schools in isolated areas with few resources in the poorest countries are quite different from those in richer countries, which are in areas with comparable population density, but otherwise very different conditions.

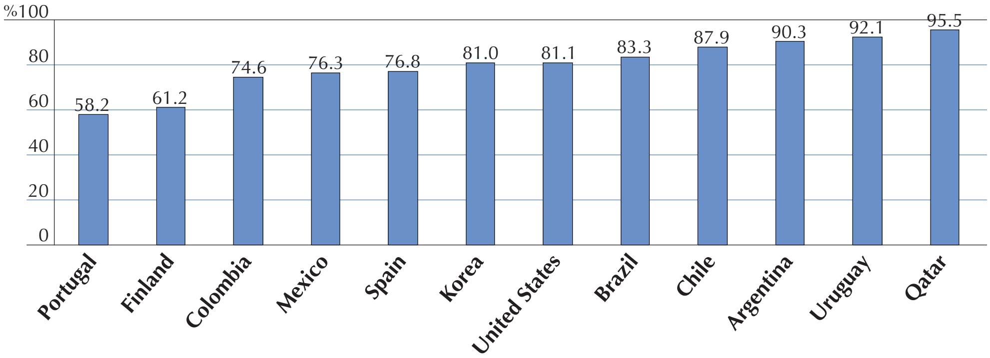
Although urban / rural classification is not identical from country to country, Uruguay, Argentina and Chile stand out as those with the most highly urbanised populations in the GIP. Among Latin-American countries, Colombia and Mexico represent the opposite extreme, while Portugal emerges as the country with the highest proportion of its population living in rural areas.

With reference to the other countries with which comparison is made, Qatar has, proportionally, the most highly urbanised population. Korea and the United States are in an intermediate position, between Spain and Brazil, while the figure for Finland is similar to that of Portugal (Graph 2.1).

It may be stressed that the educational implications of the rural or urban character of a given area are not the same for each country. Some countries, or Spanish Autonomous Communities such as Galicia and Castile-Leon, have highly rural populations but obtain very good results in PISA. But this is also the case of other, strictly urban countries and communities, such as Hong Kong. We need to correlate the degree of urbanisation of a society with other factors, such as those mentioned above, to achieve an accurate picture of educational results.

Graph 2.1

Urban population as a percentage of the total population (2006)



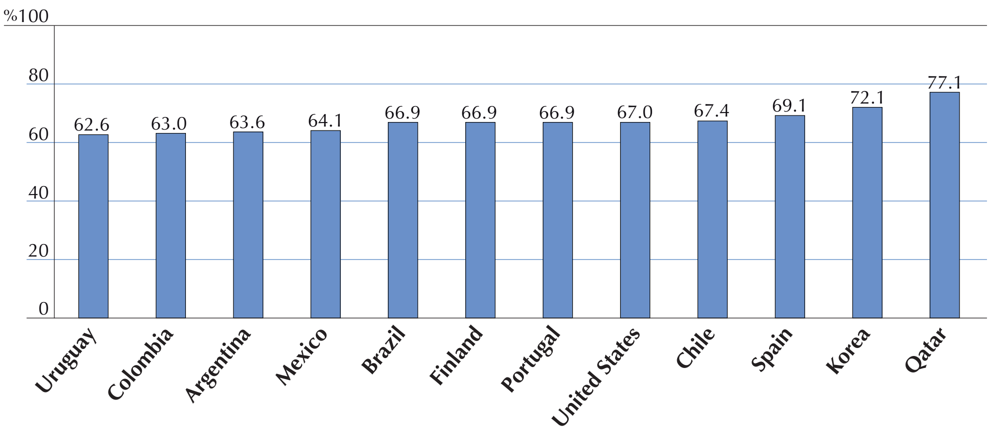
Source: World Bank, Health, Nutrition and Population (HNP) Statistics.
Data for Colombia: DANE, National Population Census 2005.
Data for Brazil: IBGE/PNAD 2006.

A second key demographic indicator is the proportion of the total population that is aged between 15 and 64 years old. This provides us with an approximate guide to the size of the working population. A country with a high active/non-active ratio is considered to have greater development potential than one with either a mainly young, or a basically elderly, population. Graph 2.2 shows that, except for Chile, the Latin-American countries are those that have proportionally the lowest populations aged between 15 and 64. In terms of demographic structure, there may be two quite different explanations: either these countries have a proportionally younger population than elsewhere, or their populations are older.

The proportion of the population in Uruguay, Argentina, Mexico and Colombia aged between 15 and 64 years old is around 65 %. Chile and Spain are the GIP countries with the highest percentage in this age bracket. Portugal and Brazil are in an intermediate position, with figures similar to those of Finland and the United States (Graph 2.2).

Graph 2.2

Population between 15 and 64 as a percentage of the total population (2006)



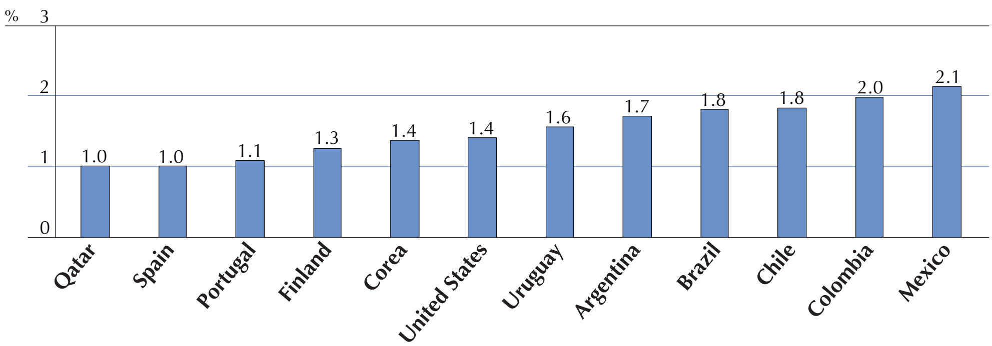
Source: World Bank, Health, Nutrition and Population (HNP) Statistics.
Data for Colombia: DANE, National Population Census 2005.
Data for Brazil: IBGE/PNAD 2006.

In order to characterise the population of PISA member countries, it is helpful to examine the proportion of 15-year-olds, as this is the age when assessment is carried out. The Latin American countries are those with the highest percentages, ranging from 1.6 % in Uruguay to 2.1 % in Mexico. The lowest, at around 1 %, are those of Spain and Portugal (Graph 2.3).

This matches differing demographic patterns in the different countries, as Latin American countries have a younger population than the other countries that were compared.

Graph 2.3

Population of 15-year-olds as a percentage of the total population (2005)



Sources: 15-year-old population: PISA 2006.
Total population: World Bank, Health, Nutrition and Population (HNP) Statistics.

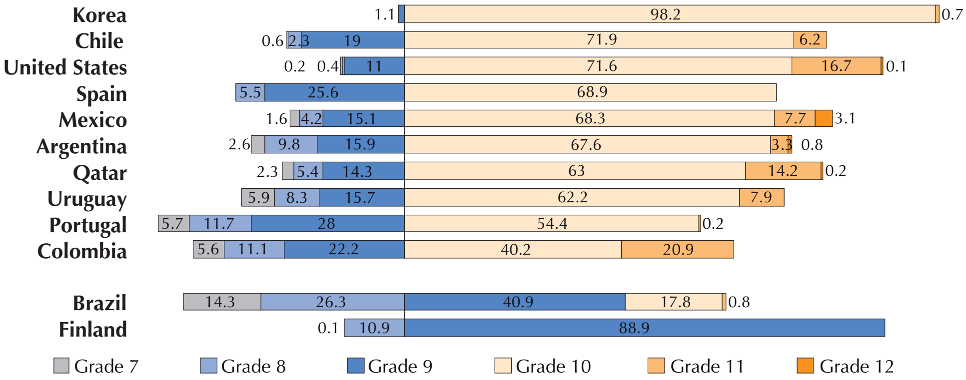
Attention should be drawn to the extent of variations in different GIP countries. Colombia and Mexico have no less than twice the proportion of 15-year-olds of Spain and Portugal. These figures reflect different stages of historical development. In some countries, the demographic transition was completed several decades ago, while in others it is today in its later stages. The rate of demographic growth has been explosive in Colombia and Mexico, where population doubled in less than 20 years during the second half of the 20th century. However, it has remained relatively stable in Spain (although major recent migration flows are changing this), Portugal, and to a lesser extent, Argentina and Uruguay. The pressure of rapid demographic change on educational systems is an essential variable in any analysis.

As Graph 2.4 shows, the 15-year-old students assessed by PISA are at different grades in their educational systems. As was mentioned above, PISA measures the level which students have acquired in key competencies by the age of 15, which is the age at which compulsory education ends in most countries. The results can therefore be used as indicators of the quality of educational systems, irrespective of curricular differences, or how long students have studied.

The information shows that countries have strongly differentiated educational systems with regard to the contrast between the school paths that were initially planned, and those that were observed. In Korea, for example 98.2 % of students who participated in PISA 2006 were at modal grade (4 years of intermediate level education), followed by Chile and the United States. In contrast, there was a greater gap in Portugal and Colombia, where the percentage of PISA students at modal grade was 54.4 % and 40.2 %, respectively. The data from Brazil and Finland must be handled carefully as primary education begins in both countries at the age of 7 (Graph 2.4), so their modal grades are not identical to those of other countries. If adjustment is made for this, Finland is in second place (almost 9 out of every 10 students are at the corresponding grade at 15), while Brazil is in penultimate position (40.9 % study at modal grade).

Graph 2.4

Population of PISA 2006 students by grade



Source: PISA 2006.

In Brazil and Finland the modal grade is Grade 9, as primary education begins at 7.

These differences in the distribution by grades in PISA countries show the importance of considering factors such as educational backwardness, or late entry into the educational system, when evaluating PISA results. To a significant extent, educational backwardness can be related to students at lower performance levels repeating a year, which is relatively frequent in several Iberoamerican countries. If the aim is to evaluate educational systems, it is therefore necessary to determine how far the heterogeneity in observed educational pathways has influenced the comparability of the results among countries.

PISA data on the proportion of young people who are at different grades in educational systems may differ significantly from the official figures for each country. While the sampling process may entail possible inaccuracies, the figures may also vary according to the specific time of year at which it is taken and the date on which students are enrolled. PISA defines its target population as being students aged between 15 years and 3 months, and 16 years and 2 months, on the date of implementation. This does not necessarily match the criteria of all countries with regard to registering the age of students enrolled at each educational level.

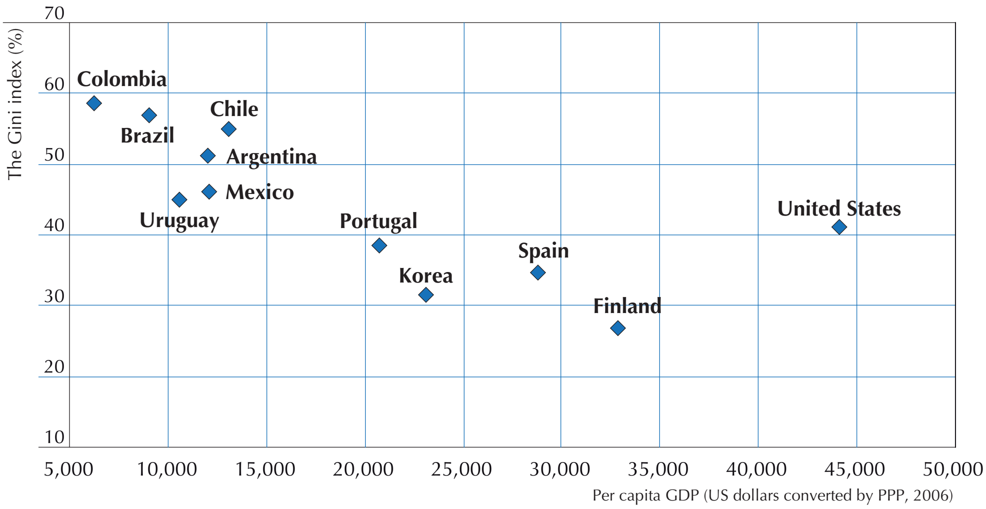
ECONOMIC AND SOCIAL DEVELOPMENT

A second issue in making a comparative analysis of the GIP is how to deal with levels of economic and social development. In this respect, two indicators that are generally used to provide information on income level, and the degree of equity of their internal distribution, can be studied together. Per capita GDP is the indicator most frequently used to indicate levels of wealth, while the Gini index provides a good approximation to the way in which wealth is distributed, more or less unequally, within countries.

The GIP Latin-American countries are grouped close to each other in Graph 2.5. Their per capita GDP ranges from 6,000 to 13,000 US dollars, converted through PPP, and the Gini index is between 45 and 57. Argentina, Mexico and, especially, Chile have the highest per capita GDP figures. The indices for Chile, together with Brazil and Colombia, show the most marked inequality, while Mexico and Uruguay have a more equitable wealth distribution, closer to that of the United States.

The GDPs of Spain and Portugal are considerably higher than in other GIP countries, and they also have a significantly more equitable distribution of income. Among the other countries under review, Korea and Finland have the most equitable distribution. The latter also has the second highest GDP, although this is well below the highest GDP, that of the United States.

Graph 2.5
Per capita GDP and Gini Index



Gini Index Sources: Report on Human Development PNUD 2007-2008.
GDP Source: International Monetary Fund, World Economic Outlook Database, April 2008.
The data for Brazil and Uruguay are estimates.

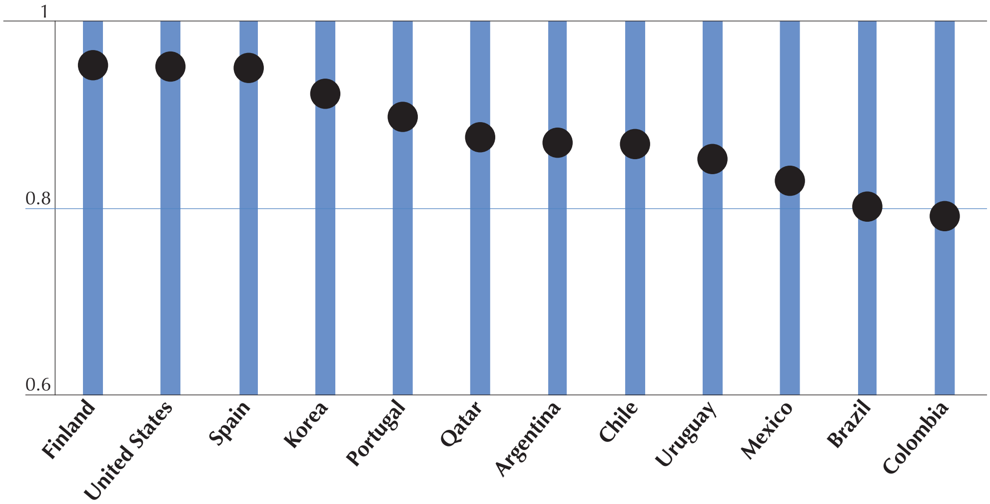
The debate on how to define the concept of development has moved on from an almost entirely economy-centred perspective, based on economic growth, to the acceptance of a plurality of dimensions which can be grouped together under the heading “human dignity”. The United Nations Development Programme has played a role in shaping this approach to human development. Its numerical measure, the Human Development Index (HDI), reflects a multidimensional outlook, which maintains that a society’s level of development needs to be evaluated by bringing together three key aspects: health, education and wealth.

With regard to the first dimension, life expectancy at birth is seen as an index of the right to live a long and healthy life. Adult literacy rates and cumulative gross enrolment rates in primary, intermediate and superior educational levels measure the second aspect (the right to education). For the third aspect, use is made of per capita GDP, which is the indicator that generally measures economic welfare.

The data again show that Portugal, and especially Spain, are better classified than the GIP Latin-American countries, with figures similar to other countries such as Finland, the United States or Korea. Colombia and Brazil are at the other extreme, while Argentina, Chile and Uruguay are in an intermediate position.

Graph 2.6

Human development index



Source: Report on Human Development PNUD 2007-2008.

INVESTMENT AND EXPENDITURE IN EDUCATION

Investment in education measures how far each country is attempting to improve the quality of learning, reduce social inequalities and provide a stimulus to the capacity for economic innovation and development. The indicators analysed here therefore give information on the extent to which educational policies are being prioritised.

The public sector is not the only agent investing in education. Depending on the configuration of the welfare system, other entities, such as the family, churches or companies, participate to a greater or lesser degree in the assignment of human, material or financial resources to the educational system. A broad indicator of all these resources is the percentage of the GDP assigned to education, including both public and private expenditure. However, it is difficult to calculate the degree of investment by private sources accurately. In order to interpret this indicator correctly, per capita GDP, population at school age, schooling rates, and the structure of the educational system, must all be taken into account, along with other factors.

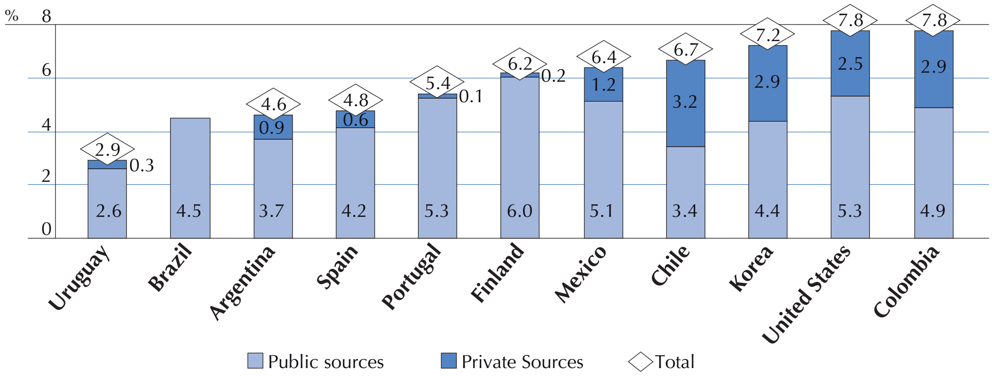
Graph 2.7 shows that countries differ significantly both in the resources they assign to education, and state participation in this expenditure. Within the GIP group, Chile, Mexico and especially Colombia, invest a very high percentage of their GDP (over 6 %). Portugal, Spain, Argentina and Brazil are in an intermediate position (about 5 %), while Uruguay is well below, at rather less than 3 %.

Moreover, state participation in the sector varies considerably from one country to another. In comparative terms, public expenditure is very high in Brazil, Uruguay, Argentina, Spain, and especially Portugal and Finland, as measured by total spending on education. Private sources account for a very high percentage of educational investment in Colombia, and even more so in Chile, where it is half of total expenditure. The United States and Colombia are the countries that invest the highest percentage of their GDP in education (7.8 %), with slight differentiation in the proportion coming from private and public sources.

While there are some inherent difficulties in measuring private expenditure, it is possible to analyse public spending with a greater degree of reliability. Public expenditure in education, measured as a percentage of GDP, is an indication of the level of national resources that the state assigns to educational policies. By

Graph 2.7

Total private and public expenditure in education as a percentage of GDP for all levels of education (2004)



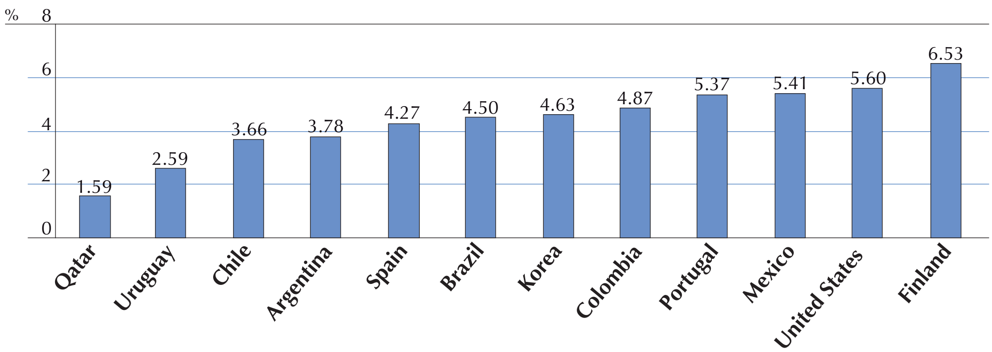
Source: UNESCO, Institute of Statistics.
Data for Brazil: INEP/MEC/Brazil.
The source above provides total expenditure and public expenditure; private expenditure has been estimated by calculating the difference between them.
The data for private sources are not available for Brazil; in other countries, items of private expenditure may not be accounted for.

this criterion, Finland is the country with the highest percentage (over 6 %), followed by the United States, Portugal and Mexico with similar percentages (all three, at more than 5 %). Next are Colombia and Korea, while Uruguay and Qatar come last, investing less than 3 % of their GDP (Graph 2.8).

It is clear that the value that attributed to each country by this indicator needs to be interpreted cautiously, as absolute levels of wealth, and the place of the state in the national economy, will influence it. Countries in which the state plays a weak role, or those with low GDPs, will inevitably figure well down on this scale, however much they seek to invest in education.

Graph 2.8

Percentage of GDP assigned to public expenditure in education (2004)



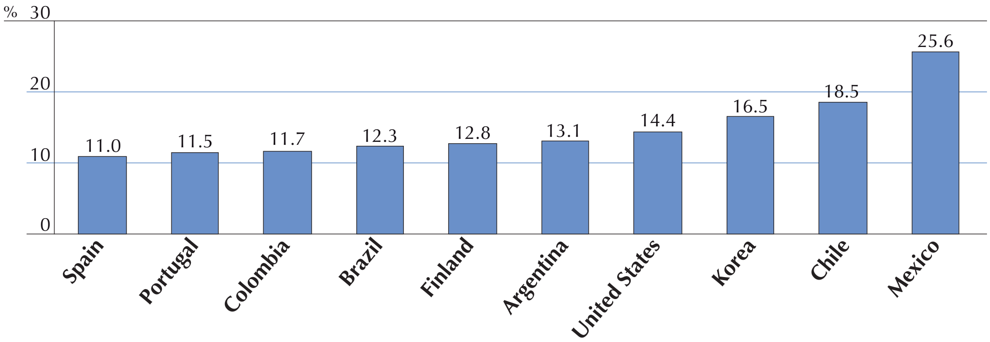
Source: UNESCO Institute for Statistics.
Source for Brazil: INEP/MEC/Brazil.

In order to counteract the influence of these two factors, another indicator can be studied, namely spending on education as a percentage of total public expenditure. (See Graph 2.9.)

Using this second type of measurement, Mexico is the country which invests the highest proportion of its resources, at more than 25 %, while Chile is in second place at rather under 20 %. Other countries have broadly comparable percentages, ranging from approximately 16 %, to 11 % for Spain. No data are available for Uruguay and Qatar.

Graph 2.9

Percentage of total public expenditure assigned to education (2004)



Source: UNESCO, Institute for Statistics.
Data for Brazil: WEI 2007, Education Counts.

It is possible for a country to make significant investment in education, as measured against its GDP and total public expenditure, and yet have overburdened educational systems. In this case, the yield from investment is qualitatively less than that of other countries that have made comparable levels of investment, but have lower educational demand. The assignment of a specific level of resources does not necessarily prove that sufficient attention is being given to social needs in education. A third indicator, public expenditure per student as a percentage of per capita GDP, enables us to make this qualitative distinction. This is established by correlating the material resources being invested in the educational system with the number of students being schooled at different levels. This provides an indicator that can generally be linked to the quality of education.

Adopting this approach, Finland and Portugal are the countries with the highest public expenditure per student as a percentage of their own GDP (about 30 %). The rate in the United States, Spain and Colombia is over 20 %, while the other countries are below this proportion. These percentages are marked within a small rhombus above the bars that correspond to each country in Graph 2.10. Each bar refers to a level in the educational system. The greatest differences between countries are found in the financing of higher education, while contrasts are less marked at lower levels.

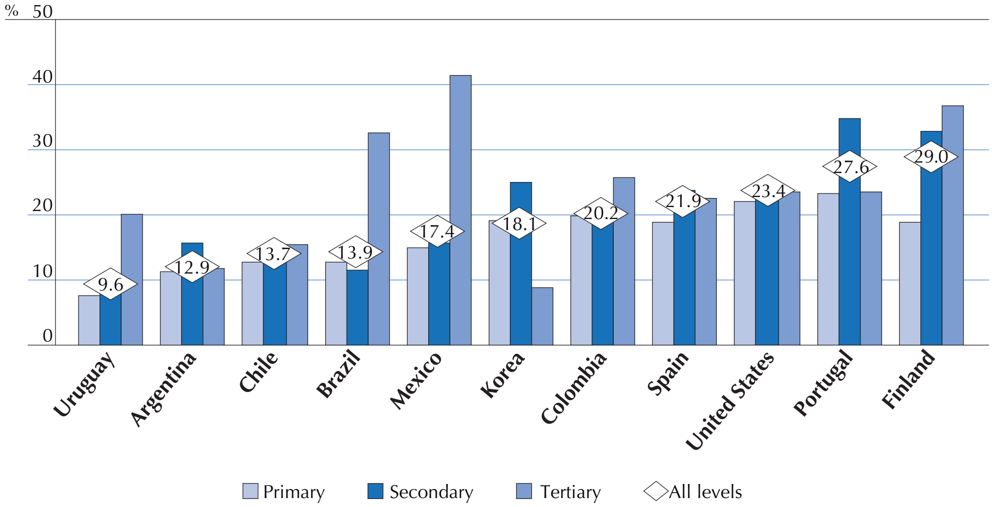
This indicator gives the highest figures to the United States and Portugal in primary education. Korea, Colombia, Spain and Finland follow at intermediate levels. Portugal is the country with the highest expenditure per student in secondary education, followed by Finland, which has a similar percentage. The United States, Spain and Korea are at an intermediate level, each with very similar figures.

In tertiary education, Mexico, is the country with the highest public expenditure per student as a percentage of the GDP (more than 40 %), followed by Finland and Brazil. Next, there are a number of countries that share a comparable level of investment in tertiary education: Colombia, the United States, Portugal, Spain and Uruguay. The greatest differences between countries for this indicator are found in tertiary education.

Another way of examining the quality of expenditure in education is to consider the relative importance of different items in the assignment of resources. It is assumed that the best-performing educational systems

Graph 2.10

Public expenditure per student as a percentage of per capita GDP (2004)



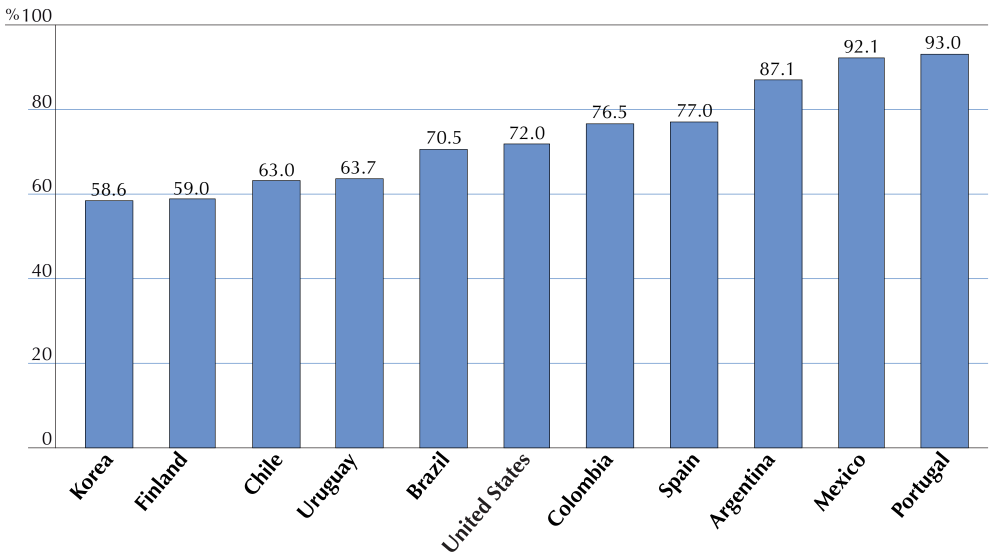
Source: UNESCO, Institute for Statistics.

assign a considerable proportion of their resources to investment in the form of building infrastructure, equipment, teaching materials, and so on. A budget with a high level of investment implies greater flexibility in extending and diversifying the educational system. On the other hand, a rigid structure in educational expenditure – one that is more closely tied to salaries – is a break on its dynamism.

Graph 2.11 shows the percentage of the current expenditure assigned to staff in each country. The figures show marked variations. Portugal and Mexico are the countries that assign the highest percentage of current

Graph 2.11

Percentage of current expenditure in primary, secondary and non tertiary post-secondary education assigned to staff (2004)



Source: UNESCO, Institute for Statistics.
Data for Brazil: WEI-Education 2007, UNESCO Institute for Statistics, Montreal, 2007.

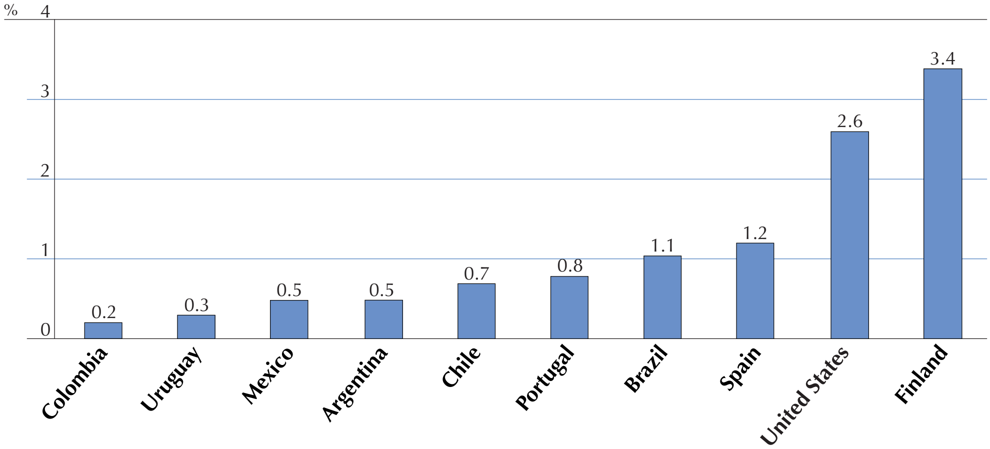
expenditure to staff (more than 90 %). At the other extreme, Korea and Finland are the countries with the lowest percentage (less than 60 %).

The final indicator on expenditure in education that will be considered at this point is the investment that each country assigns to Research and Development (R&D). This area can be defined as creative work, that is carried out systematically to improve understanding of humankind, culture and society, and the subsequent use of this knowledge in the development of new applications.

Graph 2.12 shows expenditure on R&D, calculated as a percentage of each country's GDP. As it indicates, there are significant variations in the investment by different countries. Finland and the United States are the leaders in R&D investment, with more than 2.5 %, while Uruguay and Colombia are lowest on the scale.

Graph 2.12

Expenditure on R&D as a percentage of GDP



Source: UNESCO, Institute for Statistics.

The data for Colombia are for 2001, Uruguay 2002, Chile and Mexico 2005. The data for other countries are from 2006.

SCHOOLING

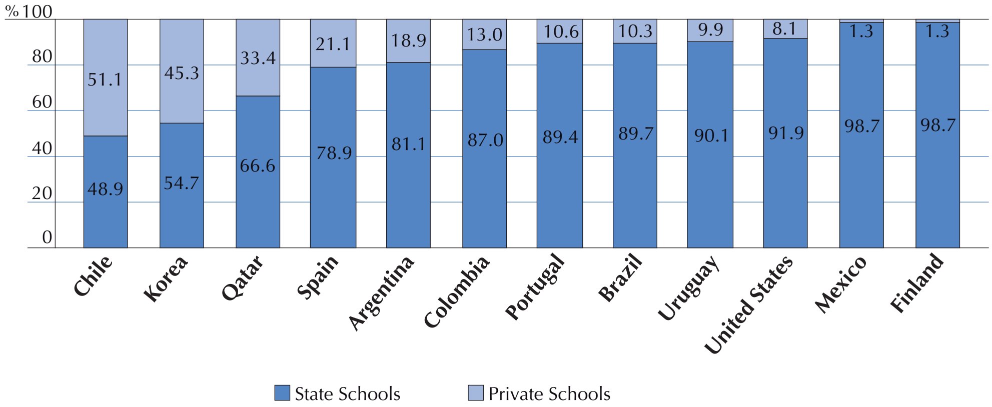
Schooling indicators are essential in analysing the development and implantation of educational systems in each country. In fact, the nations that achieve high levels of schooling in successive stages of the education cycle are the best equipped to face the challenges of the knowledge society. Sooner or later, a sustained increase in the level of education will result in greater opportunities for equitable development. This means that more educated societies create a greater capacity for innovation and change, which is an essential prerequisite for their successful entry into the process of globalisation. Moreover, once education has become universal in a country, this reduces linguistic and social handicaps, and promotes equality of opportunity.

The first indicator we will consider is the pattern of enrolment in the state and private sectors. As Graph 2.13 shows, the participation of these two institutional sectors in school enrolment at the level of primary education varies from one country to another, while this difference is not necessarily due to the relative importance of distinct sources of expenditure. The absence of a correlation between financing and type of schooling suggests that educational systems are being managed in different ways. In some countries, a high level of public financing may coincide with significant private sector participation in enrolment. Where this

occurs, mixed systems predominate, and involve state transfers to families and private schools, which are then directly responsible for the management of resources.

Graph 2.13

Percentage of students attending state and private schools in primary education (2005)



Source: UNESCO Institute for Statistics.

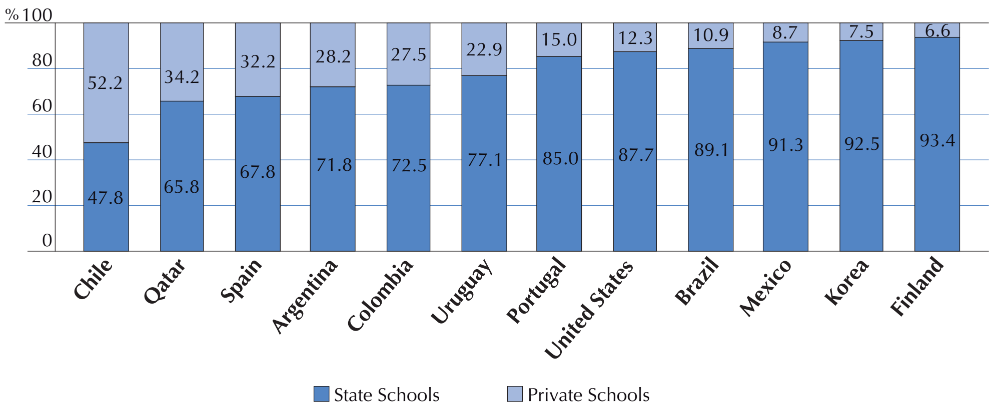
Data for Colombia (primary and secondary): Ministry of Education, SINEB.

Data for Mexico: «Educational System of the United States of Mexico, main figures, 2005-2006 school cycle», Secretariat of Public Education of Mexico.

Graph 2.14 gives this type of information for secondary education. Over 80 % of the students in Uruguay, Brazil, Mexico and Portugal attend state schools at this level. This proportion falls to between 70 % and 80 % in Colombia, Argentina and Spain. In Chile, which has the strongest private sector in the GIP, the proportion is less than half of this level. Finland and Korea have the highest percentage of students educated in state schools (98.7 %), followed by the United States (89.7 %).

Graph 2.14

Percentage of students attending state and private schools in secondary education (2005)



Source: UNESCO Institute for Statistics.

Data for Colombia (primary and secondary): Ministry of Education, SINEB.

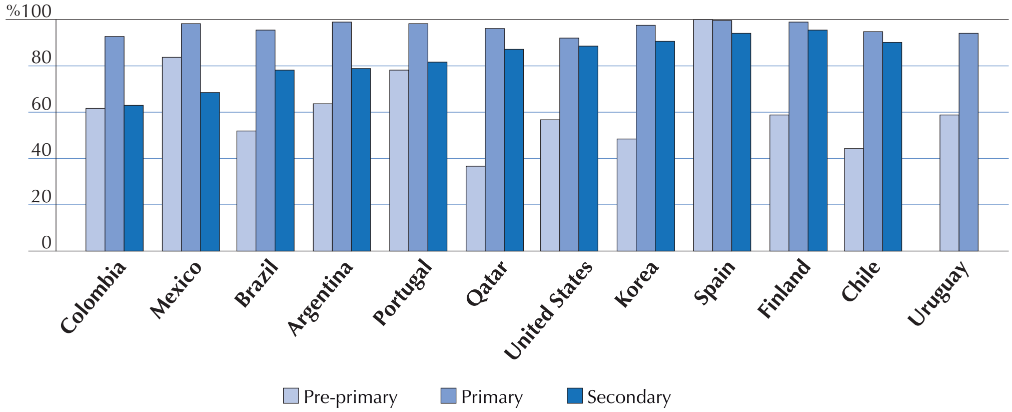
Data for Mexico: «Educational System of the United States of Mexico, main figures, 2005-2006 school cycle», Secretariat of Public Education of Mexico.

Secondly, net schooling rates are taken into consideration at the different stages. They are defined as the relationship between those schooled at each stage, and the overall population that is theoretically of school age.

As Graph 2.15 shows, only Spain approaches 100 % schooling at the pre-primary stage. It is followed by Mexico, Portugal, Argentina and Colombia, with 83 %, 79 % 63 % and 62 %, respectively. The other countries in the Iberoamerican group, and the world reference group, do not exceed 60 % in pre-primary schooling.

Graph 2.15

Net schooling rate at different stages (2005)



Source: UNESCO Institute for Statistics.
Data for Colombia (primary and secondary): calculations based on information from the Ministry of Education SINEB, 2006. The percentage of net cover in pre-primary schooling corresponds to the compulsory level, called transition.
Data for Chile (primary and secondary): Ministry of Education, Department of Studies and Development, Education Indicators in Chile 2007, draft version.

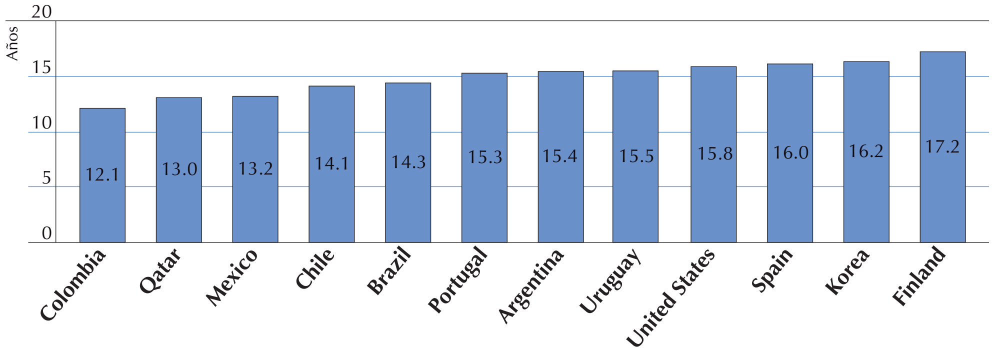
Primary education is compulsory in all countries, and no rate is lower than 92 %. However, there are still differences, which are likely to disappear over time in view of the importance of education at this stage: all countries should achieve full schooling. In the Iberoamerican group, this is practically already the case in Spain, Argentina, Portugal and Mexico. All the countries under review exceed a schooling rate of 96 %, with the exception of the United States, at 92 %. However, these figures need to be treated with some caution. It has been established that countries with the lowest rates usually have less reliable statistics, so their figures may be underestimates. Conversely, the opposite may sometimes also be the case.

The difference between countries is greater in secondary education, including both lower and higher levels. Within the GIP, only Spain exceeds 90 %. With the exception of Chile, no Latin-American country under review reaches the threshold of 80 %. (There are no data for Uruguay.) It is clear that region faces a daunting challenge if it is to achieve universal secondary education. In the other countries, rates exceed 87 %, while Finland has the highest, at 95 %.

Thirdly, another important indicator is school life expectancy at the age of 4. This is defined as the total number of years which a student of that age is expected to spend at school, assuming that the likelihood of being enrolled at a given age is equal to the current rate of enrolment. In other words, this indicator measures levels of educational development through the number of years of education that a child can expect to receive (UNESCO, 2003).

Graph 2.16

School life expectancy at the age of 4 (2005)



Source: UNESCO Institute for Statistics.
The data for Argentina, Brazil and Uruguay are from 2004.

In 2005, there were nearly four years of difference between the Iberoamerican countries. Spanish students had the highest school life expectancy of 16 years, followed by Uruguayans, Argentineans and Portuguese with figures of just over 15. Brazilians and Chileans had an expectancy of 14.3 and 14.1 years, respectively, Mexicans 13.2, while Colombian students came in last place with a school life expectancy of 12.1 years. Among the non-GIP countries under review, the Finns had the highest school life expectancy at the age of four (17.2 years), followed closely by the Koreans (16.2) and the Americans (15.8).

EDUCATIONAL RESULTS

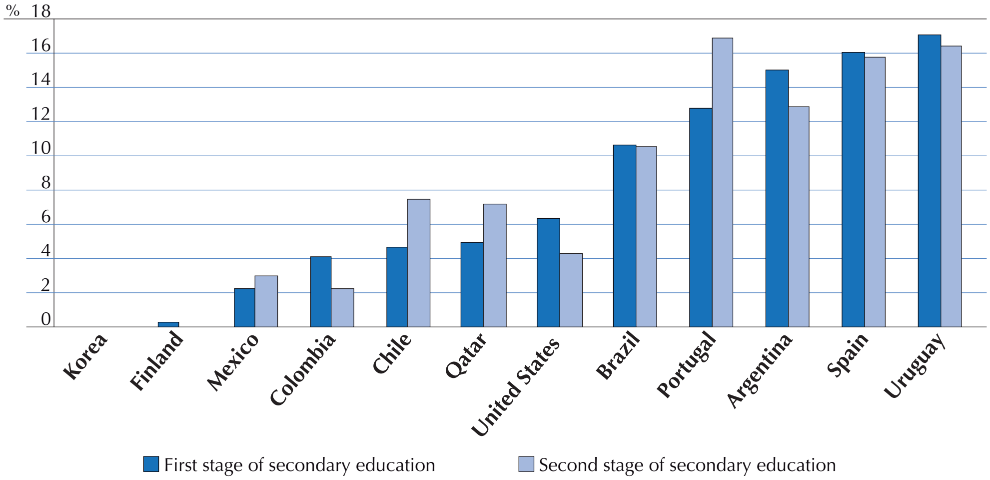
Educational results include the competencies acquired by students, but also how far they manage to complete certain educational levels. An analysis of levels of competency will be made in later chapters. At this stage, we will focus on studying indicators of the second type of educational result, which are essential to place learning in context from a comparative educational viewpoint. Two countries with high levels of enrolment may have different high school graduation rates, so they are producing distinct learning outcomes. This may also happen if we consider factors such as dropout rates or backwardness. We need to take into account both the internal functioning of the system, and the educational levels that are achieved by the population.

Firstly, in order to evaluate the internal efficiency of the system, it is important to analyse the rate of grade repetition. This indicator is defined as the proportion of students enrolled at a given level during a school year who go on to study at the same level in the following school year. This report has taken the data provided by PISA on the proportion of students repeating courses in the schools participating in the study.

According to the information supplied by the principals of schools that participated in PISA 2006, repetition is practically non-existent in Finland and Korea. The figures corresponding to Chile, Colombia, Mexico, the United States and Qatar are below 8 %. In Argentina, Spain, Portugal and Uruguay the percentage is over 10 %. Such heterogeneity in results is due to each country's distinct educational policies. However, we may stress that the data are based on the information that was collected on the students who were assessed in PISA 2006. This makes it difficult to ascertain how far early grade repetition leads some students to leave the system before completing compulsory education. This occurs in several countries, for example Mexico and Colombia, and may partially explain the low rates of repetition in these PISA countries.

Graph 2.17

Rates of grade repetition (2006)



Source: PISA 2006

In general, there are no major differences between the percentages for the first and second stages of compulsory education. We find a higher proportion of repeaters in lower secondary education in Argentina, Colombia, Uruguay and the United States, while the percentage is higher for the second stage in Chile, Portugal and Qatar. However, the data are very comparable for both stages in the other countries.

Secondly, we may look at dropout rates in primary education. This indicator refers to the percentage of students who leave school during a given academic year. This is calculated by finding the difference between 100 % and the combined promotion and grade repetition rates.

The data also show the wide disparity between the countries under review. Brazil and Uruguay are the GIP members with the highest dropout rates in primary education, at over 10 %. Mexico, Colombia and Argentina have intermediate figures. Chile is the Latin American country with the lowest dropout rate at primary level (1.6 %), while withdrawal is almost non-existent in Spain. This indicator also shows that the rate for Portugal is extremely low.

Two other countries, Finland and Korea, have data for comparative purposes. The percentage in Finland is slightly higher than in Spain, while Korea is similar to Chile.

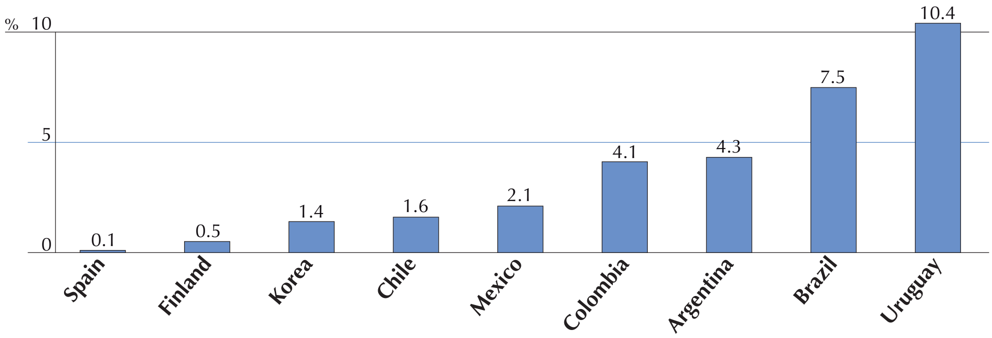
Thirdly, another key piece of data for analysing education results is the gross graduation rate in the upper stage of secondary education (2005). In addition to the graduation rates in compulsory studies, the level of success to post-compulsory studies also need to be studied. This stage has a dual purpose: it allows access to tertiary studies through general programmes, while also enabling students to prepare for direct access to the job market through pre-vocational and vocational training. As a result, it is becoming increasingly important.

The gross rate of graduation is defined as the relationship between the number of graduates, or those who have completed the second stage of secondary education, irrespective of their age, and the total population that is theoretically at the age for completing those studies.

The data presented below are for high school graduates of the OECD countries under review, partner economies, and Argentina. Data on graduates may sometimes be duplicated. The preponderance of those with high school diplomas is conspicuous in countries under review, especially Brazil, Mexico,

Graph 2.18

Dropout rates in primary education at all grades

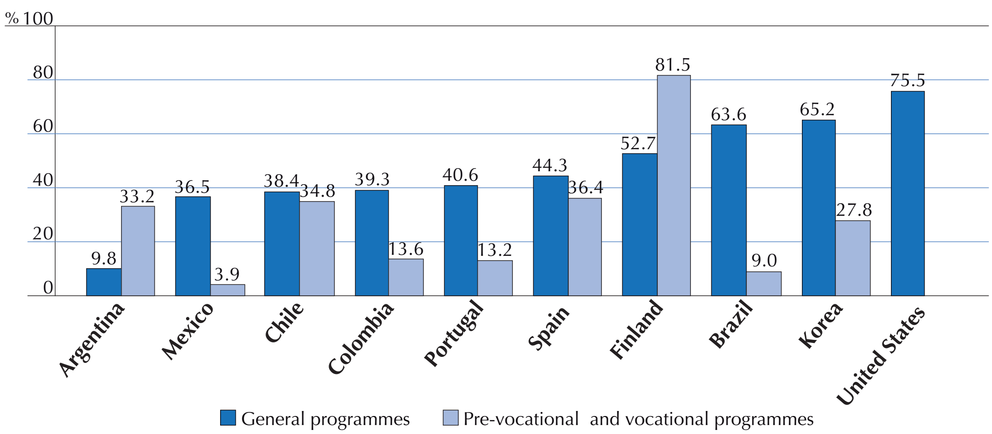


Source: Education For All, Global Monitoring Report, 2008.
Data for Colombia: Ministry of Education, SINEB.
Data for Mexico: «Educational System of the United States of Mexico, main figures, 2005-2006 school cycle», Secretariat of Public Education of Mexico.
Data for Brazil: School Census 2006, INEP/MEC.
The data for Argentina, Chile and Uruguay are for the school year ending in 2003.
The data for Brazil, Korea and Mexico are for the school year ending in 2006. For the other countries, the percentages are for 2004. The data for Spain is an estimate by the UNESCO Institute for Statistics.
There is no information for Portugal on this indicator.

Portugal and Korea. The figure is lower for Chile and Spain. In contrast, graduates in pre-vocational and vocational programmes predominate in Argentina and Finland, although the percentage differs in each country.

Graph 2.19

Gross graduation rates in the second stage of secondary education (2005)



Sources: *Education at a Glance 2007,* for the data on Argentina and Uruguay, which come from World Education Indicators 2007.
The data of Argentina and Finland are for 2004. For the United States, the data are for the total graduation rate in the second stage of secondary education, as no distinction is made between general and pre-vocational programmes.

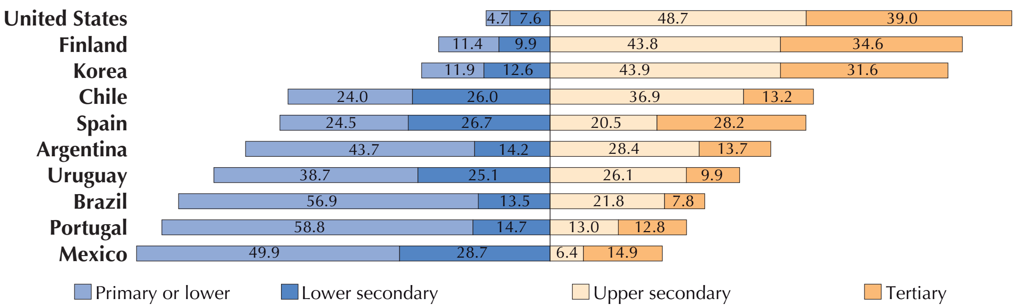
Fourthly, we may consider the level of studies of the population aged between 25 and 64 years old. This indicator provides information on a key factor in an educational context as it shapes the general population's motivation and expectations with regard to the educational system. Consequently, it influences educational planning and work careers, according to the relative importance of each educational stage for the population as a whole. The OECD uses formal academic qualifications from each country to establish the level of training that adult populations have reached.

The first stage of secondary education can be used to mark the separation between compulsory and non-compulsory education (Graph 2.20). The three non-GIP countries have the highest proportion of persons with qualifications from upper secondary education, and tertiary education. The United States leads 88 %, followed by Finland 79 %, and Korea 76 %.

Among GIP countries, nearly 50 % of adults in Chile and Spain have qualifications in non-compulsory studies. The pattern changes for the group as a whole, with a consistent rise in the proportion of persons who have only completed compulsory studies. 42 % of the population of Argentina have completed non-compulsory studies, while in Uruguay this proportion falls to 36 %, and in Brazil to 30 %. In Portugal and Mexico, only 26 % and 21 % of their populations respectively have qualifications in non-compulsory education. Also noteworthy is the high proportion of the population that has only received primary education in Portugal (59 %), Brazil (57 %) and Mexico (50 %).

Graph 2.20

Percentage distribution of the population aged between 25 and 64 according to the highest educational level reached (2005)



Sources: *Education at a Glance 2007*, except for the data on Argentina and Uruguay, which come from World Education Indicators, 2007.

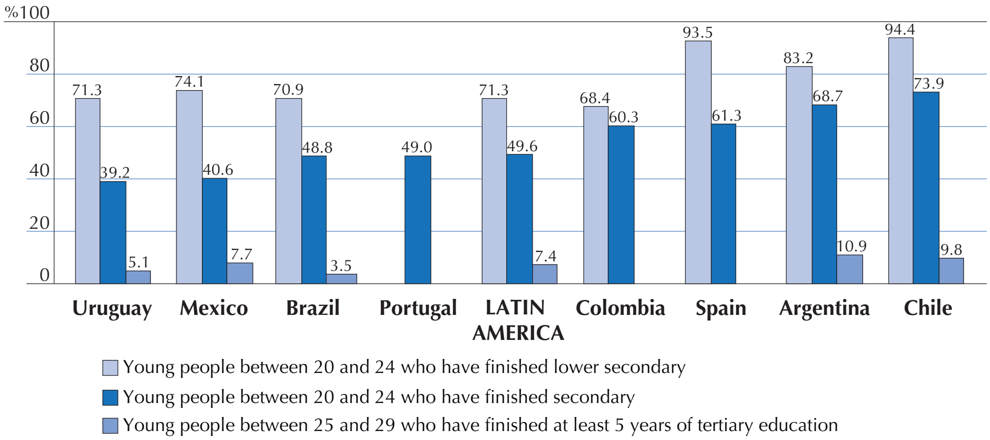
The data on Argentina, Brazil, Chile and Uruguay are from 2004. For Mexico, the data on CINE 3A programmes are included in lower secondary.

Finally, the level at which the different school cycles finish also provides another interesting point of comparison. Most GIP countries have standardised the finalisation of primary education, so no information will be provided on this. However, there are differences in the completion rates for subsequent cycles. There is also inequality between young people, as a consequence of differences in household wealth.

Graph 2.21 contains information on GIP members in this respect. Chile and Spain stand out for their higher graduation rates in intermediate education, and especially in lower intermediate education. With regard to the latter, the data indicate that almost 95 % of Chileans and Spaniards, aged between 20 and 24, have completed this level, compared to 80 % of Argentineans. In the other countries, the graduation rates are approximately 70 %. At tertiary level, there are much lower overall totals for graduation, and the differences are narrower.

Graph 2.21

Graduation rates at different educational levels in GIP countries

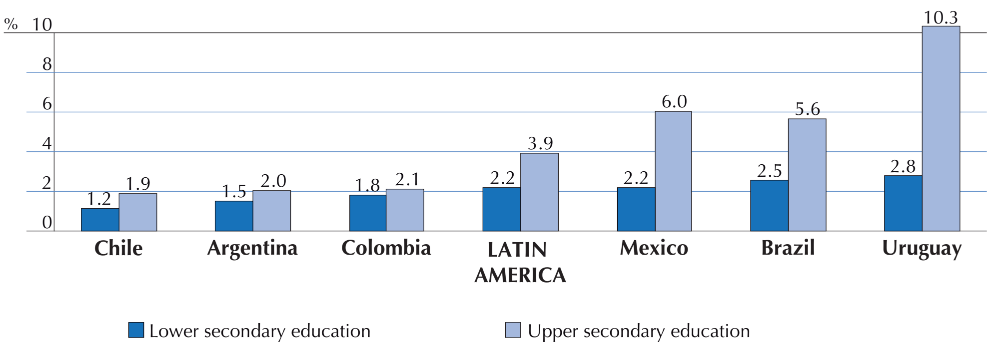


Source: GIP calculations based on CEPAL, 2007.
The data are for 2005 except for Chile (2003).
Data for Spain (2005): Statistics Office of the MEPSYD.
Data for Portugal (2005): National Statistics Institute (INE).

In Chile, Argentina and Colombia the graduation rates from the first and the final quintiles are closer together.[1] This sample shows that they are less differentiated by economic level than in other countries. Brazil, Mexico, and especially Uruguay, are at the other extreme. Uruguay has the highest ratio for its graduation rate (about 10 %), more than double the figure recorded for Latin-American group as a whole, and five times higher than the figure for Chile.

Graph 2.22

Young people between the ages of 20 and 24 who have finished lower and upper secondary education: ratio between the percentages at the V and I quintiles of per capita income for Latin-American GIP countries (2005)



Source: GIP calculations based on CEPAL, 2007.
The data are from 2005, except for Chile (2003).
In Argentina and Uruguay, the data refer to urban areas.

1 The ratio was calculated between rates at the first quintile and the fifth quintile (lower income).

SUMMARY OF THE CHARACTERISTICS OF THE EDUCATIONAL SYSTEMS OF GIP COUNTRIES

In proposing a comparative agenda at international level, the PISA research programme stresses the capacity that educational systems have to promote significant lifelong education in a globalised society. Rather than being a project designed to provide feedback to schools, the PISA programme evaluates the capacity of national educational systems. Thus, an analysis of how educational systems are organised is crucial to understanding the differences in learning outcomes that emerge from PISA testing.

This chapter concludes with the discussion of a number of important features, which make it possible to attempt a preliminary outline of educational systems in the region. It seeks to identify differences and find solutions in four major areas: the pattern of participation by the public and the private sectors; the organisation of educational cycles; political and administrative management; and the distinctive features of teacher careers and training.

To achieve this goal, and to address these four questions, a preliminary typological matrix of educational systems was devised, covering several distinct aspects.

With regard to the participation of the public and private sectors, the aim was to identify predominantly public, private or mixed systems in the management and financing of education.

In relation to the organisation of educational cycles, the objective was to find out the age for beginning and ending each cycle; the stage at which educational systems differentiated between a generalist and vocational curriculum; and the system for compulsory schooling in each country.

As regards the political and administrative organisation of the system, an attempt was made to evaluate to how far local governments had a degree of financial autonomy in managing their resources; the role of schools in creating the curriculum; and staff management. The influence of parents and teachers at different levels of educational management was also studied.

Finally, with regard to teaching careers, the aim was to establish which agents participated in assessment procedures; discuss the mechanisms for promotion to management and inspection positions; study salary and other performance-related incentives; find out the profiles of the institutions involved in teacher training; and examine the degree of professionalism in teaching careers.

As work progressed, empirically measurable indicators could be identified for each aspect. Some could be defined in a standardised way, through the presence or absence of given attributes. Parameters had to be established for others, involving a qualitative assessment of countries in the corresponding area. Discussion of both the matrix itself, and of the information that would be necessary to complete it, has involved continuous exchanges between GIP countries. Although the functional characteristics of the matrix were not always sufficiently detailed to take account of all the institutional configurations of the region, it was nevertheless possible to draw some important conclusions, which are given below.

ANALYSIS OF RESULTS

In the eight countries in the region, public sector financing is greater than that of the private sector. It was decided that the countries which had at least 85 % of public financing would be classified as predominantly public; those between 50 % and 85 % were categorised as mixed; while those under 50 % were classified as predominantly private. Two countries, Chile and Argentina, stand out as being predominantly private; both have mixed systems in which a significant number of students attend privately financed schools. There are examples of public financing that is privately administered. However, only these two countries and Spain have a significant number of students who attend schools managed by private institutions.

The organisation of educational cycles is based on a structure in which primary education lasts for approximately 6 years, and secondary education is divided into lower secondary and upper secondary, both lasting approximately 3 years. An exception to this rule is the educational system in Brazil.

The organisation by cycles is named, and structured, distinctly in different countries. Moreover, each country may stipulate a different point at which vocational education is separated from general education. In all GIP countries, less than 30 % of students attend professional education at grade 10, so they are classified as late differentiation systems. PISA shows that early professional differentiation systems have worse results than systems that separate curricular pathways later on.

While there can be no guarantee that cycles will be completed, countries stipulate ages for the compulsory education of their citizens. The duration of compulsory education in GIP countries ranges from 9 years in Brazil, to 12 in Chile. Countries also differ as to the age at which compulsory schooling begins. This is 3 years old in Mexico, and 6 in Portugal, Brazil, Chile and Spain. However, the actual age at which education begins varies from one country to another, and is gradually being extended to younger age groups. In Spain, for example, educational authorities must provide schooling for all children from the age of three years old. But although the educational system is obliged to provide facilities, schooling is not compulsory for families, although a large majority of children are indeed schooled from this age onwards.

As regards the political and administrative organisation of the educational system, local government authorities administer more than 50 % of the budget for primary and lower secondary education in all countries, except for Portugal and Uruguay. A counterpart to financial decentralisation is curricular decentralisation. The countries where local government administers most of the budget also have schools or local communities with a considerable degree of involvement in establishing the curriculum. (Local communities decide on at least one out of every four hours of the curriculum.) However, Portugal, Mexico and Uruguay are countries that follow a non-differentiated national curriculum.

The way a school operates and the autonomy with which it takes decisions about staff, the curriculum, and so on, are very different in state and private schools. There are also differences between those providing lower and upper secondary education, unless they are given in the same school, as occurs in Mexico.

In general, state schools do not have autonomy in contracting or dismissing teaching staff. This is usually the prerogative of educational authorities. However, private schools generally have greater discretion in recruiting and dismissing both teaching and non-teaching staff, and dealing with issues related to the workplace.

Another aspect of the political and administrative organisation of educational systems is the degree of influence of parent and teacher associations. As regards parent associations, three countries, Chile, Colombia and Spain, established that these participate institutionally in school decision taking, while in most countries, parents have non-voting representation. There is a more uniform pattern in GIP countries with regard to the role of teaching associations in educational management: teachers have statutory participation in five countries, while there are non-voting consultation mechanisms in three others. National educational authorities do not consult teachers in any GIP country.

Another issue, which stood out in comparative analysis, was the existence of different types of training and career structure for teachers. The basic training of intermediate stage teachers is through pedagogical studies in vocational institutes of higher education, or education faculties in universities. In Spain alone, intermediate stage teachers are trained as a continuation of, or an area of specialisation within, their university degrees. An admission exam is required to begin studies in most countries, although not in Mexico and Uruguay. The training period ranges from 3 to 4 years in Colombia and Brazil, to 5 years in Chile, Spain and Portugal.

With regard to teaching careers, educational systems differ in how performance is evaluated, promotion organised, and teachers paid. There are only two countries, Chile and Colombia, which have evaluation

institutes that have the technical and political autonomy to assess teaching performance. In most GIP countries (Mexico and Uruguay are exceptions), educational institutes carry out teaching evaluation. Inspectors generally play a role in teacher evaluation, except in Chile, Argentina and Colombia.

In six of the eight GIP countries, the exceptions being Colombia and Mexico, the main mechanism for promotion to management posts is by public exam and on merit. In all countries, except Chile and Portugal, seniority is a factor in promotion.

As regards remuneration, at least 10 % of teachers' salaries depend on teaching performance in only two countries, Chile and Mexico. In most countries remuneration is linked to ranking, but there is no performance-related variable. However, other countries, such as Spain and Uruguay, can be added to this list if other types of non-monetary benefits, linked to performance, are taken into account.

Finally, at least half of all teachers are qualified in all the countries in the region. In six countries, the level is intermediate, i.e. between 50 % and 80 % of teachers are qualified. In three, Chile, Spain and Portugal, more than 85 % of teachers are qualified. In some cases, such as Mexico, these percentages vary according to whether we are considering lower intermediate education or upper intermediate education.

In view of the diversity of these situations, it is not surprising that we find significant differences in educational results. Academic research shows that educational performance depends on how closely proposed priorities are matched to resources, and incentives to educational objectives. Many studies concur that the systems with the best results are those which encourage high expectations for student performance and teaching work; back up their actions with policies that match those objectives; and develop support policies so that all children can achieve acceptable performances (McKinsey and Company, 2007).

3

Student results in PISA 2006

INTRODUCTION

This chapter presents the results of PISA 2006 for the Iberoamerican group of countries, and the countries and regions mentioned in Chapter 1. It should be remembered that Mexico, Spain, Portugal and Brazil participated in the three PISA cycles (2000, 2003 and 2006). Argentina and Chile participated in 2000, but not in 2003; Uruguay participated in 2003 and 2006; and Colombia did so for the first time in 2006.

Brazil, Spain and Mexico participated with more extensive soundings. The report therefore includes the results that were obtained from the regions and communities, which were evaluated within these countries. The regions are as follows:

Brazil

Brazilian federal states manage their own educational systems, and have considerable autonomy. There are differences in their levels of development. Brazil is politically and geographically divided into five different regions, which have shared physical, human, economic and cultural characteristics. The frontiers of each region – North, North East, South East, South and Central West – always coincide with the borders of the states into which they are divided.

- **North Region (N).** This is the region that occupies the largest territory in Brazil, with an extension that amounts to 45.3 % of the country's total surface area. It includes the states of Acre, Amazonas, Amapá, Pará, Roraima, Rondônia and Tocantins, has the lowest population density of the country. It is almost completely covered by the River Amazon basin.
- **North East Region (NE).** This can be considered the most heterogeneous in the country, with a surface area that amounts to 18.3 % of national territory. It includes the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahía. Drought is one of the main problems of this region.
- **South East Region (SE).** This is the most important economic region in the country, with the greatest concentration of population and industrial production. It consists of the states of São Paulo, Minas Gerais, Rio de Janeiro and Espírito Santo. In spite of its economic importance, it suffers from various types of social and urban problems.
- **South Region (S).** This has a subtropical climate and occupies only 6.8 % of Brazilian territory. It includes the states of Paraná, Santa Catarina and Rio Grande do Sul. The rivers that run through this state, with their hydroelectric capacity, are of great national importance.
- **Central West Region (CW).** This is dominated by the Central Brazilian Plain, where the Federal District is located, and includes the states of Goiás, Mato Grosso and Mato Grosso do Sul. This region is undergoing a period of intense development, especially in the areas of agriculture and agro-industry.

Spain

There were ten Spanish Autonomous Communities that participated in PISA 2006 with sufficiently extensive soundings as to provide independent results. These regions have different levels of income and urbanisation. Each one is responsible for its own educational system, but all follow a common basic curriculum, and share other important features, such as the type of teacher training. These ten Communities are the following, in alphabetical order:

- **Andalusia.** This is the second largest Autonomous Community, with a surface area of 87,268 km² (17.2 % of the total). It is the most highly populated Autonomous Community in Spain, with 8,202,220 inhabitants in 2008. It consists of eight provinces: Almería, Cádiz, Cordoba, Granada, Huelva, Jaén, Málaga and

Seville, which is the capital. The income per inhabitant in the Community was €17,251 in 2006, which is still one of the lowest in Spain. Although growth in the Community was above the Spanish average, especially in the industrial and services sectors, the situation changes if we compare it with the more dynamic Communities, and with the euro zone. Given current rates of growth, it is likely that there will still be differences in years to come. Andalusia's differential economic development is due to its failure to achieve an industrial revolution in the past, and its peripheral situation in an international economic context.

- **Aragon.** This has a surface area of 47,719 km^2 (9.4 % of the total). It consists of the provinces of Huesca, Teruel and Zaragoza. Its population is 1,325,272 inhabitants. The GDP of Aragon amounts to 3 % of the total GDP of Spain, and its 2005 per capita GDP was €22,403.
- **Asturias.** This Autonomous Community is not sub-divided into different provinces. It has a surface area of 10,603.57 km^2 (2.1 % of the total), and 1,080,138 inhabitants. Despite industrial relocation, which affected the Community in earlier decades, per capita income has now risen above the national average, and stood at €19,868 in 2006.
- **(The) Basque Country.** This is in the north of the Peninsula and consists of the provinces of Álava, Guipúzcoa and Vizcaya. It has a total surface area of 7,234 km^2 (1.4 % of the total), and a current population of 2,155,546 inhabitants (2008). Despite its relatively small surface area, and a population that amounts to 4.9 % of the total Spanish population, the Basque Country contributes 6.2 % of the GDP, 10.45 % of the industrial GDP, and 9.2 % of exports.
- **Cantabria.** This Autonomous Community is not sub-divided into different provinces. It has a surface area of 5,221 km^2 (1.05 % of the total), and in 2008 it had a population of 581,215 inhabitants. In 2007, per capita GDP was €23,377 per inhabitant, which is close to the Spanish average of €23,396, although below the average figure of €29,455 for EU member countries.
- **Castile and Leon.** This Autonomous Community was created in 1983, and is situated in the northern part of the central plateau of the Iberian Peninsula (basin of the River Duero). It consists of the provinces of Ávila, Burgos, Leon, Palencia, Salamanca, Segovia, Soria, Valladolid and Zamora. It is the largest Autonomous Community in Spain with a surface area of 94,223 km^2 (18.6 % of the total), and the third most extensive region in the European Union. Despite this, the population of Castile and Leon only had 2,528,417 inhabitants in 2007, which was 5.7 % of the population of Spain. Its per capita GDP is €21,160.
- **Catalonia.** This is in the north-east of the Iberian Peninsula, and has a surface area of approximately 32,000 km^2 (6.3 % of total surface area). Its northern frontiers are with France and Andorra; the Mediterranean Sea lies to the East; to the South there is the Community of Valencia; and to the West, Aragon. This makes it a strategic nub, which has very strong links to Mediterranean countries and continental Europe. It currently has 7,364,078 inhabitants, which is 16 % of the total population of Spain. It is a very densely populated territory, and highly industrialised. Its economy is the biggest of all the Autonomous Communities, as it creates 18.7 % of Spain's GDP. In terms of per capita GDP, it is fourth after the Basque Country, Navarre and Madrid.
- **Galicia.** This Community is located in the northwest of the Iberian Peninsula and consists of the provinces of La Coruña, Lugo, Orense, and Pontevedra. It has a total surface area of 29,574 km^2 (5.8 % of the total), and had 2.78 million inhabitants in 2008. Its per capita GDP is €18,544. In the past, the Galician economy was mainly based on agriculture and fishing, although today more persons are employed in the tertiary sector.
- **La Rioja.** This is a single province Autonomous Community located in the North of the Iberian Peninsula. La Rioja has a population of 317,021 inhabitants (2008).

- **Navarre.** This Autonomous Community, which has its own legal status, is in the north of the Iberian Peninsula. It has a surface area of 10,391 km². Its population is 605,876 inhabitants (2007), and approximately a third lives in the capital, Pamplona, while over half live in the metropolitan district of Pamplona. The GDP of Navarre was €51,449 million with a per capita income of €24,509, which is above the EU average. It is the Autonomous Community with the highest net income per household (€29,845), and the lowest poverty index (below 9.8 %).

Mexico

Mexico has a federal system, and each state has been responsible for managing its compulsory education system since 1992. Nevertheless, the degree of genuine autonomy of each entity is limited because there is still a shared curriculum, and they have little discretion to take major decisions on staff and resources.

The sounding from Mexico makes it possible to provide results for each of the 32 federal entities in the country (31 states and the Federal District), apart from the state of Morelos, whose sample was not representative of the PISA population. In order to examine a manageable number, and improve the accuracy of measurements, these entities are grouped in seven regions. This was done by combining geographical criteria with several indicators of the level of development, as follows:

- **Federal District.** This is in the centre-south of the country, and is the entity that includes the oldest part of the metropolitan area of Mexico City. More than half of the metropolitan area is within several municipalities in the neighbouring federal state, also called Mexico. There are 8.7 million inhabitants in the Federal District, and all its development indicators are markedly superior to other regions.
- **North.** This consists of the seven states, which share a frontier with the United States, and have the highest levels of development in the country, after the Federal District. Baja California, Baja California Sur, Coahuila, Chihuahua, Nuevo Leon, Sonora and Tamaulipas have a combined population of 18.7 million inhabitants, and they all receive considerable immigration from the rest of the country. Parts of Chihuahua have very poor, indigenous populations, which to a lesser extent is also true of Sonora.
- **Central North.** This has a population of 12.8 million, and consists of the states of Aguascalientes, Guanajuato, Querétaro, Durango, San Luis Potosí and Zacatecas. In general, it has an intermediate level of development. There are considerable differences between the relatively developed urban centres, and smaller areas such as Aguascalientes, the poor rural zones of Zacatecas and Guanajuato, and especially the indigenous areas of Durango, Querétaro and San Luis Potosí.
- **West.** This consists of the states of Colima, Jalisco, Nayarit and Sinaloa, with a total of 10.9 million inhabitants, and an intermediate level of development. Colima is very small, urbanised and homogeneous. The three other states include areas with poor indigenous populations.
- **Central South.** This consists of the state of Mexico, which has the largest population in the country, together with Morelos, Puebla and Tlaxcala, all of which are near the Federal District. These have a combined population of 22.1 million inhabitants, which makes this the most populated Mexican region considered in this study. In terms of levels of development, it is the region with the greatest inequality. Overall, it is close to the national average, but there are rich areas, such as parts of the Mexico City conurbation, and poor regions with strongly indigenous populations. It should be pointed out that Morelos was excluded from the figures for the state of Mexico because its sample does not match the criteria of the PISA study.
- **South East.** This includes three states in the Yucatan Peninsula (Yucatan, Quintana Roo and Campeche), as well as Tabasco, near Campeche on the coast of the Gulf of Mexico. With 5.7 million inhabitants, it has the lowest population of the seven regions, and its level of development is somewhat below the national average.

- **South West.** This region has four states near the southern Pacific coast (Chiapas, Guerrero, Michoacán and Oaxaca), one in the Gulf of Mexico (Veracruz) and one in the interior (Hidalgo). It has 24.4 million inhabitants, and the lowest indicators of development in all respects.

GLOBAL RESULTS AND PROFICIENCY LEVELS IN SCIENCE, PISA 2006

The PISA 2006 test consists of exercises that assess science 60 %, reading 15 %, and mathematics 25 %. The test consists of 13 booklets, designed to be comparable with each other. Each booklet has between 55 and 70 exercises, which have to be answered in two periods of one hour. There are both multiple-choice questions 55 %, and open-response questions 45 %.

For science, scientific literacy is defined as «the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity» (OECD, PISA 2006).

The term «scientific literacy» encompasses four aspects: content, processes, situation and attitudes. «Content» refers to the type of scientific knowledge. It is sub-divided into *knowledge of science* and *knowledge about science*.

Knowledge of science consists of four content categories: Physical systems, Living systems, Earth and space science, and Technology systems. *Knowledge about science* consists of two content categories: scientific enquiry and scientific explanations.

Assessment tasks included in the testing evaluate scientific processes, or *competencies* (according to the 2006 PISA framework), establishing student proficiency in the three competencies: *identifying scientific issues, explaining phenomena scientifically* and *using scientific evidence*.

Performance results in science are presented so that those of GIP countries, and the reference group, appear on the left of each graph. To highlight similarities and differences, some of the strongest and weakest performances in PISA 2006 were selected. Data were included from Mediterranean countries in view of their affinity with Iberoamerica, and because they had intermediate level results. The results of the Spanish Autonomous Communities, and Brazilian and Mexican regions (discussed above), are on the right of each graph. For comparative purposes, the mean scores achieved by OECD countries are also given, as well as mean GIP results. Appendix 3 shows the tables with the corresponding information.

The PISA study provides total scores for the levels that were reached in each key competency (scientific, mathematical and reading literacy) that was assessed. The scores show degrees of proficiency in a particular domain. Total scores are also given for each area of knowledge, and the processes (aspects or sub-scales) that were assessed in each key competency.

Any comparison of the mean results for each country has to take into account that assessment is made from nationally representative samples of students, and that the margin of error varies according to sample size, and the variations in reported results. Similarly, another issue is the degree of confidence with which conclusions can be drawn from comparisons between national averages. For this report, a confidence level of 95 % was assumed.

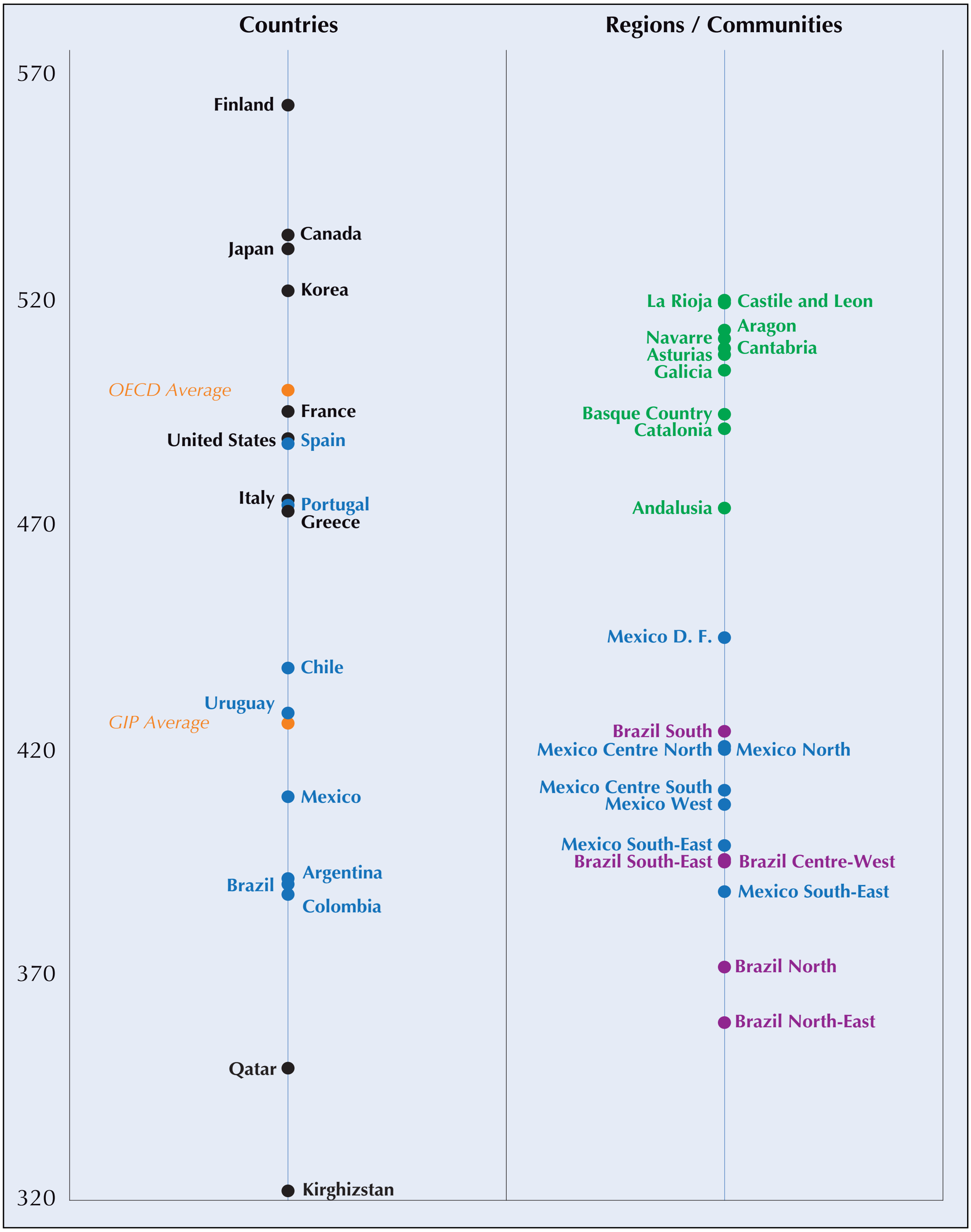
The OECD average is the mean of all OECD countries, which are given equal importance in order to prevent the results being weighted towards the countries with the largest 15-year-old student populations. The OECD mean in science is established as a score of 500 points, with a standard deviation of 100 for students across OECD countries.

In order to calculate the GIP mean in each competency, equal weight is given to the average in the Iberoamerican countries that participated in PISA 2006.

Results on the science global scale

Graph 3.1

Results on the science scale in the GIP countries, reference countries and regions and communities in Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.

The GIP mean is calculated by establishing the average of all the mean scores in the Iberoamerican countries that participated in PISA 2006. In science, this was an average score of 426 points.

Graph 3.1 relates the GIP countries and the 10 partner countries to the OECD mean (500), and the GIP mean (426). It also includes the regions and communities of Brazil, Mexico and Spain.

Firstly, Finland (563) has the highest average in science of the selected countries. It is followed by Canada (534), Japan (531) and Korea (522), which have the next highest scores above the OECD mean. France (495) is close to the mean, while the United States (489), Spain (488), Italy (475), Portugal (474) and Greece (473) are below it. Qatar (349) and Kirghizstan (322) recorded the lowest results in science of all the countries participating in PISA 2006.

It is also important to call attention to the results of the Spanish Autonomous Communities that achieved scores that were above the OECD average (500): Castile and Leon (520), La Rioja (520), Aragon (513), Navarre (511), Cantabria (509), Asturias (508) and Galicia (505). The results of these Autonomous Communities match those of the countries with the highest results.

All the Autonomous Communities of Spain, and the Federal District of Mexico, have higher results than the GIP average (426). The national mean in science was below OECD and GIP averages in Mexico (410), and especially in Brazil (370), as well as in almost all their regions. In Mexico, where seven regions were evaluated, only the Federal District (445) was above the GIP mean in science. The other Mexican regions, apart from the South West, have higher average scores than Brazil. In Brazil, the South region has scores that are above the Mexican average, while the South East and Central West are near the national average. However, the North and especially, the North East, have the lowest recorded results in the GIP, only slightly above those of Qatar in the latter case. (Appendix 3 provides the data on which Graph 3.1 is based.)

Proficiency levels on the science global scale

This section offers the results for proficiency levels on the science scale. These are defined so as to establish the knowledge and skills that 15-year-old students can demonstrate, following the range of scores established for the test (Table 3.1 and Graph 3.2).

Students who score less than 334.94 points are below Level 1. The students at this level could not demonstrate scientific capacities in the easiest items, and are unable to carry out Level 1 tasks. In other words, they have limited scientific knowledge, which can only be applied in a few familiar situations. They can give simple scientific explanations when these explicitly emerge from the data that are given. A high proportion of students at this level will fail to become full members of society, and will face difficulties in the job market.

The percentage of students at this level is low in the OECD 5.2 %, while the rate is an average 17.6 % in the GIP. PISA assessment established Level 2 as the benchmark for scientific literacy. At this level, the students have scientific abilities that will allow them to participate actively in real-life situations connected to science and technology.

The two graphs below, and pair of graphs that follow them, present the proportions of students from each country that have achieved the different proficiency levels defined by the PISA tests in 2006. In one graph, the results of GIP countries are presented, together with those of the partner countries. Another graph presents those of the Autonomous Communities of Spain and the federal states of Brazil and Mexico.

Table 3.1

Description of proficiency levels on the science global scale

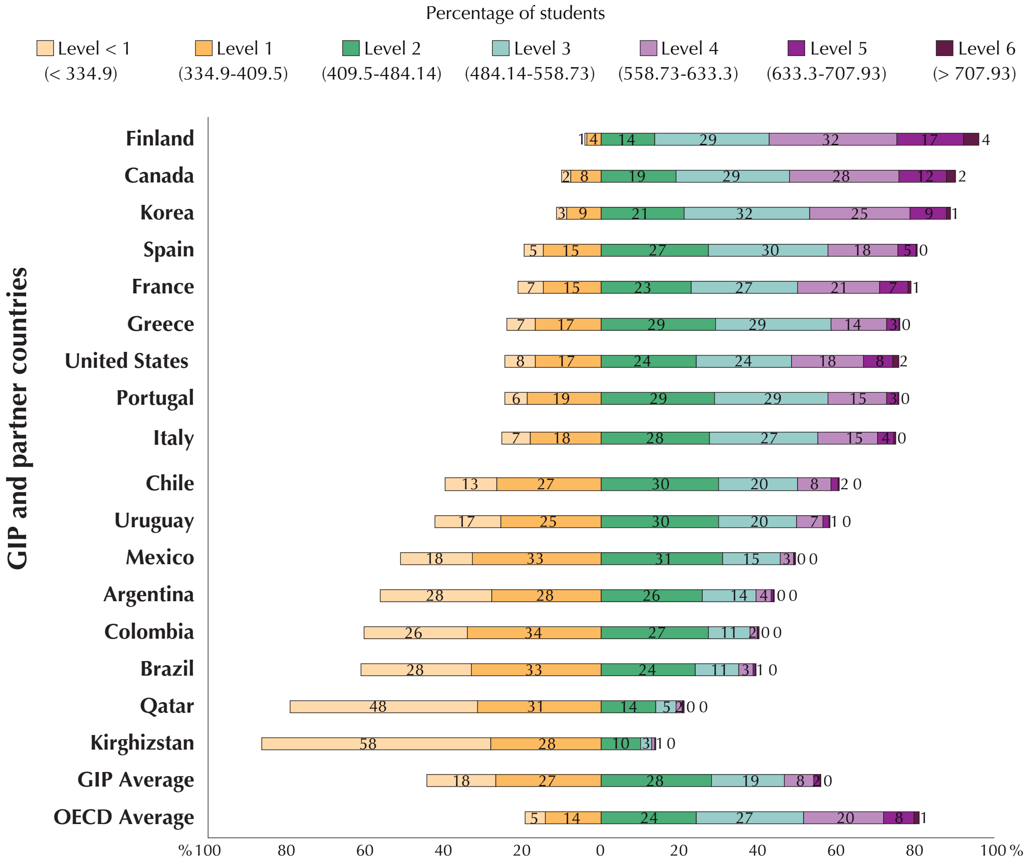
Proficiency levels	Lower points limit	Description
6	707.9	At Level 6, students can consistently identify, explain and apply scientific knowledge and knowledge about science in a variety of complex real-life situations. They can link different information sources and explanations and use evidence from those sources to justify decisions. They clearly and consistently demonstrate advanced scientific thinking and reasoning, and they demonstrate willingness to use their scientific understanding in support of solutions to unfamiliar scientific and technological situations. Students at this level can use scientific knowledge and develop arguments in support of recommendations and decisions that centre on personal, social or global situations.
5	633.3	At Level 5, students can identify the scientifi c components of many complex life situations, apply both scientific concepts and knowledge about science to these situations, and can compare, select and evaluate appropriate scientifi c evidence for responding to life situations. Students at this level can use well-developed inquiry abilities, link knowledge appropriately and bring critical insights to situations. They can construct explanations based on evidence and arguments based on their critical analysis.
4	558.7	At Level 4, students can work effectively with situations and issues that ay involve explicit phenomena requiring them to make inferences about the role of science or technology. They can select and integrate explanations from different disciplines of science or technology and link those explanations directly to aspects of life situations. Students at this level can reflect on their actions and they can communicate decisions using scientific knowledge and evidence.
3	484.1	At Level 3, students can identify clearly described scientific issues in a range of contexts. They can select facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level can interpret and use scientific concepts from different disciplines and can apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge.
2	409.5	At Level 2, students have adequate scientific knowledge to provide possible explanations in familiar contexts or draw conclusions based on simple investigations. They are capable of direct reasoning and making literal interpretations of the results of scientific inquiry or technological problem solving.
1	334.9	At Level 1, students have such a limited scientific knowledge that it can only be applied to a few, familiar situations. They can present scientific explanations that are obvious and that follow explicitly from given evidence.
Below 1		Students performing are unable to demonstrate science competencies in situations required by the easiest PISA tasks.

Graph 3.2 shows proficiency levels in science for the GIP. In Argentina, Brazil and Colombia over 20 % of students are lower than Level 1, a proportion that is higher than the GIP average.

It should also be pointed out that most GIP countries have a high percentage of students below the threshold of *scientific literacy* (Level 2). In descending order these are Argentina, Brazil and Colombia approximately 60 %, Mexico 51 %, Uruguay 42 %, Chile 40.7 %, Portugal 25 %, and Spain 20 %. (See Table 3.2 in Appendix 3.)

Graph 3.2

Percentage of students by proficiency level on the science global scale in the GIP and reference countries



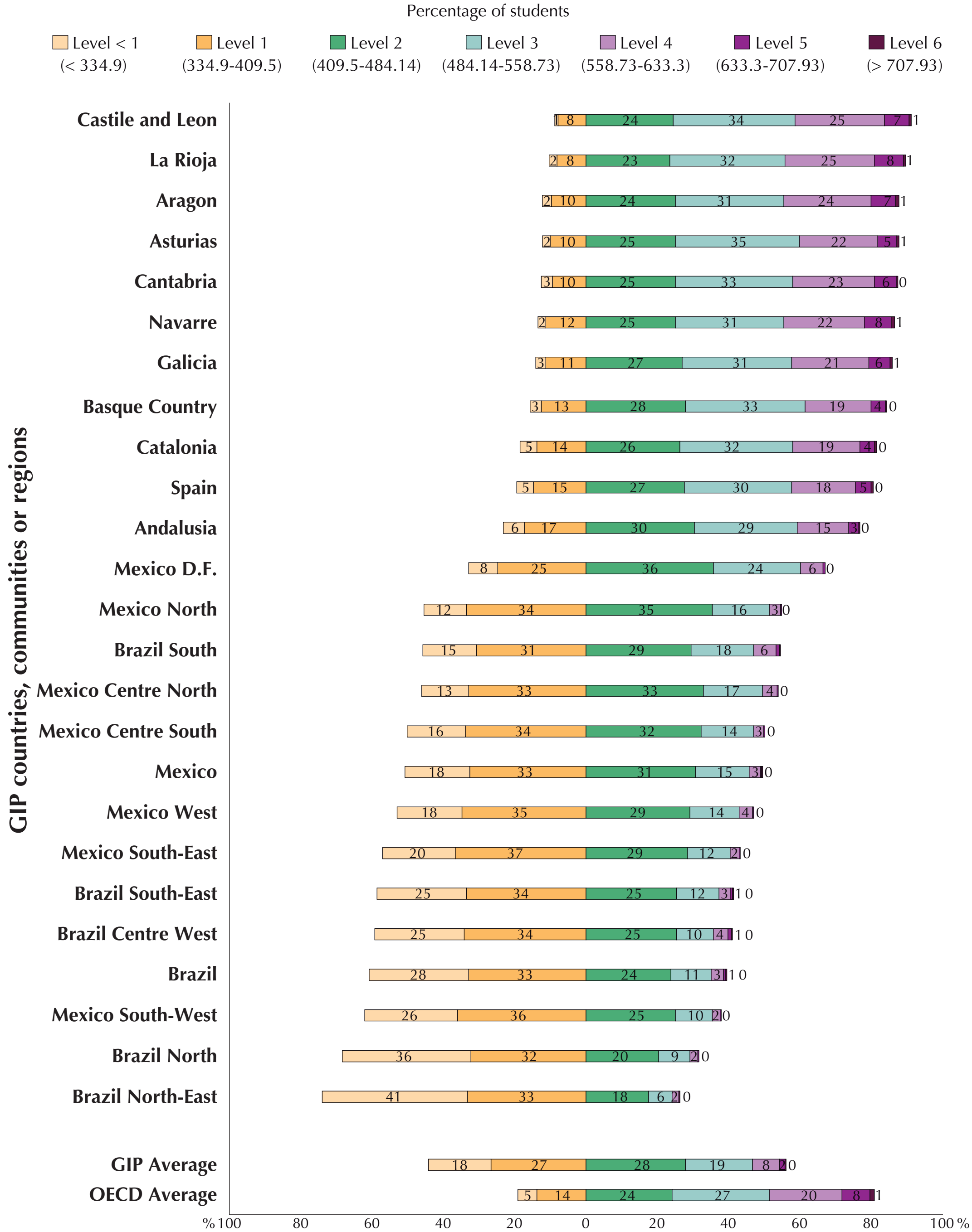
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries are ordered according to percentage of students at Levels < 1 and 1.

Less than 20 % of students in all Spanish regions, except Andalusia, have proficiency levels that are below Level 2. These figures are the same as, or higher than, the OECD mean (19 %), and well above the GIP mean (45 %). In Andalusia (23 %), and the Federal District of Mexico (33 %), the percentage of students below Level 2 is lower than the GIP average (Graph 3.3).

The other Mexican and Brazilian regions, from the North in Mexico to the North East in Brazil, have percentages of students at these levels (1 and below 1), that are greater than the GIP average. These are students who do not reach the minimum acceptable levels of scientific literacy following PISA criteria. They cannot provide plausible scientific explanations in familiar contexts, reach a conclusion from simple research, or carry out direct reasoning, or make linear interpretations, on the basis of research results.

Graph 3.3

Percentage of students by proficiency level on the science global scale in GIP countries and in the regions and communities of Brazil, Spain and Mexico



Source: GIP drafting based on the PISA 2006 database, OECD.

In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.

Countries, regions and communities are ordered on the basis of students' percentage at levels < 1 and 1.

Global results in the processes (competences) of scientific literacy

PISA evaluates the capacity of the students *to identify scientific themes*, *to explain phenomena scientifically* and *to use scientific evidence*. Below are the results for these processes (designated *scientific competencies* in the tables and graphs in this chapter, and in the PISA OECD Report), for each of the GIP countries.

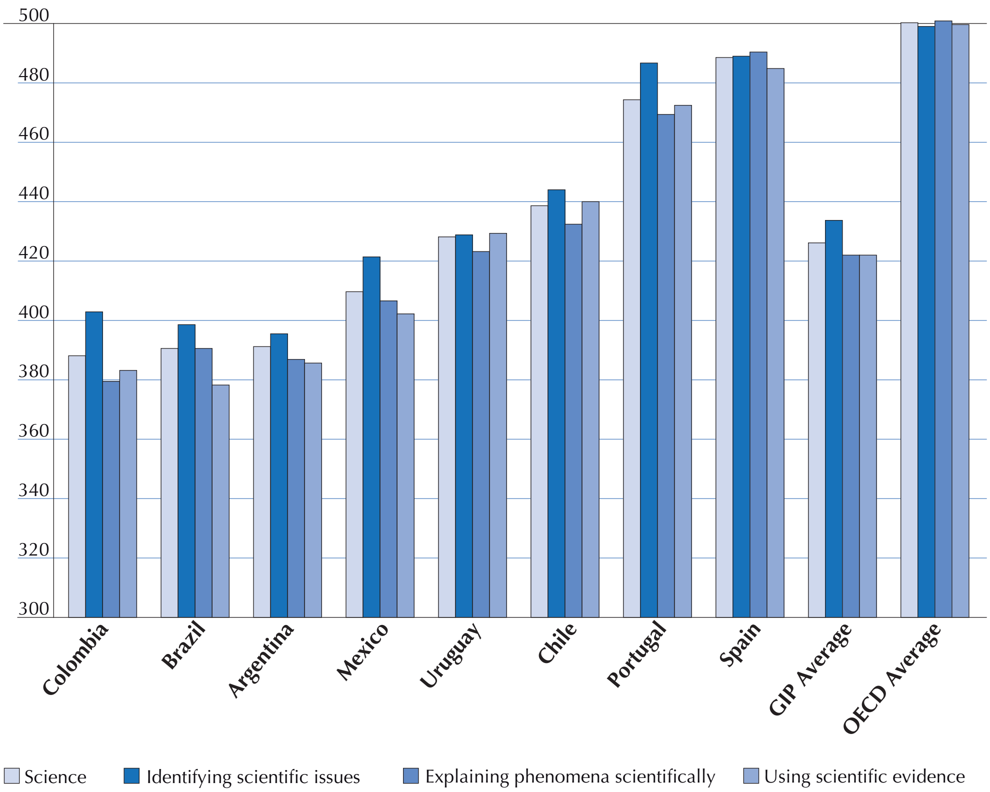
Graph 3.4 shows that the best performance is reported in *identifying scientific issues,* except for Spain, where the best results are in *explaining phenomena scientifically*. These results (whose data is presented in Tables 3.4 and 3.5 of Appendix 3) are interesting as the first competency (*identifying scientific issues*) focuses on methodological aspects of scientific work. Can this be attributed to the fact that this content receives relatively little attention in the classroom? (OECD, 2007)

The results obtained in this first domain are better than in the others. In contrast, it was expected that results for the second competency (*explaining phenomena scientifically*) would be better as it also appears to constitute a traditional application of scientific knowledge.

Except for Chile, Portugal and Uruguay, results were low in the third competency (*using scientific evidence*), that focuses on the analysis of research data.

Graph 3.4

Results on the science global scale and scientific competencies (cognitive processes)



Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.5, below, shows the averages of the GIP countries and the partner countries in these competencies, and Graph 3.6 includes the regions and communities of Brazil, Spain and Mexico.

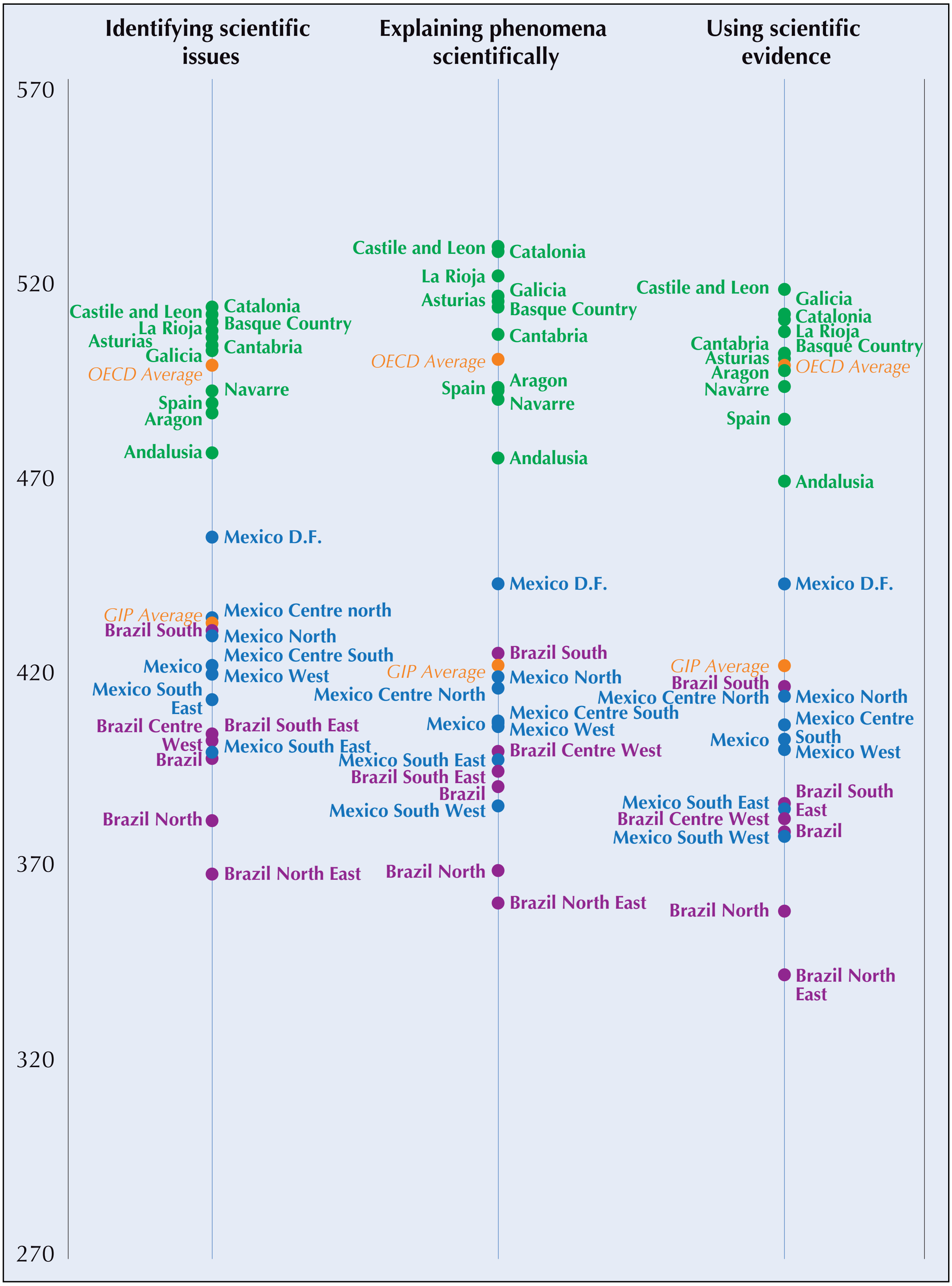
Graph 3.5

Results in scientific competencies in the GIP and reference countries

Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.6

Results in scientific competencies in the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.

Proficiency levels in the competency *identifying scientific issues*

Approximately 22 % of the tasks in PISA 2006 are related to this domain. The six levels are described below.

Table 3.2

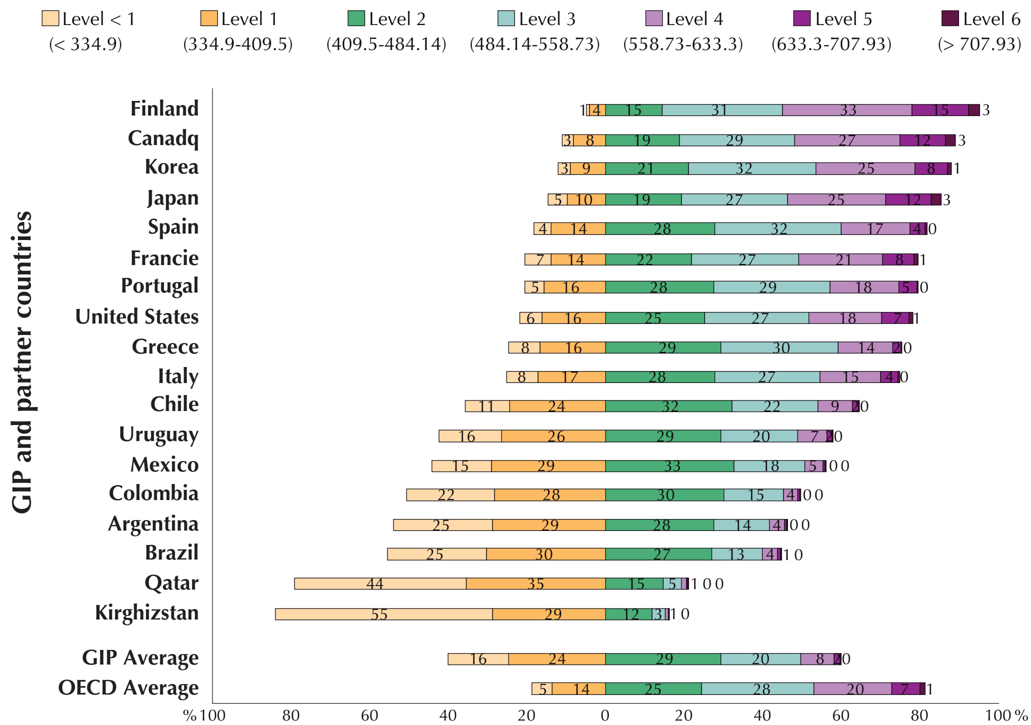
Description of proficiency levels in the competency: *identifying scientific issues*

Proficiency levels	Lowest points level	Competences of the students	Tasks they are capable of doing
6	707.9	Students at this level demonstrate an ability to understand and articulate the complex modeling inherent in the design of an investigation.	Articulate the aspects of a given experimental design that meet the intent of the scientific question being addressed. Design an investigation to adequately meet the demands of a specific scientific question. Identify variables that need to be controlled in an investigation and articulate methods to achieve that control.
5	633.3	Students at this level understand the essential elements of a scientific investigation and thus can determine if scientifi c methods can be applied in a variety of quite complex, and often abstract contexts. Alternatively, by analyzing a given experiment they can identify the question being investigated and explain how the methodology relates to that question.	Identify the variables to be changed and measured in an investigation of a wide variety of contexts. Understand the need to control all variables extraneous to an investigation but impinging on it. Ask a scientific question relevant to a given issue.
4	558.7	Students at this level can identify the change and measured variables in an investigation and at least one variable that is being controlled. They can suggest appropriate ways of controlling that variable. The question being investigated in straightforward investigations can be articulated.	Distinguish the control against which experimental results are to be compared. Design investigations in which the elements involve straightforward relationships and lack appreciable abstractness. Show an awareness of the effects of uncontrolled variables and attempt to take this into account in investigations.
3	484.1	Students at this level are able to make judgements about whether an issue is open to scientifi c measurement and, consequently, to scientific investigation. Given a description of an investigation can identify the change and measured variables.	Identify the quantities able to be scientifically measured in an investigation. Distinguish between the change and measured variables in simple experiments. Recognise when comparisons are being made between two tests (but are unable to articulate the purpose of a control).
2	409.5	Students at this level can determine if scientific measurement can be applied to a given variable in an investigation. They can recognise the variable being manipulated (changed) by the investigator. Students can appreciate the relationship between a simple model and the phenomenon it is modelling. In researching topics students can select appropriate key words for a search.	Identify a relevant feature being modelled in an investigation. Show an understanding of what can and cannot be measured by scientific instruments. Select the most appropriate stated aims for an experiment from a given selection. Recognise what is being changed (the cause) in an experiment. Select a best set of Internet search words on a topic from several given sets.

Proficiency levels	Lowest points level	Competences of the students	Tasks they are capable of doing
1	334.9	Students at this level can suggest appropriate sources of information on scientifi c topics. They can identify a quantity that is undergoing variation in an experiment. In specific contexts they can recognise whether that variable can be measured using familiar measuring tools or not.	Select some appropriate sources from a given number of sources of potential information on a scientific c topic. Identify a quantity that is undergoing change, given a specific but simple scenario. Recognise when a device can be used to measure a variable (within the scope of the student's familiarity with measuring devices).
Below 1		Students are not able to demonstrate this competency in daily life situations.	

Graph 3.7

Percentage of students by proficiency level in the competency *identifying scientific issues* in the GIP and reference countries.



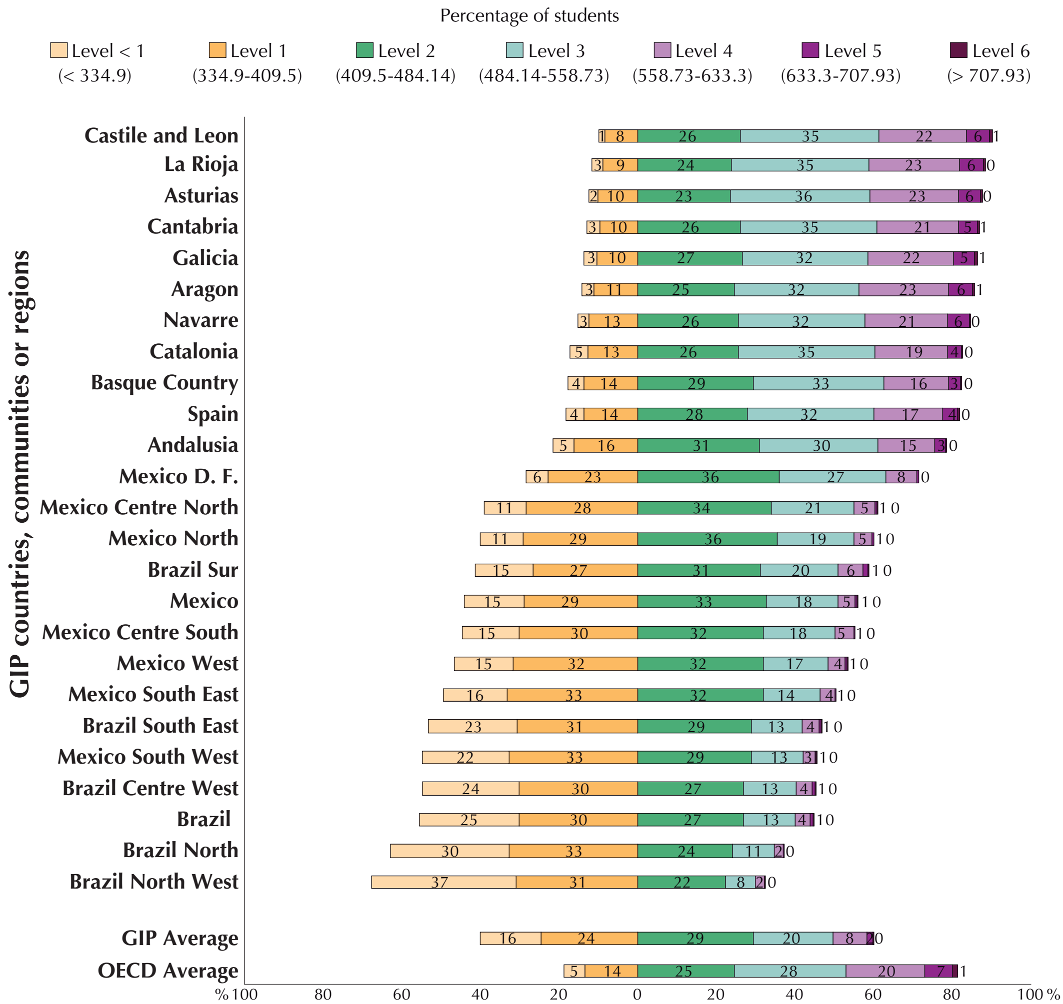
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries are ordered according to the percentage of students at levels < 1 and 1.

Graph 3.7 shows that in Argentina, Brazil and Colombia more than 50 % of students are reported as being below the basic level of scientific literacy (Level 2). At this elementary level, over half the students in these countries cannot identify whether a value can be applied to a variable in research; recognise an independent variable; differentiate between a simple model and the phenomenon being modelled; or identify the keywords for a search on a proposed research subject. Uruguay, Mexico, Colombia, Argentina and Brazil all have percentages of students below this basic level that are higher than the GIP mean (40 %).

Graph 3.8 shows that all the Spanish Autonomous Communities, as well as the Federal District of Mexico, and the Central North and North regions of Mexico have figures that are better than the GIP average. Other Mexican regions, as well as Mexico and Brazil at national level, are below the mean.

Graph 3.8

Percentage of students by proficiency level in the competency *identifying scientific issues* in the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.
Countries, regions and communities are ordered on the basis of students' percentage at levels < 1 and 1.

Proficiency levels in the competency *explaining phenomena scientifically*

The competency *explaining phenomena scientifically* is related to the more traditional tasks in the science courses of physics and biology. Areas of interest for this competency are applying knowledge of science to a given situation, describing or interpreting phenomena, and forecasting changes. Approximately 46 % of the science tasks in PISA 2006 are connected to this competency.

Table 3.9 of Appendix 3 shows the percentages of students at each level of this competency.

Table 3.3

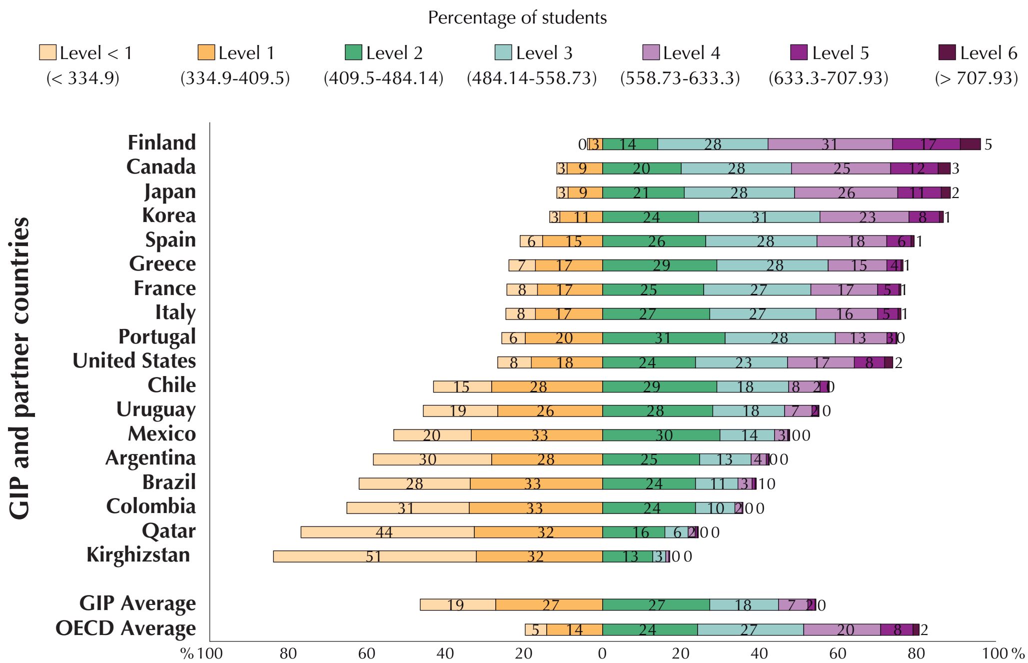
Description of proficiency levels in the competency: *explaining phenomena scientifically*

Proficiency levels	Lowest points level	Competences of the students	Tasks they are capable of doing
6	707.9	Students at this level draw on a range of abstract scientific knowledge and concepts and the relationships between these in developing explanations of processes within systems.	Demonstrate an understanding of a variety of complex, abstract physical, biological or environmental systems. In explaining processes, articulate the relationships between a number of discrete elements or concepts.
5	663.3	Students at this level draw on knowledge of two or three scientific concepts and identify the relationship between them in developing an explanation of a contextual phenomenon.	Take a scenario, identify its major component features, whether conceptual or factual, and use the relationships between these features in providing an explanation of a phenomenon. Synthesize two or three central scientific ideas in a given context in developing an explanation for, or a prediction of, an outcome.
4	558.7	Students at this level have an understanding of scientific ideas, including scientifi c models, with a signifi cant level of abstraction. They can apply a general, scientific concept containing such ideas in the development of an explanation of a phenomenon.	Understand a number of abstract scientific models and can select an appropriate one from which to draw inferences in explaining a phenomenon in a specific context (*e.g.* the particle model, planetary models, models of biological systems). Link two or more pieces of specific knowledge, including from an abstract source in an explanation (*e.g.* increased exercise leads to increased metabolism in muscle cells, this in turn requires an increased exchange of gases in the blood supply which is achieved by an increased rate of breathing).
3	484.1	Students at this level can apply one or more concrete or tangible scientifi c ideas/concepts in the development of an explanation of a phenomenon. This is enhanced when there are specific cues given or options available from which to choose. When developing an explanation, cause and effect relationships are recognised and simple, explicit scientific models may be drawn upon.	Understand the central feature(s) of a scientific system and, in concrete terms, can predict outcomes from changes in that system (*e.g.* the effect of a weakening of the immune system in a human). In a simple and clearly defi ned context, recall several relevant, tangible facts and apply these in developing an explanation of the phenomenon.

Proficiency levels	Lowest points level	Competences of the students	Tasks they are capable of doing
2	409.5	Students at this level can recall an appropriate, tangible, scientific fact applicable in a simple and straightforward context and can use it to explain or predict an outcome.	Given a specific outcome in a simple context, indicate, in a number of cases and with appropriate cues the scientific fact or process that has caused that outcome (*e.g.* water expands when it freezes and opens cracks in rocks, land containing marine fossils was once under the sea). Recall specific scientific facts with general currency in the public domain (*e.g.* vaccination provides protection against viruses that cause disease).
1	334.9	Students at this level can recognize simple cause and effect relationships given relevant cues. The knowledge drawn upon is a singular scientifi c fact that is drawn from experience or has widespread popular currency.	Choose a suitable response from among several responses, given the context is a simple one and that recall of a single scientific fact is involved (*e.g.* ammeters are used to measure electric current). Given suffi cient cues, recognise simple cause and effect relationships (*e.g.* Do muscles get an increased flow of blood during exercise? Yes or No).
Below 1		Students are not able to demonstrate this scientific competency in daily life situations.	

Graph 3.9

Percentage of students by proficiency levels in the competency *explaining phenomena scientifically* in the GIP and reference countries



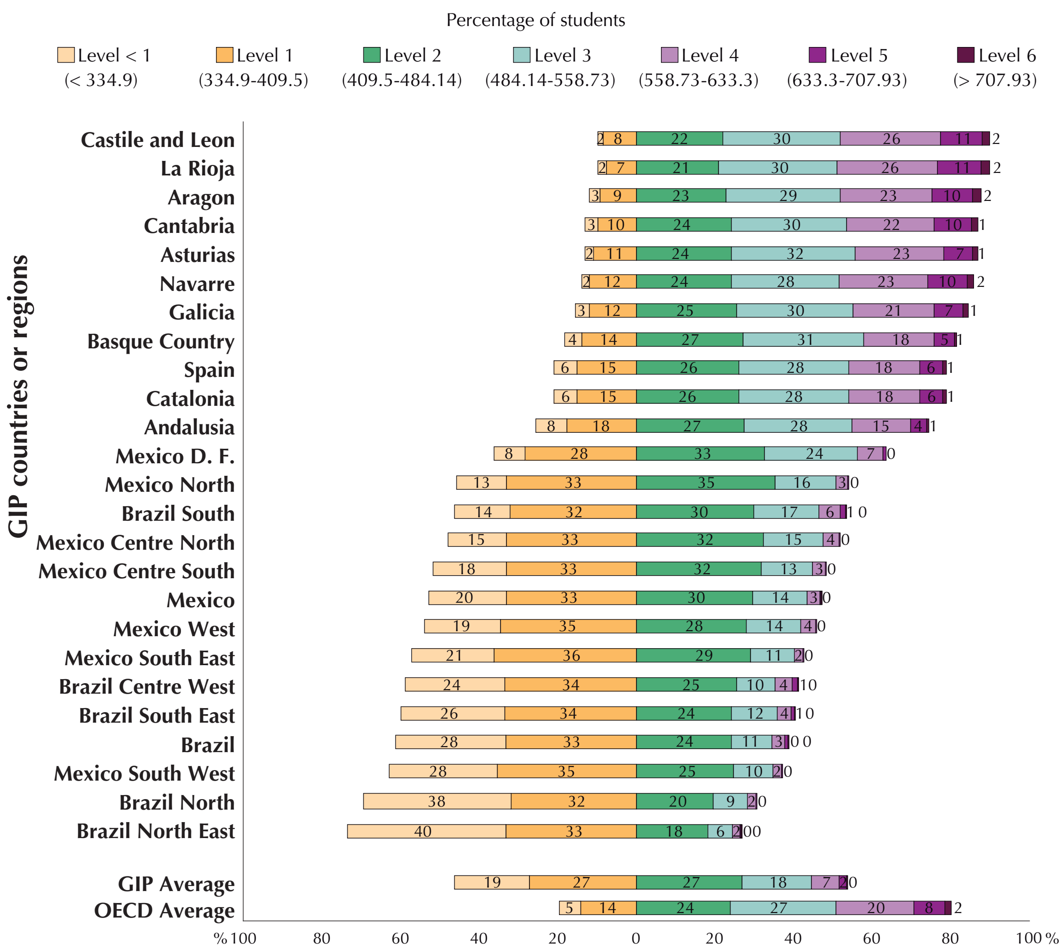
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries ordered according to the percentage of students at levels < 1 y 1.

Graph 3.9 shows that Argentina, Brazil, Colombia and Mexico have the worst percentages of performance below Level 2 among GIP countries, with approximately 60 % of students below this level. Students who reach Level 2 of this competency can recall scientific facts in simple contexts, and use them to explain or forecast a result. For example, they can predict a specific result in a simple context, and state the cause if they have additional information. (Examples: if marine fossils are found in an area, this indicates that at one time, they were under the sea; vaccination provides protection against viruses which cause diseases.)

According to Graph 3.10, the Autonomous Communities of Catalonia and Andalusia have percentages that exceed the OECD average (19 %). At this level, all GIP countries have results that are below the OECD mean. The Federal District of Mexico has 36 % of its students below Level 2, and is the only region in this country below the GIP average (46 %).

Graph 3.10

Percentage of students by proficiency levels in the domain *explaining phenomena scientifically* in the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.
Countries, regions and communities are ordered on the basis of students' percentage at levels < 1 and 1.

Proficiency levels in the competency: *using scientific evidence*

This competency accounts for approximately 32 % of the PISA 2006 test. It focuses on the ability to synthesise knowledge of science and knowledge about science, together with its application to real-life situations, or present-day problems.

The main features of this competency are interpreting scientific evidence, reaching conclusions and then communicating them; studying hypotheses, evidence and the logic behind conclusions; as well as reflecting on the social implications of scientific and technological developments.

Chart 3.4

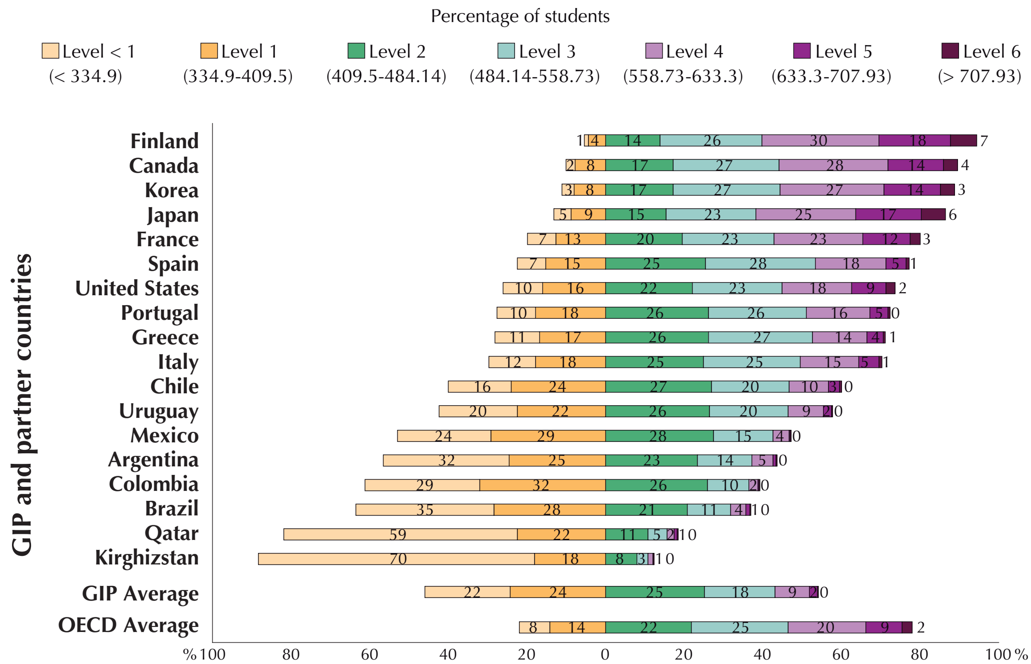
Description of proficiency levels in the competency: *using scientific evidence*

Proficiency levels	Lowest points level	Competencies of the students	Tasks they are capable of doing
6	707.9	Students at this level demonstrate an ability to compare and differentiate among competing explanations by examining supporting evidence. They can formulate arguments by synthesising evidence from multiple sources.	Recognise that alternative hypotheses can be formed from the same set of evidence. Test competing hypotheses against available evidence. Construct a logical argument for a hypothesis by using data from a number of sources.
5	633.3	Students at this level are able to interpret data from related datasets presented in various formats. They can identify and explain differences and similarities in the datasets and draw conclusions based on the combined evidence presented in those datasets.	Compare and discuss the characteristics of different datasets graphed on the one set of axes. Recognise and discuss relationships between datasets (graphical and otherwise) in which the measured variable differs. Based on an analysis of the sufficiency of the data, make judgements about the validity of conclusions.
4	558.7	Students at this level can interpret a dataset expressed in a number of formats, such as tabular, graphic and diagrammatic, by summarising the data and explaining relevant patterns. They can use the data to draw relevant conclusions. Students can also determine whether the data support assertions about a phenomenon.	Locate relevant parts of graphs and compare these in response to specific questions. Understand how to use a control in analysing the results of an investigation and developing a conclusion. Interpret a table that contains two measured variables and suggest credible relationships between those variables. Identify the characteristics of a straightforward technical device by reference to diagrammatic representations and general scientific concepts and thus form conclusions about its method of operation.
3	484.1	Students at this level are able to select a piece of relevant information from data in answering a question or in providing support for or against a given conclusion. They can draw a conclusion from an uncomplicated or simple pattern in a dataset. Students can also determine, in simple cases, if enough information is present to support a given conclusion.	Given a specific question, locate relevant scientific information in a body of text. Given specific evidence/data, choose between appropriate and inappropriate conclusions. Apply a simple set of criteria in a given context in order to draw a conclusion or make a prediction about an outcome. Given a set of functions, determine if they are applicable to a specific machine.

Proficiency levels	Lowest points level	Competencies of the students	Tasks they are capable of doing
2	409.5	Students at this level are able to recognise the general features of a graph if they are given appropriate cues and can point to an obvious feature in a graph or simple table in support of a given statement. They are able to recognise if a set of given characteristics apply to the function of everyday artifacts in making choices about their use.	Compare two columns in a simple table of measurements and indicate differences. State a trend in a set of measurements or simple line or bar graph. Given a common artifact can determine some characteristics or properties pertaining to the artifact from among a list of properties.
1	334.9	In response to a question, students at this level can extract information from a fact sheet or diagram pertinent to a common context. They can extract information from bar graphs where the requirement is simple comparisons of bar heights. In common, experienced contexts students at this level can attribute an effect to a cause.	In response to a specific question pertaining to a bar graph, make comparisons of the height of bars and give meaning to the difference observed. Given variation in a natural phenomenon can, in some cases, indicate an appropriate cause (*e.g.* fluctuations in the output of wind turbines may be attributed to changes in wind strength).
Below 1		Students are not able to demonstrate this scientific competency in daily life situations.	

Graph 3.11

Percentage of students by proficiency level in the competency *using scientific evidence* in the GIP and reference countries



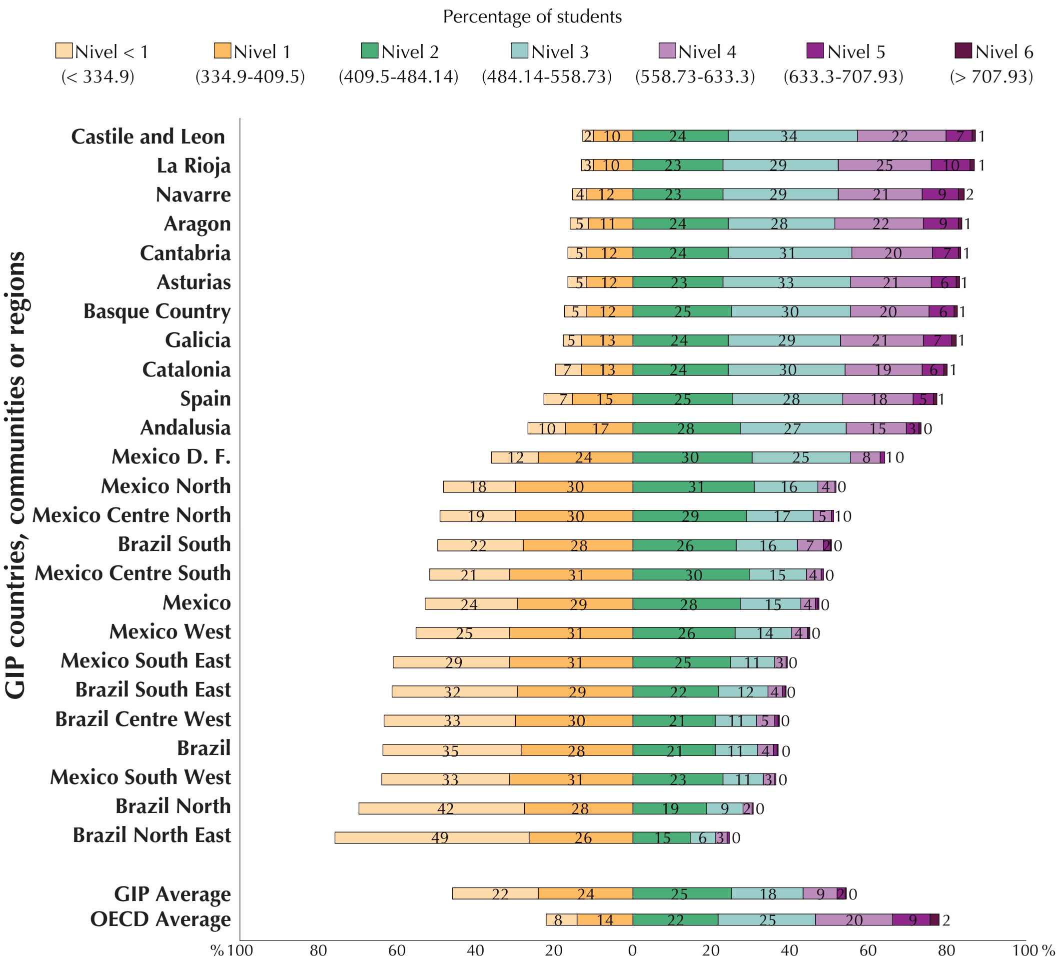
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries ordered according to the percentage of students at levels < 1 y 1.

In this competency, students at Level 2 can recognise the general features of a graph, for example, by comparing two columns in a simple table and identifying the differences, or establishing a trend from a series of measurements in a graph or bar chart. They can also recognise whether a set of characteristics can be applied to the functioning of objects in daily use, and they can take decisions on their use.

According to Graph 3.11, Argentina (32 %) and Brazil (35 %) have the highest percentages of students whose performance is below Level 1. In these two countries, together with Mexico and Colombia, between 50 % and 60 % of students are at “risk” levels of scientific literacy, according to PISA criteria.

Graph 3.12

Percentage of students by proficiency levels in the competency *using scientific evidence* in the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.
Countries, regions and communities are ordered on the basis of students’ percentage at levels < 1 and 1.

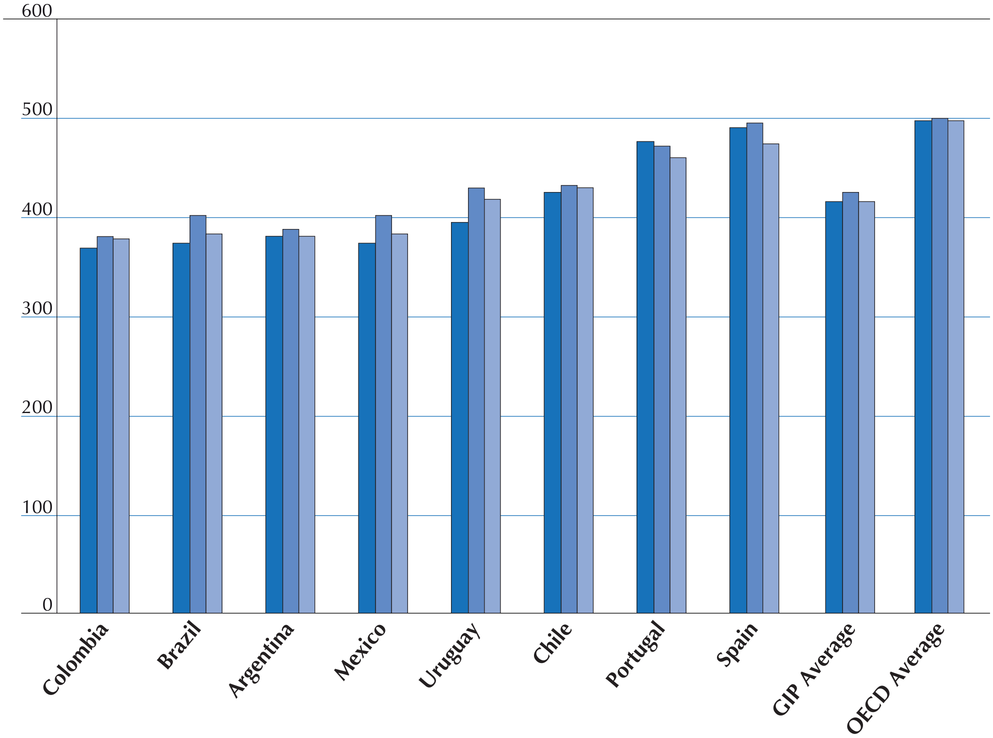
Graph 3.12 shows that Andalusia (27 %) is the only Spanish Autonomous Community, which has a percentage of students that is higher than the OECD average (22 %), although this is true of GIP countries in general. In the Federal District of Mexico 36 % of students are below Level 2, and this is the only region of Mexico where performance is better than the GIP Average (46 %).

Global results in knowledge of science

Graph 3.13 shows the averages of GIP and partner countries with regard to knowledge of science.

Graph 3.13

Results in knowledge of science



Source: GIP calculations based on the PISA 2006 database, OECD.

In most countries in the region it can be seen that the best results are in living systems, while results in physical systems and Earth and space systems alternate between second and third place. This probably indicates that these contents and competencies are less widely developed in the classroom.

Graph 3.14

Results for knowledge of science in GIP and reference countries

Source: GIP calculations based on the PISA 2006 database, OECD.

DIFFERENCES BETWEEN SCIENTIFIC COMPETENCIES, KNOWLEDGE OF SCIENCE AND THE SCIENCE GLOBAL SCALE

We will now make an analysis of the differences between each country's mean in the competencies, and the different aspects of scientific literacy assessed by PISA, in order to detect strengths or weaknesses in each case.

Each of the following graphs contains seven horizontal bars. The top three refer to the scientific processes, which were assessed (*identifying scientific issues, explaining phenomena scientifically,* and *using scientific evidence*). The next bar, under the horizontal dotted line, shows *knowledge about science*. The following three bars refer to the three specific fields of knowledge being assessed: *Earth and space systems, living systems* and *physical systems*. The seven bars for each country are divided by a vertical line, which shows the mean score obtained by the students of the country in question on the science scale. The length of the horizontal bars, to the right or left of the centre, represents the score that the country's students obtained in that particular area. The further a bar extends to the right, the better the results obtained by students in that field, as measured against the overall overage. Conversely, a bar that extends towards the left signifies a below-average result.

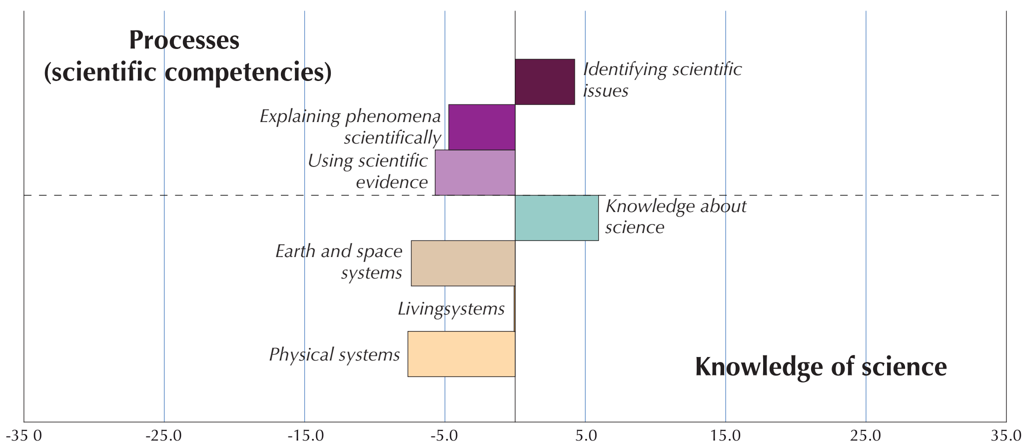
Table 3.15, below, is noteworthy because students in all the Iberoamerican countries score points above the mean in *knowledge about science*. This signifies that performance was at a higher level for questions on scientific methodology than for the traditional content of disciplines.

With regard to *knowledge of science*, the results broadly match numerous other studies carried out in the field of educational research. Scores for physics and chemistry, and Earth sciences, were lower than those for biology, except in Brazil, Spain, Uruguay and Portugal.

Graph 3.15

Differences between scientific competencies, knowledge of science and the science global scale in Argentina

Argentina = 391



Source: GIP calculations based on the PISA 2006 database, OECD.

In the Latin-American context, it is noteworthy that Mexico has good results in physics and chemistry, and Earth sciences, and very weak scores in biology.

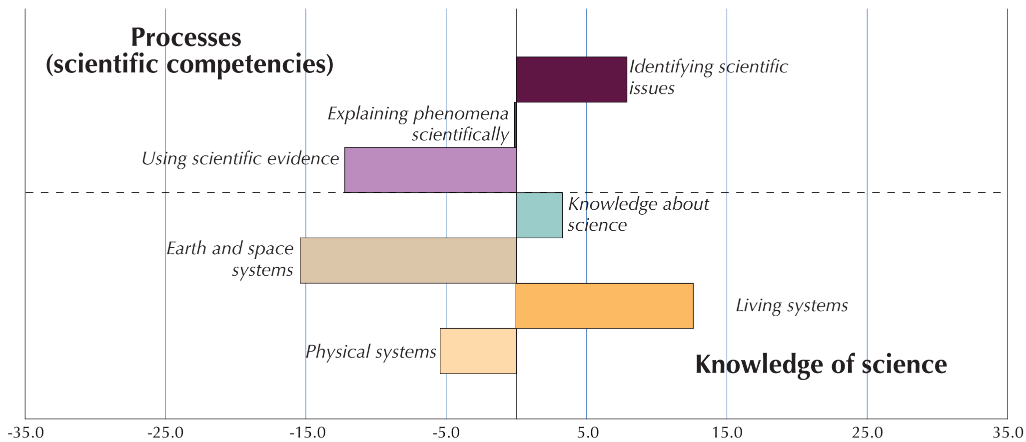
Graph 3.15 shows that in *identifying scientific issues* Argentina has 395 points, a positive difference of 4 compared to the overall average in science. However, there are negative differences on the other two sub-scales, *explaining phenomena scientifically* (-5 points), and *using scientific evidence* (-6 points). This shows that Argentinean students have quite a low level in these competencies. There is a positive difference for *knowledge of science* (6 points above the average science score), compared to *knowledge about science*. There are negative differences on the remaining science sub-scales.

The results for Argentina are interesting because higher levels of performance appear in tasks related to *knowledge about science,* while *identifying scientific issues* is the highest ranked competency (Graph 3.15). These two aspects are linked to research methodology, which probably involves more work than in areas related to *knowledge of science,* or the competency *explaining phenomena scientifically*, which seeks to apply the scientific knowledge that students normally work on in the classroom.

Graph 3.16

Differences between scientific competencies, knowledge of science and the science global scale in Brazil

Brazil = 390



Source: GIP calculations based on the PISA 2006 database, OECD.

In the Brazilian results, we may call attention to the above-average positive score in *identifying scientific issues,* which is in contrast to the below-average score in *using scientific evidence* (Graph 3.16).

Performance levels are higher for knowledge of *living systems,* but lower for content in the area of *Earth and space systems*.

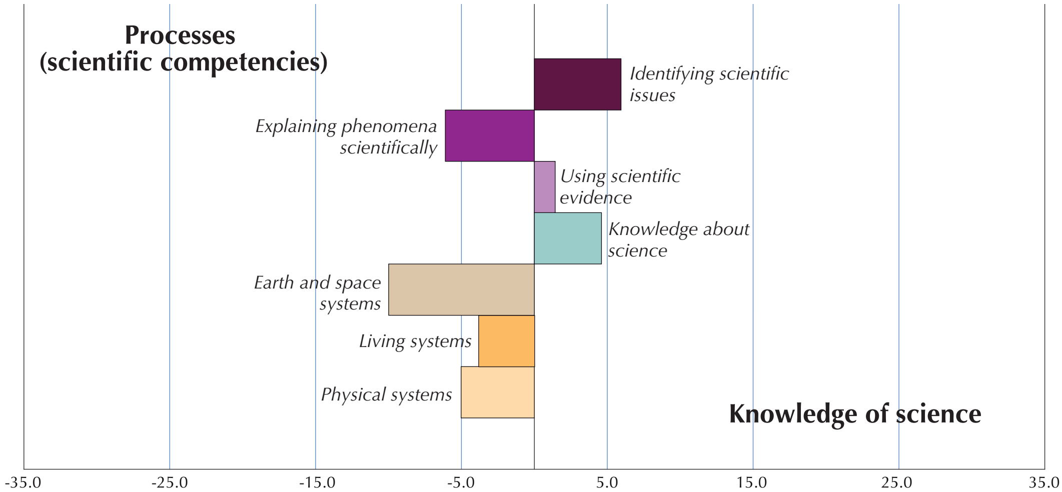
Chilean students have above-average scores in the competency *using scientific evidence*, which is considered to be most complex of the three competencies (Graph 3.17).

Results were below average in all the areas of *knowledge of science*, while scores were somewhat above average in *knowledge about science.*

Graph 3.17

Differences between scientific competencies, knowledge of science and the science global scale in Chile

Chile = 438

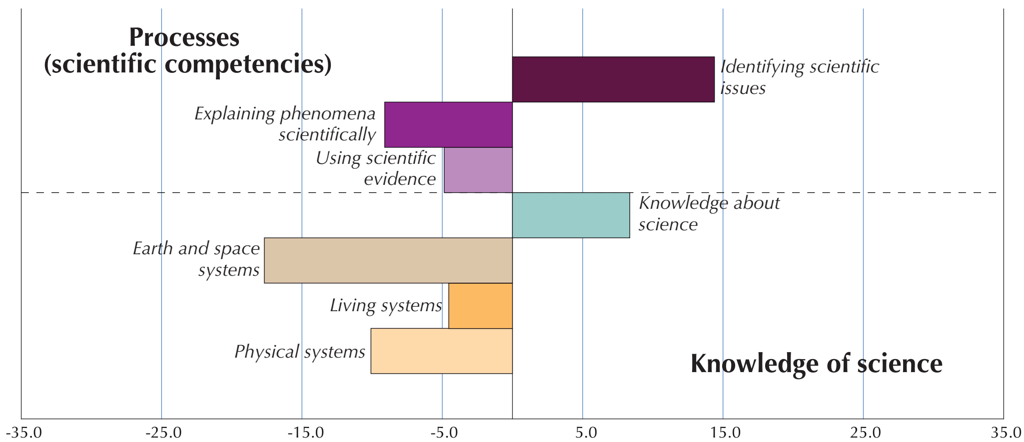


Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.18

Differences between scientific competencies, knowledge of science and the science global scale in Colombia

Colombia = 388



Source: GIP calculations based on the PISA 2006 database, OECD.

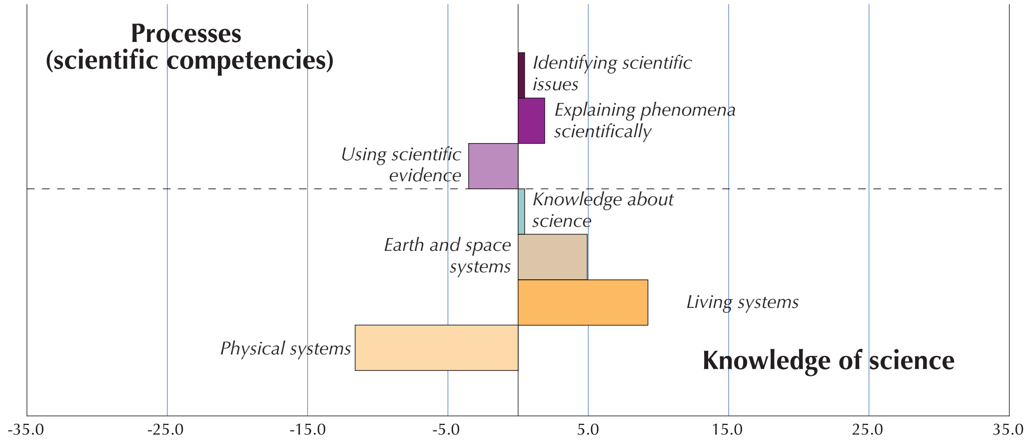
The competency *identifying scientific issues*, related to aspects of research methodology, obtains the best results in Colombia (Graph 3.18).

Knowledge about science also has above-average results, while the three aspects assessed in *knowledge of science* are below average, especially those related to *Earth and space systems*.

Graph 3.19

Differences between scientific competencies, knowledge of science and the science global scale in Spain

Spain = 488



Source: GIP calculations based on the PISA 2006 database, OECD.

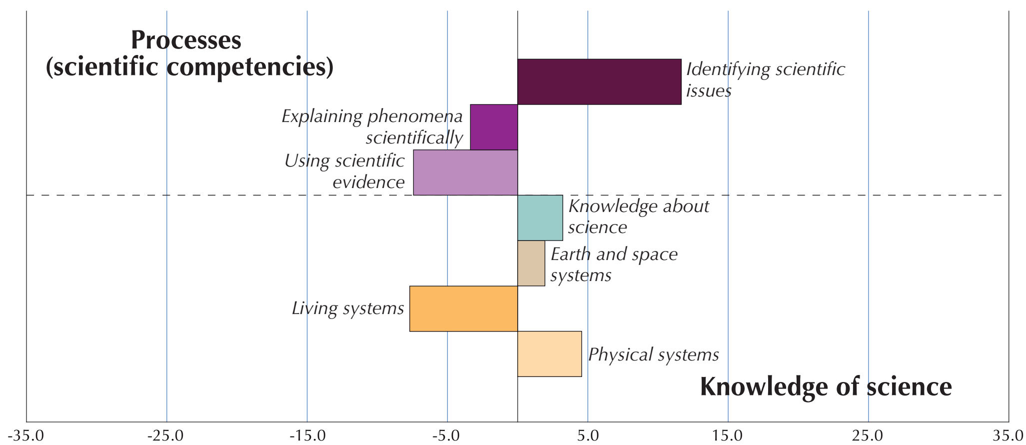
In Spain and Uruguay there are two processes in which results are higher than their respective averages (Graph 3.19). In the case of Spain, this is *identifying scientific issues* and *explaining phenomena scientifically*. On the other hand, together with Portugal, it is one of the two countries in the group to achieve above-average results in the area of *Earth and space systems*.

Spanish students obtained slightly below-average points in *using scientific evidence*.

Graph 3.20

Differences between scientific competencies, knowledge of science and the science global scale in Mexico

Mexico = 410



Source: GIP calculations based on the PISA 2006 database, OECD.

There is a significant difference in the Spanish results between the above-average scores obtained in *Earth and space systems,* and especially in *living systems,* and the much poorer results in *physical systems*. The difference is nearly 20 points. These indicators provide very useful evidence to teachers in the Spanish educational system on how to promote scientific literacy.

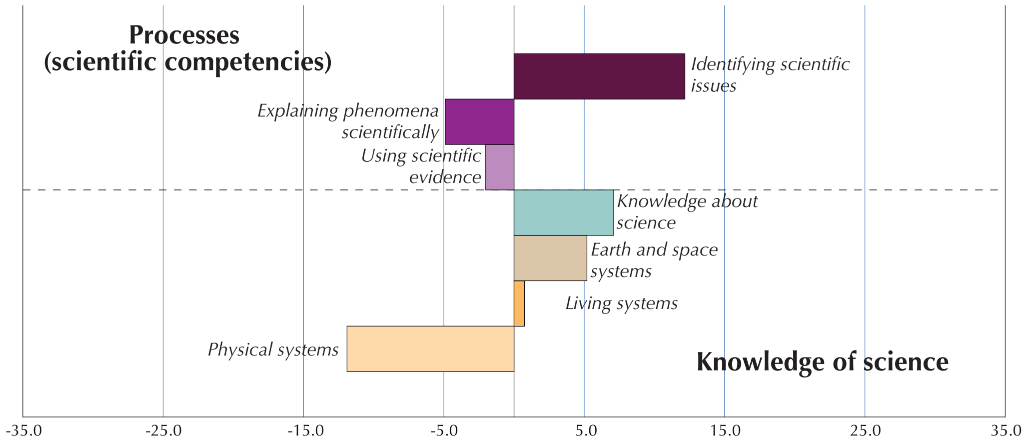
In Mexico, the most noteworthy differences are between the above-average scores in *identifying scientific issues* and the below-average results in *using scientific evidence* (Graph 3.20). The difference is almost 20 points.

In *knowledge of science,* Mexico is the only GIP country in which the area of *physical systems* shows above-average results.

Graph 3.21

Differences between scientific competencies, knowledge of science and the science global scale in Portugal

Portugal = 474



Source: GIP calculations based on the PISA 2006 database, OECD.

Portugal scores well above the national mean in the competency *identifying scientific issues*, but in the area of *knowledge of science,* the results for *physical systems* are well below average (Graph 3.21).

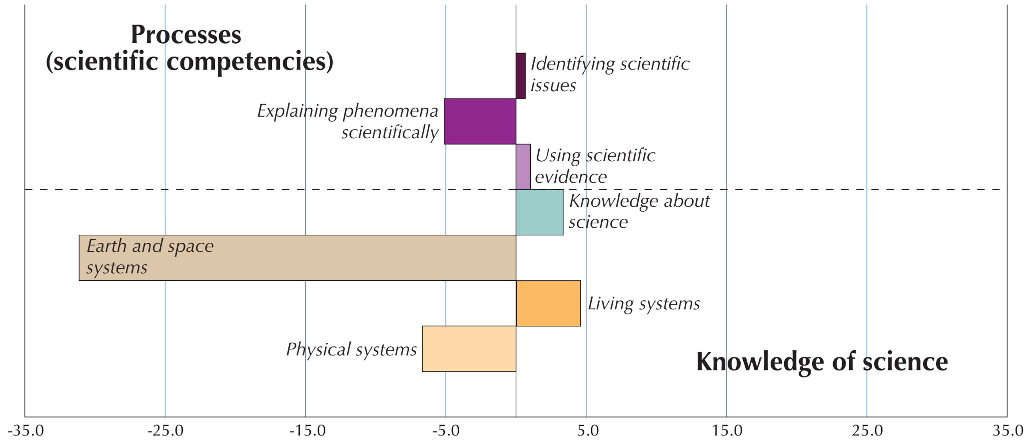
As was pointed out above, these differences in the results for specific cognitive processes, or aspects of the knowledge of science, may reflect didactic strengths or weaknesses, and show how effectively teaching is contributing to the acquisition of the different features of scientific literacy. These indicators may therefore be extremely useful in helping teaching teams to make progress.

Uruguay has positive results in two competencies (Graph 3.22). However, in *knowledge of science*, the area of *Earth and space systems* produces a result that is more than 30 points below the mean. Unless there has been a freak error, this result is extremely striking, and needs to be studied closely. The earlier discussion about the usefulness of the information provided by these results is especially pertinent in this respect.

Graph 3.22

Differences between scientific competencies, knowledge of science and the science global scale in Uruguay

Uruguay = 428

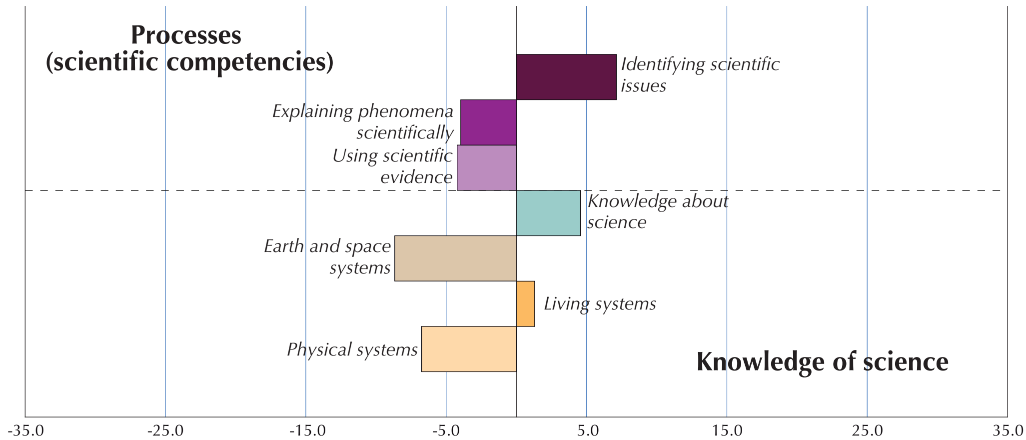


Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.23

Differences between scientific competencies, knowledge of science and the science global scale: the GIP Average

GIP Average = 426



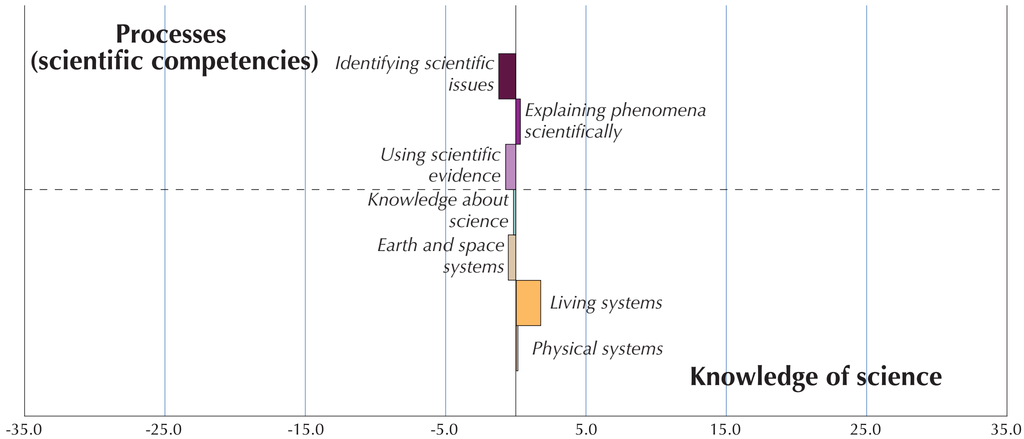
Source: GIP calculations based on the PISA 2006 database, OECD.

For the countries in the region the competency with the best results is *identifying scientific issues* (Graph 3.23). *Knowledge about science* is also above average. In *knowledge of science* the only positive results are in the field of *living systems*. The contents of this area are probably those on which most work is done in the science classroom.

Graph 3.24

Differences between scientific competencies, knowledge of science and the science global scale: the OECD Average

OECD Average = 500



Source: GIP calculations based on the PISA 2006 database, OECD.

Final considerations on overall global results and proficiency levels in science

For most of the 20th century, the science curriculum was basically aimed at establishing a framework for the professional scientific training of a small number of students. Most of these proposals focused (as they often still do) on natural science, and knowledge of the scientific disciplines figured prominently. On the other hand, little importance was attached to knowledge about science or technological applications to daily life.

However, the influence of scientific and technological progress on society and the central role that information technology now holds require that all citizens, and not just future scientists and engineers, acquire scientific literacy. The proportion of students with a very low level of literacy is therefore also an important indicator of people's capacity to become effective citizens, and enter the job market.

As was mentioned above, Level 2 in science has been established as the baseline level in defining proficiency on the PISA science scale. This is the level at which the students begin to show the scientific knowledge and skills that will enable them to participate actively in life situations related to science and technology. In most Latin-American countries, except for Chile and Uruguay, approximately 50 % of students are below this level. This indicates that key features of research are often confused, incorrect scientific information is used, and personal opinions play a role, alongside scientific data, in reaching conclusions. This low level in key scientific competencies is a matter of concern. Some competencies, such as *using scientific evidence* to reach an explanation, can be acquired by working in laboratories and carrying out demonstrations and experiments. Other competencies, such as *identifying scientific issues*, may require an analysis of past experiments, or descriptions of current work.

With regard to *knowledge of science*, the challenges lie in developing ongoing work, which gives the students the opportunity to learn in those sciences that in the past have not held a sufficiently prominent place within the system of compulsory education. These are physics, chemistry, and Earth and space sciences. Biological science also needs to be strengthened.

We hope that results will improve by building on the efforts of society as a whole, but most especially the commitment of teachers, parents and students. This should contribute to narrowing the distance between the higher and lower performance levels achieved by students. Reaching this goal will bring us closer to the education of quality towards which we all strive.

GLOBAL RESULTS AND PROFICIENCY LEVELS IN MATHEMATICS AND READING, PISA 2006

Global results in mathematical literacy

PISA defines the concept of *mathematical literacy* as the capacity of students to analyse, reason and communicate ideas effectively, while they pose, solve and interpret mathematical problems in a variety of situations. They deal with quantitative concepts, as well as other types of mathematical concept including space and uncertainty.

Mathematical literacy is an individual's capacity to identify and understand the role that mathematics play in the world, to make soundly based judgements, and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen (OECD, 2006).

Students' mathematical knowledge and skills were assessed according to three aspects relating to:

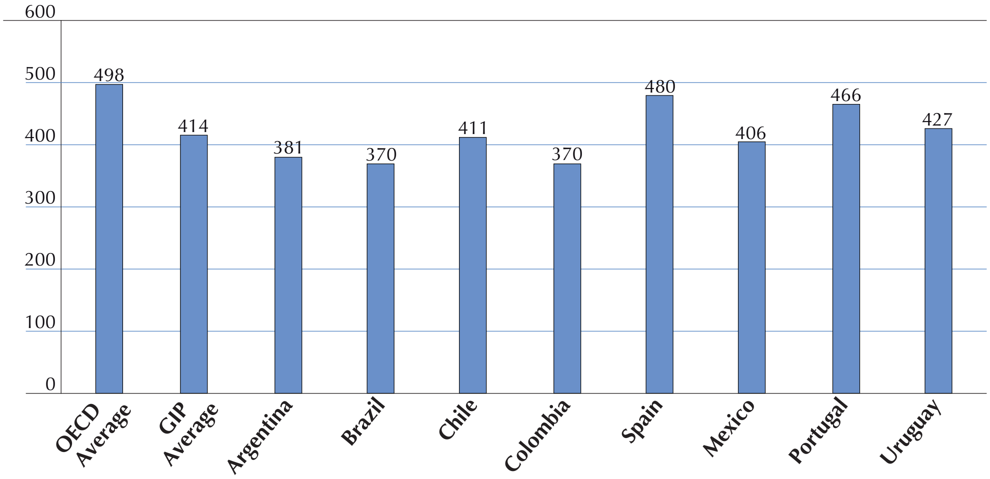
1. The mathematical *content* to which different problems and questions relate.
2. The *processes* that need to be activated in order to connect observed phenomena with mathematics and then to solve the respective problems.
3. The *situations* and *contexts* that are used as sources of stimulus materials and in which problems are posed.

The competency levels that are used for mathematics in PISA 2006 are those that were established for this subject when mathematics was the main area of assessment in PISA 2003.

The process that was followed to establish proficiency levels in mathematics is similar to that described in detail in the previous section. There are six levels of competency in mathematics.

Graph 3.25

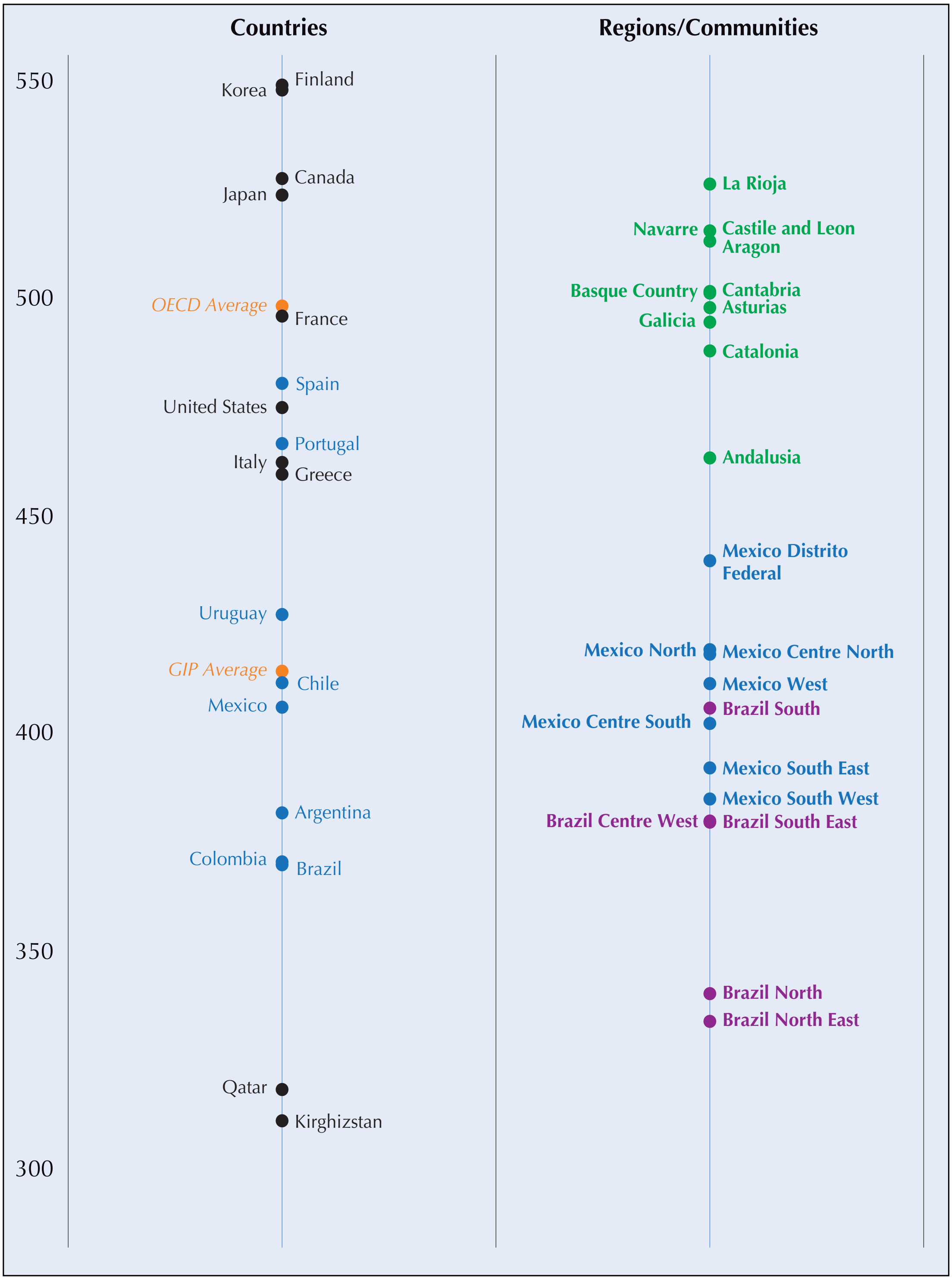
Global results in mathematical proficiency in the GIP countries (the GIP and OECD averages)



Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.26

Results in mathematical proficiency global scale in the GIP and reference countries, and the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.

Graph 3.25 shows the results for mathematical literacy in the Iberoamerican countries. The highest recorded results are for Spain (480), Portugal (466) and Uruguay (427), which are above the GIP average (414). It has to be indicated that all GIP countries are below the OECD average (498).

According to Graph 3.26, Spain (480) is above the United States (474), Italy (462) and Greece (459), partner countries with intermediate level results, while Portugal (466) has higher scores than Italy and Greece. Results from the Latin-American countries are well above Greece (the partner country with the lowest intermediate scores). All are above Qatar (318) and Kirghizstan (311), which are partner countries with very low scores.

Graph 3.26 also includes the communities and regions of GIP countries. In Spain, high scores are achieved in the Autonomous Communities of La Rioja, Castile and Leon, Navarre, Aragon, the Basque Country, Cantabria and Asturias, which are above both the OECD mean (498), and the GIP mean (414). In contrast, the West, Central South, South East and South West regions of Mexico, and all Brazilian regions, together with Chile (411), Mexico (406), Argentina (381), Colombia (370) and Brazil (370), are below the GIP average.

Proficiency levels in mathematical literacy

In order to synthesise the data obtained from the responses given to the evaluation instruments, PISA designed the scale according to six proficiency levels.

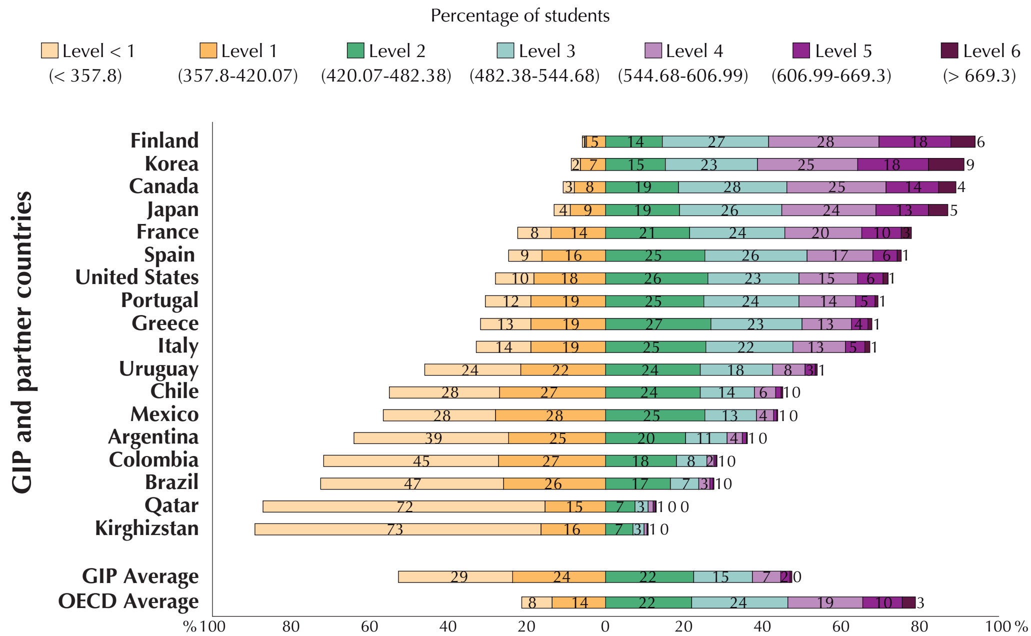
Table 3.5
Description of mathematics proficiency levels

Proficiency levels	Lower points limit	What are the students' proficiency levels in mathematics?
6	669.3	At Level 6 students can conceptualise, generalise, and utilise information based on their investigations and modelling of complex problem situations. They can link different information sources and representations and fl exibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understandings along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situations.
5	607.0	At Level 5 students can develop and work with models for complex situations, identifying constraints andspecifying assumptions. They can select, compare, and evaluate appropriate problem solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.
4	544.7	At Level 4 students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic ones, linking them directly to aspects of real-world situations. Students at this level can utilise well-developed skills and reason flexibly, with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.

Proficiency levels	Lower points limit	What are the students' proficiency levels in mathematics?
3	482.4	At Level 3 students can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They can develop short communications reporting their interpretations, results and reasoning.
2	420.1	At Level 2 students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures, or conventions. They are capable of direct reasoning and making literal interpretations of the results.
1	357.8	At Level 1 students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.
Inferior a 1		Students with results below Level 1 are usually not able to resolve the most basic type of mathematics which PISA endeavours to measure. They can respond to less than half the tasks in a test composed of tasks exclusively at Level 1. These students would have serious difficulties in using mathematics as an effective tool in order to benefit from new educational opportunities and learning throughout their lives.

Graph 3.27

Percentage of students by mathematics proficiency level in the GIP and partner countries



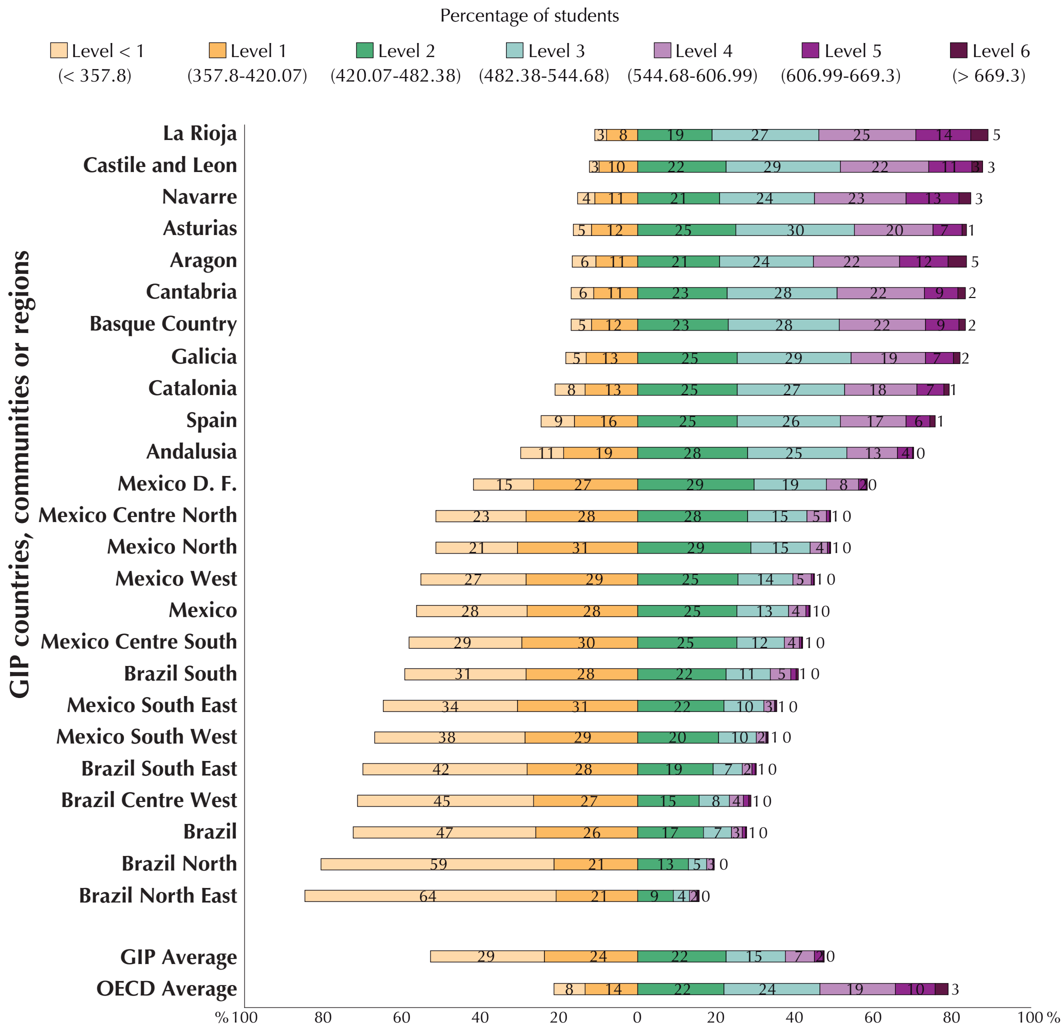
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries placed in order according to the percentage of students in levels < 1 and 1.

Argentina (64 %), Brazil (73 %) and Colombia (72 %) are the countries with most students below mathematical proficiency Level 2 (Graph 3.27). In Mexico and Chile approximately 55 % of students do not reach this baseline level. All the countries exceed the GIP mean (53 %). This indicates that their students cannot use basic formulae, algorithms, conventions and procedures, and that they are not capable of direct reasoning and making literal interpretations of the results.

Among Latin-American countries, Uruguay has the best results, with 46 % of the students at Level 1 and below Level 1. Spain (25 %) and Portugal (31 %) are close to, but above, the OECD mean (22 %).

Graph 3.28

Percentage of students by mathematics proficiency level in the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.
Countries, regions and communities are ordered on the basis of students' percentage at levels < 1 and 1.

Global results in reading literacy

The PISA concept of reading literacy goes beyond the simple measurement of the capacity of a student to decode and understand certain information literally. In PISA, reading literacy also implies the capacity to understand and use written texts and to reflect on them. Another aspect that must also be taken into account is the importance of reading literacy in enabling people to achieve their objectives as individuals and participate in society as active citizens. This signifies that, for PISA, reading literacy is a complex set of capacities which allow people to understand, use and analyse written texts in order to achieve their goals, develop their knowledge and fulfil their potential, and participate in society. PISA focuses on three main features to assess reading.

The first aspect, the text format, divides reading material into *continuous texts* and *non-continuous texts*. The former are usually sentences which make up paragraphs. These may then form part of broader structures, such as sections, chapters and books. The latter are structured in another way; they require a different reading method and can be classified according to text type.

The second dimension is defined in relation to three features of reading. Some tasks require the students *to retrieve information*: to locate isolated or multiple data in a text. Others require the students *to interpret texts:* find the meaning, and draw conclusions, from written information. The third type of task requires the students *to reflect on the texts and evaluate them:* to relate the written text to their previous knowledge, ideas and experience.

Thirdly, there is the situation or context that reflects the classification of texts according to the use intended by the author; the relationship to other people implicitly or explicitly connected to the text; and the general content. The situations included in PISA were chosen to achieve minimum diversity of content in the assessment tests: *reading for private use* (personal), *reading for public use*, *reading for work* (professional) and *reading for education*.

As reading was the main area in the PISA assessment of 2000 and PISA Plus (2001), a theoretical framework was developed, along with the instruments to measure reading literacy, by establishing an OECD mean of 500 points as a point of reference. This has been the basis for assessing results in reading since then. Reading scores are presented in PISA 2006 according to five levels of proficiency, which correspond to tasks of varying degrees of difficulty.

As with scientific and mathematical literacy, the creation of a series of proficiency levels makes it possible to produce a scale of student performance, and describe what students are able to do. Each successive level features tasks of increasing difficulty.

A group of experts ensured that the tasks at each level of reading literacy shared certain common features and requirements, while being consistently different from tasks at higher or lower levels. Subsequently, the technical difficulty of tasks was compared empirically on the basis of student results from the participating countries. An analysis of task selection made it possible to discover a sequence of skills and strategies in knowledge acquisition. For example, the easiest task, *retrieving information*, requires the students to locate specifically defined information, following a single criterion, in a text entirely, or almost entirely, lacking in any other information. They may be asked to identify the main subject of a familiar text, or establish a simple connection between an extract from a text and daily life.

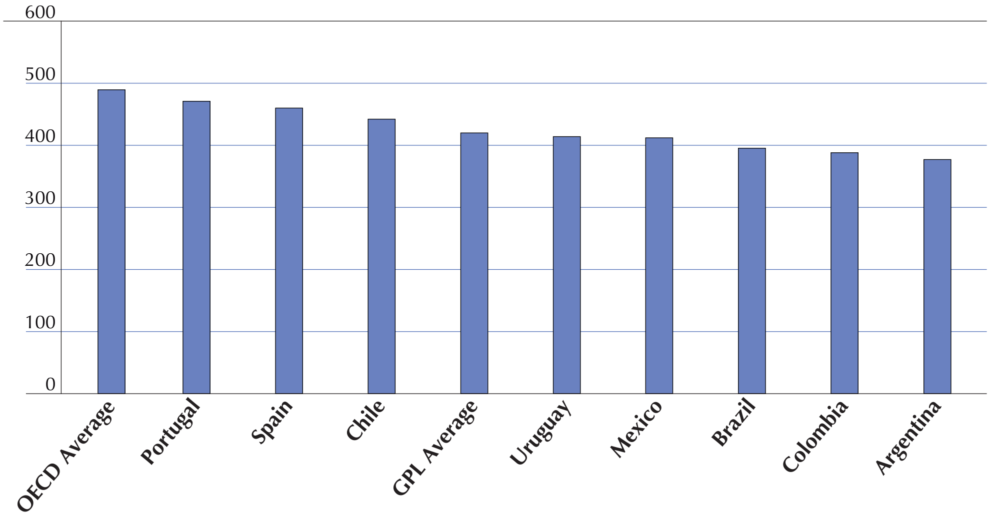
In general, information is a key part of the text, and is structured fairly simply. However, the more difficult tasks in which information is obtained require the students to locate and order several pieces of information hidden within the text, often following distinct criteria. There is often other information within the text,

which shares some of the features of the information that is required for the answer. Similarly, with regard to *interpretation* or *reflection* and *evaluation,* tasks at the lowest level differ from those at the highest level in several ways. These include the processes required to carry out the tasks correctly; the extent to which the processes are explicitly mentioned in the questions or instructions; the strategies required to respond adequately; the level of complexity and familiarity with the text; and the amount of information contained in the text.

Below are the results for reading proficiency. Graphs 3.29 and 3.30 show that Portugal (472) and Spain (461) stand out again as the countries with the best results in the group. Next comes Chile (442) among the countries which exceed the GIP mean (419). Argentina (374), Colombia (385) and Brazil (393) have the lowest scores.

Graph 3.29

Results on the reading global scale in the GIP countries (the GIP and OECD averages)



Source: GIP drafting based on the PISA 2006 database, OECD.

In this case, almost all the Autonomous Communities in Spain were below the OECD mean, although only by a small margin. The exception was Andalusia, which was below the Federal District of Mexico. The other regions of Mexico and Brazil were similar to other PISA areas, while the Mexican South West and North and the Brazilian North East were in the lowest positions.

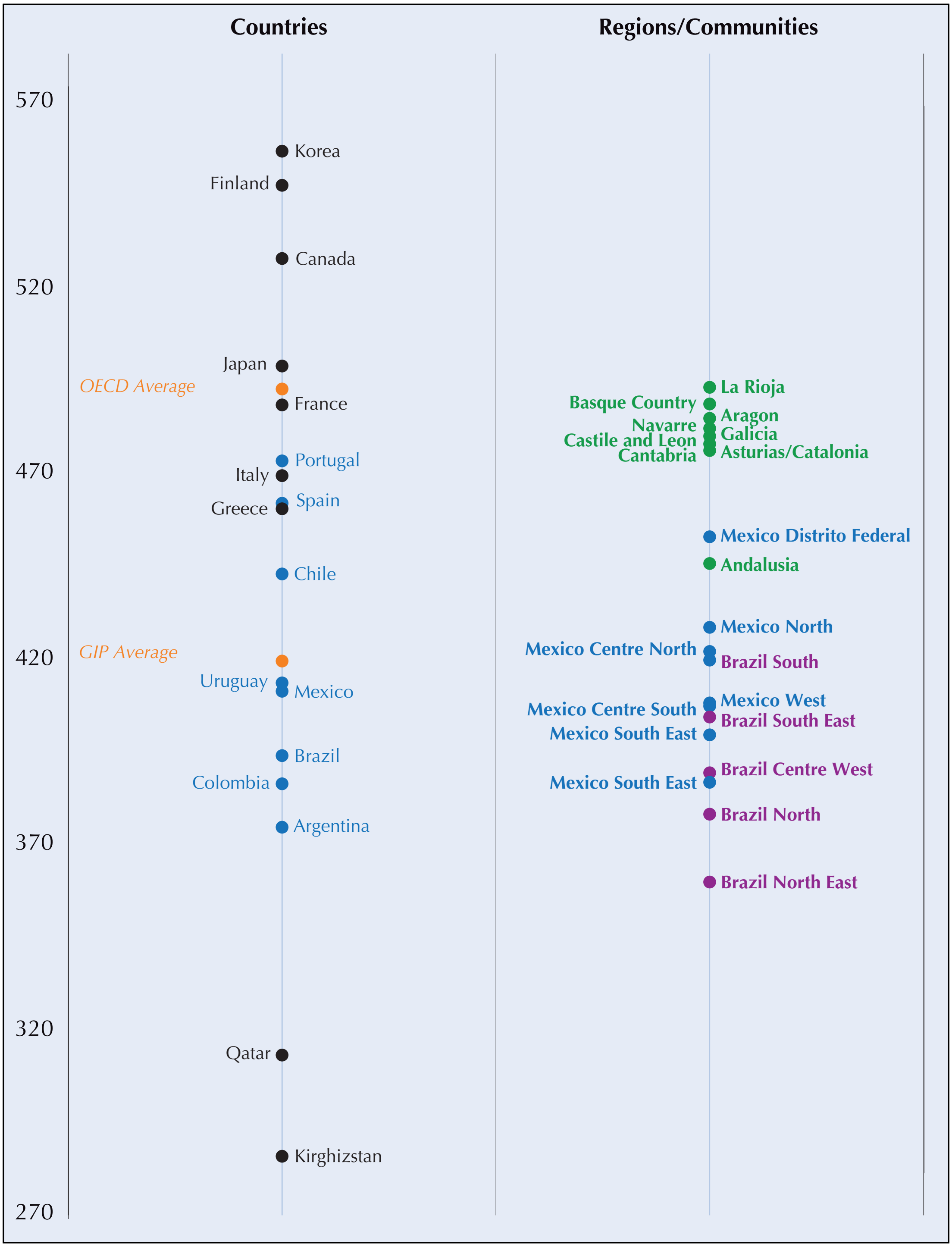
Proficiency levels in reading literacy global scale

The assessment of reading literacy in PISA is presented through three sub-scales: retrieving information, interpreting texts and reflecting and evaluating. Five levels of capacity were created in order to assess student reading performance.

At higher levels, students carry out very challenging tasks, such as finding complex information in a text they are not familiar with. At lower levels, the students only have to find the most obvious type of information, choosing from fewer alternatives.

Graph 3.30

Results on the reading global scale in GIP countries, reference countries and the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
The United States does not have results for technical reasons.

The students at higher levels are expected to be able to reflect on the intentions of the author of a given extract from a text. Lower level students are expected to be able to establish simple connections between the information in the text and daily life.

Table 3.6, below, describes the five reading proficiency levels.

Cuadro 3.6

Description of the reading proficiency levels

Proficiency levels	Lower points limit	What are the students' levels of reading proficiency?
5	525.6	Locate and possibly sequence or combine multiple pieces of deeply embedded information, some of which may be outside the main body of the text. Infer which information in the text is relevant to the task. Deal with highly plausible and/or extensive competing information. Either construe the meaning of nuanced language or demonstrate a full and detailed understanding of a text. Critically evaluate or hypothesise, drawing on specialized knowledge. Deal with concepts that are contrary to expectations and draw on a deep understanding of long or complex texts. In *continuous texts* students can analyse texts whose discourse structure is not obvious or clearly marked, in order to discern the relationship of specific parts of the text to its implicit theme or intention. In *non-continuous texts*, students can identify patterns among many pieces of information presented in a display which may be long and detailed, sometimes by referring to information external to the display. The reader may need to realise independently that a full understanding of the section of text requires reference to a separate part of the same document, such as a footnote.
4	552.9	Locate and possibly sequence or combine multiple pieces of embedded information, each of which may need to meet multiple criteria, in a text with familiar context or form. Infer which information in the text is relevant to the task. Use a high level of text-based inference to understand and apply categories in an unfamiliar context, and to construe the meaning of a section of text by taking into account the text as a whole. Deal with ambiguities, ideas that are contrary to expectation and ideas that are negatively worded. Use formal or public knowledge to hypothesise about or critically evaluate a text. Show accurate understanding of long or complex texts. In *continuous texts* students can follow linguistic or thematic links over several paragraphs, often in the absence of clear discourse markers, in order to locate, interpret or evaluate embedded information or to infer psychological or metaphysical meaning. In *non-continuous texts* students can scan a long, detailed text in order to find relevant information, often with little or no assistance from organisers such as labels or special formatting, to locate several pieces of information to be compared or combined.

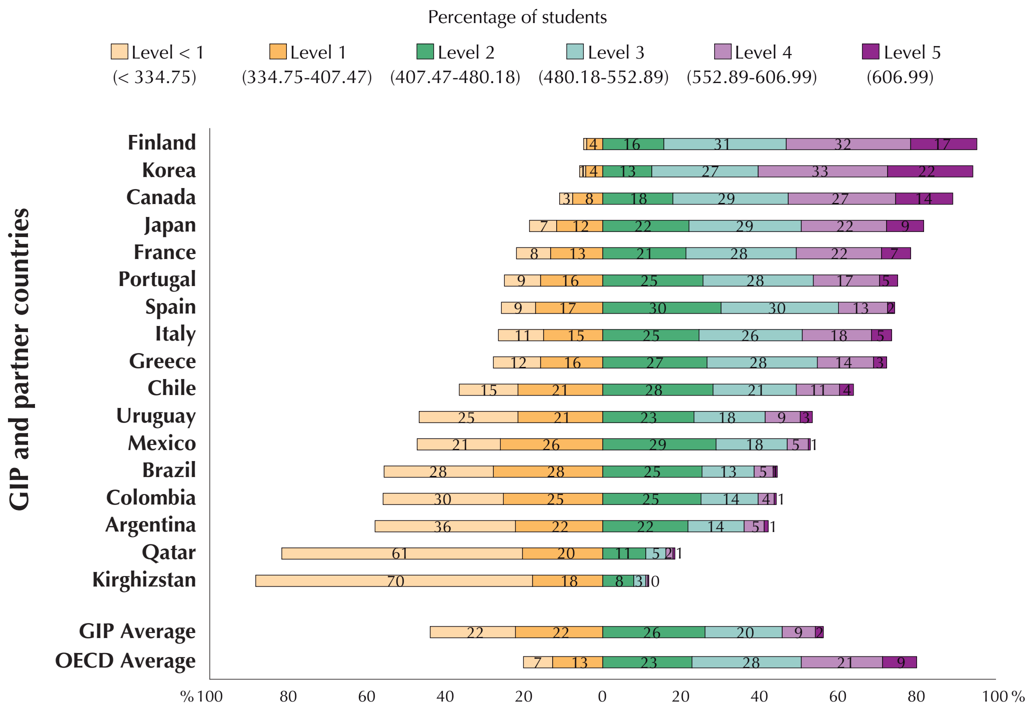
Proficiency levels	Lower points limit	What are the students' levels of reading proficiency?
3	480.2	Locate, and in some cases recognise, the relationship between pieces of information, each of which may need to meet multiple criteria. Deal with prominent competing information. Integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. Compare, contrast or categorise taking many criteria into account. Deal with competing information. Make connections or comparisons, give explanations, or evaluate a feature of text. Demonstrate a detailed understanding of the text in relation to familiar, everyday knowledge, or draw on less common knowledge. In *continuous texts* students can use conventions of text organisation, where present, and follow implicit or explicit logical links such as cause and effect relationships across sentences or paragraphs in order to locate, interpret or evaluate information. In *non-continuous texts* students can consider one display in the light of a second, separate documents or displays, possibly in a different format, or combine several pieces of spatial, verbal and numeric information in a graph or map to draw conclusions about the information represented.
2	407.5	Locate one or more pieces of information, each of which may be required to meet multiple criteria. Deal with competing information. Identify the main idea in a text, understand relationships, form or apply simple categories, or construe meaning within a limited part of the text when the information is not prominent and low-level inferences are required. Make a comparison or connections between the text and outside knowledge, or explain a feature of the text by drawing on personal experience and attitudes. In *continuous texts* students can follow logical and linguistic connections within a paragraph in order to locate or interpret information; or synthesise information across texts or parts of a text in order to infer the author's purpose. In *non-continuous texts* students demonstrate a grasp of the underlying structure of a visual display such as a simple tree diagram or table, or combine two pieces of information from a graph or table.
1	334.8	Locate one or more independent pieces of explicitly stated information, typically meeting a single criterion, with little or no competing information in the text. Recognise the main theme or author's purpose in a text about a familiar topic, when the required information in the text is prominent. Make a simple connection between information in the text and common, everyday knowledge. In *continuous texts* students can use redundancy, paragraph headings or common print conventions to form an impression of the main idea of the text, or to locate information stated explicitly within a short section of text. In *non-continuous texts* students can focus on discrete pieces of information, usually within a single display such as a simple map, a line graph or a bar graph that presents only a small amount of information in a straightforward way, and in which most of the verbal text is limited to a small number of words or phrases.

Proficiency levels	Lower points limit	What are the students' levels of reading proficiency?
Below 1		The fact that there are no reading literacy tasks with values below 334.8 does not make it possible to state that these students completely lack reading literacy or are totally incompetent. However, it is highly likely that they will resolve less than half the tasks in a test with questions exclusively taken from Level 1. That is to say, these students will have difficulty using reading independently as a tool which can help them to acquire knowledge and skills in other areas.

The fact that a significant proportion of students are at, or below, Level 1, or indeed even at this level, suggests that many students are not acquiring the knowledge, and developing the skills, which are a prerequisite for them to take full advantage of their educational opportunities. This situation is of even greater concern given the wealth of data that shows that is increasingly difficult to make up for early learning deficiencies later on in life.

Graph 3.31

Percentage of students by proficiency level in reading literacy global scale in the GIP and reference countries



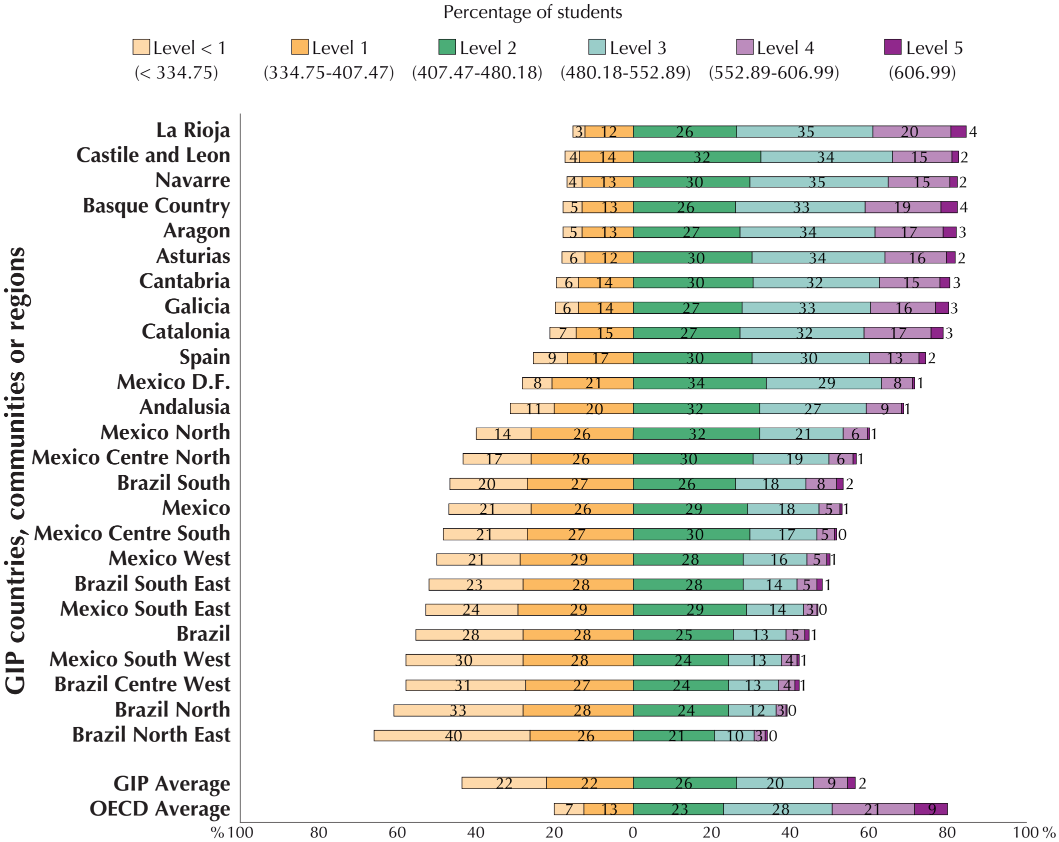
Source: GIP calculations based on the PISA 2006 database, OECD.
Countries ordered according to the percentage of students at levels < 1 y 1.
The United States does not have results for technical reasons.

The OECD data seem to indicate that education continues to be related to professional environments and training. There is a difference in skills compared to when individuals conclude their initial education (OECD, 2007). The reading skills of adults are closely related to their participation in adult education and professional training programmes, even if other features which affect participation in training courses are taken into account. Reading skills, education and professional training are inter-connected and complementary, so that, generally speaking, the adults who do the least training are exactly those who need it most.

Graph 3.31 shows that more than 50 % of students in Argentina, Colombia and Brazil do not reach Level 2 of reading proficiency. In Mexico and Uruguay over 40 % of students do not reach this baseline. Students below Level 2 cannot locate extracts containing information, process contradictory information, or identify the main idea in a text, understand relationships using simple categories, and so on.

Graph 3.32

Percentage of students by proficiency levels in reading literacy global scale in the GIP countries and the regions and communities of Brazil, Spain and Mexico



Source: GIP calculations based on the PISA 2006 database, OECD.
In calculating the averages and standard errors of Mexico, the state of Morelos (Mexico Central South) was not included, because only secondary school students were assessed there.
Countries, regions and communities are ordered on the basis of students' percentage at levels < 1 and 1.
The United States does not have results for technical reasons.

Among Latin-American countries, only Chile has 36 % of its students below, or at, Level 1. Spain (26 %) and Portugal (25 %) have more satisfactory results, but they do not achieve the OECD mean (20 %) for this baseline level.

Graph 3.32 shows that the Spanish Autonomous Communities of La Rioja, Castile and Leon, Navarre, the Basque Country, Aragon, Asturias, Cantabria and Galicia have better results than the OECD mean of 21 %. Catalonia, Spain, Andalusia, and the Federal District of Mexico record results for below Level 2 that are just over the OECD mean. The other Mexican and Brazilian regions have more than 40 % of their students at the lower levels.

4

Analysis of the main factors affecting results in science

RAISING THE PERFORMANCE LEVELS OF ALL IBEROAMERICAN STUDENTS, AND REDUCING INEQUALITIES IN THEIR RESULTS

Perhaps the most important question that educators should ask themselves is the following: *How can we raise educational performance in general, and yet also reduce inequalities between students who come from different family backgrounds*?

PISA data can be used to describe the relationship between educational performance and socio-economic status (SES). This relationship is described by terms such as *socio-economic gradient* or *learning bar*. In the terms of the latter, the initial question turns into the following one: *How can we raise and level the learning bar*? (Willms, 2006). In addressing this question, it is important to clarify, firstly, how students from different backgrounds are distributed in schools; and, secondly, the quality of the education they receive at those schools. The quality of the schools may vary from one sector to another. There may be differences between state and private schools, rural and urban schools, as well as between schools in different provinces or regions.

In this chapter, four evaluation instruments are used for responding to the question on the *learning bar*. We have called these *socio-economic gradients*, *school profiles*, *graphs of learning resources* and data on *equality-equity*. Taken together, these tools provide a profile of the educational system that can guide educators, and those responsible for education policies, towards the type of reforms that are most effective in raising student performance and reducing inequalities.

The following section of this first part describes these evaluation tools, using the Mexican data as examples. In the second section, the profiles of each country are presented and analysed. The third section shows the degree of variation in the results from the provinces and regions of Brazil, Spain and Mexico, the three countries that provided regional data for PISA 2006. Information is supplied on each of these regions. The heads of PISA in each Iberoamerican country that participated in PISA 2006, added their comments and observations so that results could be put into perspective, and better understood.

In the fourth section, an analysis is made of the relationship between social, economic and cultural levels and national results. Lastly, a concluding section of final considerations reflects on the scope and limitations of the data, as well as the implications of the results for educational policies. Some ideas are also put forward on possible ways to follow up on these analyses.

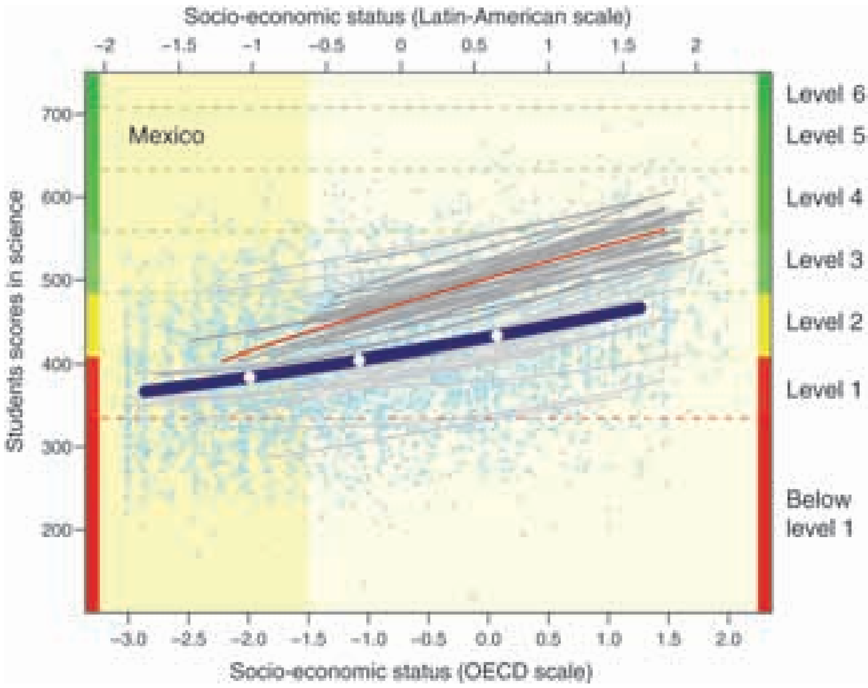
Socio-economic gradients

Graph 4.1 shows the relationship between science performance and the social, economic and cultural status (SES) of the students assessed in PISA 2006. Mexico is represented by a blue line, the countries participating in PISA by grey lines, and the combined group of OECD countries by a red line. The small blue points represent the scores of students in the PISA science test (on the vertical axis), in relation to their family SES (on the horizontal axis). The scores correspond to a sample of 5,000 Mexican students, considered to be representative.

The science progress scale, with an average of 500 points and a standard deviation of 100 for the group of OECD countries, was explained in detail in Chapter 1. The colour bars on both sides, and the dotted lines that join them, show the six proficiency levels used in PISA. Students who obtain grades at Level 1 or below, generally lack the basic skills required to enter higher education, or obtain employment in the developing knowledge economy.

Graph 4.1

Socio-economic performance gradient of science performance in Mexico compared to the OECD



The SES scale is a compound system of measurement. It includes the students' economic, social and cultural backgrounds, taking into account the data on their parents' education and occupations, as well as each household's material possessions and cultural environment.

The previous, and following, graphs employ two different measurements of socio-economic status. The SES measurement on the lower horizontal axis uses a scale designed to have an average of 0 and a standard deviation of 1 for all OECD students. However, the SES measurement of the upper horizontal axis was standardised so that its average of 0, and its standard deviation of 1, correspond to all the students from the Iberoamerican countries that participated in PISA 2006.

The regression lines, or gradients for each country, as well as the OECD line, are drawn from the 5^{th} to 95^{th} percentiles on the SES scale. In the case of Graph 4.1, the gradient line for Mexico is drawn from -2.86 (5th percentile) to 1.26 (95th percentile) on the lower horizontal axis. The white points on the blue gradient line indicate the 25^{th}, 50^{th} and 75^{th} percentiles of Mexico.

The students who have a value below -1.5 according to the OECD SES scale (lower horizontal axis) are in the lowest 8 % of socio-economic status of the group of OECD students. The same value is equivalent to -0.61 on the SES scale of Latin-American countries (upper horizontal axis); approximately 25 % of all Latin-American students have the lowest SES points. In this chapter *students with low socio-economic status* are defined as those with SES points below -1.5 on the standardised OECD scale, or below 0.61 on the scale for Latin-American countries. The background of Graph 4.1, at below these values (-1.5 or -0.61), is highlighted by a slightly darker yellow colour.

There are at least five important results, which emerge from the graph and show the socio-economic gradient for Mexico:

Firstly, a high concentration of students who come from very low SES environment. The average SES for Mexico is -0.87, and approximately 39 % of students come from low SES families, according to the limit value of -1.5 on the OECD scale.

Secondly, there is a high proportion of students with science scores at Level 1, or lower. More than 40 % of students had grades at these low levels. (See Chapter 2.)

Thirdly, most of these «vulnerable» students – those who had grades at Level 1, or below – come from homes with low SES.

Next, there are many *resilient* students, who come from a low SES environment, but nevertheless obtain grades at Level 3. However, very few students from low SES environments reach Level 4, or above.

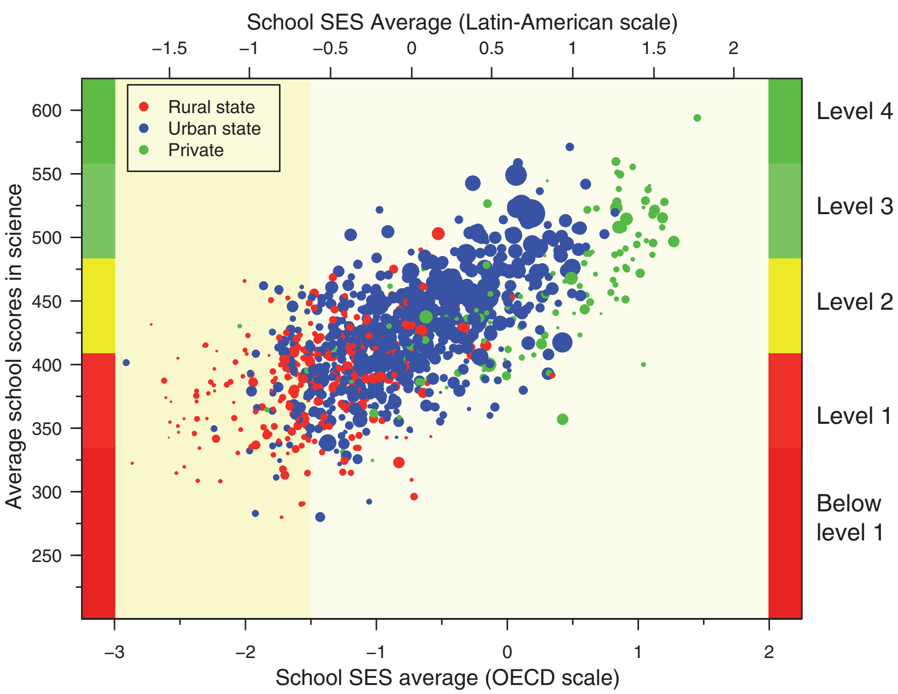
Finally, the gradient of Mexico is less steep than the OECD gradient. The gap in achievement levels between Mexico and the OECD for students with low SES is quite narrow, ranging from about 25 to 50 points. On the other hand, the gap for students with average and high SES is considerably wider, reaching about 100 points on the science performance scale.

School profiles

The *school profiles* represent the *average levels by school* of student performance in science compared to the SES average, also by school. Graph 4.2 shows the *school profile* of science performance in Mexico. Each small circle represents one of the schools in Mexico, which participated in PISA. The colour indicates whether these are rural state schools (red circles), urban state schools (blue circles), or private schools (green circles). The relative size of each circle corresponds to the square root of the enrolment at the school represented. *Rural schools* are those which are located in small villages with less than 3,000 inhabitants, as

Graph 4.2

School profiles of science performance in Mexico



well as in towns with between 3,000 and 15,000 inhabitants. *Urban schools* are those in towns and cities with more than 15,000 inhabitants.

The most noteworthy conclusion established by the school profile is that the socio-economic backgrounds of students are markedly different in rural state schools, urban state schools and private schools. However, within each of these three groups there is considerable differentiation between schools. Most private schools receive students from families with relatively high SES, although some receive students from families with average SES, and where this is the case, results are generally lower than in state schools. Rural schools have very low grades, often showing mean proficiency levels of Level 1, or lower. Urban state schools which receive students with SES backgrounds that are comparable to those of the students attending private schools also have similar proficiency levels.

The school profile also shows that the average performance range of schools varies considerably at all levels of student SES. In general, there is a range of approximately 100 points on the science performance scale between schools with higher and lower levels of proficiency, assuming comparable levels of student SES.

Graphs of learning resources

The strong variation in average school performances that emerges clearly from the school profile raises the following question: *Why do some schools have higher average proficiency levels than others*? The third evaluation instrument, the graph of *learning resources*, uses PISA data to show the distribution of school resources, which is thought to be related to educational performance (Willms, 2006). This type of analysis is based on a learning model developed by Caroll and others (Caroll, 1963), which has influenced the development of PISA and other comparative international studies.

The five factors of the learning model are: *quality of teaching,* which is concerned with how effectively the school curriculum is taught by teachers the classroom; *appropriate level of teaching*, whether the teaching is at a level which is consistent with the students' abilities to learn; *time assigned to learning,* which includes the time that students devote to learning at school and at home; *attitudes to learning,* which refers to the active engagement of the students in learning, the degree to which they value schooling outcomes, and whether they identify with the school; and human and material *school resources*. All of these must be present if optimal learning is to take place. Students can be highly motivated, but if there are low levels of teaching quality, or if little time is allocated to this, not much learning will be achieved.

The relative importance of these factors is estimated by using the statistical technique called Hierarchical Linear Modelling (HLM). This analysis was at three levels: the students in the schools, schools in each country, and the countries themselves. The underlying idea in HLM analysis is to calculate the school science performance of an *average student,* for example, one with an average SES level. This makes it possible to obtain an *adjusted school mean,* that is to say, the average score of the school after making adjustment for SES level.

In all the countries that participated in PISA there is a significant between-school variation in the *adjusted school mean* in science. Consequently, at the next level of the hierarchy, we can ask whether some of the variations in the adjusted school mean can be due to distinct educational factors, such as the quality of the teaching, the time allocated to learning, or school resources. In selecting PISA variables to include in the graph of *learning resources*, we take into account whether a factor may partially explain some of the variations in the adjusted school means. The variables that were used are described in the following table.

Table 4.1 School level factors used in the HLM analysis

Teaching quality. This is based on the responses given by the students to two questions on whether their teachers and the subjects studied at school provide them with the skills they require for a career related to science. The results for this variable in Mexico range from 6 to 8.5 points in most schools, and the average score is 7.25. A value of 5.0 for this variable indicates a neutral result, signifying that students do not show either a positive or a negative attitude on questions about teaching quality. The results therefore indicate that most students in Mexican schools responded positively. The average score for Mexico for this variable are well above the OECD mean, which is 6.18.

The public accountability of schools. This is based on four questions that were addressed to school principals. They were asked whether they considered that teachers are responsible for student performance, given that they have to inform parents on student performance, as measured by national or international criteria. They were also asked whether there was pressure from parents to maintain high standards, whether the data on academic results were publicly available, and whether the data on student performance was used to evaluate teachers. The points for this variable varied considerably in Mexican schools. In general, the calculations show that teachers have relatively high levels of public accountability: the average Mexican grade is 4.59, which is above the OECD mean of 4.15.

Coverage of the curriculum. This is based on the information given by the students on whether they covered specific science subjects in class, such as photosynthesis or nuclear energy. The average points for Mexico for this variable was 6.54, below the OECD mean of 7.12.

Appropriate level. This was obtained with six questions the students were asked on whether it seemed easy or difficult to learn new subjects and concepts in science. 5 points on this scale indicate a neutral response. The Mexican average for this variable was 6.32, while that of the OECD is 5.12. This indicates that Mexican students have a generally positive attitude towards their school experience.

Time allocated to science. This is based on the information provided by the students on how much time they spent each week on normal science classes at school. Each point on the scale of ten represents 40 minutes of class time per week. The average score for Mexico is 5.03, which is slightly higher than the OECD mean (4.46). The results of this analysis show that there is a wide variation between schools in the amount of time devoted to science teaching.

Number of courses. This indicates the average number of courses taken by students in the current year, and the previous one, in biology, physics, chemistry, and science in general. The average score for Mexico was 4.85, which is similar to the OECD mean (4.86). Results from schools varied considerably.

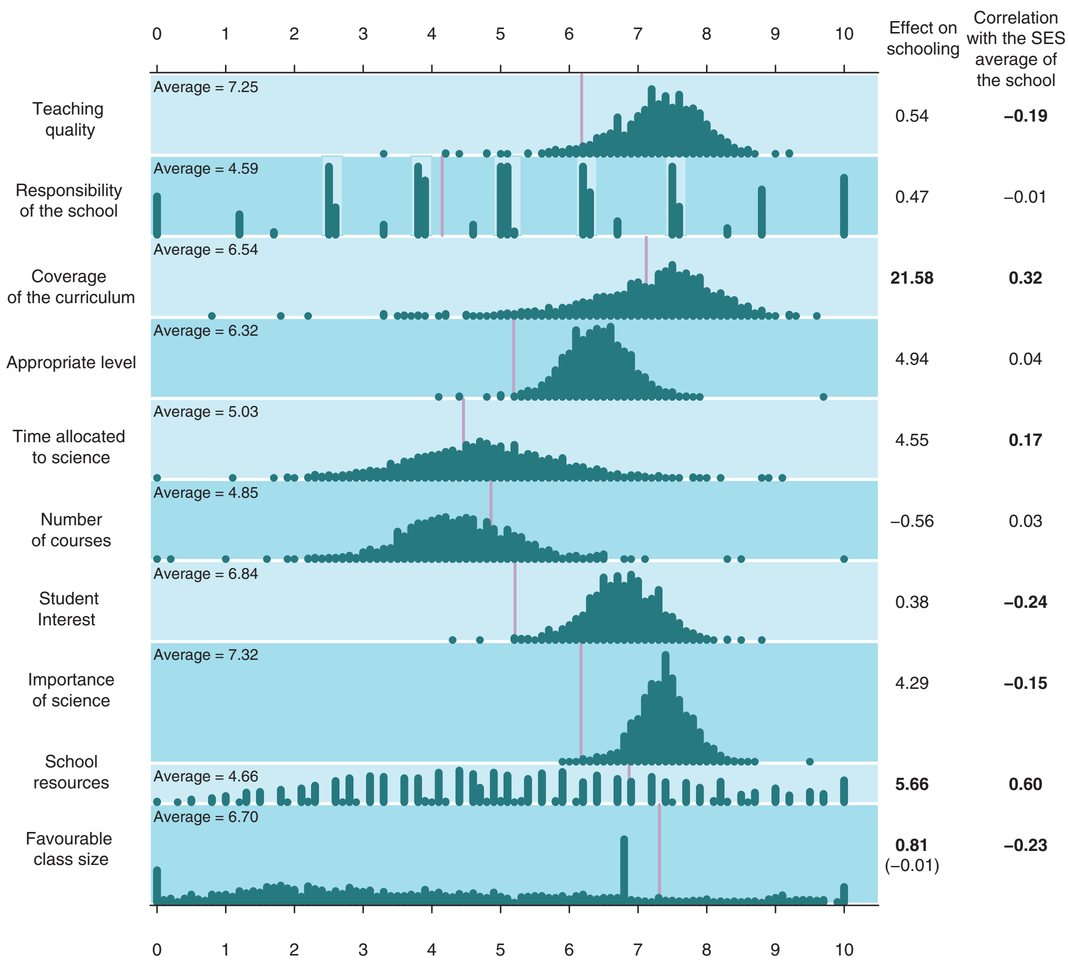
Student interest. This is based on 12 questions which show student interest in learning science. A score of 5.0 points indicates a neutral response. The results show that Mexican students are extremely motivated to study science: the average grade was 6.84, which is well above the OECD mean of 5.21.

Importance of science for students. This variable was obtained from the responses to 14 questions on whether the students felt that scientific issues are important for society, relevant to their daily lives, and significant for their future. The Mexican average is 7.32, which is also well above the OECD mean of 6.17.

School resources. This variable indicates whether the principals considered that they had sufficient human and material resources in their schools. It was based on the responses given by the principals to 13 questions on their schools. The Mexican average is 4.46, which is much less than the OECD mean of 6.87. There were considerable variations between schools, and many were below 5.0.

Class size. This was based on the reports provided by the principals on average class size in their schools. The scale was set in such a way that low points represent large classes, while high points indicate small classes. Schools with an average class size of 60 or more students obtain 0 on this scale, while an average size of 55 students receives a score of 1. Following this progression, an average class size of 15 students receives a score of 9, while class sizes of 10 students are given 10. The mean score for Mexico is 6.70, which indicates an average class size of approximately 26.5 students. The OECD mean for this variable is somewhat higher (7.31), corresponding to an average class size of approximately 23.5. In Mexico, average class sizes varied considerably from one school to another.

Graph 4.3
Learning resources in Mexico



Learning resources in Mexico are presented in Graph 4.3. The graph shows the pattern of scores in Mexican schools for the ten variables mentioned above. Each variable is presented on a scale of 10 points, in which high scores show the most favourable learning conditions. For each variable, the points that are grouped into small columns represent the Mexican schools that participated in PISA, and the vertical red line indicates the OECD mean. As was stated above, the variables were chosen for their relationship to science performance in PISA 2006.

Graph 4.3 shows the pattern of each of the ten educational factors studied in the HLM analysis. It also provides some results in two columns presenting data, which are included on the right of the graph. The first column shows the estimated values of the coefficients, or *schooling effects,* of each factor, which are based on a two-level HLM analysis of the Mexican data. While the term *schooling effect* is widely used, it cannot be inferred that there is a *causal* effect here, as the data on which the analysis is based (PISA 2006), correspond to a single implementation. No information is given that shows change over time.

Each coefficient indicates an increase in student science performance, leading to a one-point rise in the corresponding factor, while the other factors of the model remain unchanged. In the case of the two coefficients of the *favourable class size* factor, a linear and a quadratic term are included, and the effect refers to the change in performance when class size increases by one student, as is analysed below. The second column on the right of the graph on *learning resources* correlates school averages for each factor with the same schools' SES averages. The results indicate that the three most important schooling factors that are positively related to the SES average are coverage of the curriculum, time allocated to science teaching, and school resources. These factors are also strongly linked to student performance in the tests. However, the average level of interest shown by the students in science, as well as the importance which they attach to science, are inversely related to the schools' SES means. Students who are in schools with low SES generally report quality teaching levels that are higher than those given by those attending high SES schools. Small class size also showed an inverse correlation with the schools' mean SES, which is probably because classes are smaller in rural schools.

Issues of equality and equity

The *socio-economic gradients* and *school profiles* indicate that there are inequalities in student performance in science, and suggest that these are connected to family background. In addition to the data on these inequalities, it is also important to have information on the *inequity of learning opportunities*.

Inequality of educational results refers to the differences in academic performance between certain groups of students, such as those of distinct socio-economic status, ethnic origin, immigrant or non-immigrant background, and gender.

The term *inequity of learning opportunities* refers to how inequality of results emerges, and whether they reflect fair and objective procedures. If inequalities do exist, we want to understand the underlying processes that have created them. For example, we could ask the following questions: *At what age do inequalities in educational results become marked? Does the educational system increase or reduce inequalities as the children progress through school?* If there are inequalities between ethnic groups, we could ask: *Are the inequalities seen in results mainly due to poverty, or has prejudice also played a role? If so, how do these processes come to constitute a pattern in the educational system and society?* A full understanding of inequalities, and the absence of equity, requires longitudinal data and a combination of research methods. Thus, PISA can only provide a general picture of the extent of inequalities, and related factors, in the educational system.

Issues of inequality, and the lack of equity, are often controversial politically, but it is essential to address these issues in order to develop educational and social policies, which seek to raise and level the learning bar. Perhaps the biggest problem is related to the frequency with which students of distinct SES are assigned to different types of schools. Educational systems which have high levels of segregation also have low levels of academic proficiency in reading literacy and other fields, than those which are more inclusive (Willms, 2006).

The term *segregation* is widely used to refer to the separation of persons of different social classes, ethnic or racial groups, or gender, in different schools, classrooms, neighbourhoods or social institutions. This separation is not necessarily due to deliberate policies, or limited access, and may result from a combination of economic, social and political factors. As a result of residential separation, a certain degree of socio-economic segregation is inevitable in all countries. There is practically no city anywhere in the world that does not have are rich and poor residential areas, while SES levels are generally higher in urban areas than in rural ones. Consequently, if children attend state schools in their own neighbourhoods, and this is usually the case, then average student SES will vary from one school to another.

Educational administrators can mitigate this problem by adopting several strategies, such as open enrolment policies, the creation of *magnet schools* in low SES areas, which attract middle class families, or specifying catchment areas so that they counter-balance SES-linked admission. Nevertheless, such policies may not be successful, as high SES parents rapidly detect the rules underlying enrolment, and have a wider range of possibilities to choose from.

Segregation can also reflect structural aspects of the educational system. The strength of the private sector is significant as parents with greater economic resources usually have both the means and the inclination to send their children to private schools. However, even within the public sector some characteristics of schools and educational systems may increase segregation on the basis of socio-economic status. Special programmes, such as immersion courses in a second language and those provided for gifted students, tend to increase segregation between schools. Many of these programmes base selection on formal academic criteria, which generally increases the variation in academic performance between schools.

The degree of segregation by SES is related to school performance because the learning context or environment of a school is a major factor in determining the speed at which children learn. (See McPherson and Willms, 1987; Murnane, 1981; Rutter, 1983; Sammons, Hillman and Mortimore, 1995; Scheerens, 1992.) When students are segregated according to SES, those who come from privileged backgrounds generally perform better, while those from disadvantaged economic or social backgrounds tend to perform less well (Brookover *et al.*, 1978; Henderson, Mieszkowski and Sauvageau, 1978; Rumberger and Willms, 1992; Shavit and Williams, 1985; Willms, 1986).

Initially, researchers attributed the *context effect* to peer interaction. They argued that when brilliant and motivated students work together, they learn from each other, and establish higher performance standards. However, other factors also contribute to the context effect. For example, schools in which students have high SES backgrounds are generally more likely to attract and retain talented and motivated teachers. High SES schools also tend to receive greater parental backing, and their teachers are more likely to establish and maintain high performance levels, and progress more rapidly through the curriculum. There is likely to be a lower proportion of children with special needs or disciplinary problems. Moreover, in some school systems higher SES schools are also likely to have smaller size classes, and better teaching resources.

Analysis of the PISA 2000 data by Willms (2004) established that, in all countries, reading literacy levels were more closely linked to the composition of schools according to student SES, than the effects of family environment on each student. Although the impact of this *composition effect* differed from one country to another, it was related to several aspects of the schooling context and the classroom. Many of these contextual factors were related to the reading literacy level of students. Compared to PISA 2006, the PISA 2000 data included a wider range of factors describing the school and classroom environments. However, we may also consider the role of the schooling context in PISA 2006, and see to what extent average school SES is related to factors which influence learning. This type of analysis sheds light on how equitably educational opportunities are provided in each country.

The problem of equality and equity can be addressed, using statistical techniques derived from the analytical work of educational researchers, epidemiologists and sociologists.

Hierarchical Linear Models (HLM) make it possible to calculate the proportion of total variation between schools, both for student results and SES; the latter is an indicator of SES-related segregation. HLM models are also used to distinguish the within-school, and between-school, socio-economic gradients. A socio-economic gradient is calculated for each school (Graph 4.1); the average of these gradients is the *average within-school gradient*. Using the data by school from Graph 4.2 it is possible to calculate the *between-school gradient*.

The distinction is important because some educational systems have *within-school gradients,* which only slope slightly, but steeply inclined *between-school gradients*. Other systems have steeply inclined *within-school gradients,* and an only slightly inclined *between-school gradient*. In the first instance, results are likely to improve if the focus is on schools that have obtained low results. In the second case, however, it is more appropriate to aim for the improvement of results achieved by low performance students in all schools. In Mexico, 47 % of students had science scores that placed them at proficiency Level 1, or lower. 39 % had low SES levels (below -1.5 on the OECD scale). In the six Latin American countries that participated in PISA 2006, about 25 % of students were considered to have low SES.

Approximately 41 % of the variance in reading scores occurs *between schools*, which is rather higher than the OECD average of 36 %. 35 % of the SES variation occurs *between schools*, which is considerably higher than the OECD average of 24 %. The average slope of *within-school gradients* in Mexico is very gradual, at only 4.5, which indicates that, within schools, reading skills are not closely linked to student SES. However, the slope of the gradient *between schools* is very steep, at 49.5, which indicates that there are major inequalities in achievements between schools. This was also seen in science performance in the *school profiles* (Graph 4.2).

Five types of possible intervention

Socio-economic gradients, school profiles, graphs of learning resources and diagrams of equality-equity are key tools for establishing which type of intervention will be the most appropriate to *raise and level the learning bar*. In the UNESCO report, *Learning Divides* (2006), Willms examines five types of policy intervention:

Performance-targeted interventions

These are aimed at improving the levels of academic achievement of students whose performance is insufficient in a given area. They may include proposing a modified curriculum, or additional teaching resources. These include early prevention programmes for children with deficient skills when they start

school. Remedial reading programmes are another example. These programmes are focused on performance, and do not need to be aimed at individual students. They can be directed at low performance schools, which has the advantage that it is usually less expensive to focus on schools. When there is high variance in academic performance between schools, as is the case in Mexico, it is logical to focus on performance, and intervene in specific schools. However, a major drawback is that there are many weak students at schools with average or high SES. A performance-targeted strategy, aimed at schools, will not reach these students.

SES-targeted interventions

These may involve a similar type of action to those mentioned above, but are aimed at children with low SES. For example, special summer learning programmes can be provided for children from low SES families. SES-targeted interventions are justified when there is an inclined socio-economic gradient, and a high level of risk is attributed to the population. As with performance-based interventions, initiatives based on SES are aimed at low SES schools, and not to individual children from low SES backgrounds.

Compensatory interventions

These involve additional economic resources for children from low SES environments. They can also be aimed at children or schools with low SES, but they are not intended to be educational programmes that have a direct bearing on the learning process, or otherwise influence student results. Instead, these interventions are intended to mitigate some of the damaging effects of poverty. One example of compensatory intervention would be a programme that provided free breakfasts to children from poor families.

Compensatory programmes do not generally play a major role in raising and levelling the learning bar. However, their importance need not be minimised, as children should not have to suffer the indignity of living in poverty, while ongoing compensatory interventions are valuable in themselves, regardless of their academic consequences. Compensatory interventions have the modest but widely significant effect of helping to reduce behavioural problems, improving self-esteem and increasing student levels of commitment. This can also contribute to the improvement of academic proficiency levels in the long run. A country can also implement a compensatory intervention, which offers certain types of school resources to low SES schools. In poor countries, compensatory interventions can help to address inequalities in educational opportunities.

Universal interventions

These are aimed at increasing the educational performance of all children in a region. Examples of overall interventions would be an increase in the amount of time allocated to reading, or a reduction in class size, applied uniformly throughout an educational system. These are intended to raise the learning bar, but they do not necessarily level it as all children benefit. Universal interventions are more appropriate when the socio-economic gradient is relatively flat, and there is little SES-linked segregation between schools.

Inclusive interventions

The aim is to reduce SES-linked segregation between schools. Policies are implemented that redistribute low SES students, or those who are vulnerable for other reasons, in schools in which students have average SES. For example, a country or a region can try to reduce segregation by redefining the boundaries of catchment areas, integrating schools, or creating magnet schools in areas with low SES. This type of intervention is required when educational systems reach a high level of segregation between schools as a

result of divergent SES. In practice, inclusive interventions are difficult to put into effect wherever SES-linked segregation differentiates strongly between urban and rural schools. This is in fact the case of many of the countries in this study. Moreover, they are often politically contentious, as they encounter strong resistance from middle-class parents who benefit from a segregated system.

No single type of intervention, or combination of interventions, is invariably appropriate. In fact, to a considerable extent their utility depends on adaptation to local circumstances.

The following sections of this chapter present the results for each Iberoamerican country that participated in PISA 2006. It also shows the findings on the regions of three of these countries. It is based on the tools that were discussed above, and includes a brief analysis of the implications of its findings. As was mentioned above, these considerations take into account the types of intervention required to improve educational standards, but from the viewpoint of those heading PISA in each country.

THE IBEROAMERICAN COUNTRIES

Argentina

Graph 4.4 shows that the socio-economic gradient of Argentinean students is fairly steep. (There is a 150 point difference between percentile 5 and 95 of SES.) This socio-economic slope is almost parallel to that of the OECD, but well below it, as it does not rise above Level 2. It is clear that 25 % of Argentinean students have a low socio-economic level, which is below -1.5 on the OECD scale. If we look at the students belonging to this group, only a minimum percentile is above Level 2, which is the baseline level for this competency.

According to Graph 4.5, there are great variations between schools. It may be observed that among state schools, smaller ones have a lower performance level. In contrast to other countries, however, not all of these schools are rural. No school reaches an average of Level 4 or higher. Most private schools achieve results at Level 2 and Level 3, although to a considerable extent this depends on student SES. State schools are below Level 3, except for those that have a higher level SES intake.

Graph 4.6 shows learning resources. Once the hierarchical linear model has been adjusted at two levels, there are four factors that are significant for schools.

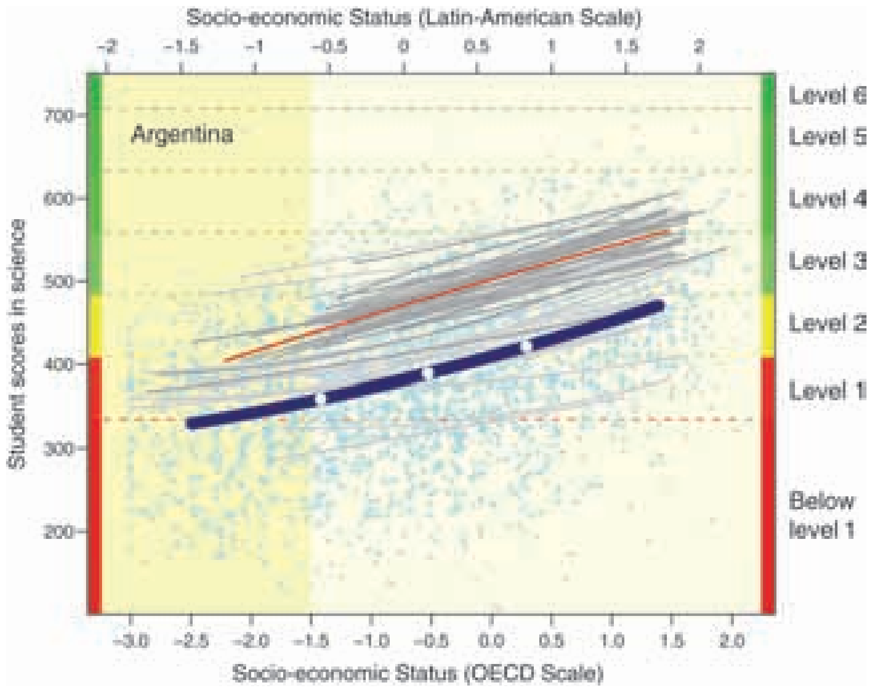
Teaching Quality

Argentina has an average score of 6.77, ranging approximately from 4.5 to 8.7. This signifies that most Argentinean students gave positive responses for this indicator. Argentina's average score is just above the OECD mean of 6.18.

On adjusting the hierarchical linear model, it is noteworthy that results are negative despite the students' high opinion of teaching quality. The indicators suggest that, as the perception of teaching quality by the students rises, the level of science performance actually diminishes. In order to understand this, it may be helpful to study the correlation between this indicator and the socio-economic level of students, which is –0.51.

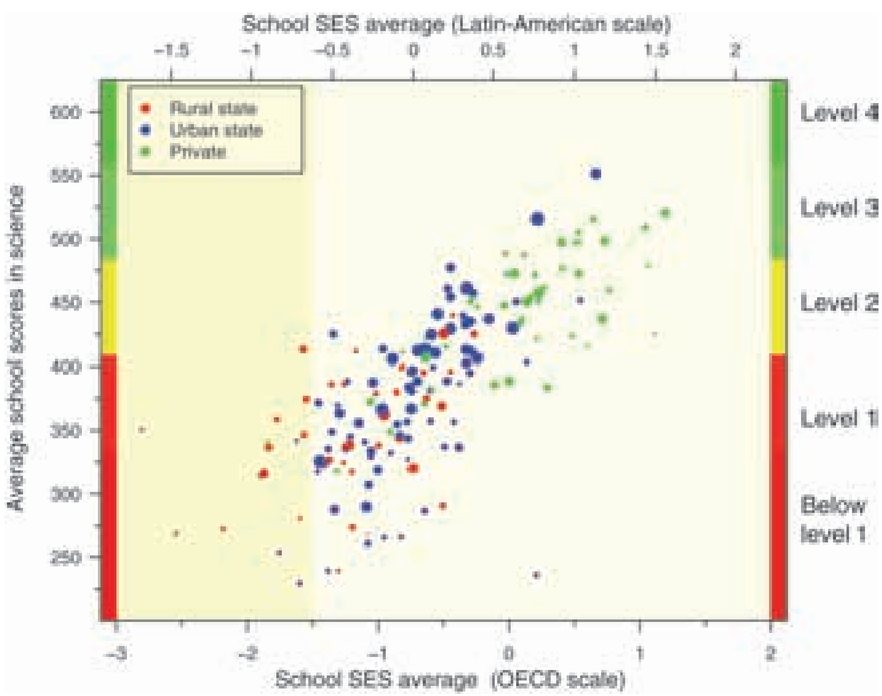
Graph 4.4

Socio-economic gradient of science performance in Argentina, compared to the OECD



Graph 4.5

School profile of performance in science in Argentina



As this average is determined by the opinion of the students, it can be inferred that those from more vulnerable backgrounds value the school more highly as a transmitter of knowledge than those from less disadvantaged sectors.

Coverage of the Curriculum

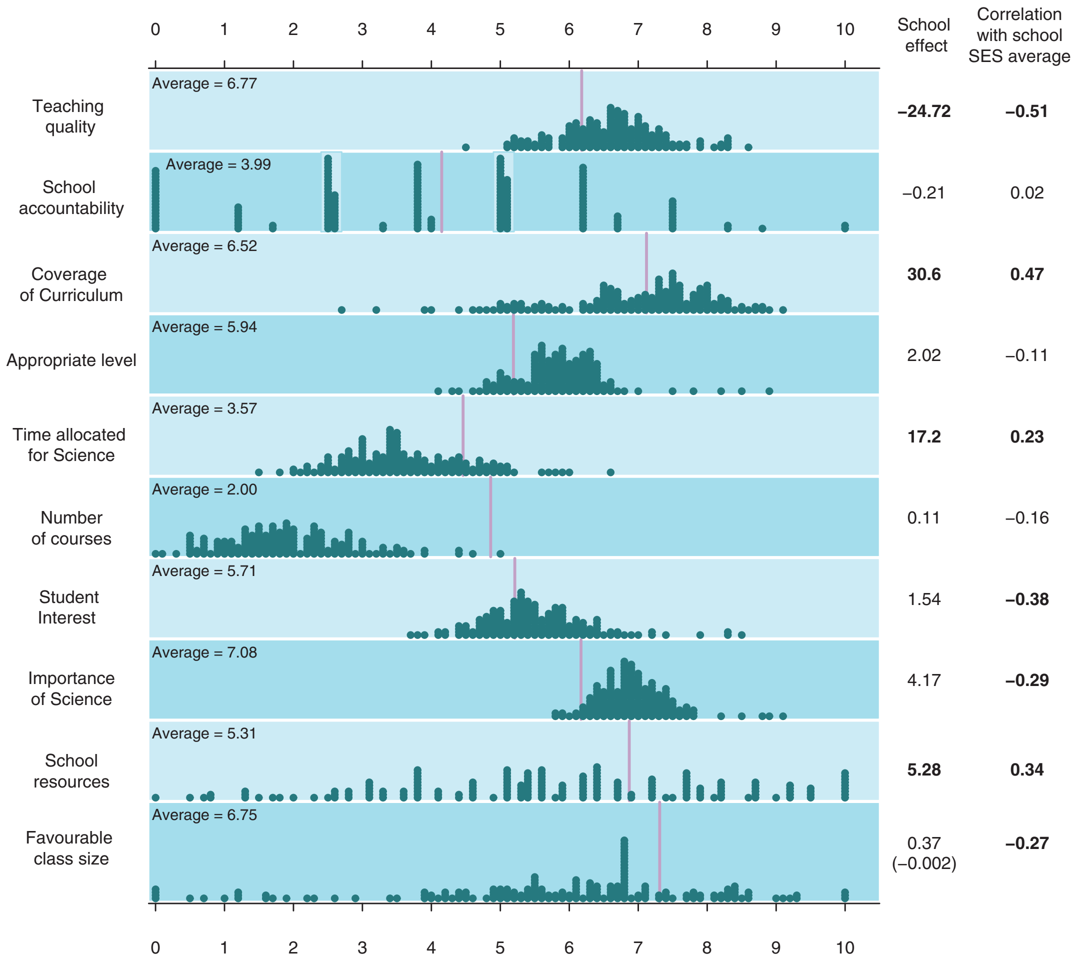
Argentina's average scores for this factor are 6.52, which is below the OECD mean (7.12). However, it should be pointed out that the effect of this factor is the highest of all GIP countries. It can be deduced from the analysis that a small change in this factor can have a major effect on science performance, when other factors remain constant.

Time allocated to science

Argentina's average score is 3.57, a figure that is below the OECD mean of 4.46. The effect of the time allocated to science teaching shows that, if this factor is raised by one point (40 minutes per week), then the performance could increase by 17.2 points as long as other factors remain constant.

Graph 4.6

Learning resources in Argentina



School resources

The average for Argentina is 5.31, which is below the OECD average (6.87). The indicator shows wide variations, and a considerable number of schools are below 5.

With regard to the equity and equality of the system, the percentage of students with a lower reading performance is significantly greater than the percentage of low SES students. That is to say, a high percentage of students with average or high SES have a low reading level.

45 % of the variation in the SES results is due to differences between schools, which is below the OECD figure 36 %.

It can also be seen that the 36 % variation in SES between schools is higher than the OECD average of 24 %. The indicator shows that there is greater variety among schools.

The slope of the within-school gradient is slight, which indicates that the relationship between SES and reading proficiency is low. On the other hand, the between-school gradient is steeper which shows that there is considerable between-school segregation of students.

The relative risk linked to lower SES is 1.43. This means that the likelihood of poor performance by low SES students is 1.43 times greater than that of a student with an intermediate or high socio-economic level. The risk attributed to the population is 10 %, that is to say, 90 % of the students with inferior performance do not have low SES status.

Brazil

The bar showing the socio-economic gradient in Brazil is below the OECD mean, and reaches very low levels of SES. Many students at all levels of SES are found at the lowest proficiency levels, and there are a considerable number of students below Level 1.

As regards lower SES students, differences in performance are not very significant, but there are low SES students who reach Level 4, which is above the OECD average. Nevertheless, most low SES students obtain results that are below Level 2.

There major differences in performance between students with higher SES levels. Some higher SES students achieve very good results at Levels 4 and 5, while others have low proficiency levels.

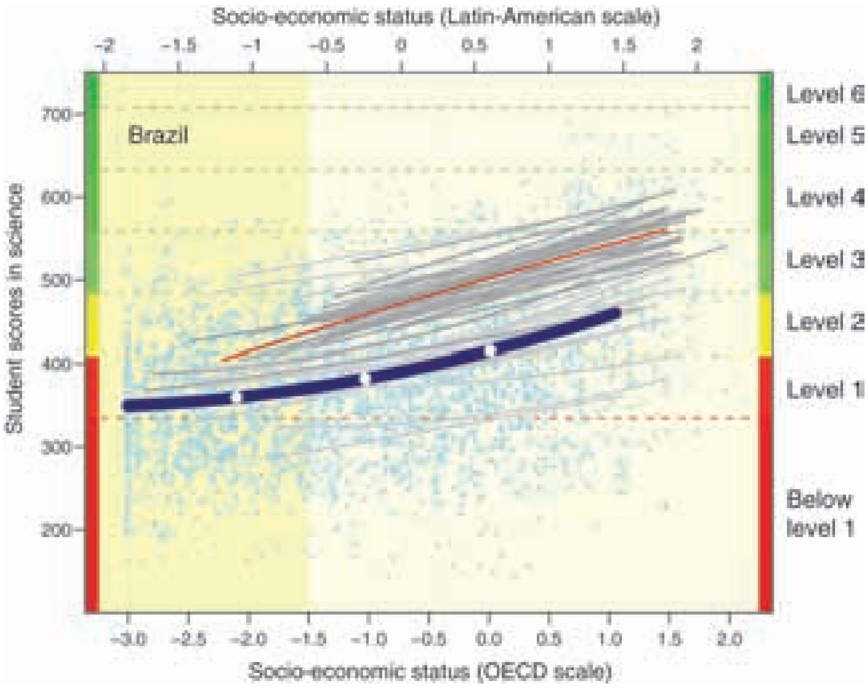
The pattern of student distribution shows that the social, economic and cultural environment is extremely important. However, there are other factors that may also influence proficiency. In the light of the comments that have been made about school performance in Brazil, it is likely that these factors are concerned with pedagogical work promoted by schools, including a differentiated curriculum; teaching work; and family involvement in educational activities.

There is a marked difference between state and private schools. Most private schools have high SES, and are at higher proficiency levels. Both rural and urban state schools have lower SES levels, and most of them have lower proficiency levels. However, there are a few state schools that achieve a performance above Level 2, even though they have low SES.

Most Brazilian primary schools are urban state schools. Both urban and state rural schools obtained low performance levels in PISA, so most Brazilian schools are below Level 2. Few private schools have proficiency ratings of Level 1, and none are below that level.

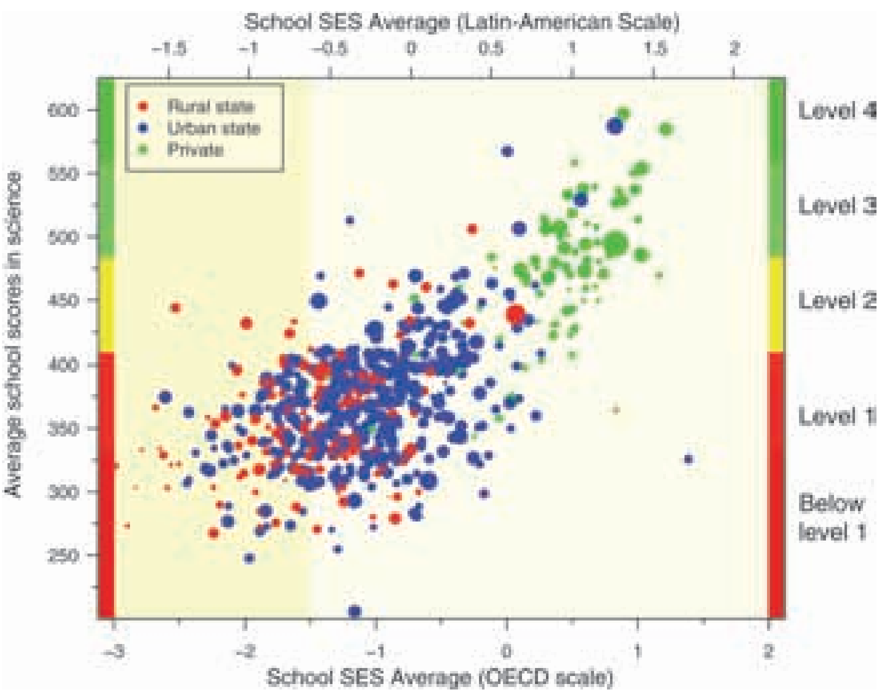
Graph 4.7

Socio-economic gradient of science performance in Brazil, compared to the OECD



Graph 4.8

School profiles of science performance in Brazil



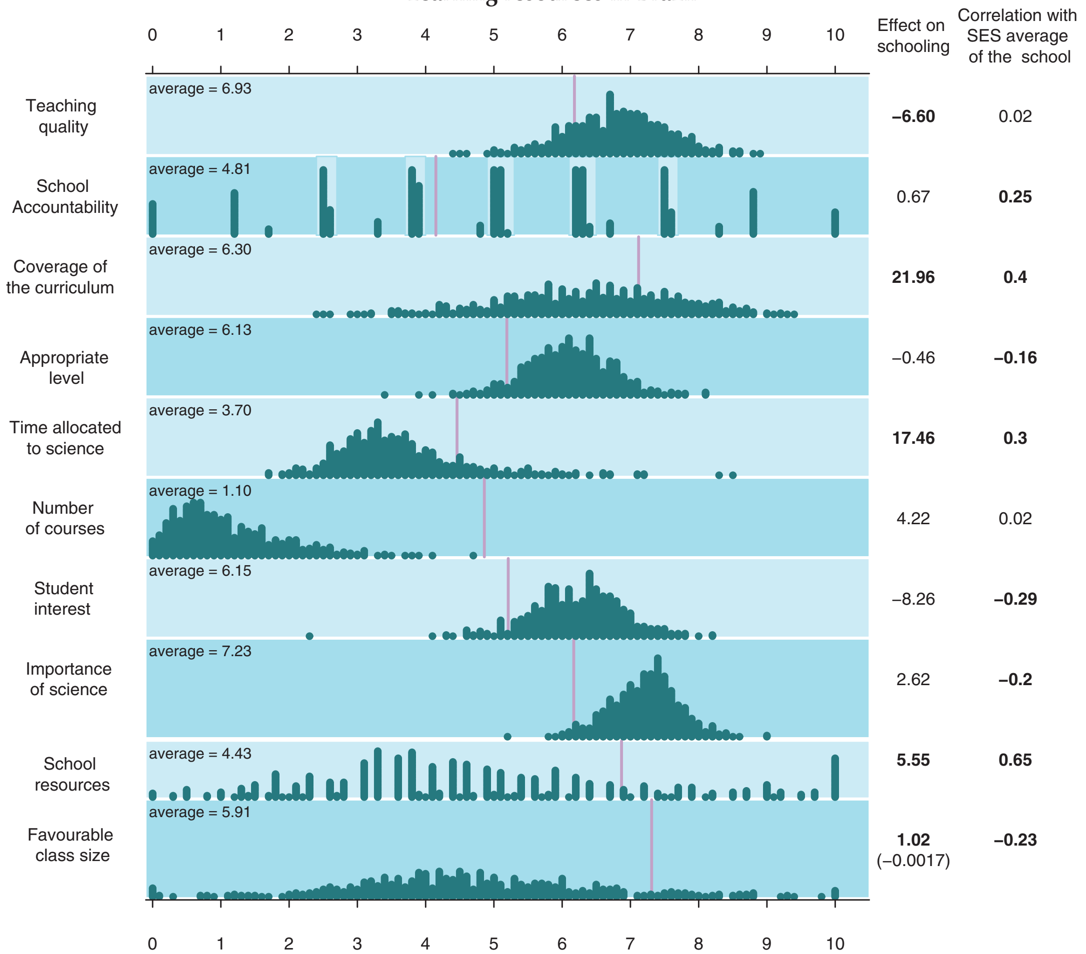
The analysis of related factors shows that Brazilian students are broadly unfamiliar with science teaching. The time allocated to this discipline, and the number of science courses in Brazilian schools, are well below the OECD average. Coverage of the curriculum is also reported to be low. Nevertheless, Brazilian students show a great deal of interest in science, and strongly believe that the study of science is important for their lives.

Another related factor that seems to influence the performance of Brazilian students is the high number of students per classroom, which is well above the OECD average.

From this analysis, it is clear that there is a need to establish educational policies, which improve the quality of the competencies of Brazilian students. It is true that the national assessments have shown that Brazilian students have considerable difficulty in acquiring language skills, and this affects their academic performance in all areas, including science and mathematics. Consequently, one of the goals of national education should be to improve reading skills.

Graph 4.9

Learning resources in Brazil



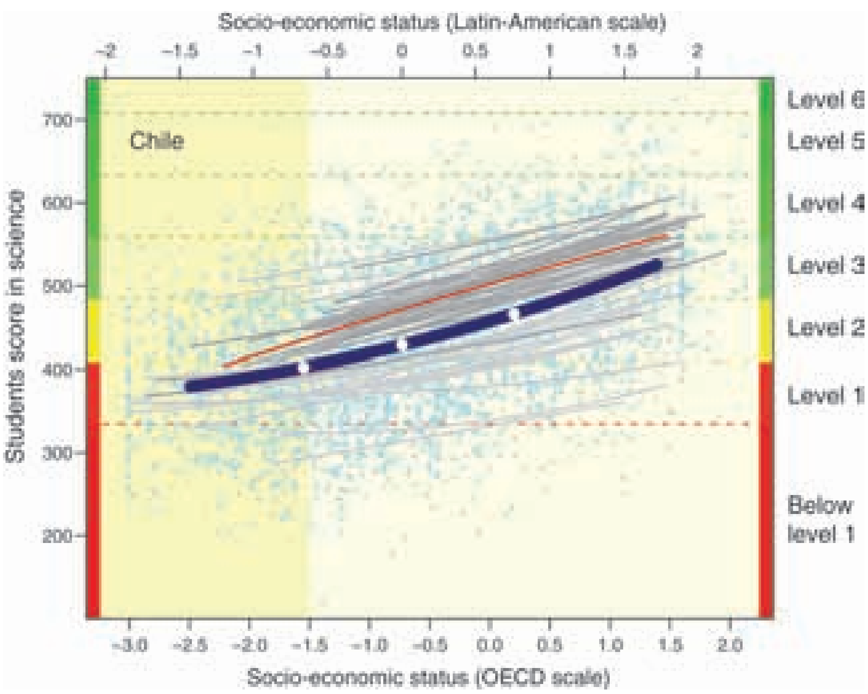
The general pattern of scores for students and school environments suggests that it is necessary to implement policies that counteract these negative results. The aim needs to be to provide real equality of opportunity, especially for the majority of state schools, which operate in disadvantaged environments. Their efforts and good work could make up for their adverse circumstances, and enable students to achieve results above the level that is expected of them.

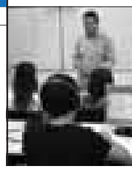
Chile

The socio-economic gradient for Chile is below the equivalent OECD gradient. It is slightly convex, and is flatter (less significant) in the low SES range than in the higher (more significant) SES range. It can also be seen that the distance from the OECD gradient is less in the lower SES range (percentile 25), than in the higher range (percentile 75). Nonetheless, most student results below SES percentile 25 are at performance levels that do not reach PISA Level 2.

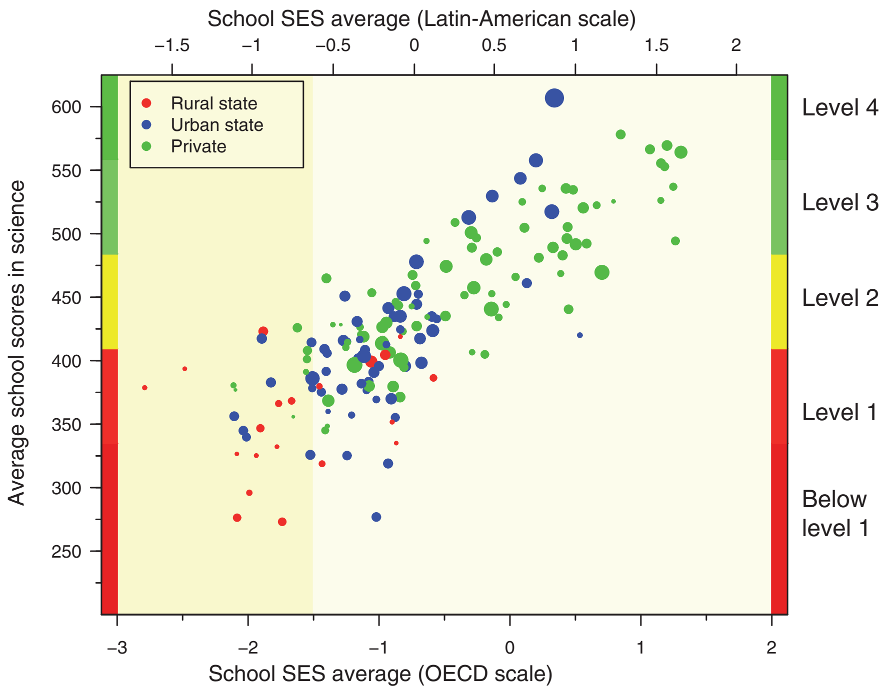
The graph of school profiles shows that urban state schools receive students with an average SES that is below the Latin American average, while private schools have students whose socio-economic background is higher than the Latin American average. With regard to these private schools, some are financed by the State, but administered privately. In the SES ranges in which both private and states schools can be found together there do not seem to be significant differences in their average performance.

Graph 4.10
Socio-economic gradient of science performance in Chile, compared to the OECD





Graph 4.11
School profiles of science performance in Chile



Rural schools show consistently low proficiency levels. However, it can also be seen that urban schools have higher performance levels than might be expected, in view of their SES. Low SES levels closely match residence in rural areas.

We find exceptions among both students and schools, in the form of performances, which are either higher or lower than SES would lead us to expect. Clearly, socio-economic conditions do not wholly determine performance. This highlights the importance of providing support for socially and economically disadvantaged students to pursue their studies.

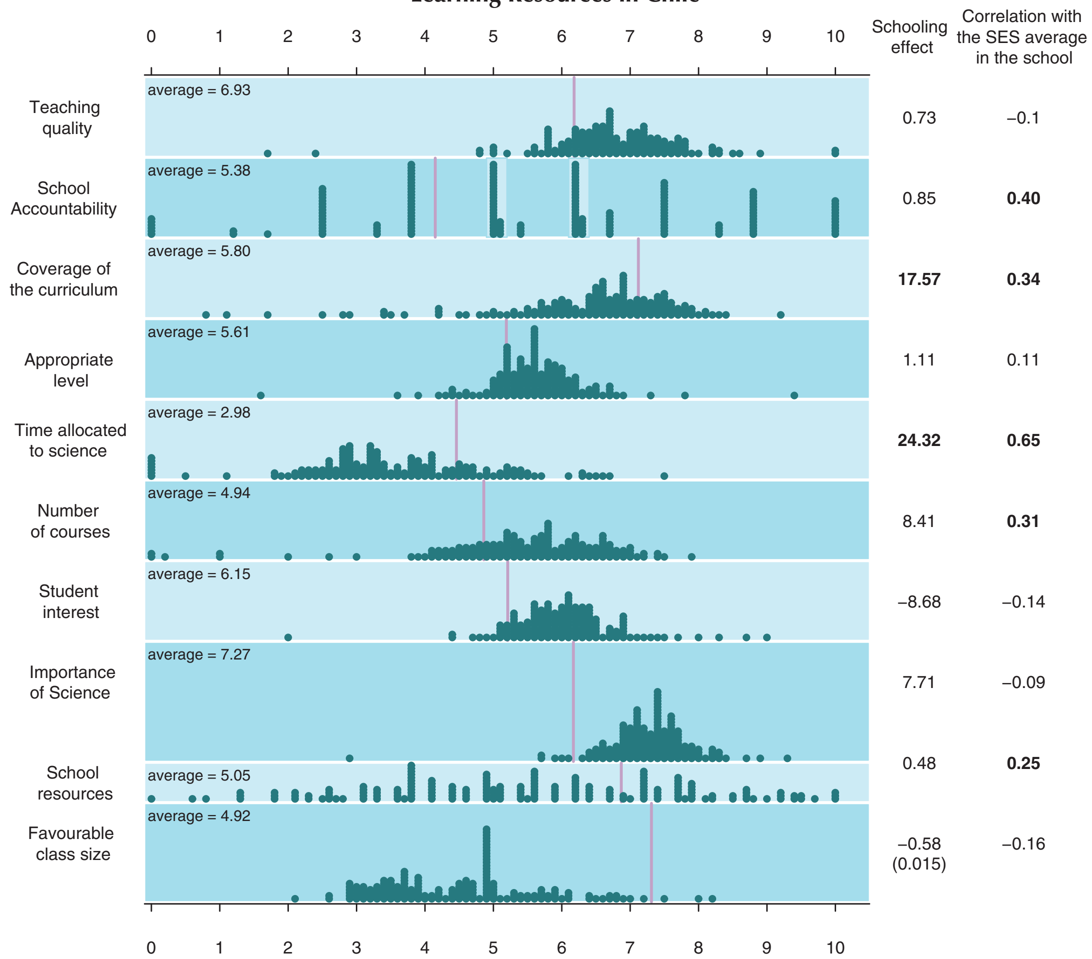
Among the factors analysed in the model, coverage of the curriculum and the number of science class hours have a discernible and significant effect on the performance of Chilean students. However, both variables are also associated positively with SES school averages. The importance attributed to these variables should therefore not be over-stated.

One major finding is the scant time allocated to the study of science, and the excessive number of students per class compared to the OECD.

It should be pointed out that the other factors that were studied are also connected to average school SES, although they have no significant recorded effect on the performance of Chilean students. These are school accountability, the number of classes, and school resources. They can be seen as indicators of inequality between schools.

Graph 4.12

Learning Resources in Chile

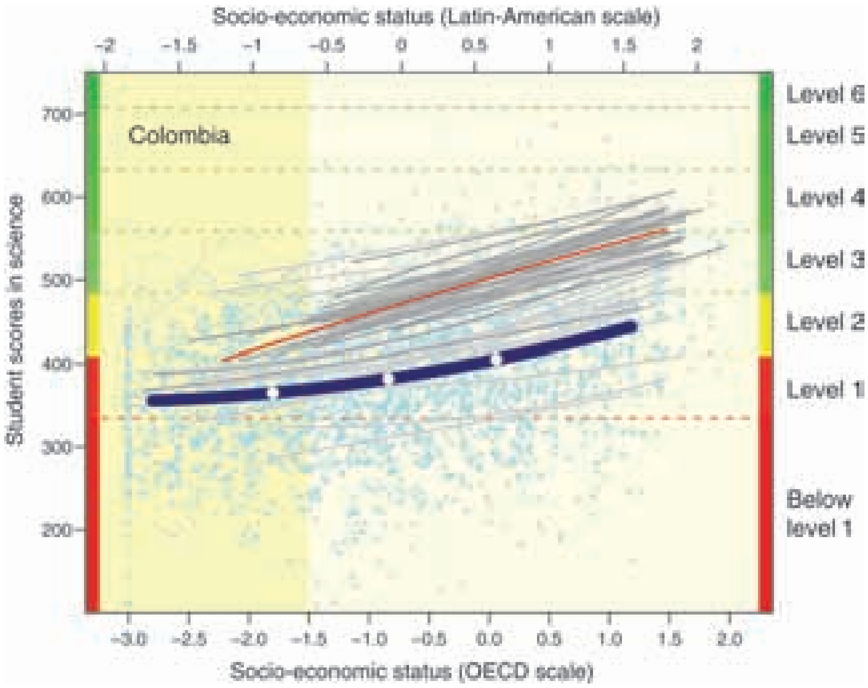


Colombia

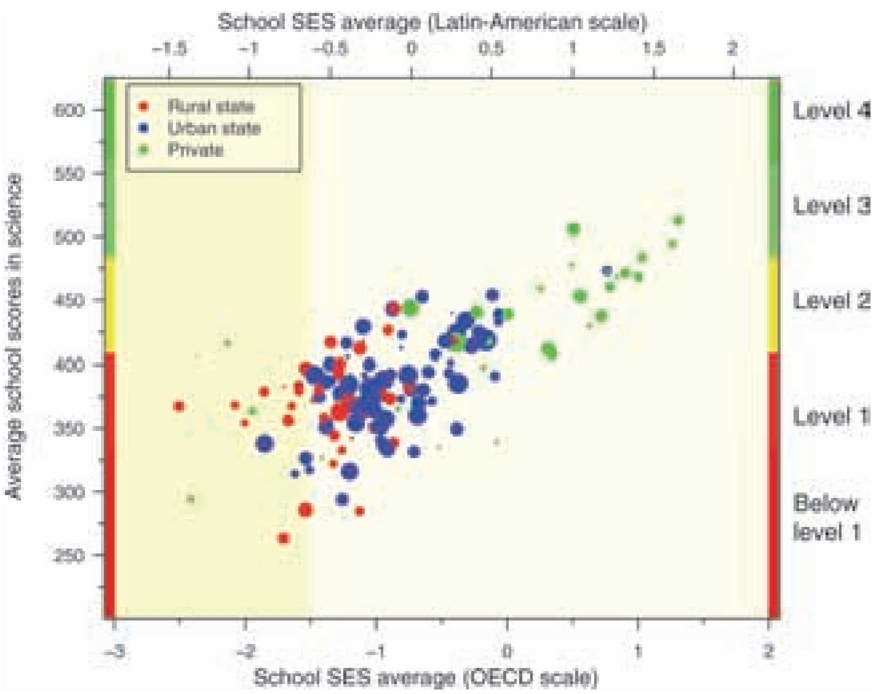
Graphs 4.13 to 4.15 show the results for Colombia. The first indicates important differences between the Colombian and OECD socio-economic gradients. Firstly, the Colombian socio-economic gradient is below the OECD gradient, indicating that Colombian students achieve results that are below those of their OECD peers at all SES levels. The average scores of the Colombian students in PISA are between Levels 1 and 2, while those of OECD students are between Levels 2 and 4.

Secondly, Graph 4.13 enables us to see the differences between the socio-economic breakdown of Colombian and OECD students. The differences in the starting points of the lines, which describe the socio-economic gradient in each group, enable us to see that a higher proportion of Colombian students are at the lowest SES levels, compared to the OECD. The continuation of the OECD line shows that the results of Colombian and OECD students are similar at the lowest levels.

Graph 4.13
Socio-economic gradient of science performance in Colombia, compared to the OECD



Graph 4.14
School performance profile in science in Colombia

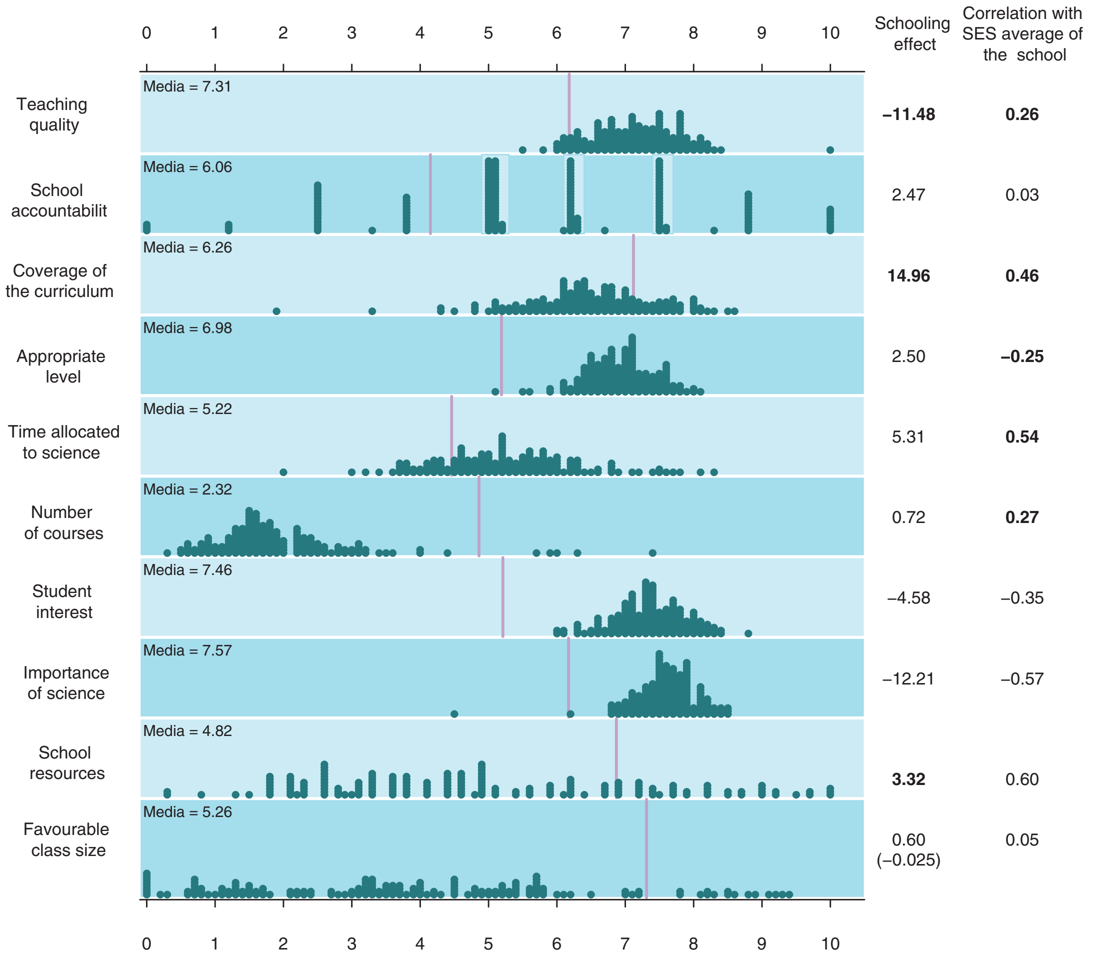


Thirdly, Graph 4.13 shows that the slope of the Colombian socio-economic gradient is not as steep as that of the OECD. This suggests that the Colombian educational system is more equitable insofar as SES does not affect its results in PISA, as much as in the OECD. It means that while results are not significantly different from the OECD at lower levels, they increase considerably as SES rises. To a considerable extent, the differences between Colombia and the OECD reflect the fact that students who have an SES similar to their OECD peers fail to achieve the expected results.

The school profiles shown in Graph 4.14 reveal important differences both for PISA results and the socio-economic background of students. On the one hand, almost all the Colombian schools participating in PISA, with an SES average above zero (the OECD average) belong to the private sector, while most state schools register an SES below the OECD mean. Among state schools, rural schools are grouped together at levels below those of urban schools even though their PISA results are similar. On the other hand, it is clear that, while there is a direct relation between school SES and PISA scores, some schools with low SES levels achieve results that are comparable or better than schools with higher SES levels. This invites us to reflect

Graph 4.15

Learning resources in Colombia



on the efficiency of these schools – namely those that attain better results than expected, given their student SES – and why this should be so.

Finally, Graph 4.15 illustrates the resources that are made available for the learning process in Colombian schools. According to most indicators, Colombian scores are above the OECD mean. The students and school principals usually give higher points in areas such as teaching quality and accountability. The students report greater levels of interest and motivation. For Colombian students, the weekly time allocated to science teaching is similar to the OECD average and even slightly higher, while the number of courses taken, and coverage of the curriculum are lower. Finally, the most worrying factors are school resources, which vary significantly from one school to another, and average class size, which shows similar variations.

With regard to the effect that the factors have on learning levels, only two have values statistically above zero. Coverage of the curriculum is the factor with the greatest impact as a one point rise would mean an increase of 15 points in the scores for the Colombian students in PISA. The second most important factor is the availability of resources in schools, where a one-point increase of would increase the score by 3.4 points. The two other factors register negative values, and demand a thorough reflection on the quality of the answers, and their significance in educational terms.

These results highlight the need to undertake universal interventions so as to improve student competencies. Nonetheless, this would require the allocation of greater resources to urban and rural state schools, so budgetary constraints, and the feasibility of implementing educational policies, need to be taken into account.

Spain

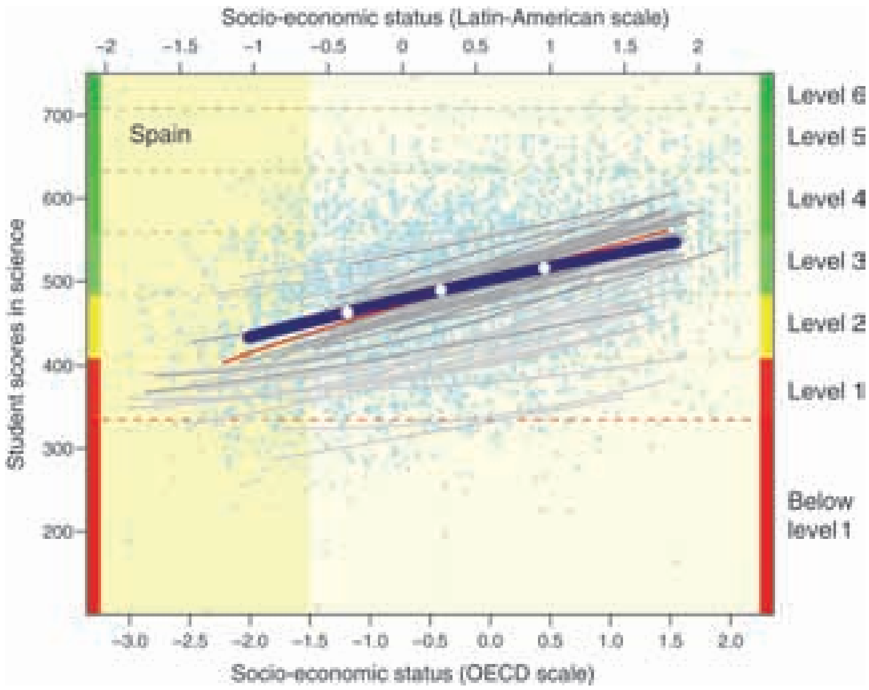
The Spanish bar gradient is at a level that is similar to the OECD average. However, it is noteworthy that low SES students achieve results that are considerably higher than the OECD mean, and are above Level 1. Students with average, or high SES, achieve results that are similar to the OECD mean (Graph 4.16). The slope of the graph shows that the characteristics of the Spanish educational system are more equitable than in most of the OECD. This feature has been consistently demonstrated in recent national and international studies of educational assessment. It suggests that students from disadvantaged backgrounds and their teachers are making good progress, precisely when circumstances are most challenging. Indeed, if we analyse the cluster of points that produce the curve in the low SES stage, it can be seen that a considerable number of students achieve proficiency at Levels 3 and 4.

The pattern of student distribution shows that while social, economic and cultural factors all have a major influence, the attitudes of students and their families, and class work with teachers, are even more decisive. At both low and high SES levels, there are some students with very good results, and others with disappointing ones. A considerable number of students from very disadvantaged backgrounds achieve results of over 500 or 550 points. At the same time, other students from more favoured backgrounds may have scores of less than 450. These figures exemplify the importance of the school, the work environment, teacher teamwork, and the attitude of students and their families. It is essential to develop individualised measures so as to improve results across the board. In short, the Spanish gradient suggests that policies to achieve progress should aim to promote all student performances (raising the entire curve), while maintaining, or even improving equity (achieving a more horizontal curve). This goal should be pursued through compensatory actions in the more disadvantaged environments.

Spanish school profiles (Graph 4.17) show that urban and rural state schools achieve better results when SES is average, or below average. (These attend to the schooling of two-thirds of the population.) PISA

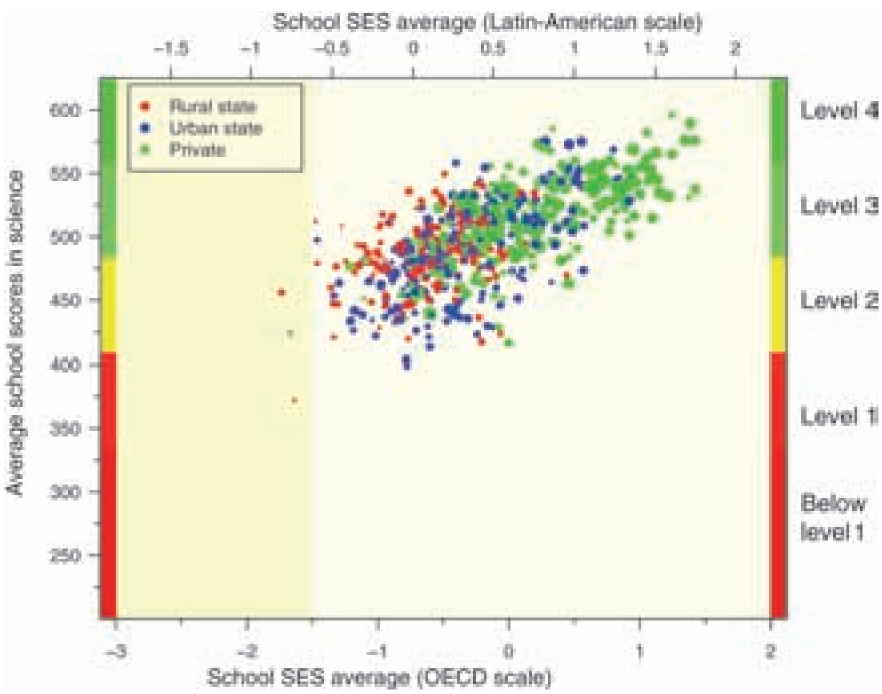
Graph 4.16

Socio-economic gradient of science performance in Spain, compared to the OECD



Graph 4.17

School profiles of science performance in Spain

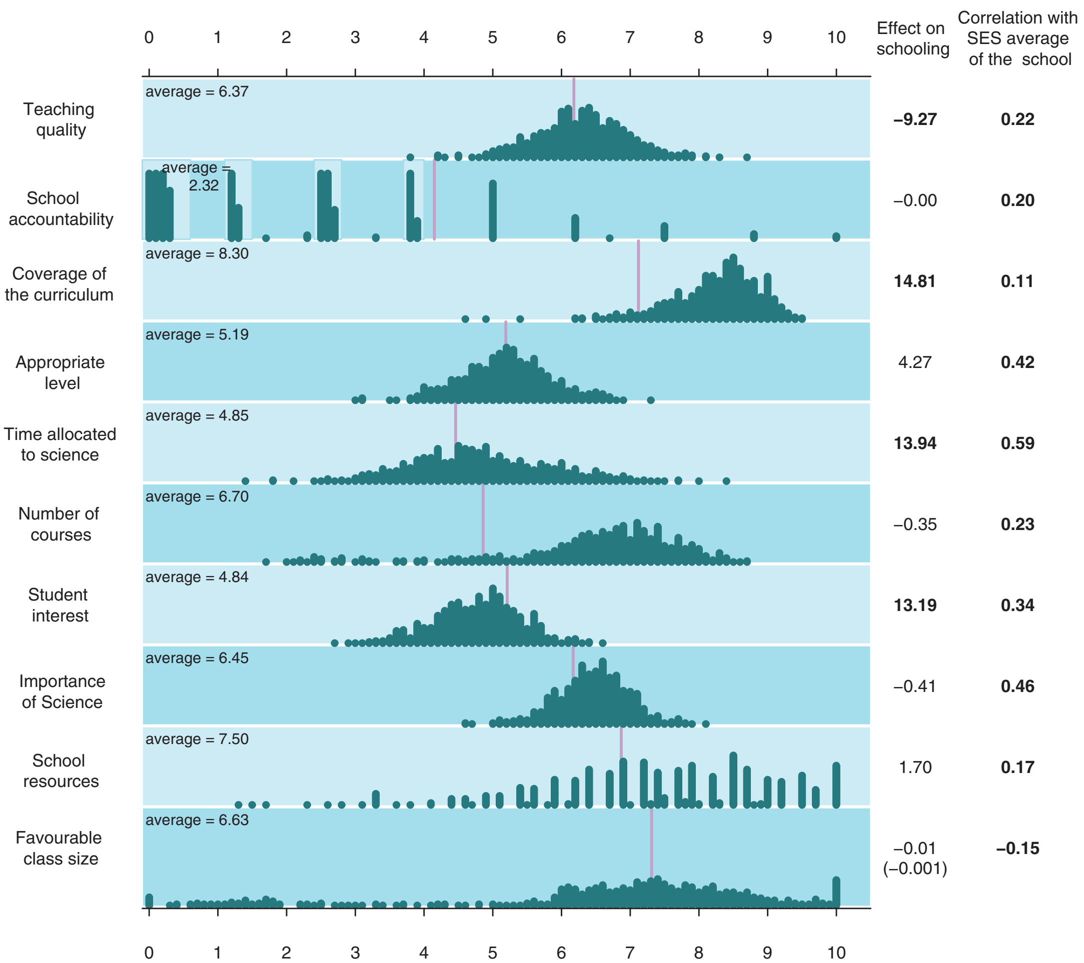


2006 warns against making generalisations about the results of students at private and state schools, or rural and urban schools, in Spain. Students with a high SES mainly attend private, state-subsidised schools. However, when the SES factor has been discounted, the results of students at state schools are practically the same as for private schools. Some Spanish rural state schools achieve better results than private ones with similar intakes. This is also true of urban state schools. In each case, the role of school management, and the effective functioning of the school, provides the best explanation for differing results from schools that have similar backgrounds. This often makes it possible to counteract, and overcome the social, economic and cultural obstacles faced by students as a result of their environments. The performance of nearly all Spanish schools is above Level 1, and most are at Level 3, irrespective of whether they are state-run or private.

As stated above, the analysis of related factors is based on the opinions of school principals and students (Graph 4.18). Firstly, the quality of teaching is seen in Spain as being acceptable in terms of future student career prospects in science-related areas. Secondly, students consider that difficulties in acquiring new

Graph 4.18

Learning Resources in Spain



scientific knowledge can be overcome with the help of the teaching they receive. On this point, we may note a positive correlation with the SES average of the school. As this rises, students consider the level of difficulty in scientific learning to be more appropriate. For both these factors – teaching quality, and level of learning difficulty – mean scores in Spain are similar to the OECD mean.

In Spain the number of courses and the teaching time allocated to science are above the OECD mean. There is a marked and positive correlation between teaching time and the SES average of schools. That is to say, in Spain, the higher the SES, the more time is assigned to science teaching.

The perception that Spanish students have of the importance of science in society at large, and in their own future, is above the OECD average. Furthermore, there is a close correlation with the SES mean of the school. A similar correlation, although not as strong, also exists between the school SES mean and the degree of student interest in learning science. Nevertheless, in this case, the average level in Spain is below the OECD mean. These data indicate that Spanish students consider that knowledge of science is important for their future and for society, but they are not strongly motivated to learn science. Finally, it should be pointed out that there is a wide variety and irregularity in the data on school accountability. The average size of classes in Spain is above the OECD mean, while school principals report favourably on the level of resources available in schools.

It emerges from the analysis of equity and equality in schools that the between-school differences in SES are greater than the differences that are recorded in results. This appears to show that schools have a moderating influence on the environmentally related differences that allegedly affect results, thus fulfilling one of the basic social objectives, which was outlined above. In this case, the general pattern of results in relation to school and student environments suggests that it is strongly beneficial to implement policies that compensate for adverse circumstances if the intention is to provide genuine equality of opportunity. This is especially true of the majority of state schools which operate in disadvantaged environments, in which effort and good work offset the disadvantages, and students can achieve results at a higher level than would normally be expected from them.

Certain aspects which are relevant to the whole of Spain are clarified In the section on regions.

Mexico

Socio-economic gradients

The gradient for Mexican students shows that their cultural and socio-economic situation is more worrying than those of their peers in OECD countries, and in the other Latin American countries examined in this study. This point emerges clearly when we consider that approximately 39 % of Mexican students have a low SES, whereas only 25 % of the Latin-American students, and 8 % of OECD students, are in the same situation.

It has been established that Mexican students with a low SES perform less well than OECD students with the same SES, by a difference of between 25 and 50 points. However, there are differences of more than 100 points between students with a high SES and similar OECD students. This suggests that the educational policies in Mexico ought to be aimed at improving the performance of all Mexican students irrespective of their socio-economic, cultural or educational level.

School Profiles

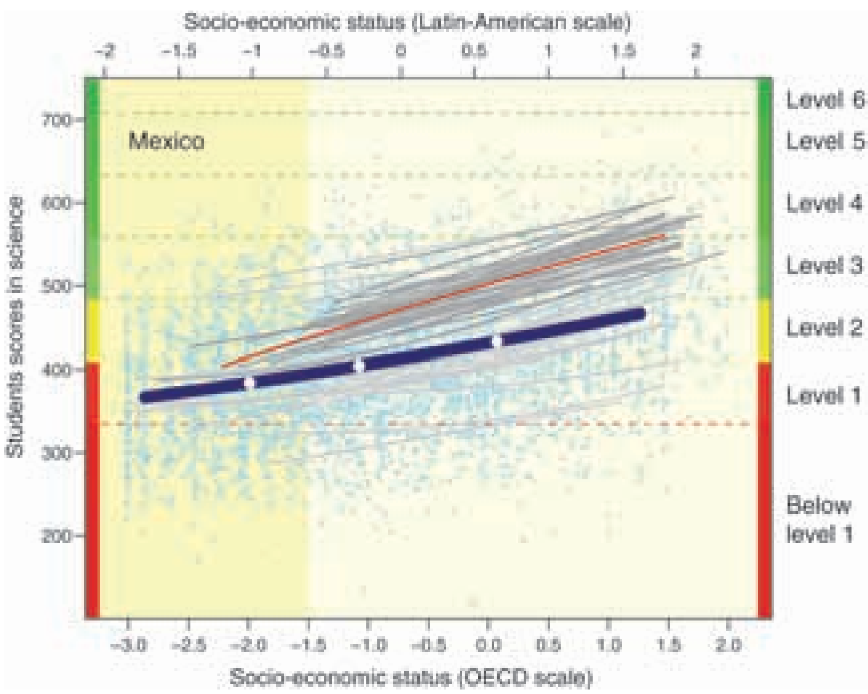
In order to interpret the Mexican school profiles, it is necessary to clarify the following points:

- The definition of rural schools used in this study is different from that used in Mexico. In Mexico a rural school is defined as being one in a town with a population of less than 2,500, while an urban school is in a town with over 2,500 inhabitants. In this study rural schools are considered to be those in towns with less than 15,000 inhabitants, and urban schools are those in towns and cities with populations above that figure. This means that schools in Mexico in towns with populations of between 3,000 and 15,000 inhabitants are classified as urban.
- Earlier analyses of the Mexican data in PISA 2006 show that there are major differences between lower secondary education schools (CINE 2), and higher secondary education schools (CINE 3A and CINE 3B). These differences are both performance and SES-related, and are more important than location (urban and rural) and type of system (public and private). As this analysis does not consider the differences between schools in CINE 2 and CINE 3, the suggestions that are given on the basis of this profile may not reflect the whole picture.

Taking the previous information into consideration, the gradient of the school profile in Mexico shows a trend that has already been seen in national studies. Private schools attain a better average performance than state urban and rural schools, and state urban schools achieve better performance levels than state rural schools.

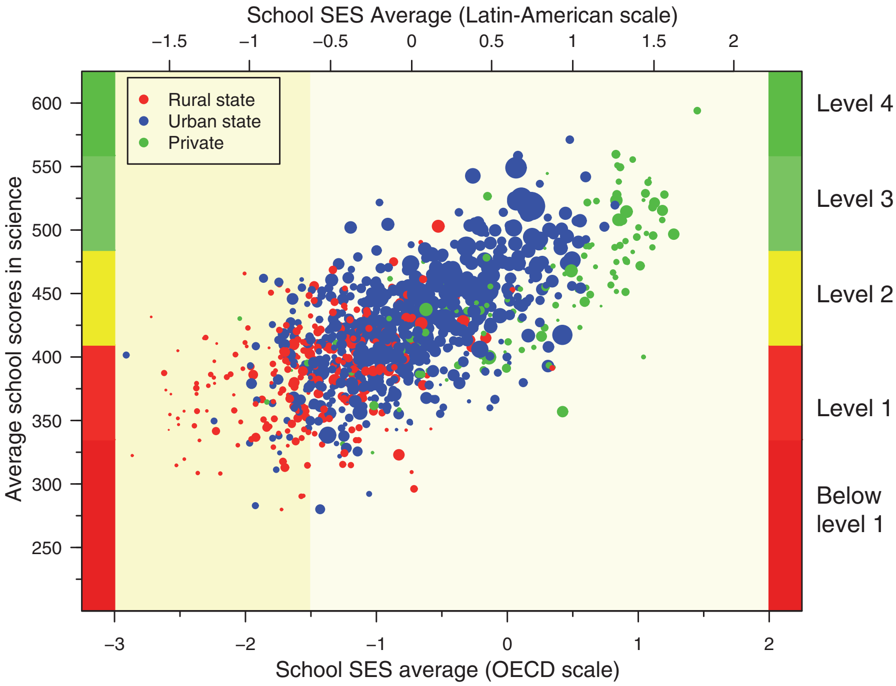
We may stress that there are important variations in average proficiency levels between urban state, rural and private schools. These variations are approximately 200 points, and show once again that Mexican schools do not succeed in counteracting socio-economic inequalities among students. Educational policies

Graph 4.19
Socio-economic gradient of science performance in Mexico, compared to the OECD



Graph 4.20

School profiles of science performance in Mexico



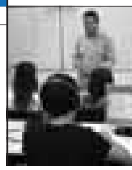
need to pursue the goal of reducing inequalities between schools by managing the assignment of resources in order to offer greater support to schools in small towns.

Learning resources

In accordance with hierarchical linear modelling, factors that significantly affect performance in Mexico are coverage of the curriculum, school resources, and class size. It should be borne in mind that the indicators are established on the basis of the opinions stated by students and school principals, who may choose to give socially acceptable responses, and thereby distort the connection between these factors and student performance.

The indicator for coverage of the curriculum is based on the opinions of students, and consists of an evaluation of school science teaching. On the basis of hierarchical linear modelling, this is the factor that most decisively influences performance. Students who say that they have dealt with science subjects at school perform at a significantly higher level in PISA than those who claim that they have not studied them. Consequently, schools seeking an improvement in performance should carry out actions to achieve adequate coverage of the curriculum. These could include updating scientific subjects dealt with in class, and reducing teacher absenteeism so that the time allocated to science classes is sufficient.

The indicator for school resources is based on answers given by school principals. The question they were asked is whether their school had sufficient material and human resources to carry out its activities effectively. In Mexico, the average for this indicator (4.46) is well below the OECD mean (6.87), which



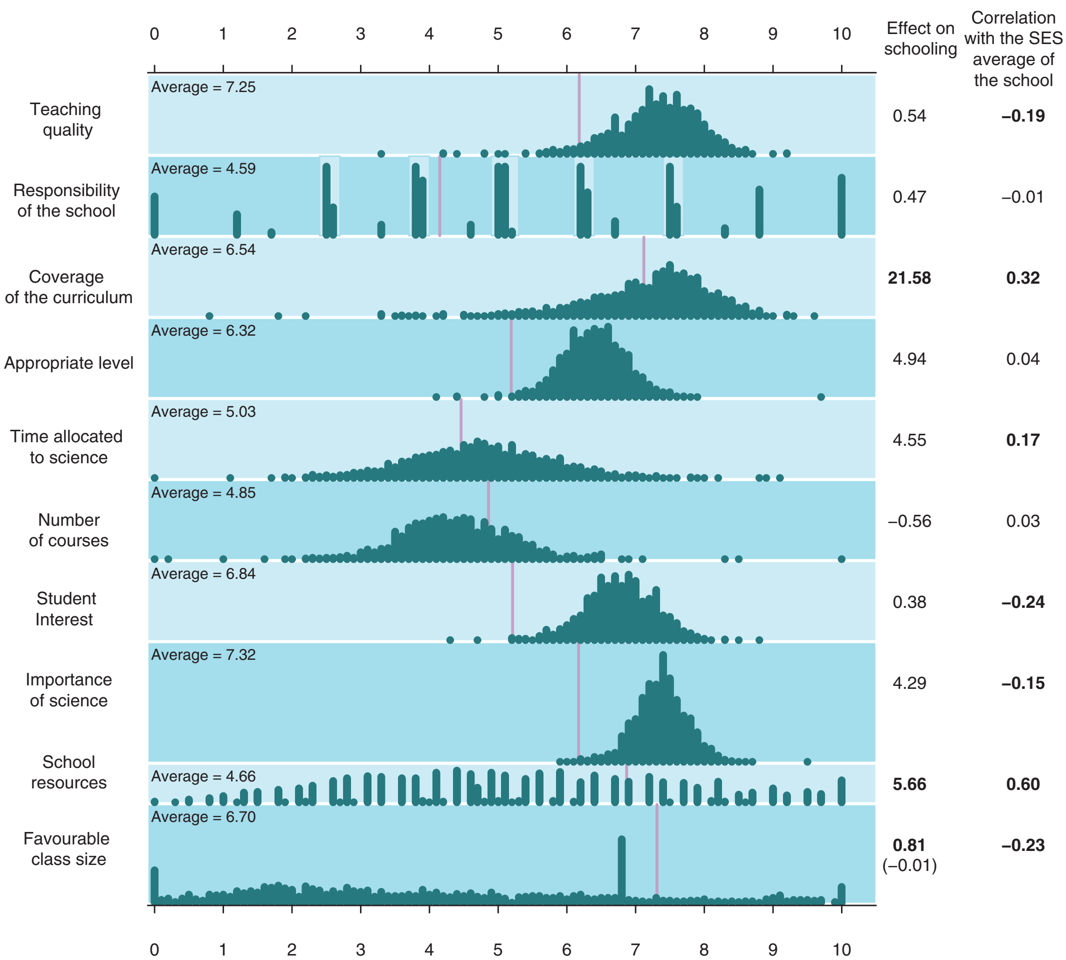
demonstrates the need to increase and improve the assignment of material and human resources. This enables schools to carry out their activities more effectively, as the lack of resources affects student performance.

Class size is the average number of students in a typical group of 15-year-old students. This indicator is difficult to change in Mexico as there are large classes in urban areas, and its infrastructure cannot cope with excess demand. The country's educational authorities have created new entities, but these have failed to keep pace with demographic growth. However, developing the Mexico's infrastructure is not a viable option, as it is predicted that the rate of population growth will decline over the next few years.

Equity and Equality

In Mexico the percentage variance between schools is 41 % for reading performance, compared to 36 % in the OECD. These percentages indicate that schools are not achieving the goal of improving a

Graph 4.21
Learning resources in Mexico



pattern of results shaped by the students' socio-economic background. There is a significant variation in performance according to whether a student attends one school or another. Similarly, we may compare the proportion of variance in the socio-economic index to that of the socio-economic index of schools. The proportion is 35 % in Mexico, while in the OECD it barely reaches 24 %. This means that in Mexico students with higher socio-economic status are segregated in schools with a higher performance level. In order to prevent this segregation, a large-scale policy needs to be implemented that achieves a greater degree of uniformity in schools. A policy that brought together parents, teachers and the authorities responsible for assigning educational resources would improve student performance. Once schools achieved a good performance level, high SES parents would not hesitate to send their children to these schools. It would therefore be possible to achieve similar between-school SES, and differences would be within schools. Schools can offer equal opportunities, even though it is impossible for them to reduce the differences in socio-economic status between students. Performance would then be due to more to individual effort than SES.

Portugal

Graphs 4.22 to 4.24 show the results for Portugal. The socio-economic gradient suggests that low SES Portuguese students achieved science performances that were just above the OECD mean; those with high SES performed slightly below average.

Given that the gradient for Portuguese students is below the OECD average, it can be inferred that SES in Portugal has a limited impact on student science performance. The Portuguese education system therefore seems to be more equitable than in most OECD countries.

The profile of Portuguese schools shows that private schools are not predominant in the educational system. In fact, there are only a few private schools, approximately 10 % of the total, and these perform at Level 2 or above, and have average, or high, SES. It should be pointed out that low levels of proficiency, Level 1 or below, are characteristic of state schools, either rural or urban, with low SES. These schools only provide basic education (up to the 9th year of compulsory education), and include students who have repeated grades once or more during their schooling. Some of these schools are included in the Priority Intervention Education Territories (*Territorios Educativos de Intervenção Prioritária*). These are special assistance programmes for students at risk of social or academic exclusion, for example, those who have a record of academic failure, and are likely to leave school before completing compulsory education.

As regards learning resources, the Portuguese educational system has indicators that are considerably above the OECD mean, except for school accountability. The value of these indicators is obtained through questions addressed to students and school principals. These indicators vary from 0 to 10, 5 represent an average neutral response, unless otherwise stated.

Teaching quality

Portuguese students have a high opinion of the way their teachers prepare them for scientific, or science-related, careers. This indicator has a value of 6.68, while the OECD mean is 6.18. It is positively related to SES, with a correlation coefficient of 0.36, showing that student perception of teaching quality improves as SES rises.

Coverage of the curriculum

This indicator, which is also based on questions answered by the students, seeks to establish whether the students received information on specific scientific subjects. It has a value of 7.79 (the OECD average is 7.12), and has a positive correlation with the average schooling SES (0.33). In accordance with hierarchical linear modelling, each increase by one point in the indicator corresponds to a rise of 17.80 points in student science performance.

Appropriate level

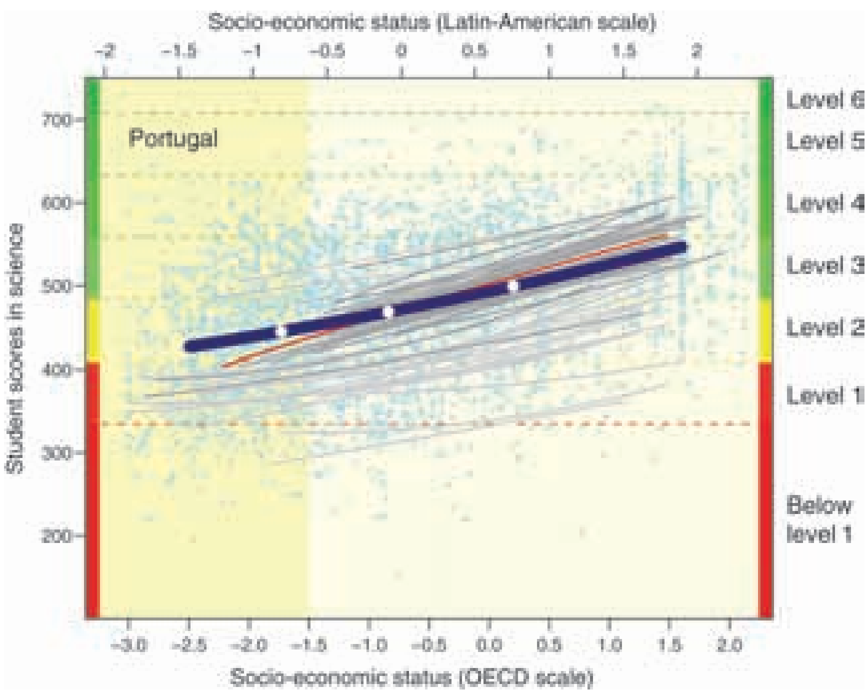
From the six questions that Portuguese students were asked to establish this indicator, it is clear that they consider that an acceptable level of difficulty is involved in learning new scientific subjects and concepts. This indicator has a value of 6.1, compared to the OECD mean of 5.12, and shows a positive statistical correlation with the SES average (0.35).

Time allotted to science

The answers of Portuguese students vary considerably with regard to the time allocated to science teaching. However, the average value of this indicator in Portugal is 4.67, while the OECD mean is 4.46. Each point on the scale represents 40 minutes of science class time per week. The indicator also has a positive statistical correlation with the SES average (0.39). In accordance with the hierarchical linear regression model, each one-point increase in the indicator corresponds to an increase of 19.62 points in student science performance.

Graph 4.22

Socio-economic gradient of science performance in Portugal, compared to the OECD



Number of courses

This shows the average number of courses taken by students in biology, physics, chemistry and geology during the school year, and the previous school year. The average value in Portugal is 5.24, compared to 4.86 in the OECD, although it varies considerably between schools. There is no significant statistical correlation between this indicator and SES.

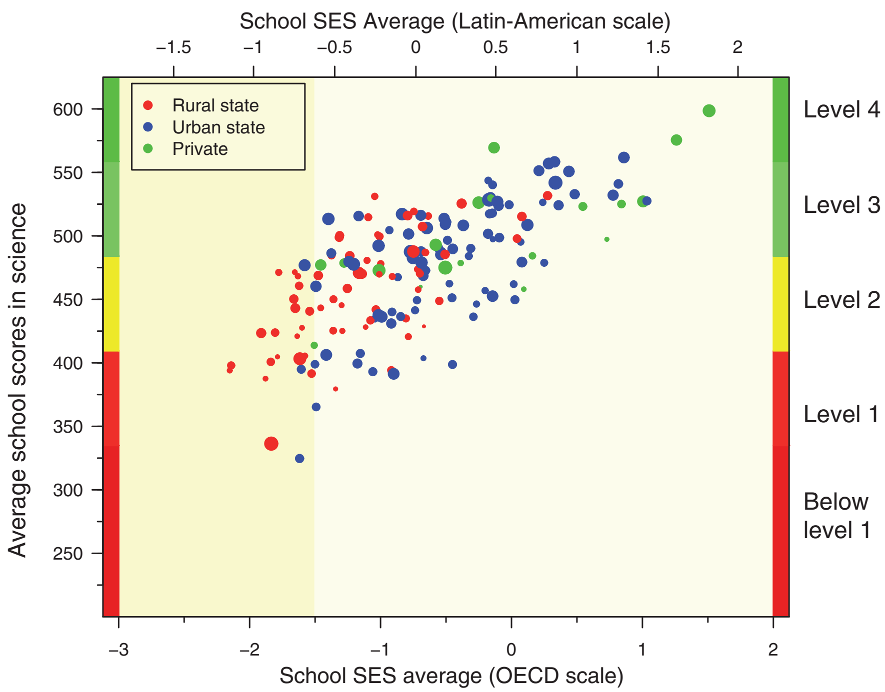
Student Interest

This indicator is based on 12 questions, which show the interest of students in learning science. The average score in Portugal is 5.75, which is above the OECD mean (5.21). There is no significant statistical correlation between the indicator and SES.

Relevance of science for students

This indicator is based on answers to questions about whether the students felt that scientific subjects were important for society, applicable to their daily lives and important for their future. It has an average value of 7.06 in Portugal (6.73 for the OECD countries). As this indicator is positively related to SES, it can be said that as the students' SES rises, their perception of the importance of science also increases. In accordance with the hierarchical linear regression model, each one-point increase in the indicator corresponds to an increase of 36.10 points in student science performance.

Graph 4.23
School profiles of science performance in Portugal



School resources

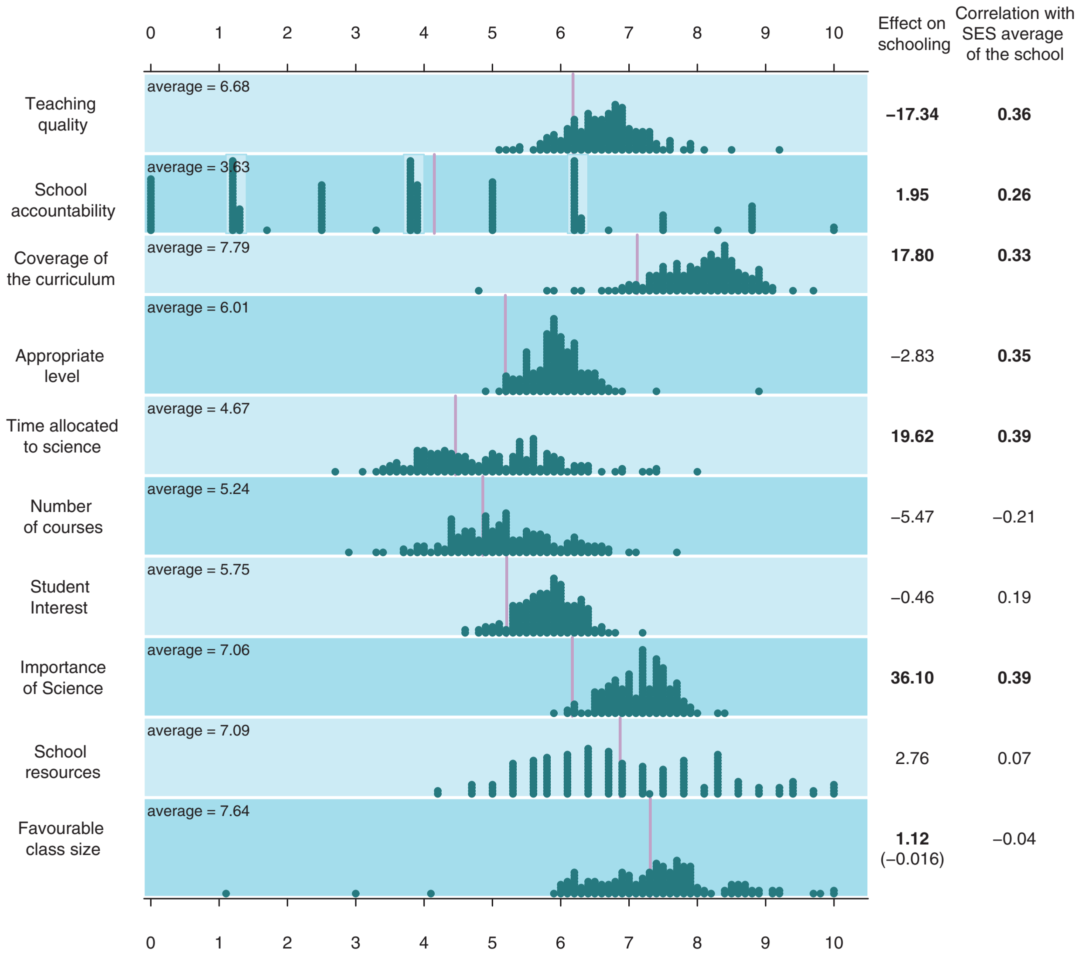
This indicator is established from 13 questions put to school principals on whether they consider that they have adequate material and human resources. The average value in Portugal is 7.09, which is above the OECD average (6.87). The indicator shows no significant correlation with SES, so it would seem that the resources of Portuguese schools are not linked to student SES. This suggests that there is an equitable distribution of human and material resources.

Class size

This indicator is also based on answers given by school principals. Schools with average class sizes of 60 students or more receive 0. Each reduction in the average size of the class by 5 students means an increase of one point in the indicator, and schools that have classes of 10 or fewer students obtain a value of 10. In the Portuguese educational system, the value of the indicator is 7.64. This means that average class size is 20 to 25 students, which is slightly better than the OECD mean (7.31). This indicator shows no significant correlation with average SES.

Graph 4.24

Learning resources in Portugal



School Accountability

This is the only indicator that has an average value in Portugal below the OECD mean, at 3.63 and 4.15 respectively. It is based on four questions put to school principals. These are whether they consider that teachers keep parents informed about student performance (in relation to the national and international standards); whether parents put pressure on their children to establish high standards; whether academic results are made publicly available; and whether data on student performance are used to evaluate teachers. Recognition of this weakness in the Portuguese educational system was decisive in leading to new legislation whose main goal is to make a major improvement in school accountability. This is achieved by making results publicly available, and especially to those responsible for education.

Portugal can raise its student proficiency levels greatly by concentrating its efforts on measures aimed at low SES students. In order to achieve this goal, interventions should be focused on reducing the number of repeaters in primary schools and schools with low SES levels. These measures are now being implemented.

Uruguay

The results for Uruguay are shown in Graphs 4.25 to 4.27.

The socio-economic and cultural gradient for Uruguay is below that of the OECD, and the length of the segment is greater as it extends to the low index values. As regards students with low SES levels, the difference in performance is less than that of students with high SES levels, which contradicts perceptions of student performance in elite schools. If the gradient is compared with that of the OECD, Uruguayan students are between Levels 1 and 2, while OECD students show a higher level of performance, at between Levels 2 and 3.

Graph 4.26 shows a strong difference between state and private schools on the basis of student SES. Private schools tend to have higher proficiency levels than state schools. However, this comparison should be drawn cautiously, as there are very few state schools with SES levels comparable to most private schools. The international report shows that, if the socio-cultural context of the students is controlled, the performance of private schools is no better than that of state schools. This study confirms that there are many schools with very low SES and a very low performance level.

With regard to the indicators on teaching resources that are shown on the graph, Uruguay has relatively low levels of school accountability. In most schools teaching time allocated to science is low, as is the number of courses chosen by the students. The latter may be because the students evaluated are in different school years, and have different science schedules. There is a single national curriculum in Uruguay, and there are no optional science subjects.

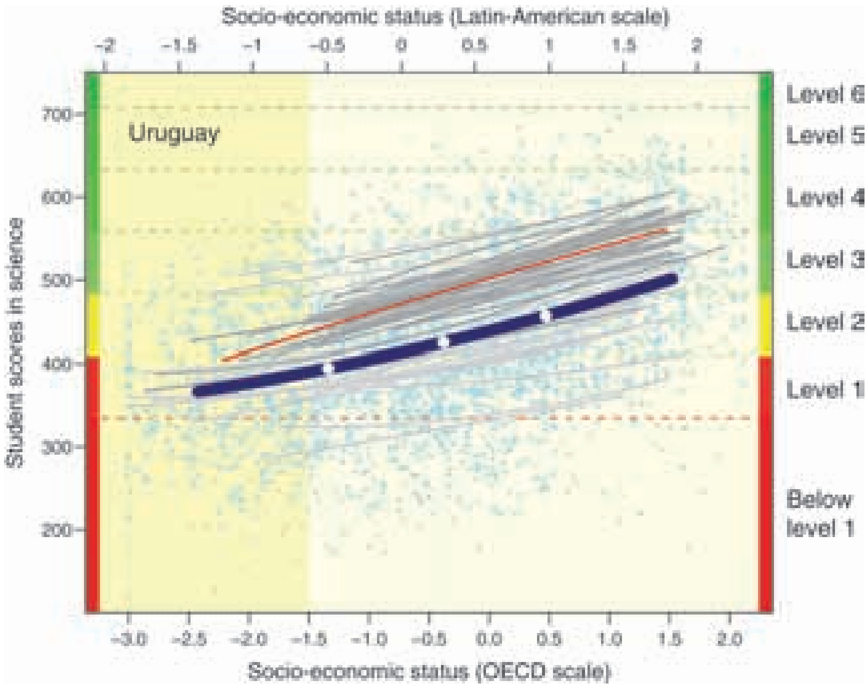
Levels of educational resources are low in many schools in Uruguay, and the majority of schools have an average class size above the OECD mean, which shows that Uruguay still needs to improve teaching conditions.

The results for equality and equity indicate relatively high variation between schools as regards both SES and performance. Almost 50 % of students have low proficiency levels. The relative risk of low performance being linked to poverty is not especially high. About 40 % of the students with average, or low, SES also show low performance.

The correlation between average SES and the indicators of learning resources show that students in low SES schools receive less science teaching, and that in general there are also fewer learning resources.

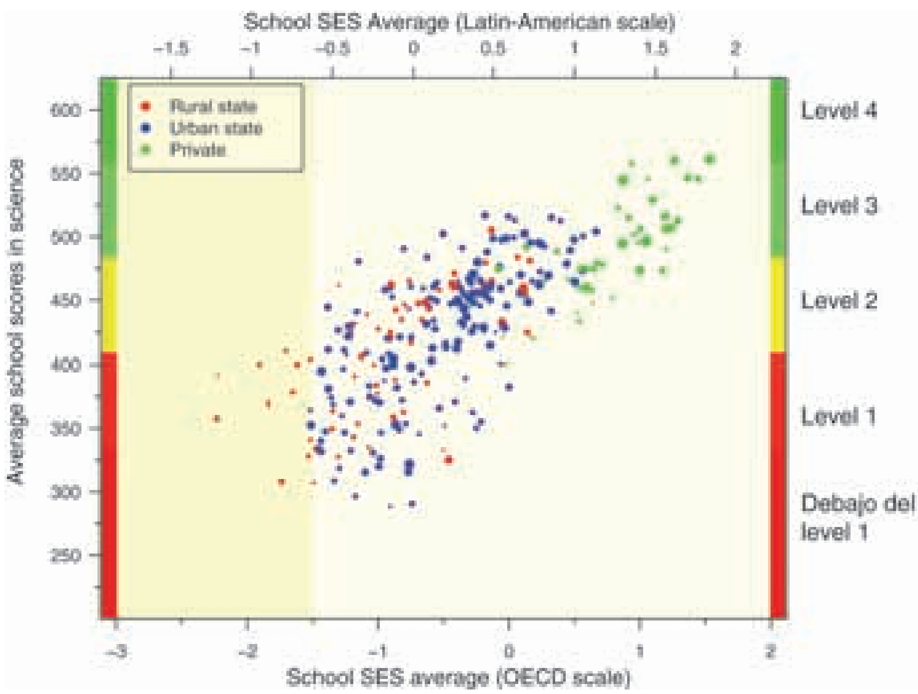
Graph 4.25

Socio-economic gradient of science performance in Uruguay, compared to the OECD



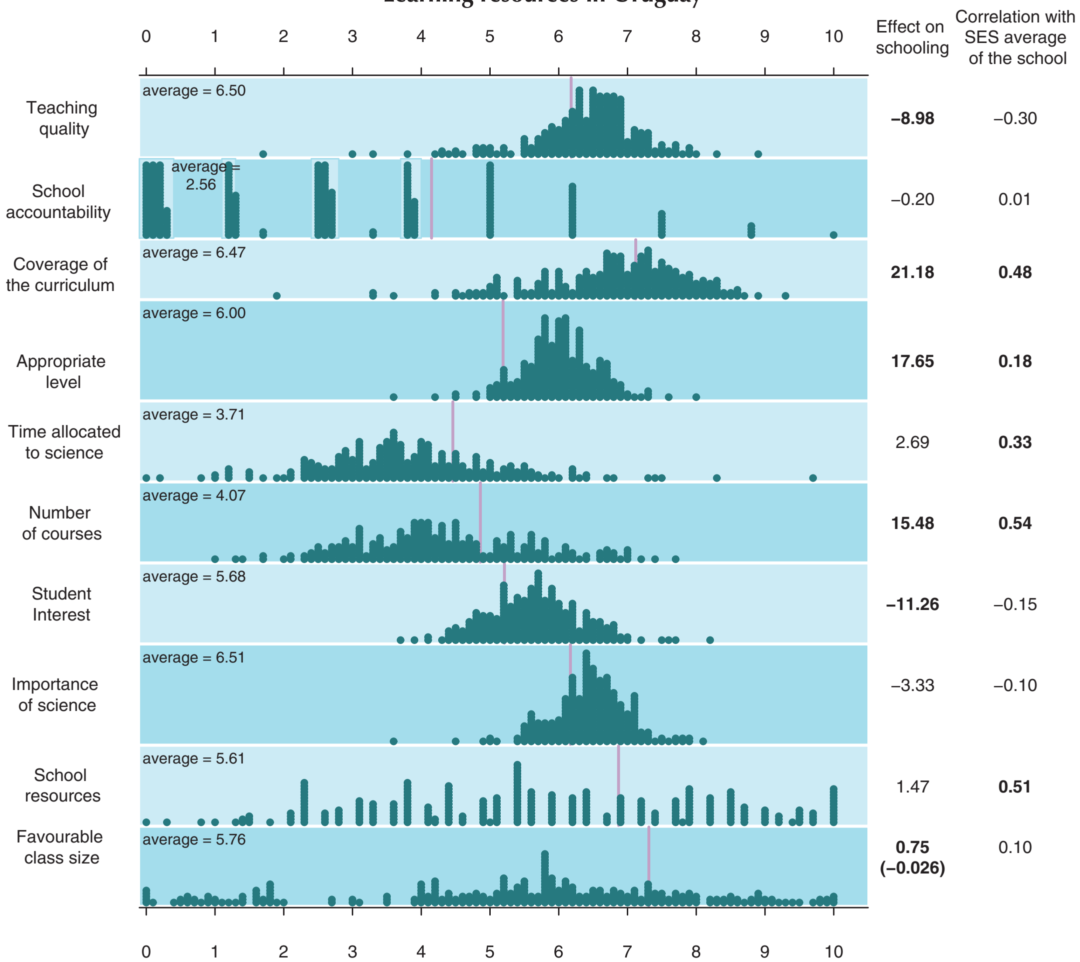
Graph 4.26

Academic profile of performance in science in Uruguay



Graph 4.27

Learning resources in Uruguay

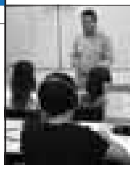


These results suggest that universal interventions are required to improve student skills, especially in low SES rural and urban state schools. These interventions should begin by addressing inequality in terms of the availability of learning resources in more disadvantaged schools.

REGIONAL VARIATIONS IN BRAZIL, SPAIN AND MEXICO

In three of the Iberoamerican countries that participated in PISA (Brazil, Spain and Mexico) the model was designed to include regional strata. This makes it possible to make analyses that are not limited to comparisons between countries. Although the size of the samples from each region is small, it is possible to examine the differences between these regions using the tools employed in this chapter.

The graphs for each of these regions of Brazil, Spain and Mexico are presented below.



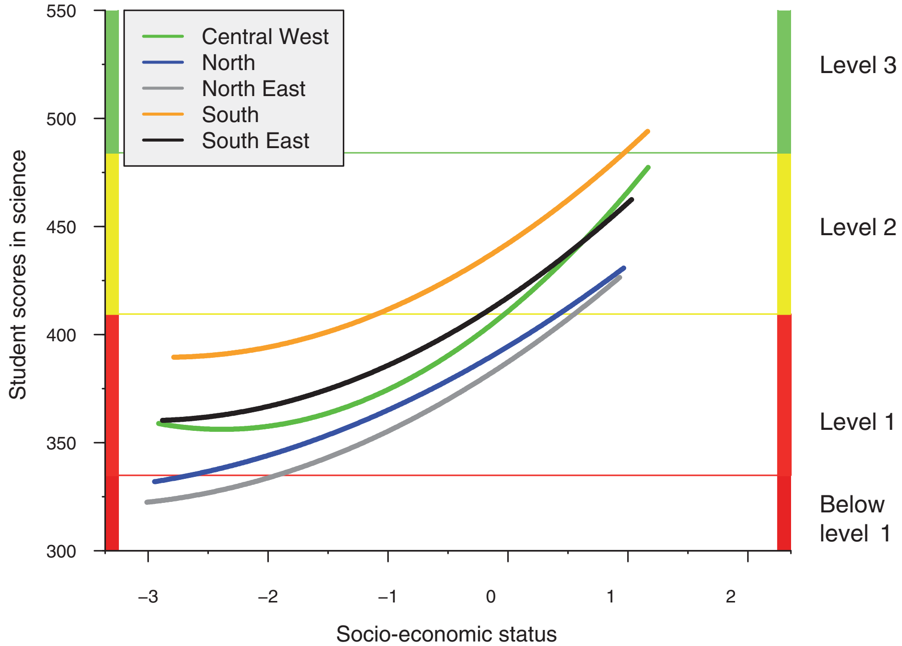
Regions in Brazil

The results of the analysis for Brazil show significant variation between the five regions of the country. However, the slope of the gradients is very similar and indicates that high performance only occurs when it is linked to higher SES levels.

The South region stands out above the rest with gradients of at least 30 points above the other regions at all SES levels and reaches performance Level 3 at the highest SES. The gradient for the South East region is below the gradient for the South region, and 30 points above the North and North East. The two latter gradients are almost entirely at performance Level 1, and barely reach Level 2 in the highest SES. The Central West region has a gradient which is very close to that of the South East region, but shows higher performance ratings at the highest SES levels, which suggests that there is a stronger influence of socio-economic differences on performance.

Graph 4.28

Socio-economic gradients of science performance in the regions of Brazil



Brazil Central West

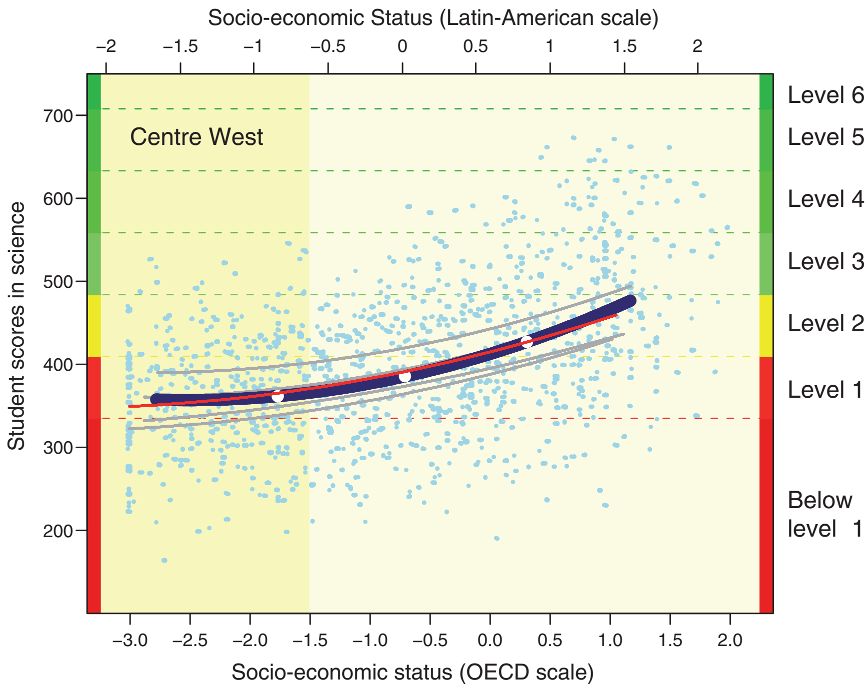
The gradient of the Central West region falls within the average performance range of the country, although the SES indices move to the right. Student distribution in the region shows differences in performance at both the lowest and highest SES levels. However, it should be pointed out that many students achieve proficiency levels above Level 2, which is considered the minimum level for effective citizenship.

Although high SES students predominate at the higher proficiency levels, there are also low SES students who achieve good results.

School distribution in this region follows the general pattern of the country. With rare exceptions, higher SES private schools are those which attain the highest proficiency levels.

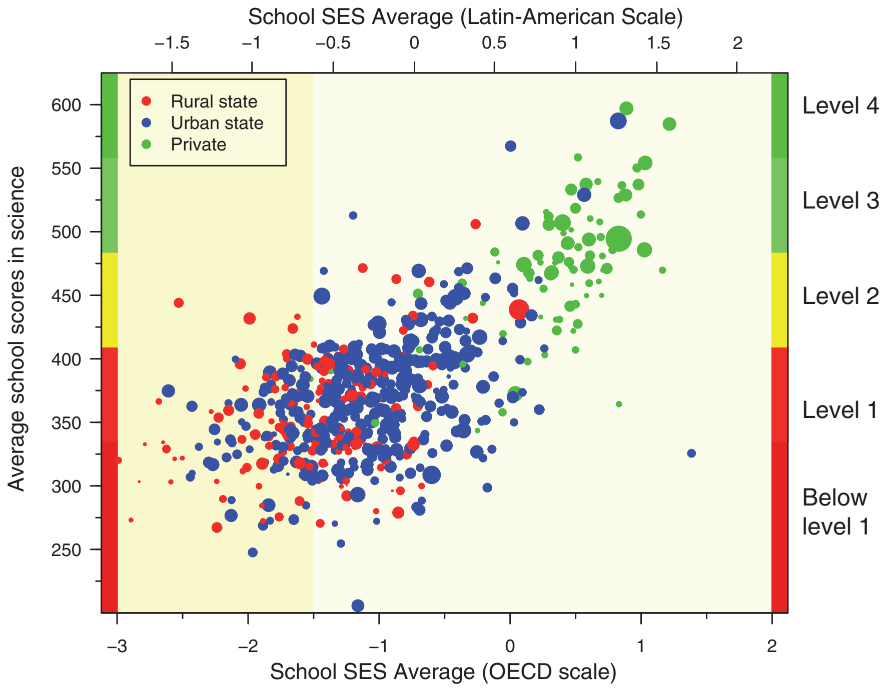
Graph 4.29

Socioeconomic performance gradient in science in the Centre West region in comparison with Brazil



Graph 4.30

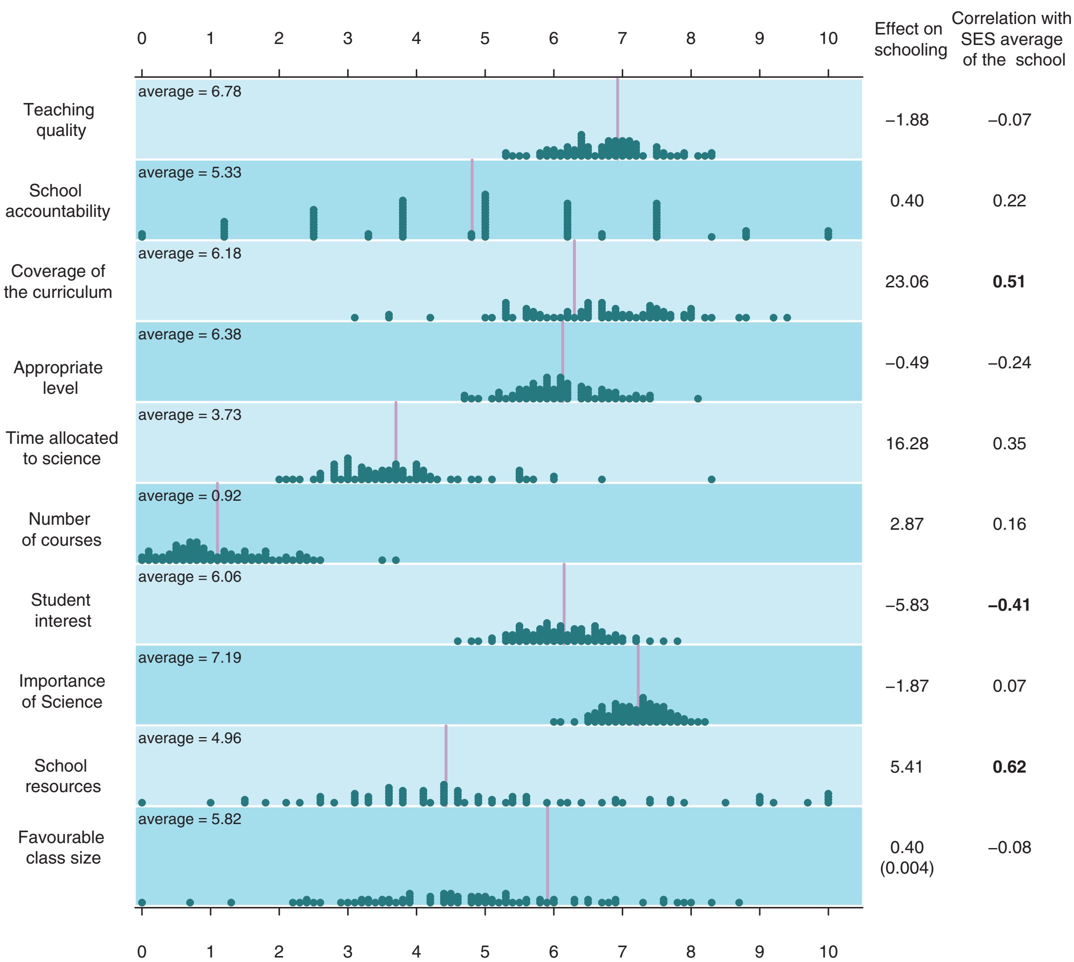
School profile of performance in science in the Centre West Region in comparison with Brazil (points in lighter colours)



Most private schools attain proficiency levels above Level 2, while most state schools are below Level 2. Rural state schools in the region, all with low SES, have performance rates clustered at Level 1. Nonetheless, it is interesting that a state school achieves the highest performance rate in this region, although it also has a high SES level.

The analysis of related factors shows that student perception of the coverage of the curriculum, time allocated to science, and the number of science courses in schools, is slightly below the national average in the Central West Region. However, these students show the same interest in science as the national average, and they also consider the study of science to be very important in their lives.

Graph 4.31
Learning resources
in the Central West Region

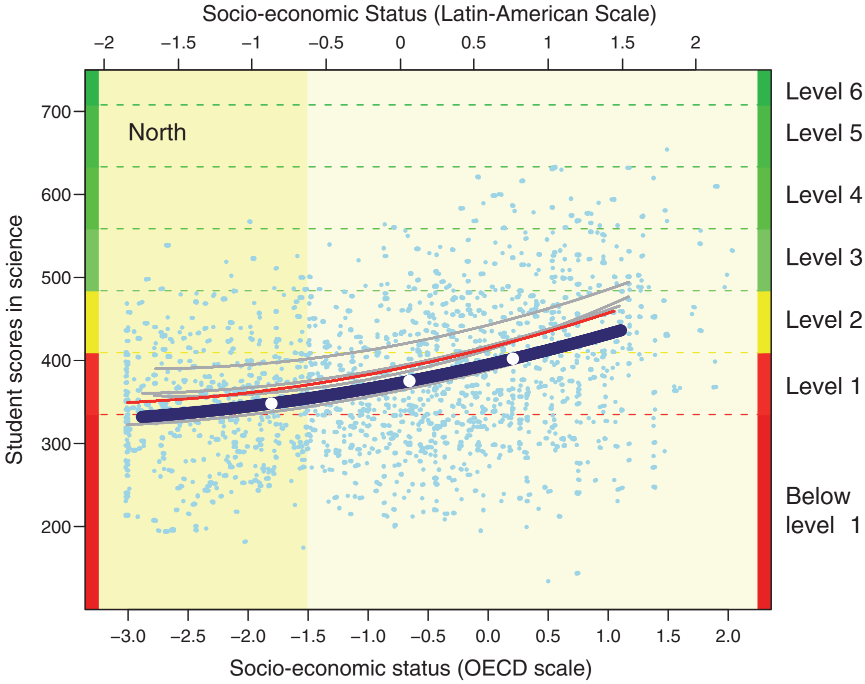


Brazil North and North East

The gradients for the North and North East regions are below the Brazilian average, but the gradient of the North East extends a little more to the left, with a lower SES. The pattern of student performance is very

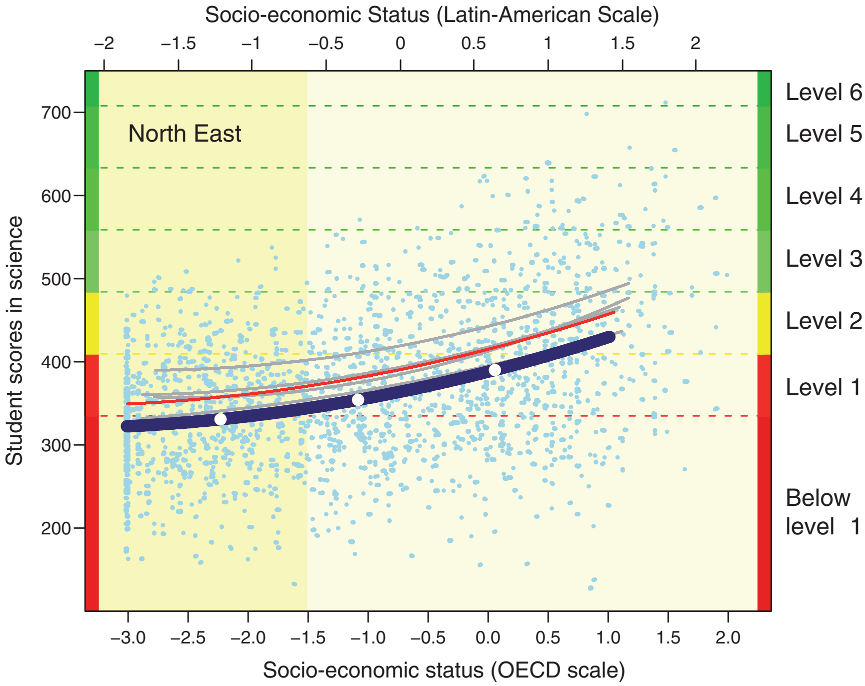
Graph 4.32

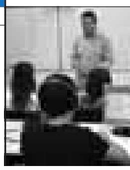
Socio-economic gradient of science performance in the North region, compared to Brazil



Graph 4.33

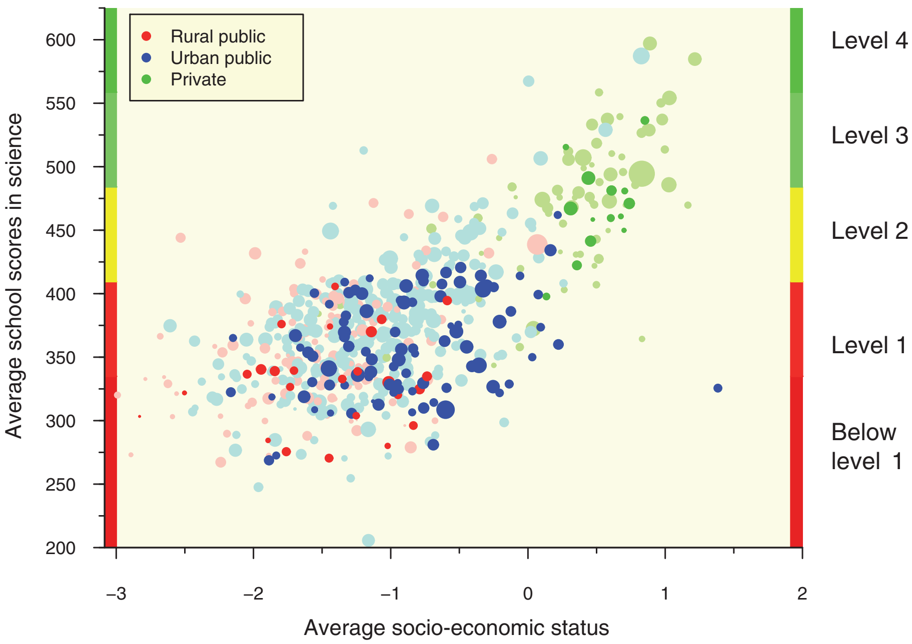
Socio-economic gradient of science performance in the North East Region, compared to Brazil





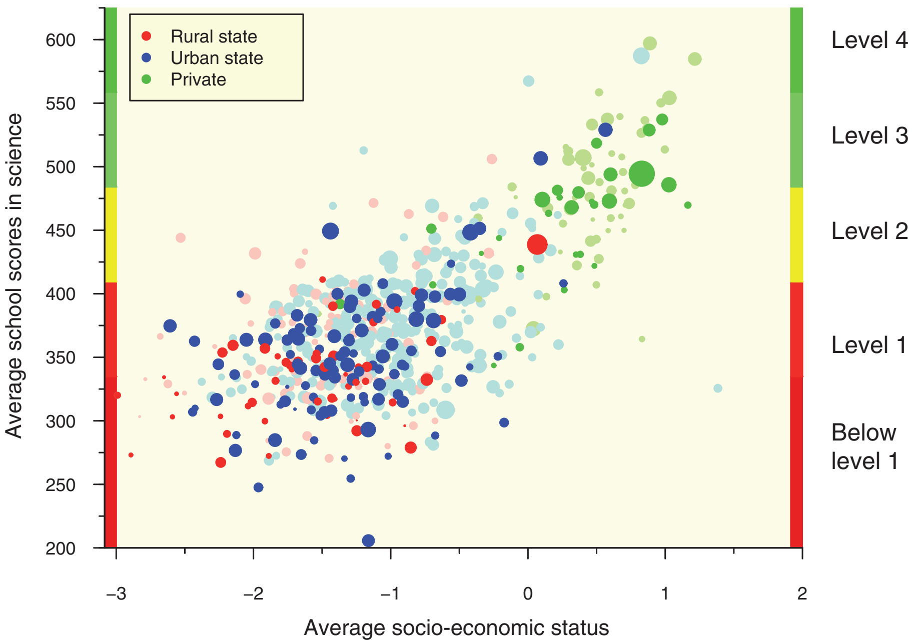
Graph 4.34

School profiles for science performance in the North Region, compared to Brazil (points in lighter colours)



Graph 4.35

School profiles for science performance in the North East Region, compared to Brazil (points in lighter colours)



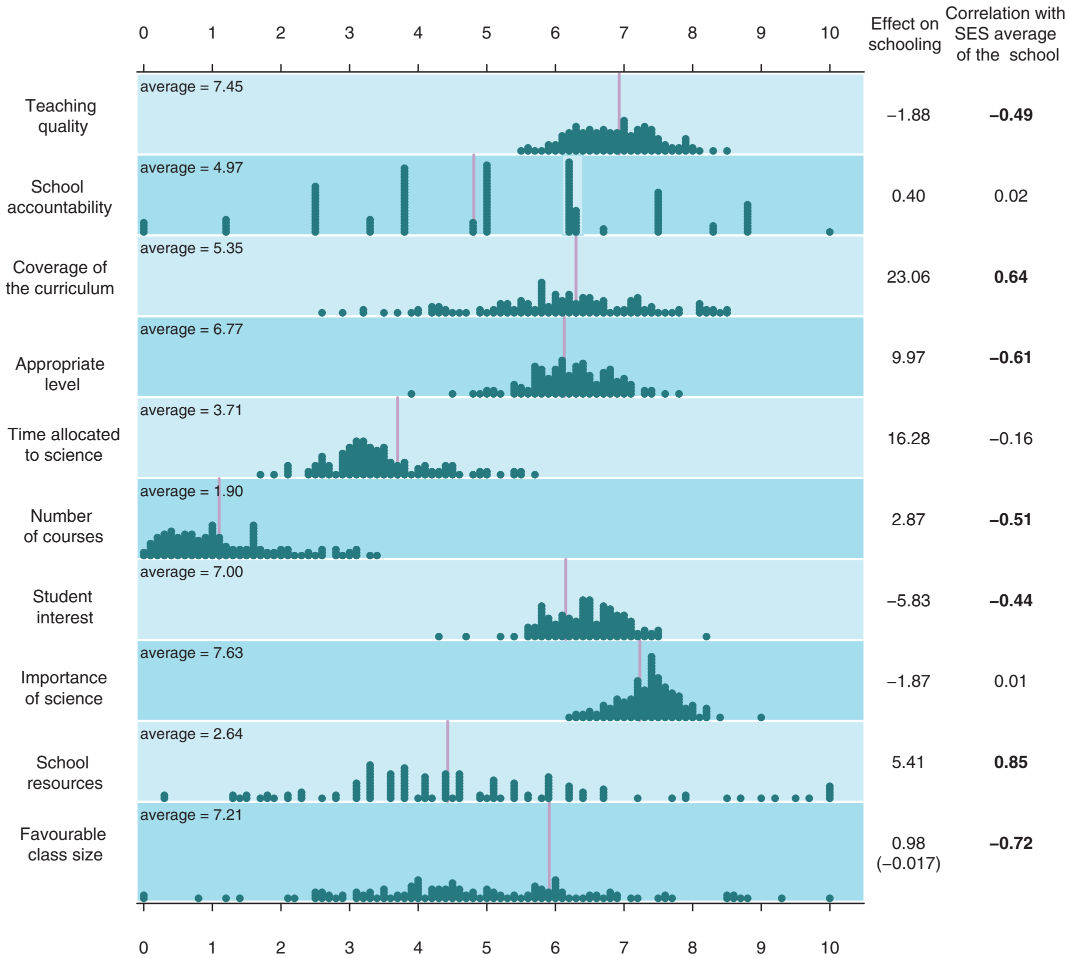
similar in the two regions, and most students are below performance Level 2. Many students in the North East region are below Level 1. However, some higher SES students manage to achieve Level 4 of science proficiency in both regions.

The pattern of the schools shows that most of the state schools in the two regions are below Level 2. Private schools in the North are almost all at Level 2, while in the North East private schools are found at Levels 2 and 3 of science performance. There are also state schools at Level 3 in the North East region.

From the analysis of the related factors it can be seen that there are no major differences between the two regions. According to the perceptions recorded by students in these regions, the time allocated to science is slightly greater than the national average. The interest of students in science, and the importance attached to the study of science for life in the future, is also considerably greater in these two regions than in the rest of the country. Despite their low proficiency levels, students from the North and North East therefore show most interest in science.

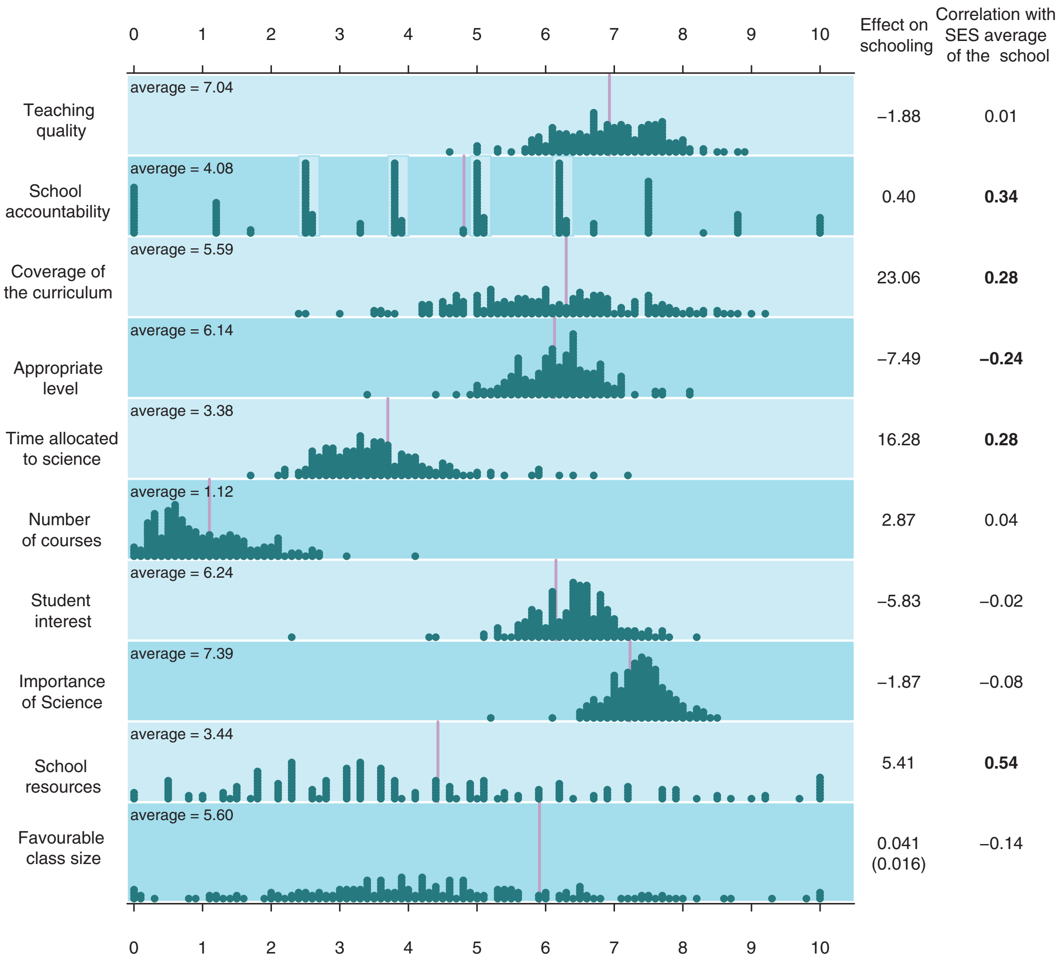
Graph 4.36

Learning resources in the North East Region



Graph 4.37

Learning Resources in the North eastern Region



Brazil South

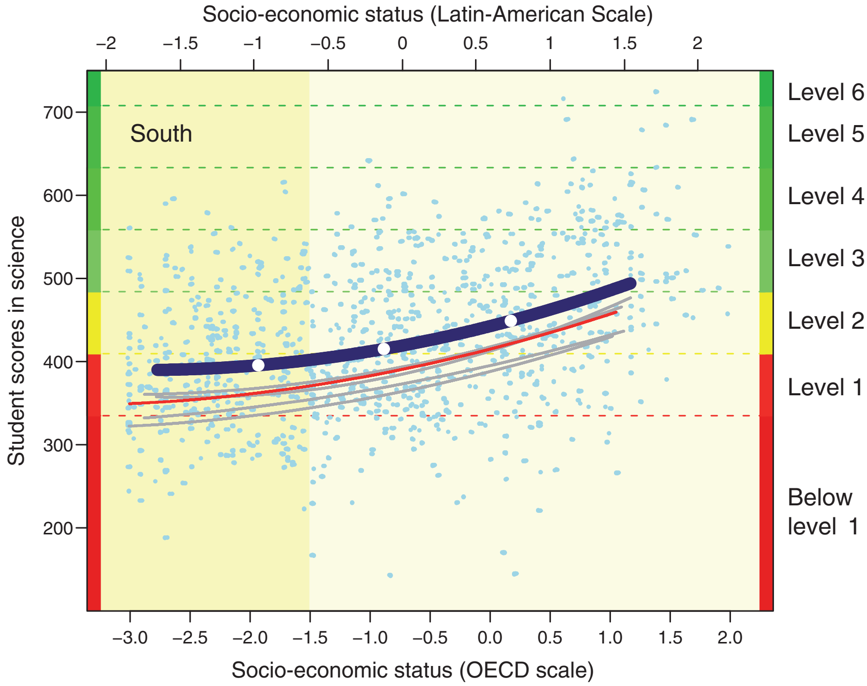
The gradient for the South region is clearly above the national average and moves to the right, reaching performances at Level 3 at higher SES levels. Most students in this region reach Level 2 or even higher levels of proficiency. It should be pointed out that a large number of low SES students in this region have proficiency levels above the national average, which raises the gradient at lower SES levels. This region also has the fewest students with performance at below Level 1.

The distribution of schools in the South region follows the general pattern for the country, with a higher SES and better performance in private schools. However, there are more state schools in the region with low SES at proficiency Levels 2 and 3. Rural schools in these regions also achieve better results compared to the rest of the country, even at very low SES levels.

The analysis of related factors shows that perceptions of the importance of the study of science for life are no different from the rest of the country. However, coverage of the curriculum is viewed more positively in the South, as is the time allocated to the study of science. A possible explanation is that students

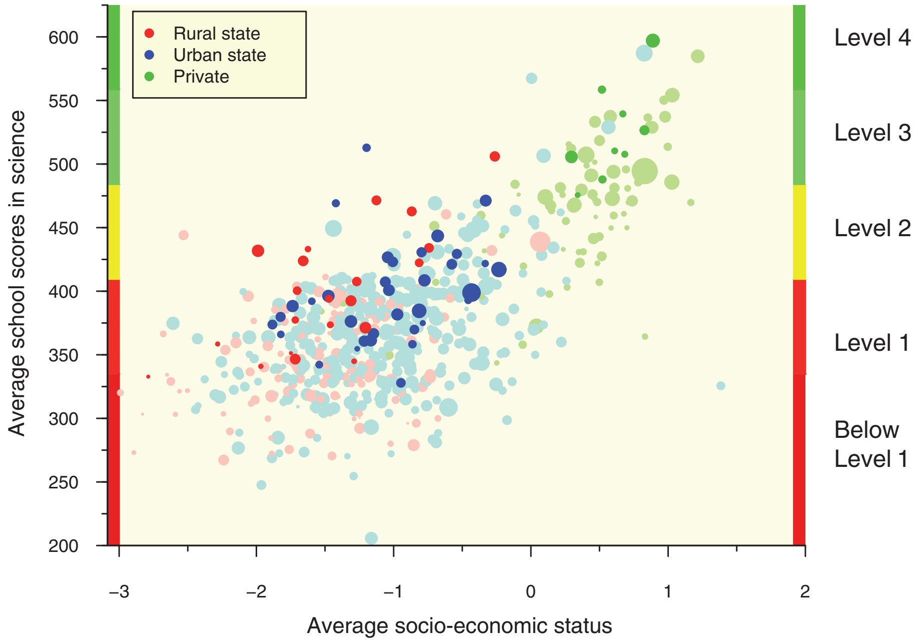
Graph 4.38

Socio-economic gradient of science performance in the South region, compared to Brazil



Graph 4.39

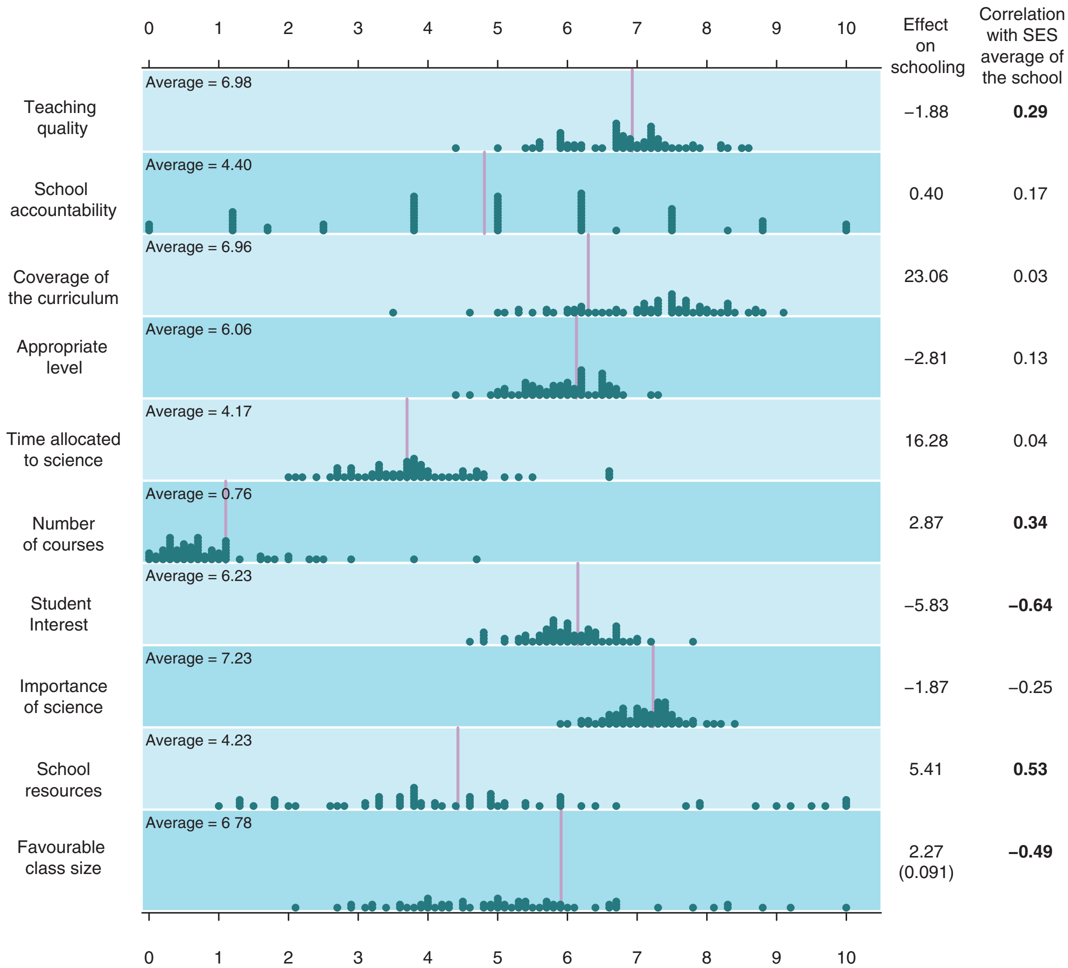
School profiles for science performance in the South Region, compared to Brazil (points in lighter colours)



who reach higher proficiency levels show greater capacity for applying the subject matter acquired in school.

Graph 4.40

Learning Resources in the South Region



Brazil South East

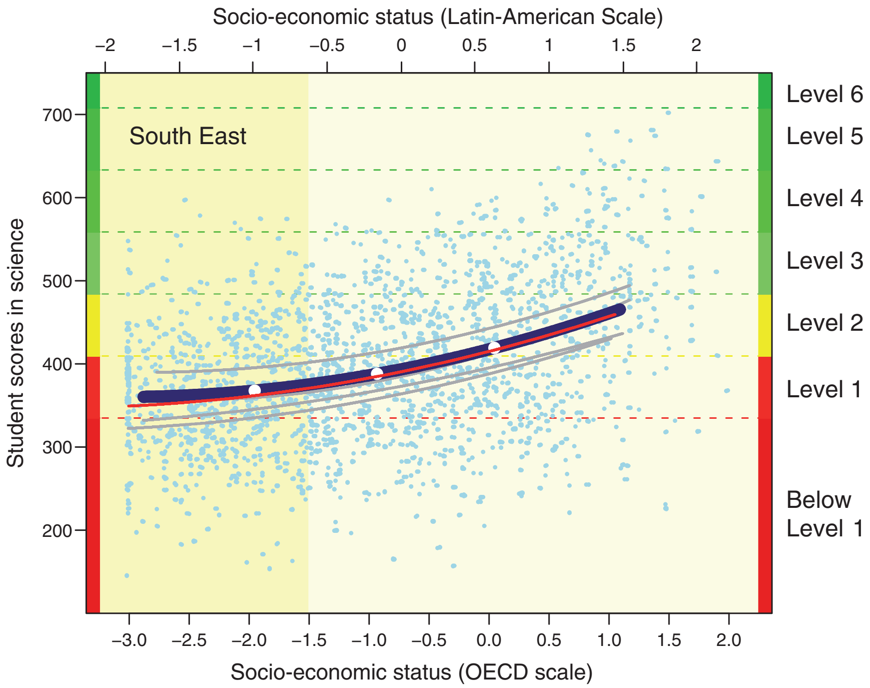
The gradient for the South East region is very similar to the national curve, but is slightly displaced towards the right. The left extreme of the gradient is slightly higher, as in the South region, showing that more low SES students achieve better results. In fact, Graph 4.41 shows that many low SES students manage to achieve proficiency at Levels 3 and 4.

School distribution also reveals a difference between state and private schools. Private schools have higher proficiency levels, while most state schools are below performance at Level 2. However, as in the South region, there are more rural schools with performance at above Level 1 than the national average.

The analysis of related factors shows that the regional averages for student perceptions of science teaching, time allocated to science, the number of science courses in the schools, and coverage of the curriculum are higher than in the rest of the country. Furthermore, the interest that the students show in sci-

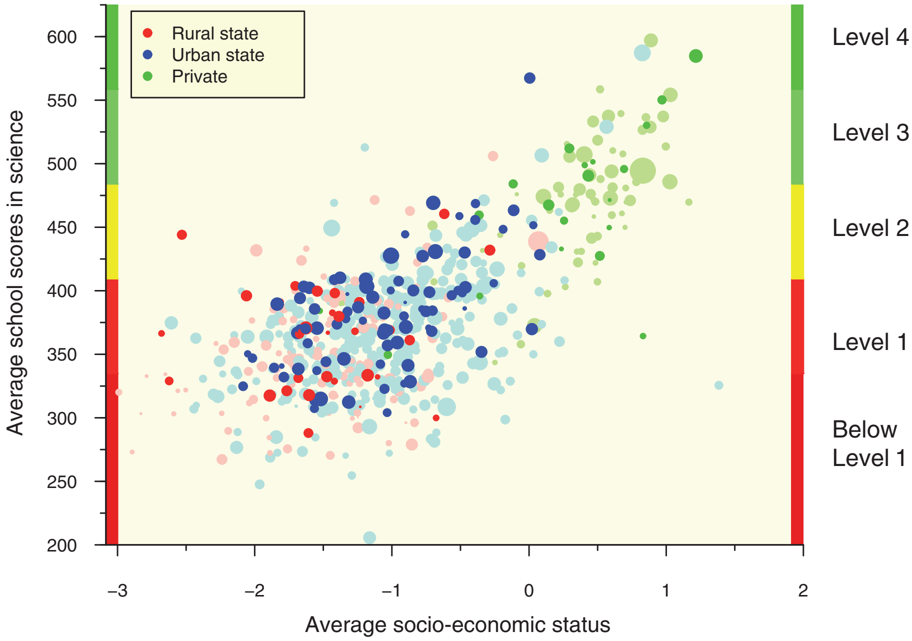
Graph 4.41

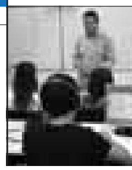
Socio-economic gradient of science performance in the South East region, compared to Brazil



Graph 4.42

School profiles for science performance in the South East Region, compared to Brazil (points in lighter colours)

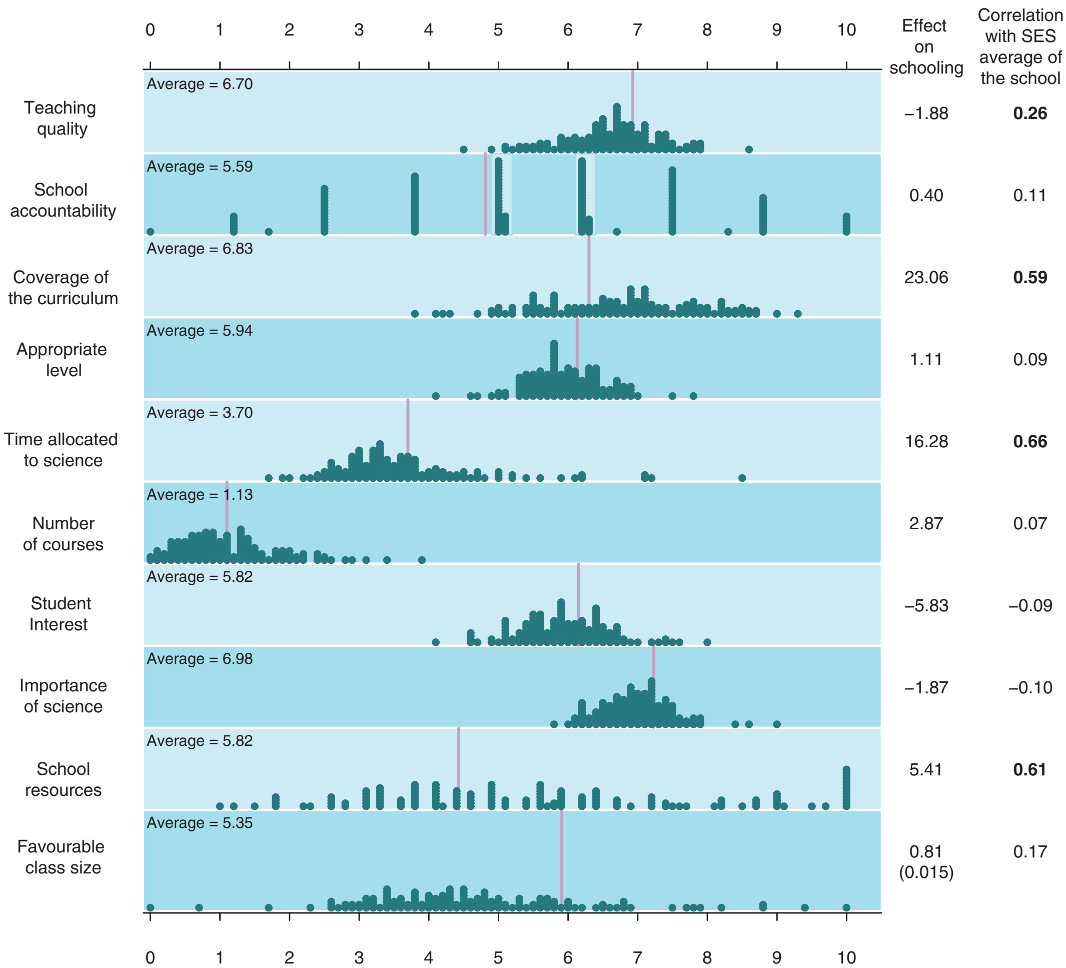




ence, and their recognition of the importance of the study of science for life, is greater than the national average.

Graph 4.43

Learning resources in the South East Region



Spanish Autonomous Communities

The gradient bars for the Spanish Autonomous Communities have a similar slope to the Spain as a whole, but there are slight differences. The level of seven of the communities is above the Spanish average in all SES factors, while the other three, Catalonia, the Basque Country and Andalusia, are very close to the Spanish and, therefore, to the OECD average.

As we have seen, the most noteworthy aspect for Spain as a whole is that the students of all the Autonomous Communities with low SES achieve results that are well above the OECD mean. All the bars of the gradient are above Level 1.

The Autonomous Communities all have similar patterns, which points to the homogeneity of the Spanish educational system. The slopes of all the curves are less steep than across the OECD, so all Autonomous Communities show the equitable characteristics of the Spanish educational system, which we have already commented on. This may be due to the importance of common factors such as the basic curriculum, teacher training that is comparable at its initial stages, or organisational resources and methods, which share some common features.

At the same time, the example of the Spanish Autonomous Communities sheds light on factors, which may greatly influence student performance. The gradients of Castile-Leon, La Rioja, and Aragon, among others, show average results that are equivalent to those of the Netherlands, and are better than most European countries that generally achieve good results. They also show a high level of equity.

The pattern of the Spanish Autonomous Communities shows that greater demographic dispersal is not always a handicap for the more rural areas (Galicia, Castile and Leon, La Rioja). The results from these communities seem to show that it is possible to counteract environmental circumstances in such a way that students are not negatively affected. A similar conclusion emerges if we study the effect of a greater level of economic development, or high levels of per capita wealth. The results from Galicia, for example, are better than those from richer and more economically developed Spanish communities, and even those of several Scandinavian countries, cautioning against any hasty generalisations about the link between wealth and educational results.

We cannot attribute any marked differences in proficiency levels between Communities to the basic curriculum, teacher training or school organisation, as these are similar across the whole country. As we cannot correlate educational results with rural environments, or a more modest level of development, the explanation for the excellent results from certain areas, compared to both the national average and the results from more developed countries, may very well be due to other factors. The determinants could be classroom processes, the work of teaching teams, the attitudes of students and their families, and so on. None of these have been definitely identified through PISA, but a multilevel analysis, discussed below, does provide some information along these lines.

Following the same pattern as for the country as a whole, the schools that achieve the best results in all Autonomous Communities, when SES is average or low, are either rural or urban state schools. This also occurs in an Autonomous Community such as Andalusia, irrespective of SES. The average performance of practically all schools in all Autonomous Communities studied are above Level 1 and most are at Levels 2 and 3, especially in Aragon, Asturias, Cantabria, Castile and Leon, Galicia and La Rioja. These PISA 2006 results for the Spanish Autonomous Communities caution us against generalising about the results from state and private, rural or urban schools.

With regard to distinct SES levels, the differences between schools in similar social, economic and cultural environments are 50 points or more in Andalusia, Aragon, Cantabria, Castile and Leon, Catalonia, Galicia. This rises to above 100 points in Asturias, La Rioja, Navarre and the Basque Country. The organisation of schools and how well they function, as well as the contribution of teaching teams, may explain how results can be so different in schools which share broadly similar characteristics. These factors make it possible to counteract, and often overcome, the effects of the students' social, economic and cultural backgrounds.

The analysis of school-related factors provides similar, significant results in the Spanish Autonomous Communities as a whole. In the first place, the following two factors show a high positive correlation both with the SES average (above 0.40), and with student results in tests:

- ***Time allocated to science**:* the highest correlation in Spain as a whole, and in seven of the ten Autonomous Communities
- ***Student interest**:* a correlation above 0.30 in six Communities.

Six factors have a strong positive correlation with SES, but a weak correlation with results in tests:

- ***Importance of science for students*** (in eight communities)
- ***Appropriate level*** (in four communities)
- ***Number of courses*** (in five communities)
- ***Teaching quality*** (above 0.40 in four communities but in eight this surpasses 0.15)
- ***School accountability*** (over 0.20 in seven communities)
- ***School resources*** (above 0.20 in four Autonomous Communities)

Coverage of the curriculum has a strongly positive correlation in four communities, but is not related to SES, or is negative, in the other six. However, together with the two factors stated at the head of this list, it is one of the factors that strongly influence student test results.

Finally, **class size** has no relationship with SES in two communities, or has a strong negative correlation in the other six. Moreover, there is no correlation between class size and student results in the Spanish Autonomous Communities.

The results for equity and equality provided by HLM analysis show that in Spain as a whole, and in practically all the Autonomous Communities that were studied, fewer than 20 % of students are at low proficiency levels in science. The percentage is below 16 % in seven of the Autonomous Communities (all except Andalusia and Catalonia).

Students with low SES (below -1.5 on the OECD scale) can be considered to be vulnerable in educational terms. The percentage of these students is 28 % in Andalusia, 16 % in Galicia and in Spain as a whole, 13 % in Catalonia, and 10 % or lower in the other Spanish Autonomous Communities.

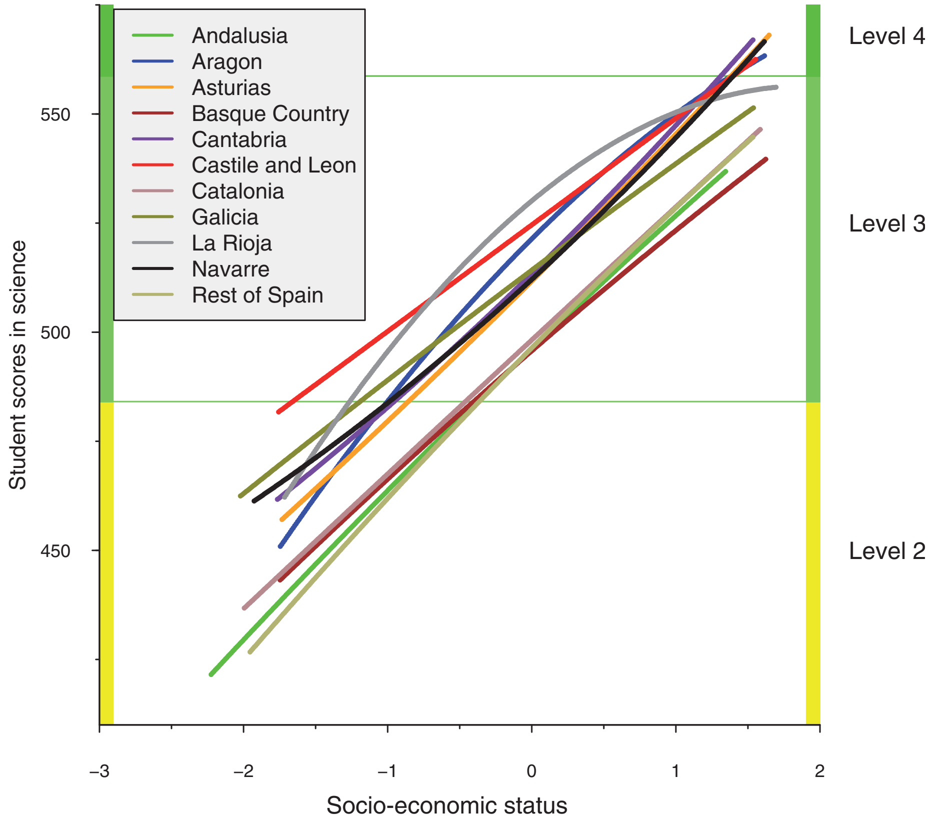
In Spain there is a 17 % variation in reading results in schools, and this is practically half the variation found in the OECD (36 %). The OECD figure is exceeded in Aragon (38 %), Asturias (40 %), Cantabria (49 %), La Rioja (64 %), and the Basque Country (66 %). In the other communities that participated in PISA 2006, these percentages range between 5 % in Andalusia and 18 % in Castile and Leon.

SES variation between Spanish schools is 24 %, the same as the proportion in the OECD. This figure is exceeded in seven Spanish regions, La Rioja (68 %), Navarre (66 %) the Basque Country (65 %), Cantabria (60 %) Asturias (58 %), Aragon (43 %), and Galicia (35 %). As we discussed in the introduction to this chapter, this variation in SES indicates that between-school segregation is occurring as a result of differences in social, economic and cultural status.

As was stated above, factors which are related to **student attitudes** and the influence of their families (*importance of science for students, student interest*); to the **organisation and functioning of the schools** (*appropriate level, number of courses)*; to the **work of teaching teams** (*teaching quality*); and **school accountability** and **school resources,** are those which clearly have a greater positive impact on student results in the Spanish Autonomous Communities. Ascertaining the influence of these internal factors within schools is undoubtedly one of the most important challenges of evaluation, if it is to become a truly effective instrument in improving educational policies and practice. It is also one of the most interesting lessons provided by PISA assessment, which opens up the possibility of comparing countries and regions.

Graph 4.44

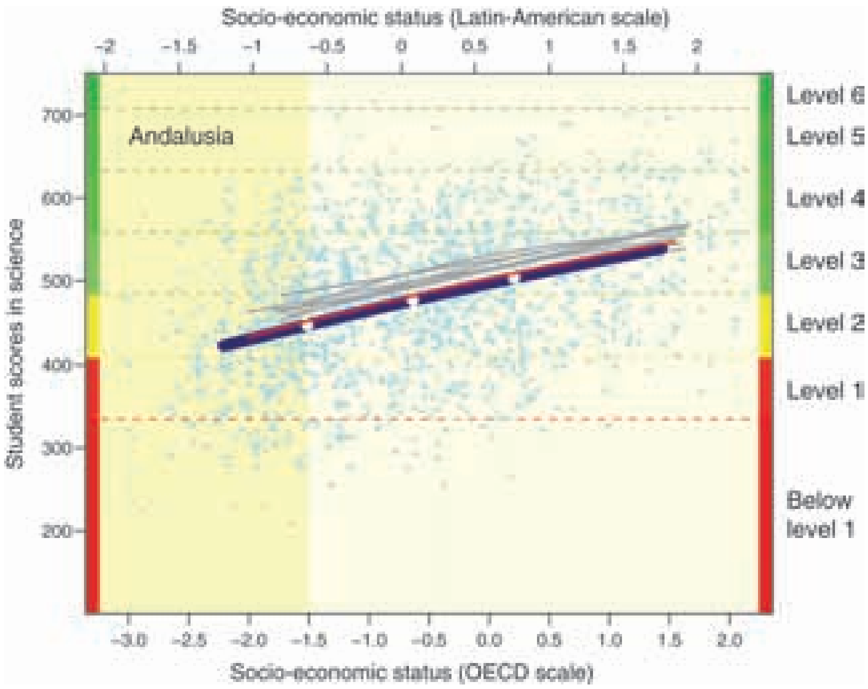
Socioeconomic gradients of performance in Science in the Spanish Regions



Andalusia

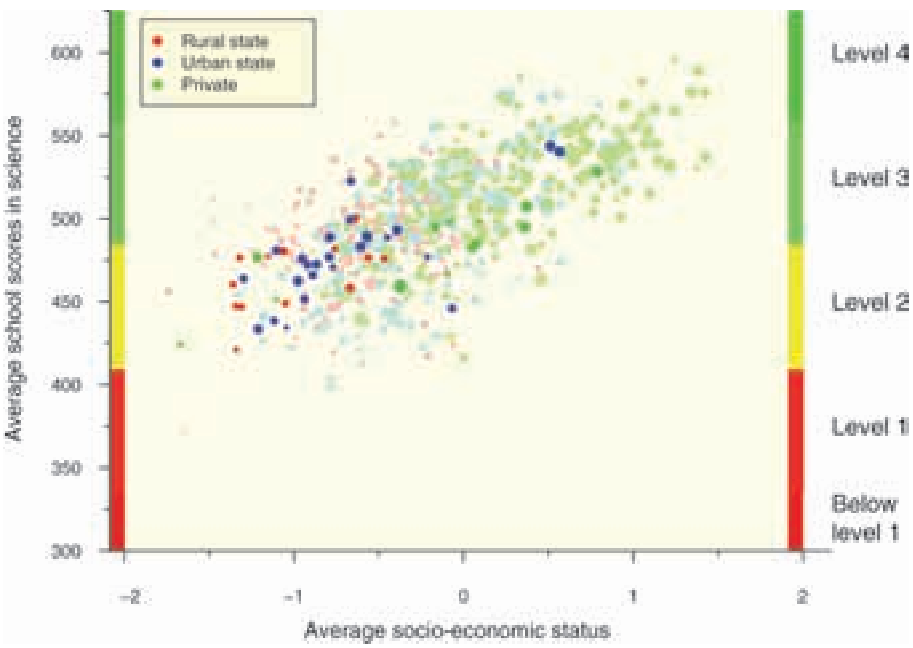
Graph 4.45

Socio-economic gradient of science performance in Andalusia, compared to Spain



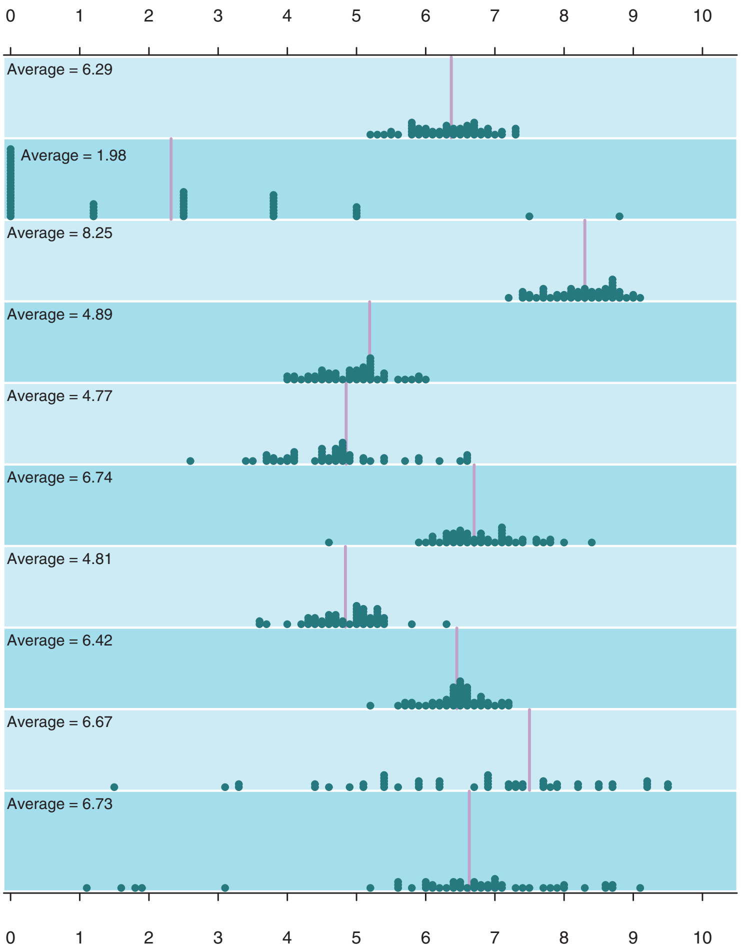
Graph 4.46

School profiles for science performance in Andalusia



Graph 4.47

Learning Resources in Andalusia

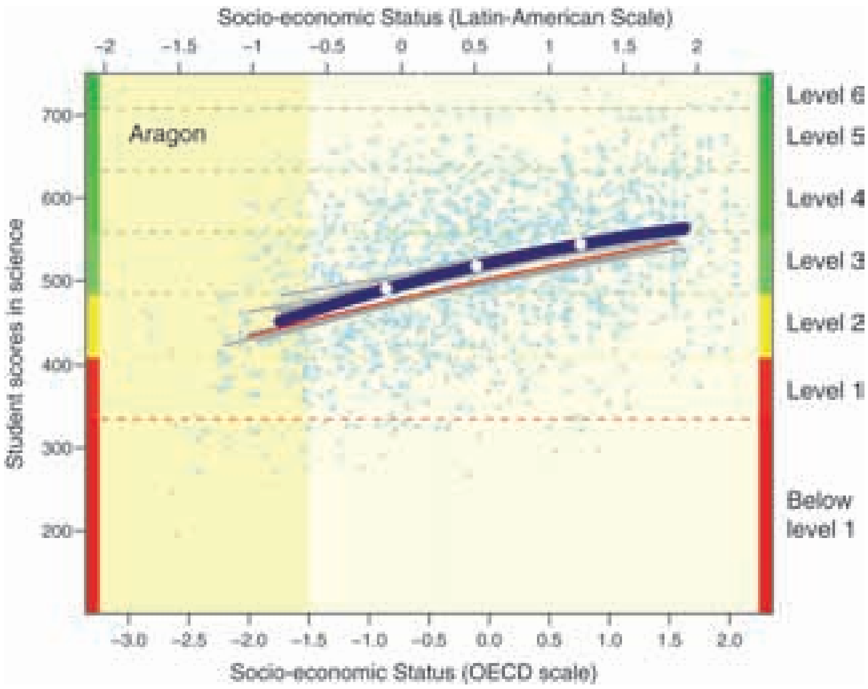


	Effect on schooling	Correlation with SES average of the school
Teaching quality	–5.93	0.17
School accountability	0.081	0.12
Coverage of the curriculum	13.84	0.25
Appropriate level	–2.94	**0.55**
Time allocated to science	5.23	**0.65**
Number of courses	0.59	**0.42**
Student Interest	13.76	**0.34**
Importance of science	–2.60	**0.59**
School resources	–0.082	0.22
Favourable class size	0.38 (–0.026)	**–0.48**

Aragón

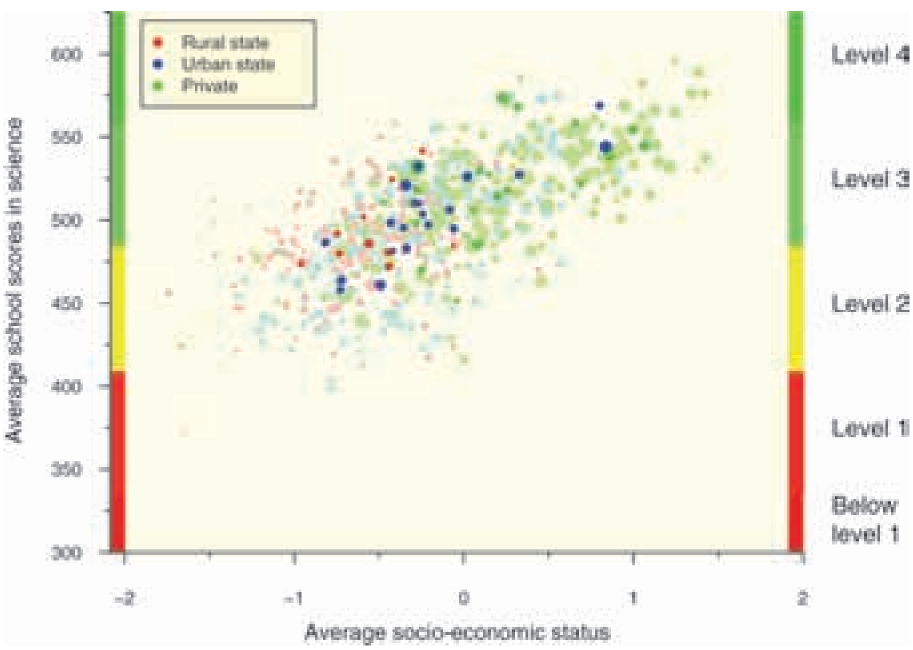
Graph 4.48

Socio-economic gradient of science performance in Aragón, compared to Spain



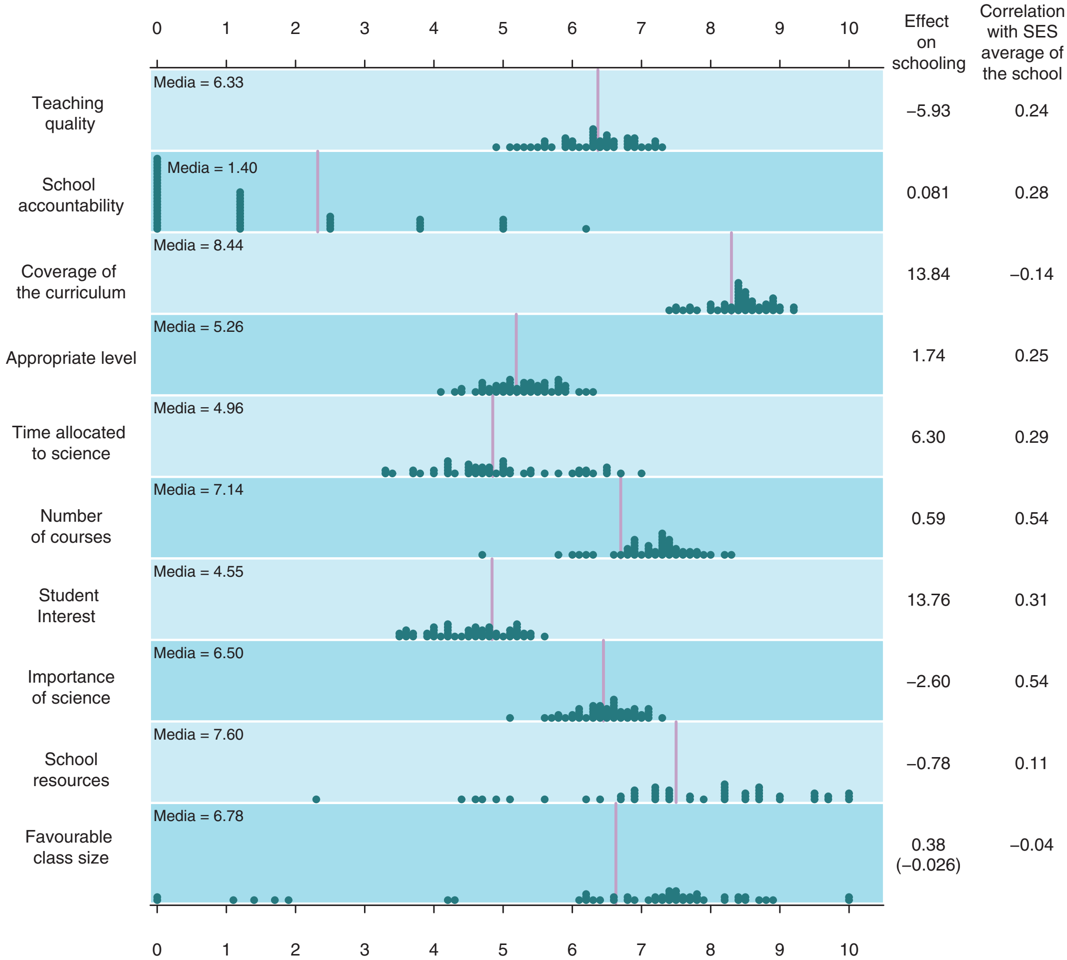
Graph 4.49

School profiles for science performance in Aragón



Graph 4.50

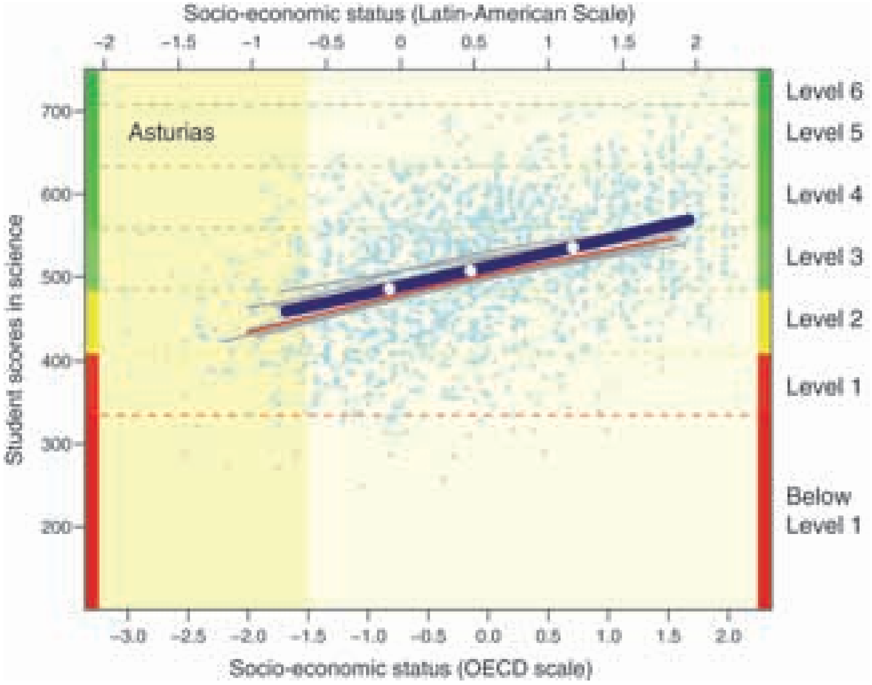
Learning resources in Aragón



Asturias

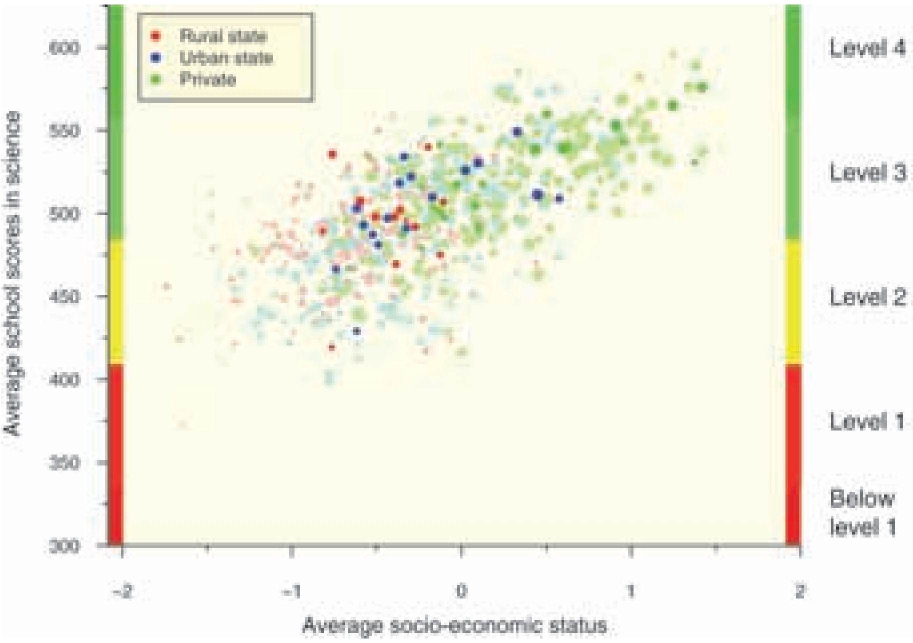
Graph 4.51

Socio-economic gradient of science performance in Asturias, as compared to Spain

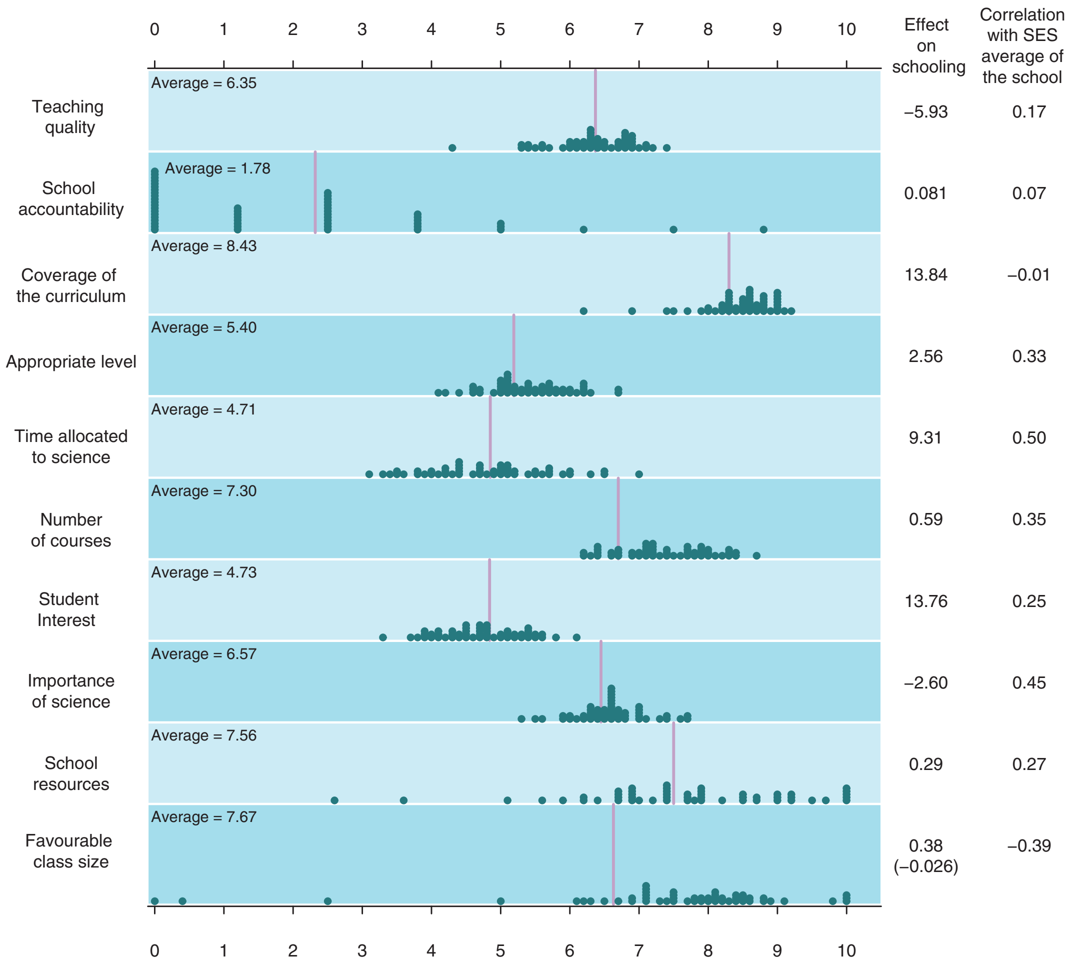


Graph 4.52

School profiles for science performance in Asturias



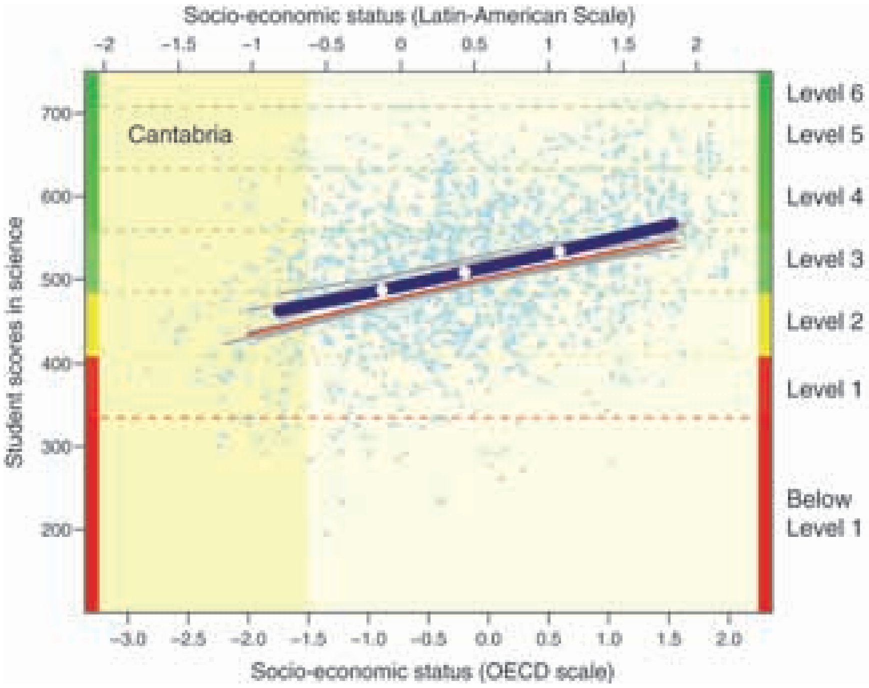
Graph 4.53
Learning resources in Asturias



Cantabria

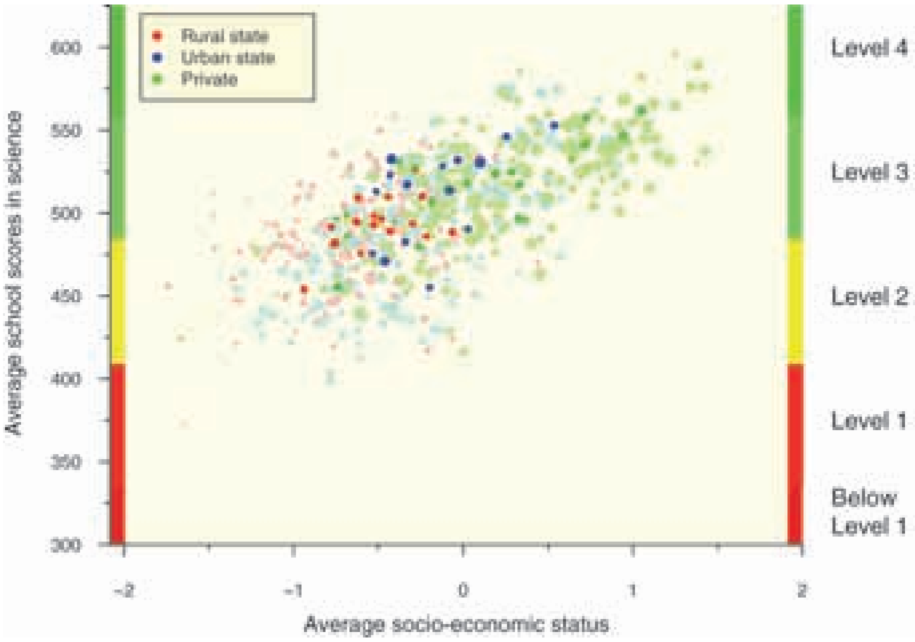
Graph 4.54

Socio-economic gradient of science performance in Cantabria, compared to Spain

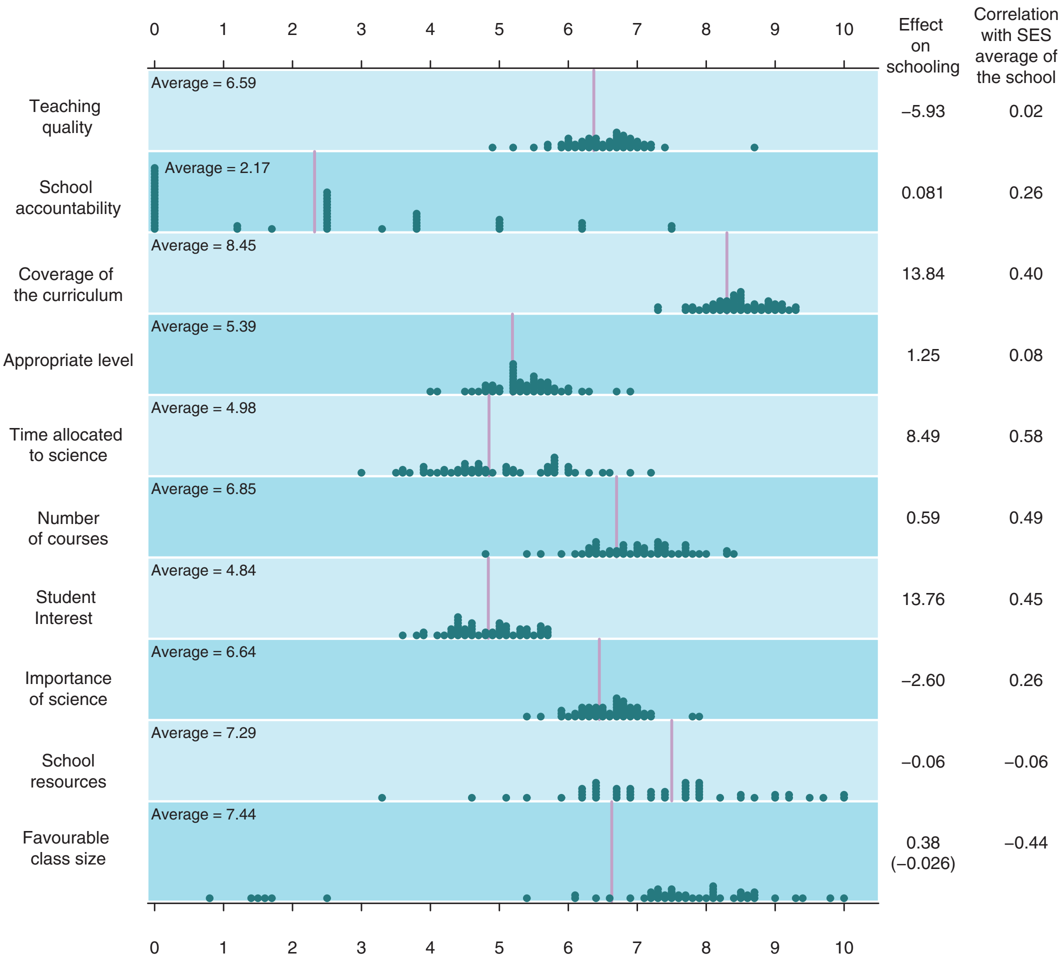


Graph 4.55

Academic profile for performance in science in Cantabria



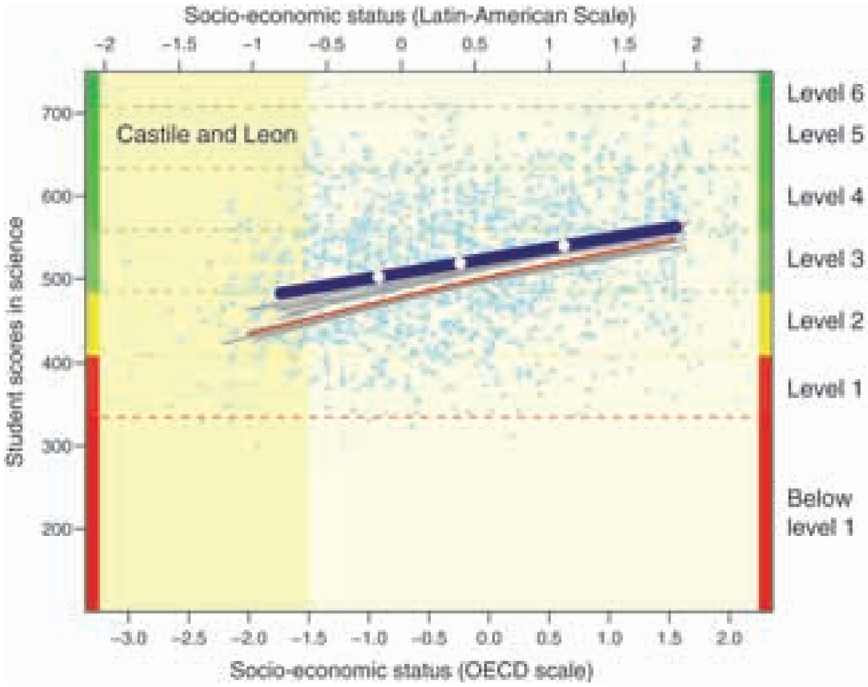
Graph 4.56
Learning resources in Cantabria



Castile and Leon

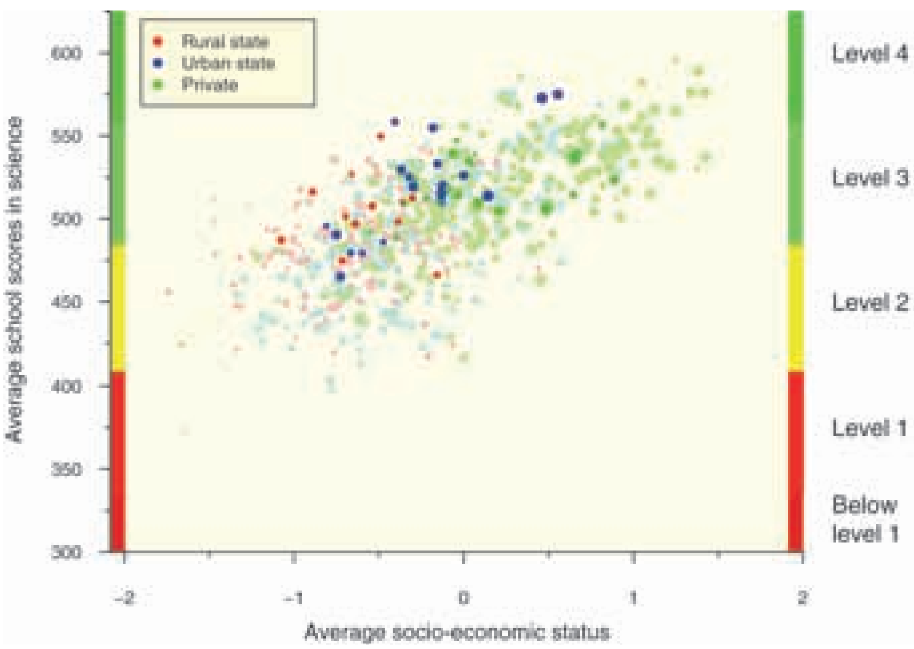
Graph 4.57

Socio-economic gradient of science performance in Castile and Leon, compared to Spain

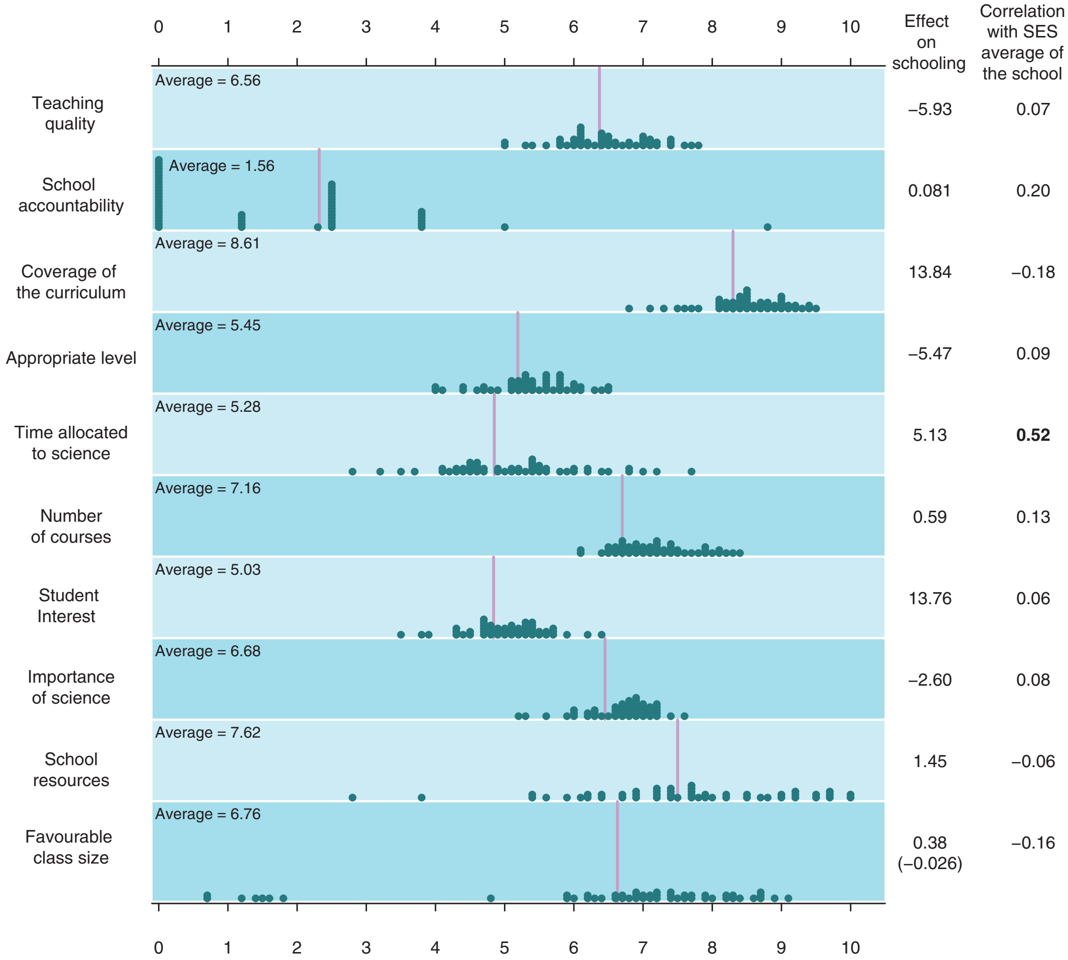


Graph 4.58

School profiles for science performance in Castile and Leon



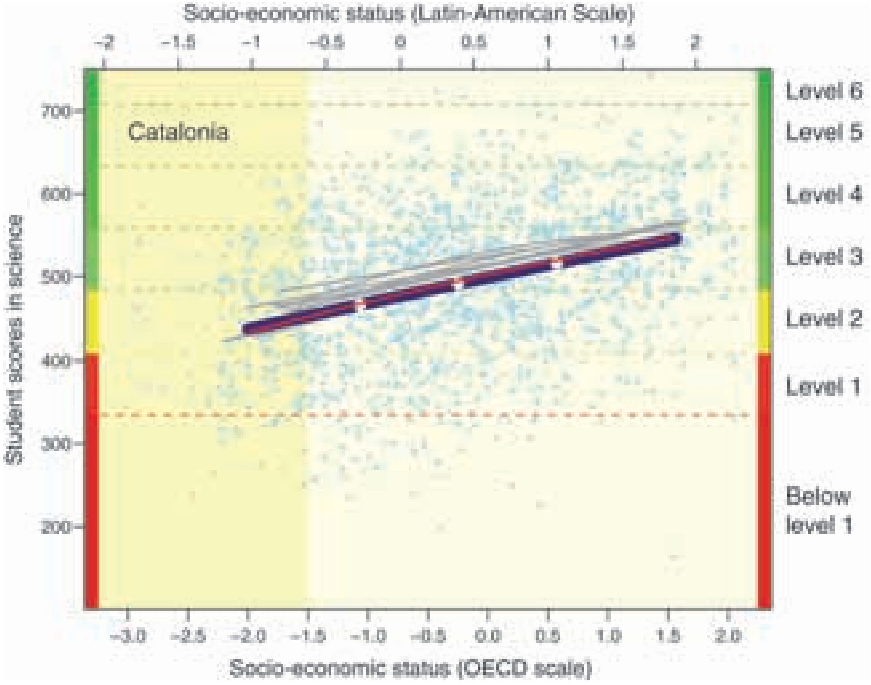
Graph 4.59
Learning resources in Castile and Leon



Catalonia

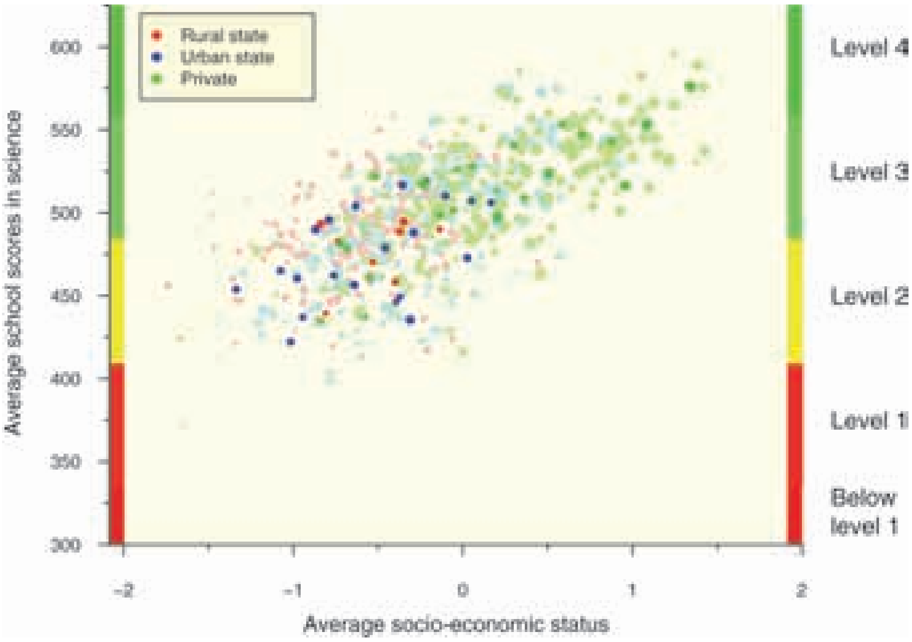
Graph 4.60

Socio-economic gradient of science performance in Catalonia, compared to Spain



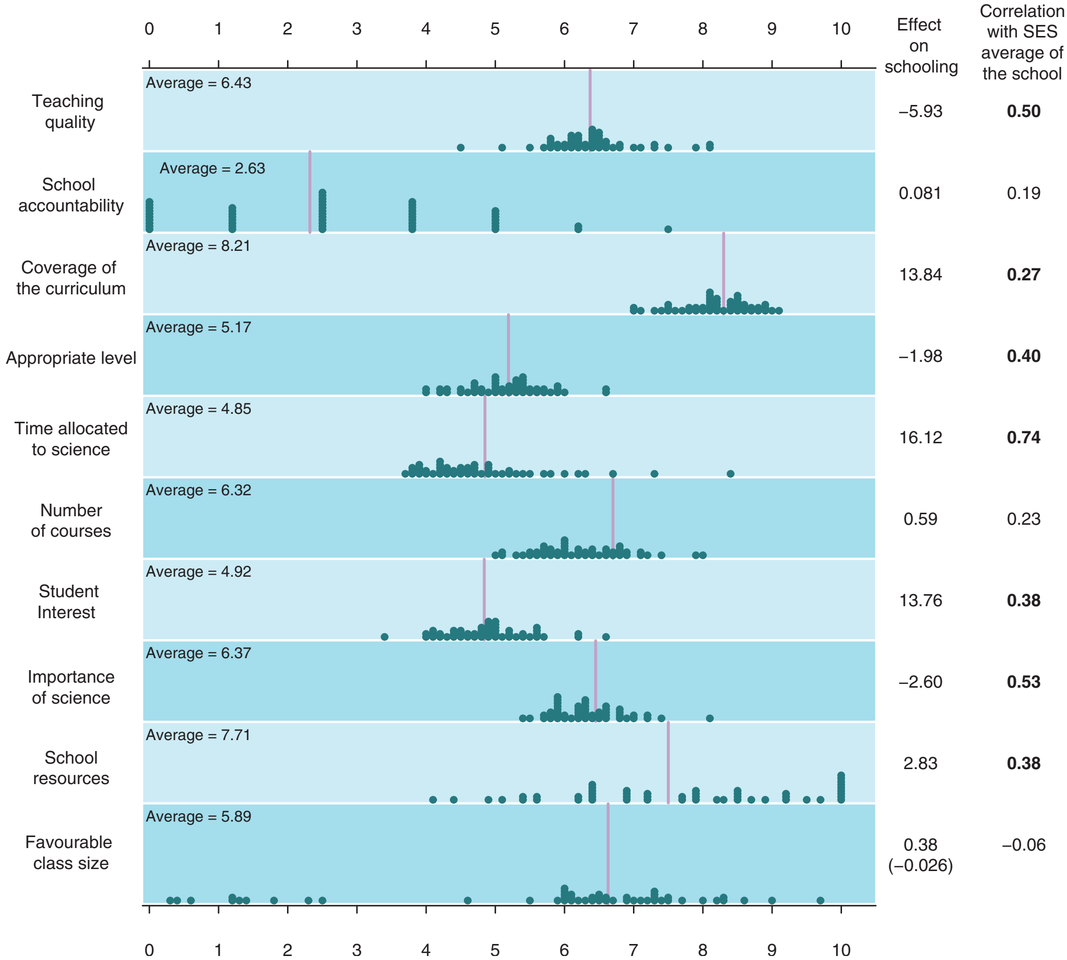
Graph 4.61

School profiles for science performance in Catalonia



Graph 4.62

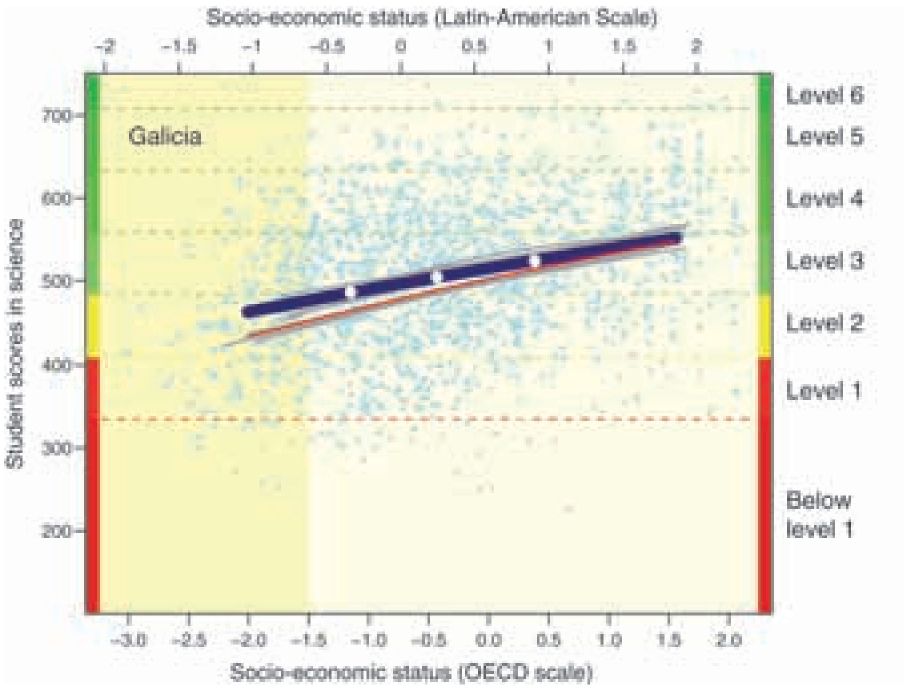
Learning resources in Catalonia



Galicia

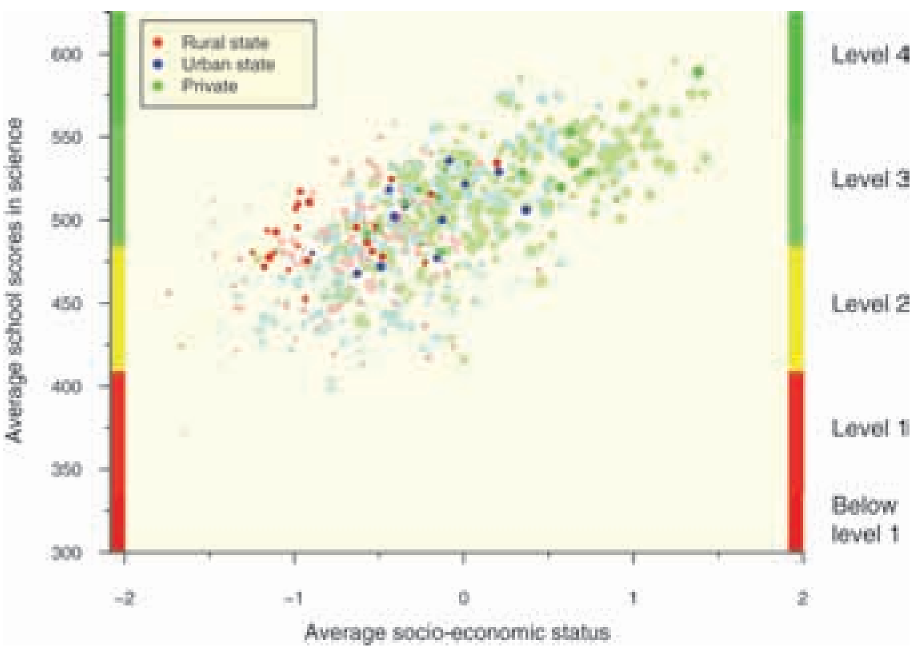
Graph 4.63

Socio-economic gradient of science performance in Galicia, compared to Spain

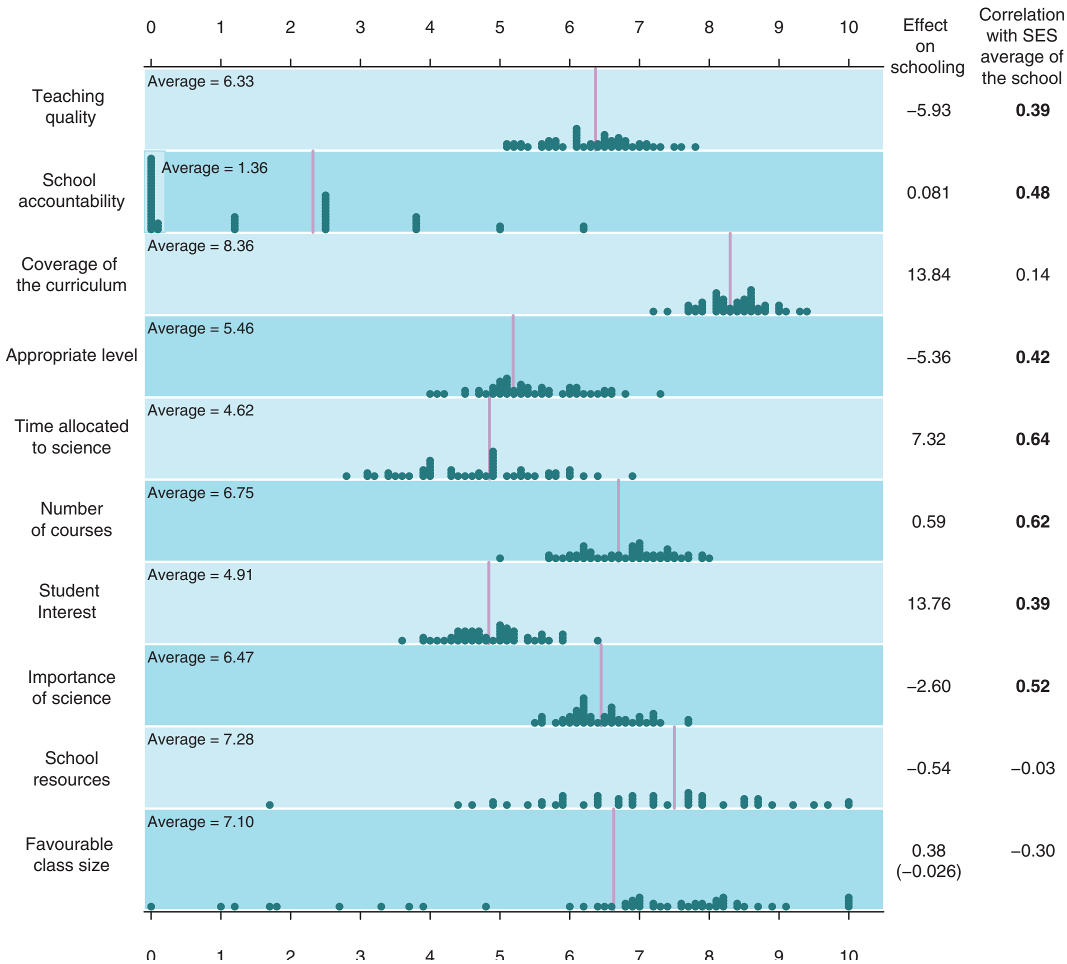


Graph 4.64

School profiles for science performance in Galicia



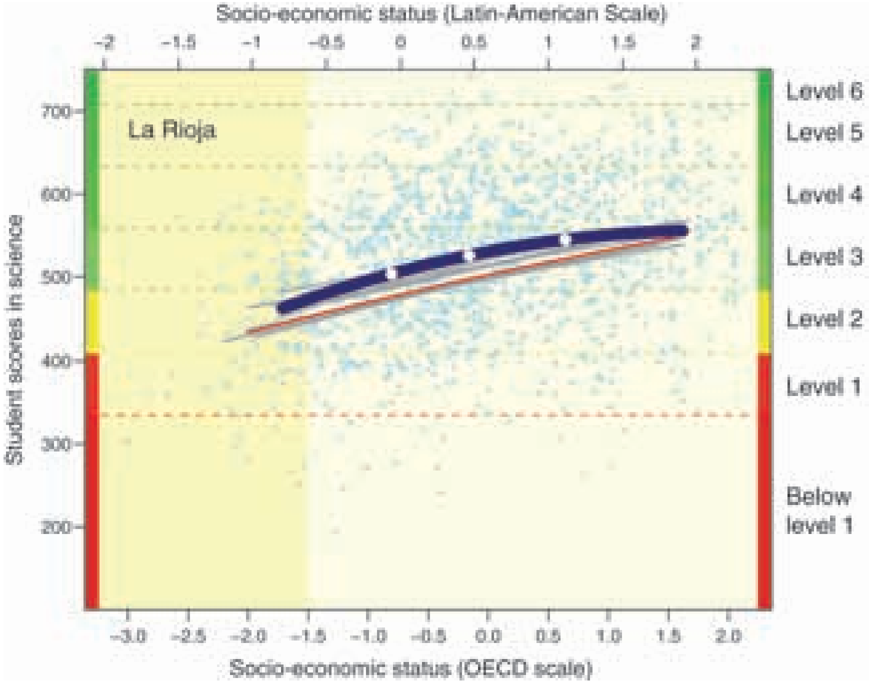
Graph 4.65
Learning resources in Galicia



La Rioja

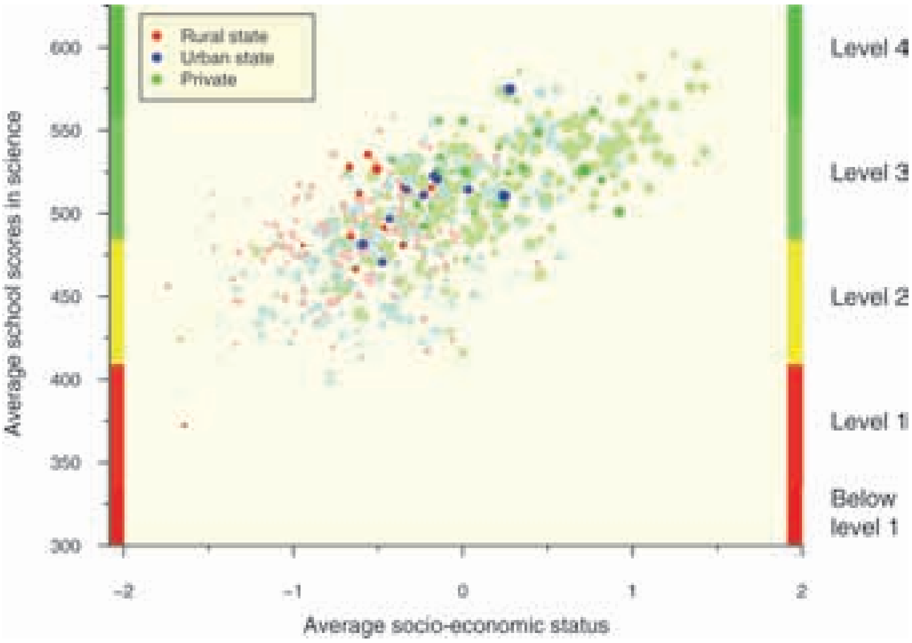
Graph 4.66

Socio-economic gradient of science performance in La Rioja, compared to Spain



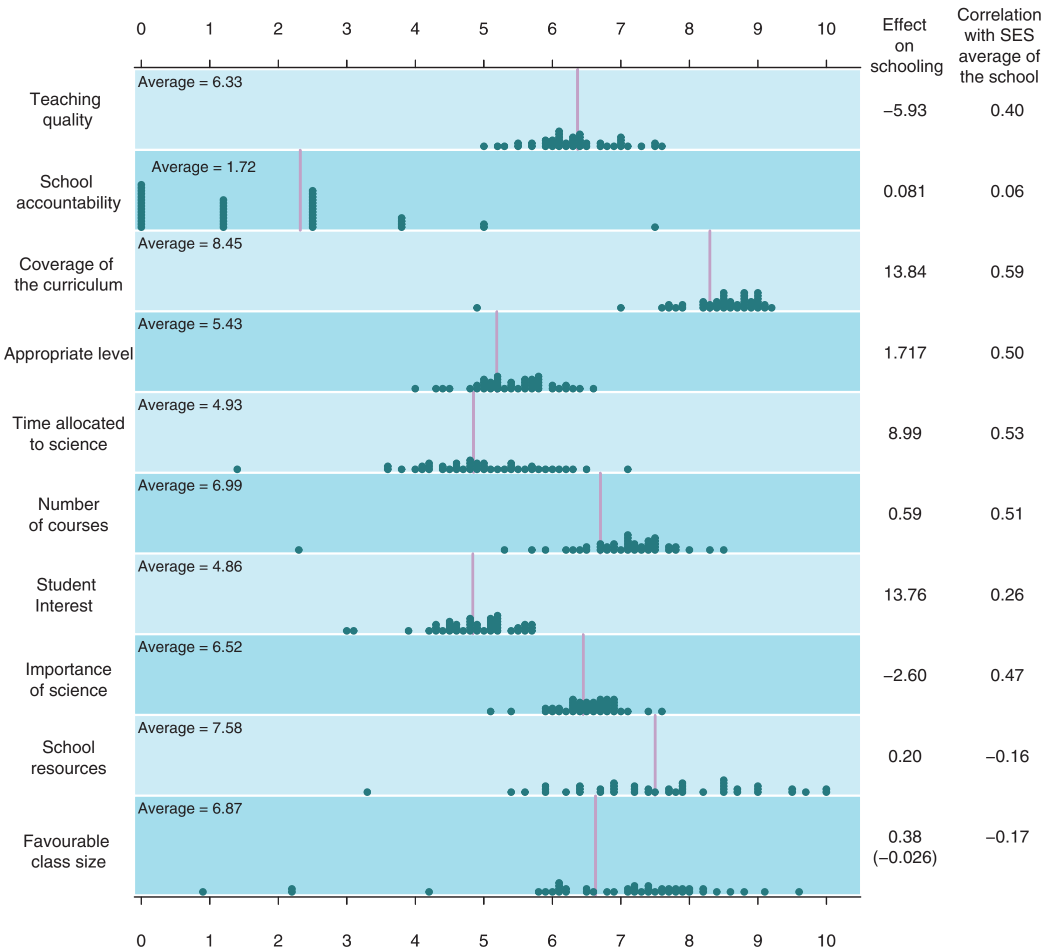
Graph 4.67

School profiles for science performance in La Rioja



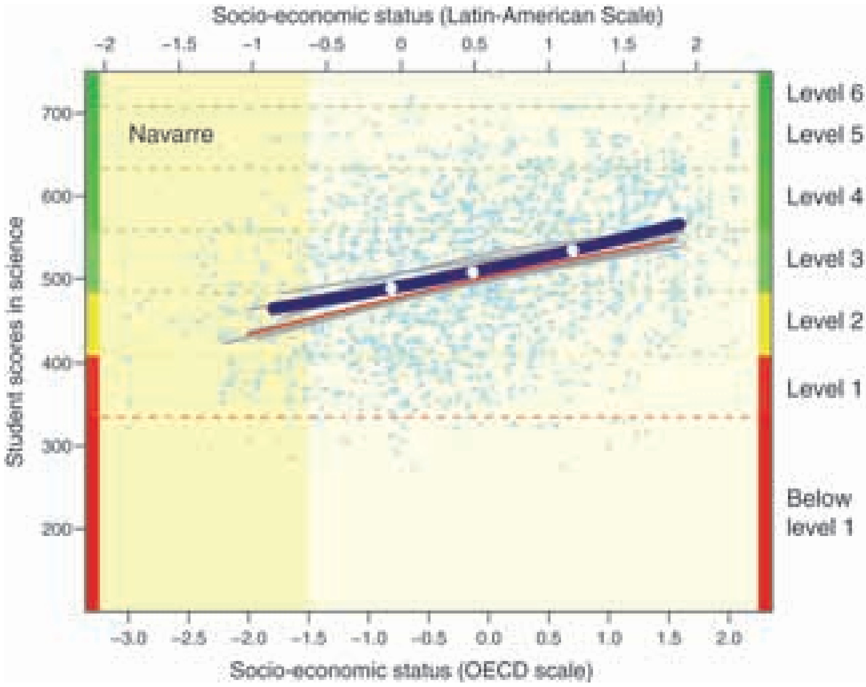
Graph 4.68

Learning resources in La Rioja

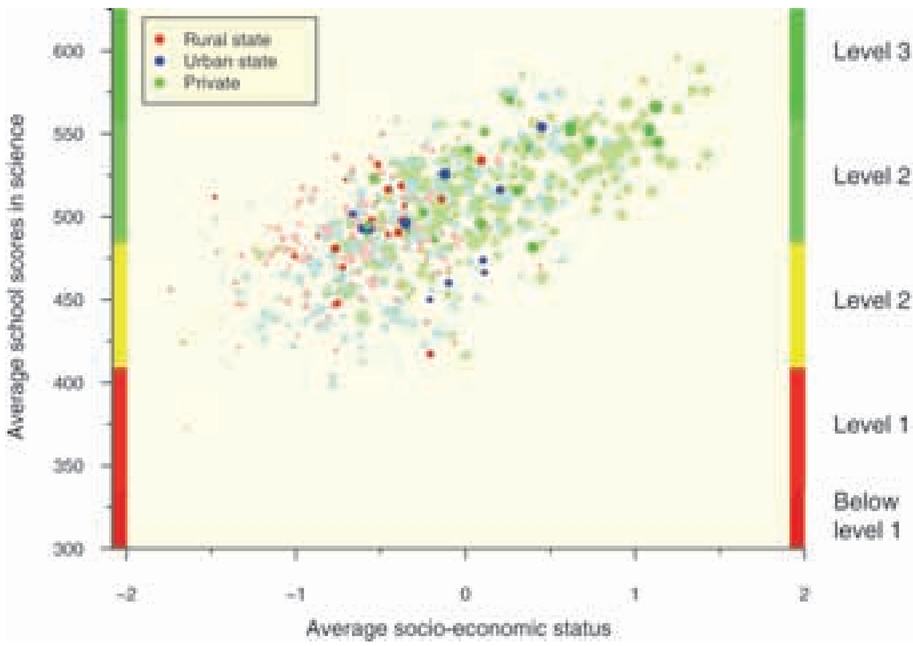


Navarre

Graph 4.69
Socio-economic gradient of science performance in Navarre, compared to Spain

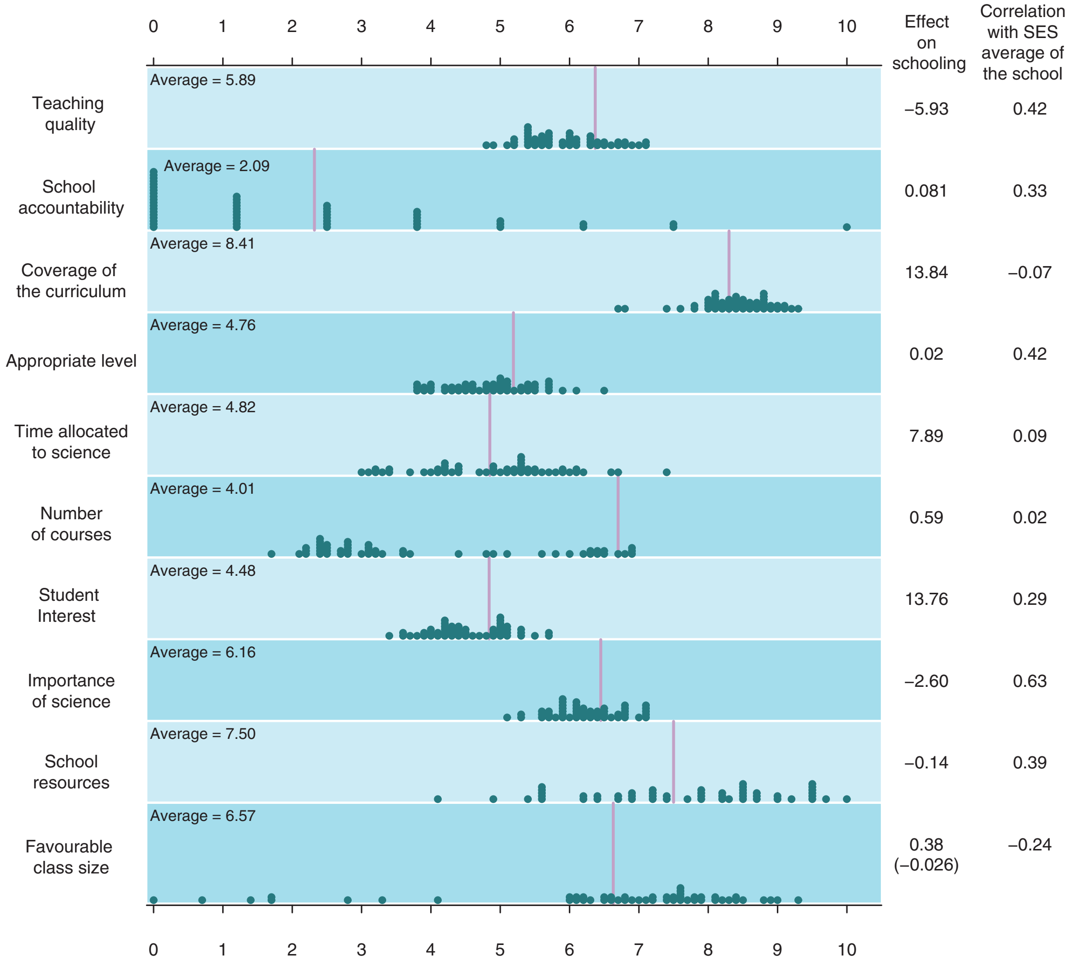


Graph 4.70
School profiles for science performance in Navarre



Graph 4.71

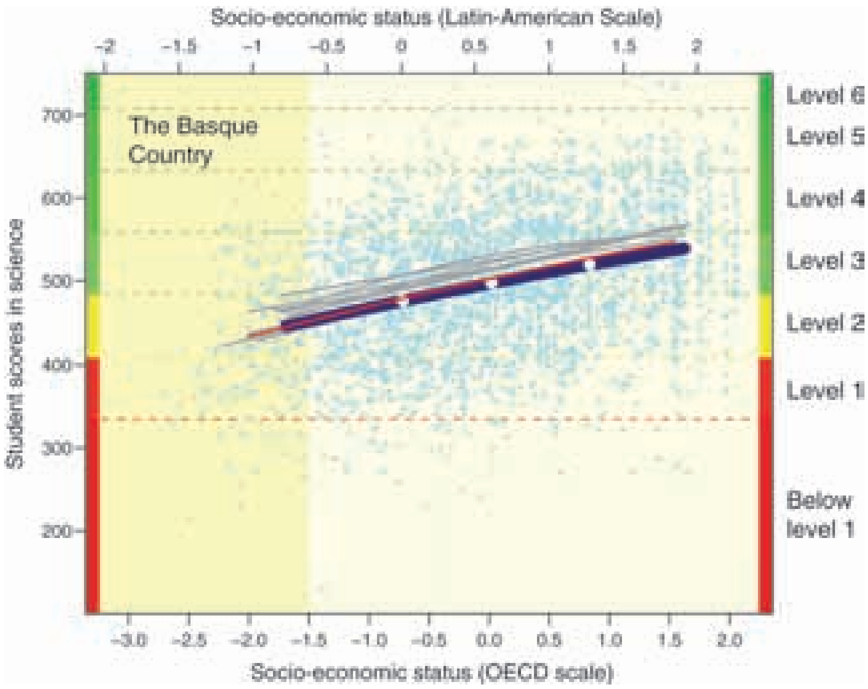
Learning resources in Navarre



The Basque Country

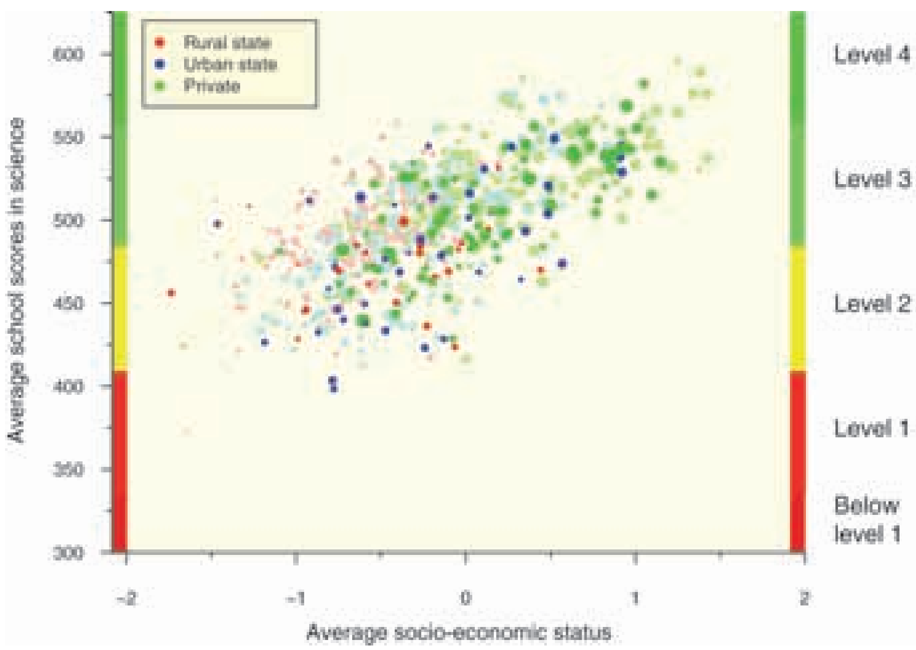
Graph 4.72

Socio-economic gradient of science performance in the Basque Country, compared to Spain



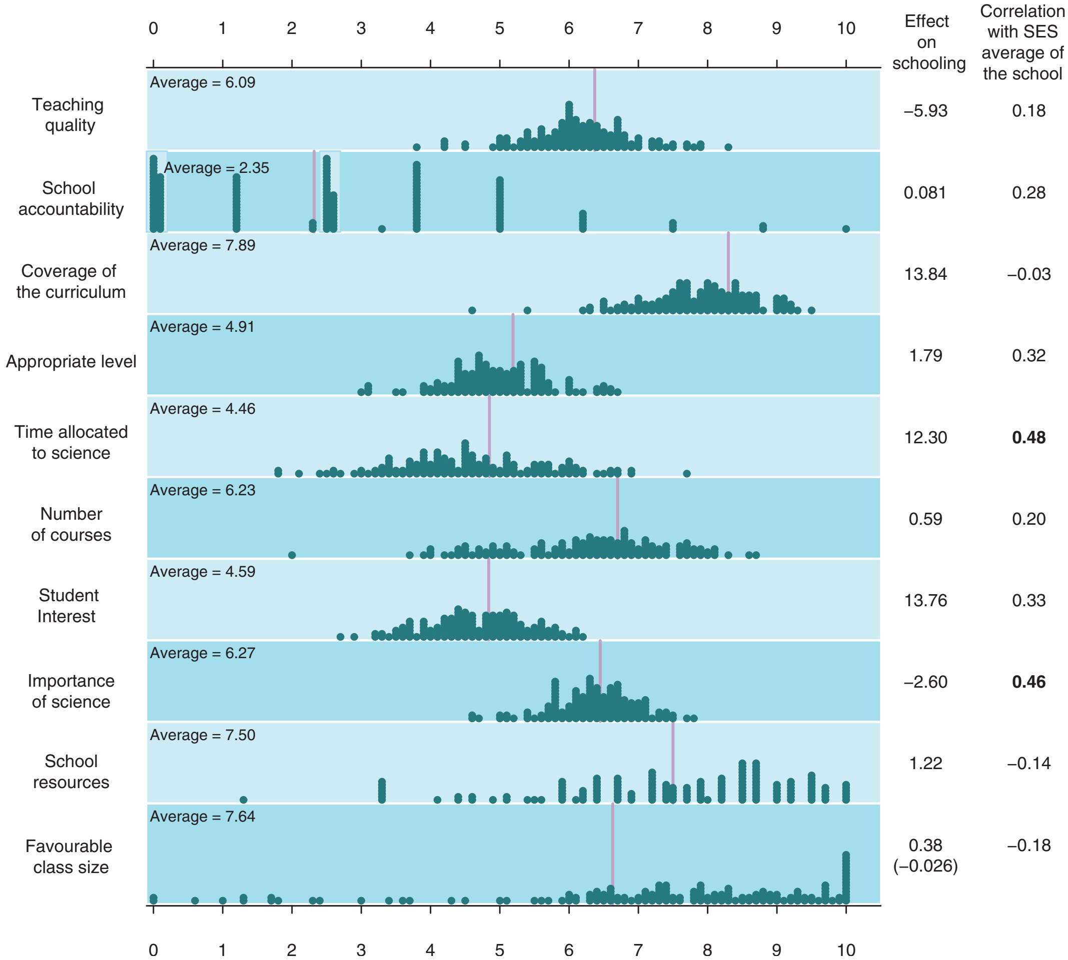
Graph 4.73

School profiles for science performance in the Basque Country



Graph 4.74

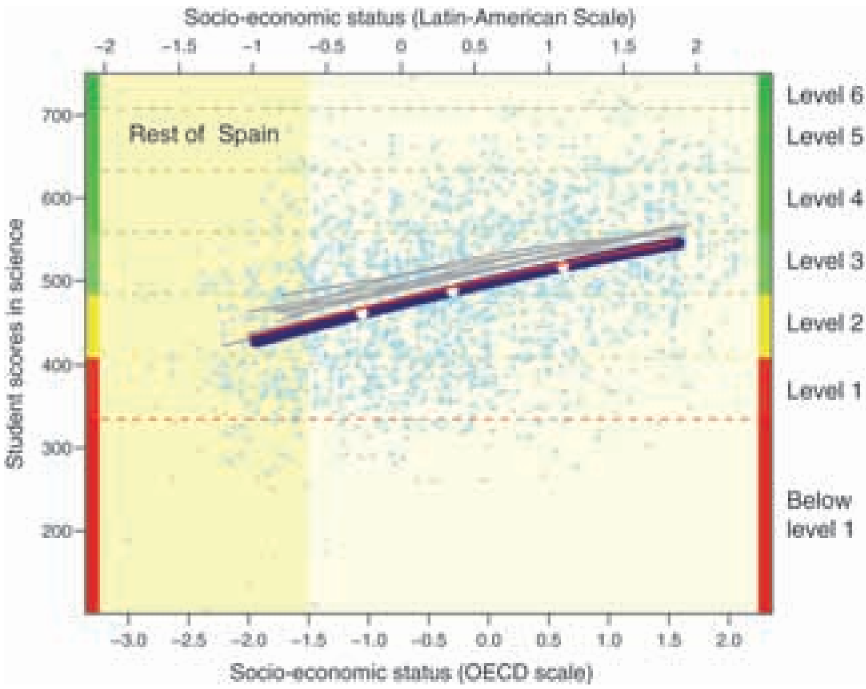
Learning resources in the Basque Country



Rest of Spain

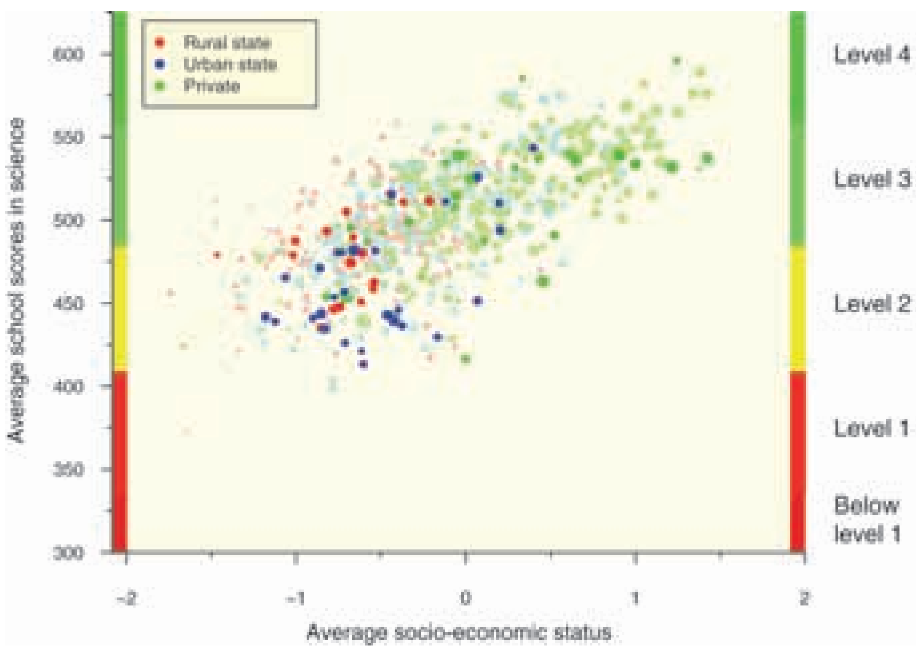
Graph 4.75

Socio-economic gradient of science performance in the rest of Spain, compared to the national Spanish gradient



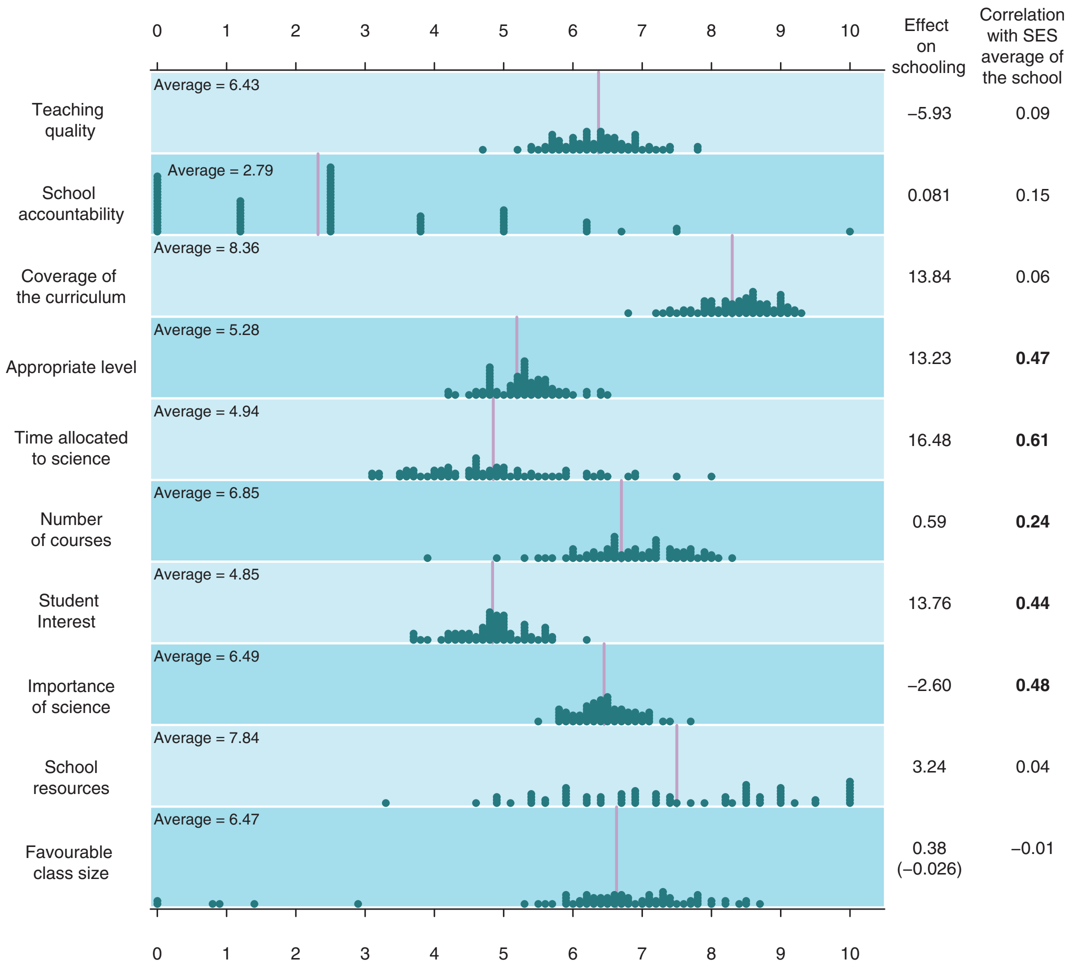
Graph 4.76

School profiles for science performance in the rest of Spain



Graph 4.77

Learning resources in the rest of Spain



Mexico

This section includes the results of the study for the seven regions in which the country is divided. The names of the regions are North, Central North, Central South, Federal District, West, South East and South West.

The analyses will be discussed in the same order as the presentation at national level. The regional breakdown is intended to show the differences in the results of the assessments by area, that is, to explain the pattern of results for an educational system at a level that is greater than a state.

Socio-economic gradients

At regional level, the analysis shows that the socio-economic gradients of the Central South regions and the Federal District are above the national gradients. However, as SES increases, both of these regional gradients join the national gradient.

As the graphs show, the science performance of low SES students indicates that they benefit from the socio-economic conditions of the Central South and Federal District regions. However, high SES students do not seem to take advantage of the socio-economic and cultural advantages of their regions.

The results for the Federal District are logical, as this is the country's capital, and has a higher level of development than most states. Nevertheless, the results for the Central South region are surprising and atypical, as they are better than those of the more developed regions, such as the North, which might have been expected to reach the same level of performance as the Federal District.

The gradients of the South East and South West regions are consistently below the national gradient. In the South West region, the gradient indicates that about 40 % of students have a low SES and about 75 % are at Level 1 or lower. The proportion of low SES students declines in the South East Region, but the rate of students with low performance levels rises. Although these differences are fairly modest, they are quite visible in the gradients for the regions. They call for urgent policies to be implemented so that student performance is raised to a level, which is at least similar to that of the country as a whole.

The gradients of the West, North and Central North regions follow the same pattern as the national gradient. However, it should be noted that in the North low SES students obtain higher performance ratings than students at national level, while higher SES students have a lower score than students with the same SES at national level. We may call attention to the results of high SES students in the North region as, given their privileged socio-economic backgrounds; they might be expected to achieve better results. This calls for a review of the pattern of results in this region.

School profiles

It can be seen that at regional and national levels, a considerable number of state schools achieve Level 2, which is the minimum established by PISA for effective participation in contemporary society. These schools also achieve scores that are similar to, or even better than, private schools, which are attended by students with an SES above the national average. In the light of this analysis and the slope of the gradient, it appears that high SES Mexican students in private or state schools would also benefit from policies enabling them to achieve a higher educational level, comparable to that of students in OECD countries.

Private schools can be classified into two groups: high SES schools that achieve average scores at Level 3, and lower SES schools at Levels 1 and 2. This suggests that private schools with students who have a similar SES to students attending state schools do not manage to surpass them in performance. It is important to point out that, both at national and regional level, private schools do not rate below Level 1.

Learning Resources

The HLM coefficients were significant at national level, but not at regional level, because of the considerable dispersion revealed by the indicators. This was especially true of school accountability for the curriculum, school resources and class size. The variation is due to the differences in the educational system from one state to another. The consequence of major dispersion is that it is not possible to establish whether the indicators are better or worse than the national average. It also becomes difficult to make comparisons between regions, in view of the wide differences between one school and another, even within the same region.

Equity and Equality

There are major differences between the Federal District and the other regions, and the greatest problems are in the South and North of the country. This point may be illustrated by comparing the Federal District and the South East. The percentage of variance in the Federal District can be attributed to a between-school variance of 15 % in reading performance. In contrast, this figure reaches 51 % for the South East region. This means that in the Federal District, the greatest variance is within schools, while in the South East region this is between schools. Greater between-school variance shows that it is indeed important which school a student attends. Similarly, the proportion of between-school variance in SES is also significant. The figure is 15 % in the Federal District, while it is 48 % in the South East region. The segregation of the latter region is regrettable, as it seems that student SES shapes school functioning, and there is no equality in the education provided by different schools. It is advisable to implement in-depth policies which could help to counteract these adverse circumstances, especially in schools with more disadvantaged environments. In this way, students are given equal opportunities, which enable them to attain better proficiency levels. Differences would then be the result of individual effort, and would not be due to differences in academic infrastructure.

Comparison of the socio-economic gradients of Mexico and Brazil at regional level

Finally, we will present a comparative study of the regions of Mexico and Brazil. These two countries have the biggest populations in Latin America, and are at a similar socio-economic level.

It can be seen that on the science scale the regions of Mexico perform better than the regions of Brazil (Graph 3.1). In considering the socio-economic gradients, it can be seen that there are steep curves in the regions of both countries, which reflect a high level of socio-economic inequality in all of them. However, this is more pronounced in the Brazilian regions than in the Mexican ones. In the five Brazilian regions high SES students register performance levels that are well above low SES students, while in Mexico this only occurs in two of the seven regions (West and South East). High SES students in Brazil achieve performance levels that reflect the benefits of their advantageous socio-economic conditions, but this does not occur in Mexico.

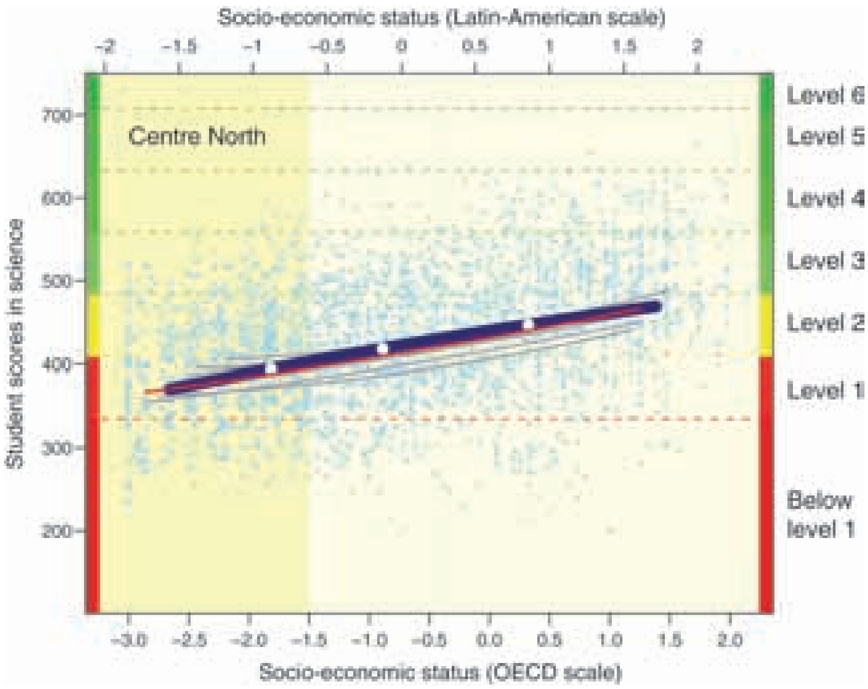
Brazilian regions show greater inequality in performance than Mexican regions, as the gradients for the North and the North East regions of Brazil start at below Level 1, and reach Level 2, while the South region starts at Level 1 and attains Level 3. In the Mexican case, there is less SES-related inequality in performance, as the seven regions of the gradient begin at Level 1 and reach Level 2.

It can also be seen that the differences in Brazilian regional performance are greater than in Mexico. Thus, the gradient of the South region of Brazil is approximately 40 points above the nearest region in Mexico, which is the South East region. The gradient of the Federal District of Mexico does not exceed the Central South and North regions. Although the Federal District has a higher SES than the other regions, its performance is similar.

Mexico Central North

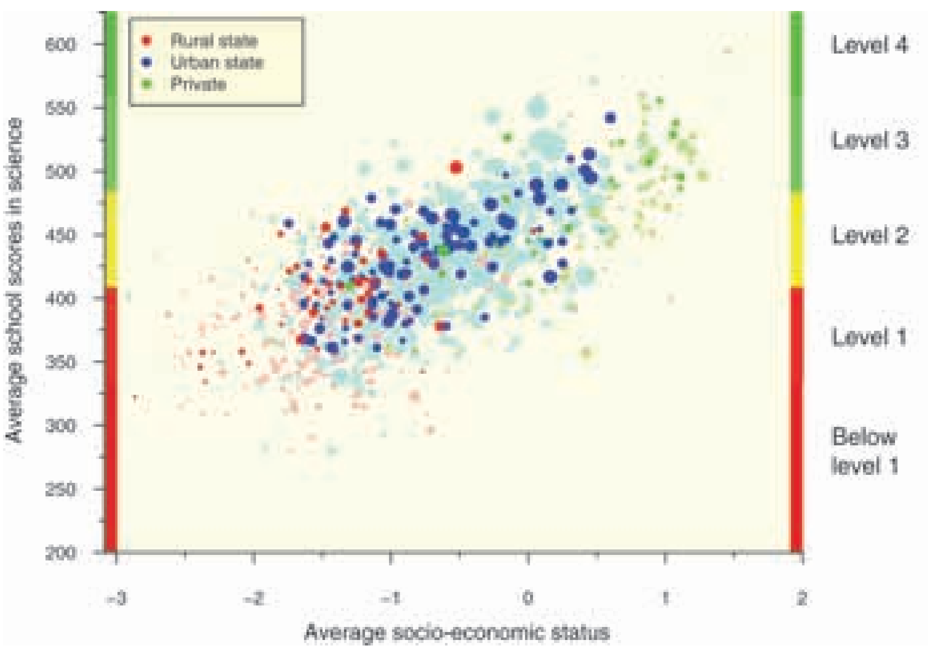
Graph 4.78

Socio-economic gradient of science performance in the Central North, compared to Mexico

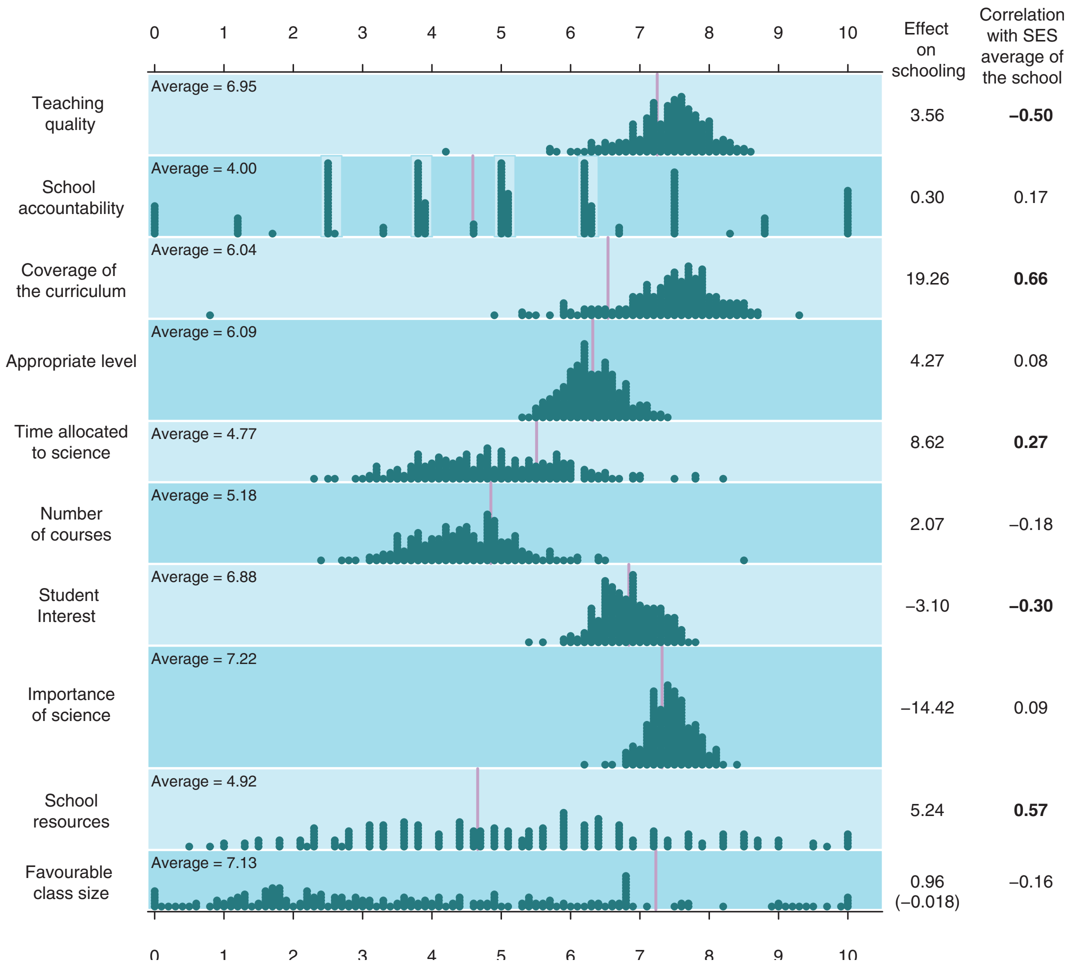


Graph 4.79

School profiles for science performance in the Central North



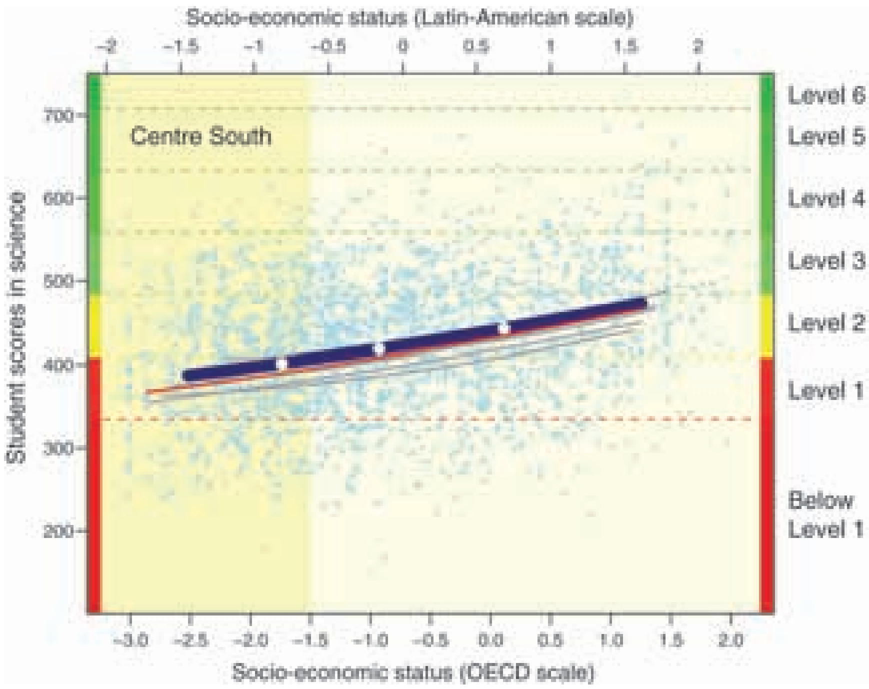
Graph 4.80
Learning resources in the Central North



Mexico Central South

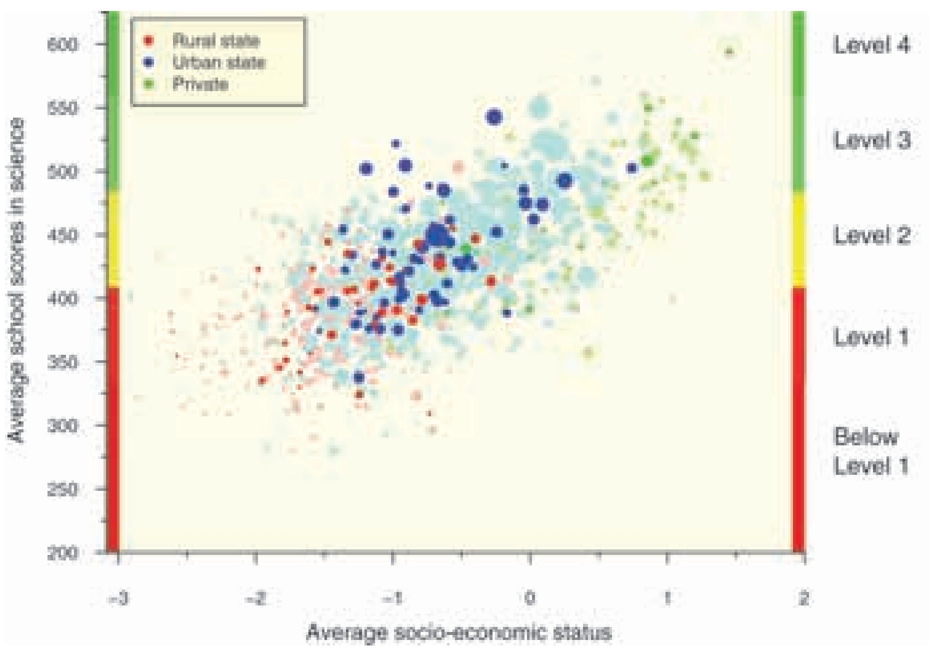
Graph 4.81

Socio-economic gradient of science performance in the Central South, compared to Mexico

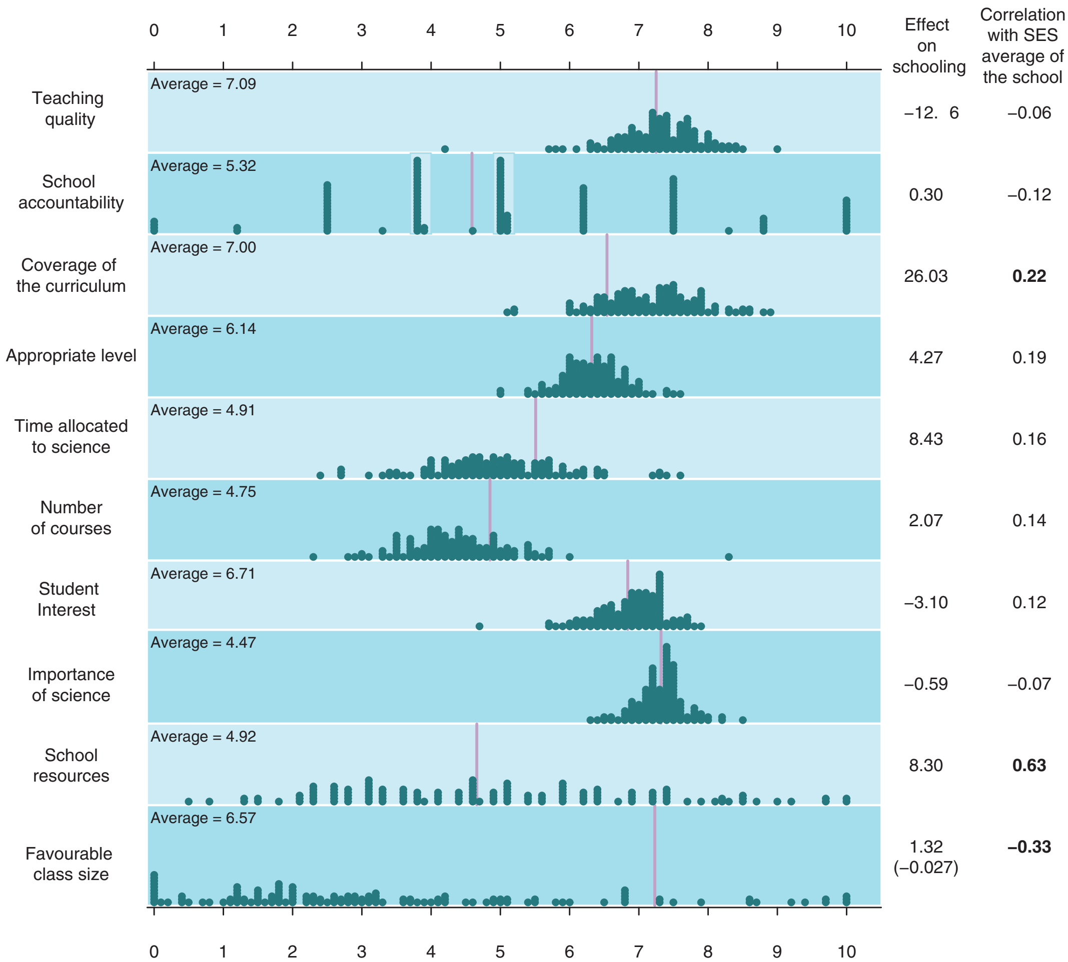


Graph 4.82

School profiles for science performance in the Central South



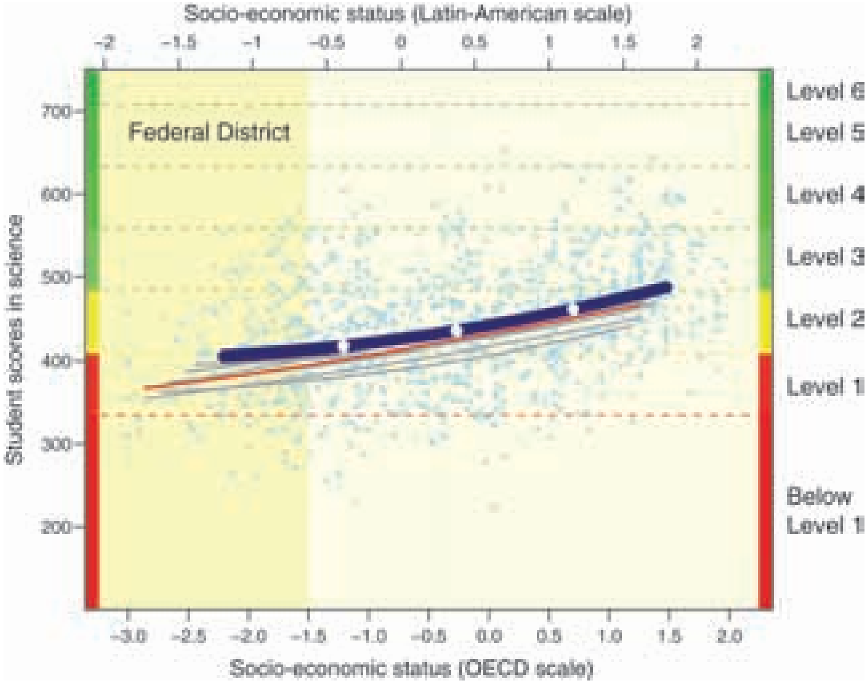
Graph 4.83
Learning resources in the Central South



Mexico Federal District

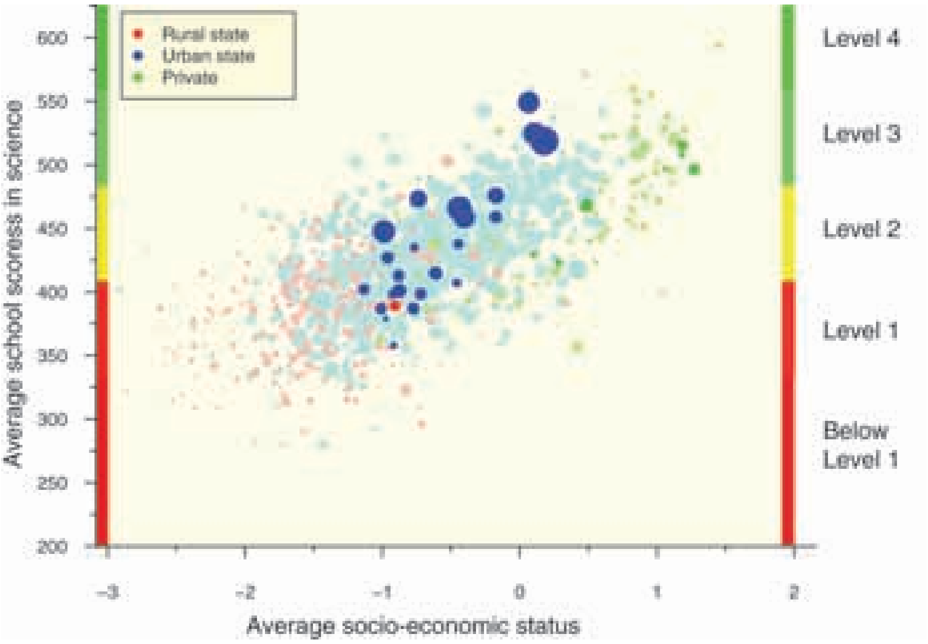
Graph 4.84

Socio-economic gradient of science performance in the Federal District of Mexico, compared to Mexico



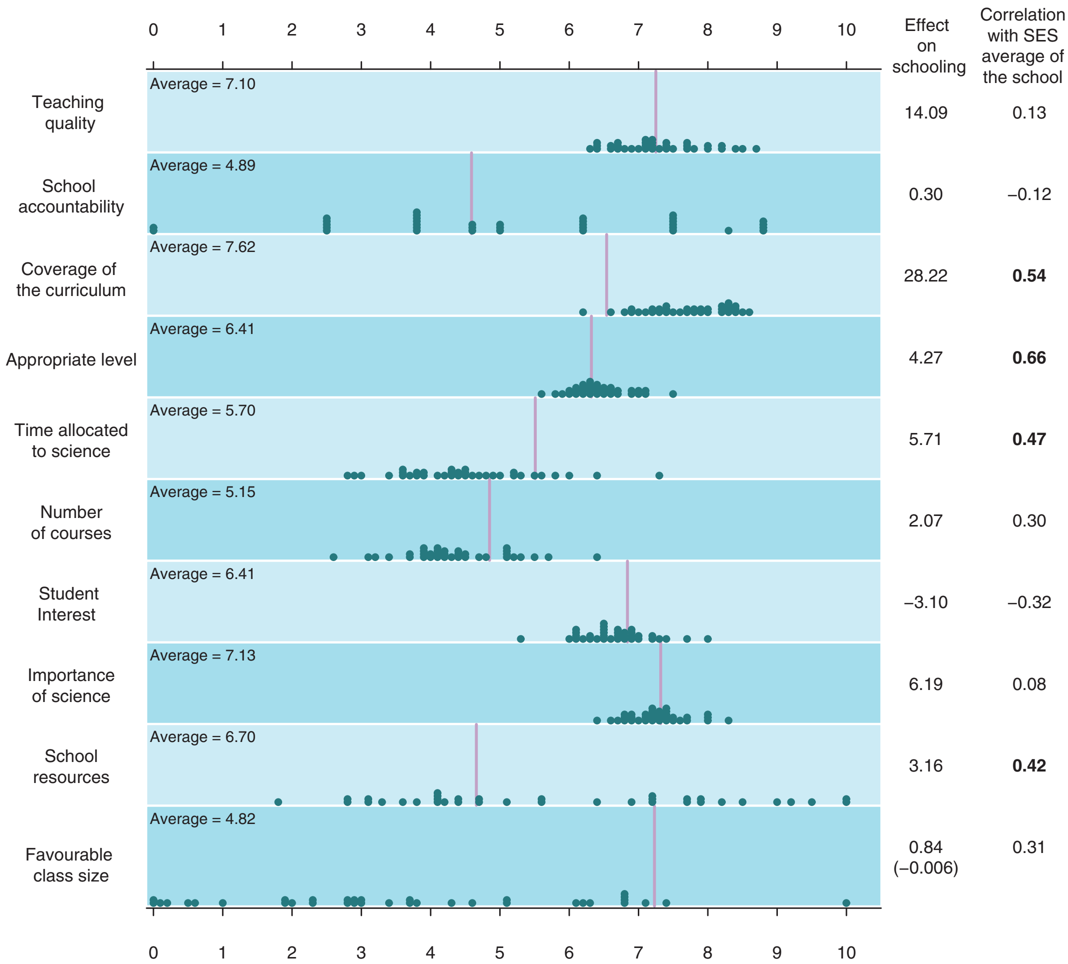
Graph 4.85

School profiles for science performance in the Federal District of Mexico



Graph 4.86

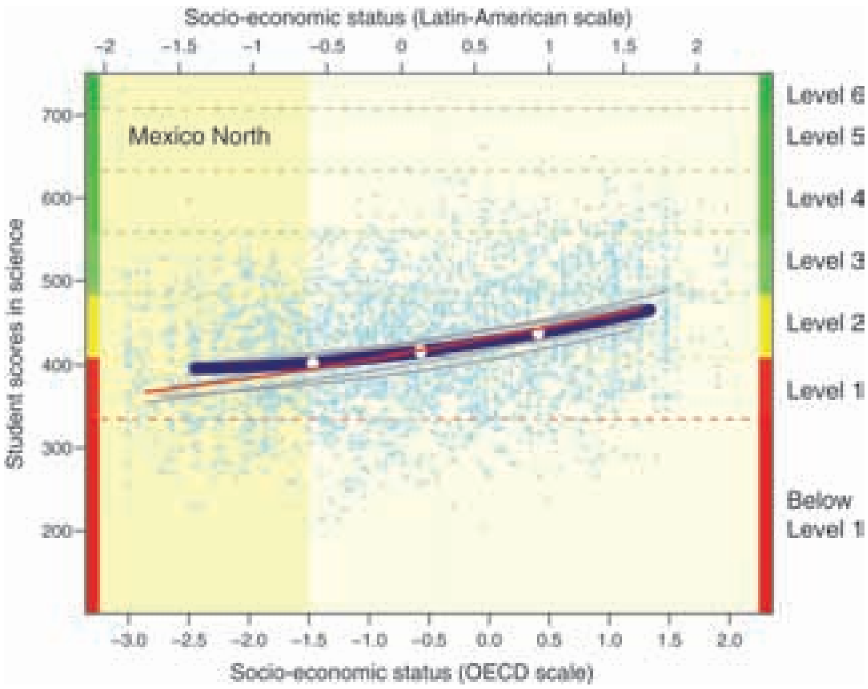
Learning resources in the Federal District of Mexico



Mexico North

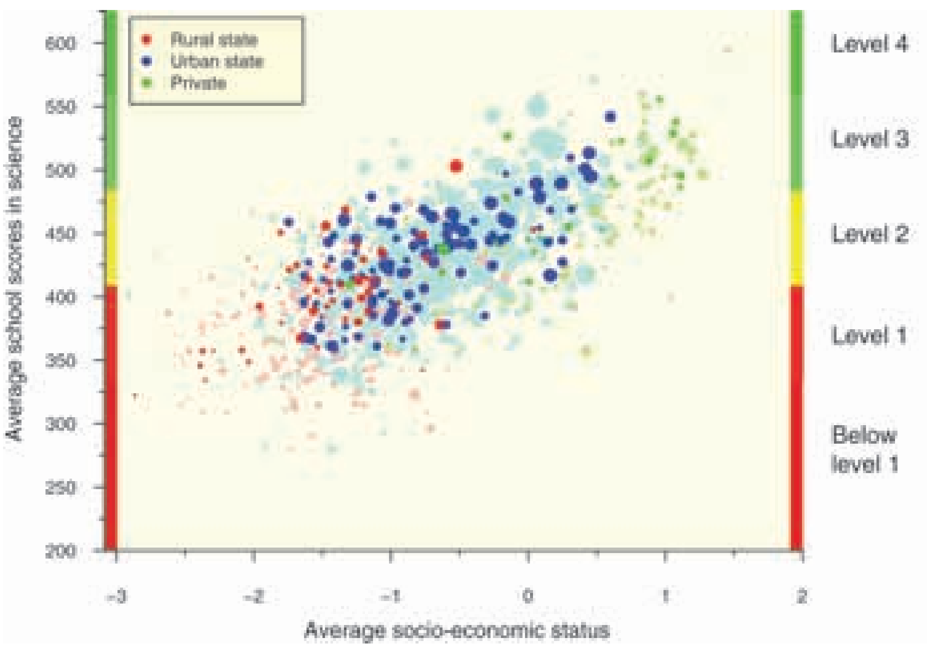
Graph 4.87

Socio-economic gradient of performance in science in the North, compared to Mexico

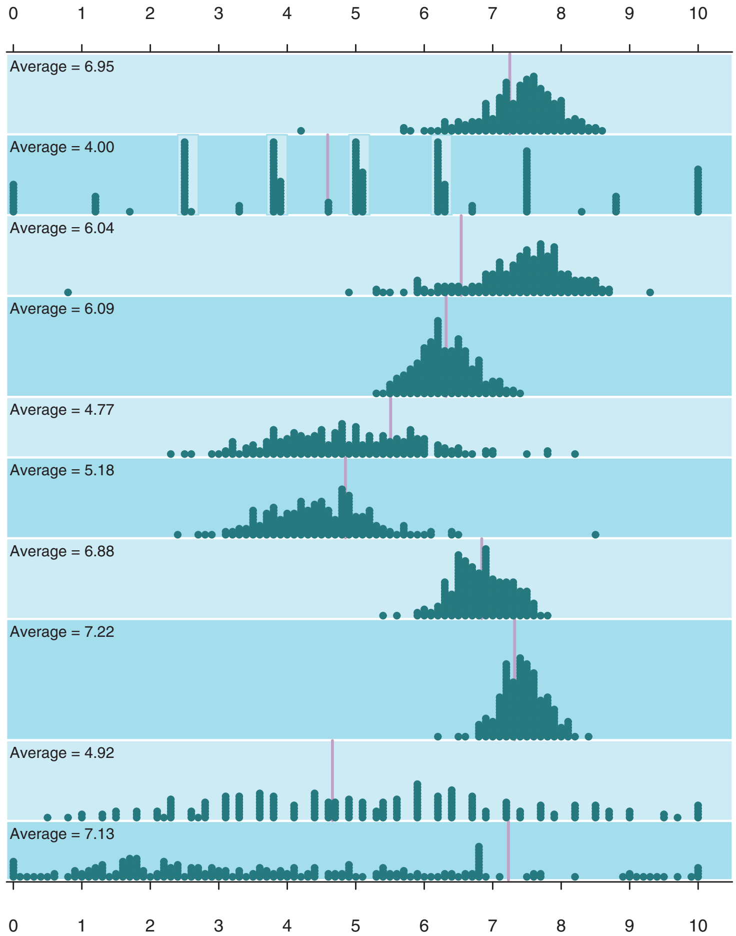


Graph 4.88

School profiles for science performance in Mexico North



Graph 4.89
Learning resources in Mexico North

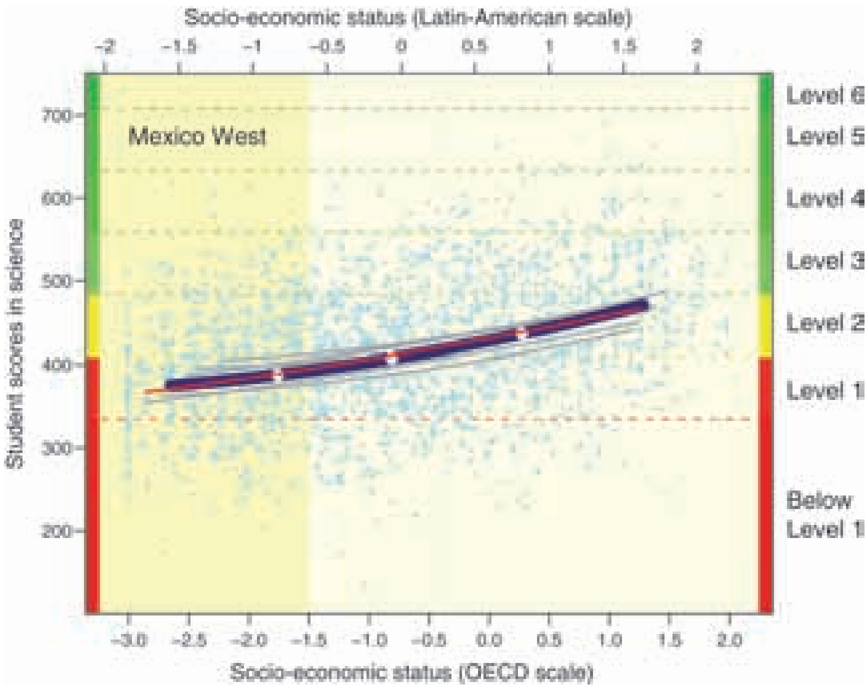


	Effect on schooling	Correlation with SES average of the school
Teaching quality	3.56	**–0.50**
School accountability	0.30	0.17
Coverage of the curriculum	19.26	**0.66**
Appropriate level	4.27	0.08
Time allocated to science	8.62	**0.27**
Number of courses	2.07	–0.18
Student Interest	–3.10	**–0.30**
Importance of science	–14.42	0.09
School resources	5.24	**0.57**
Favourable class size	0.96 (–0.018)	–0.16

Mexico West

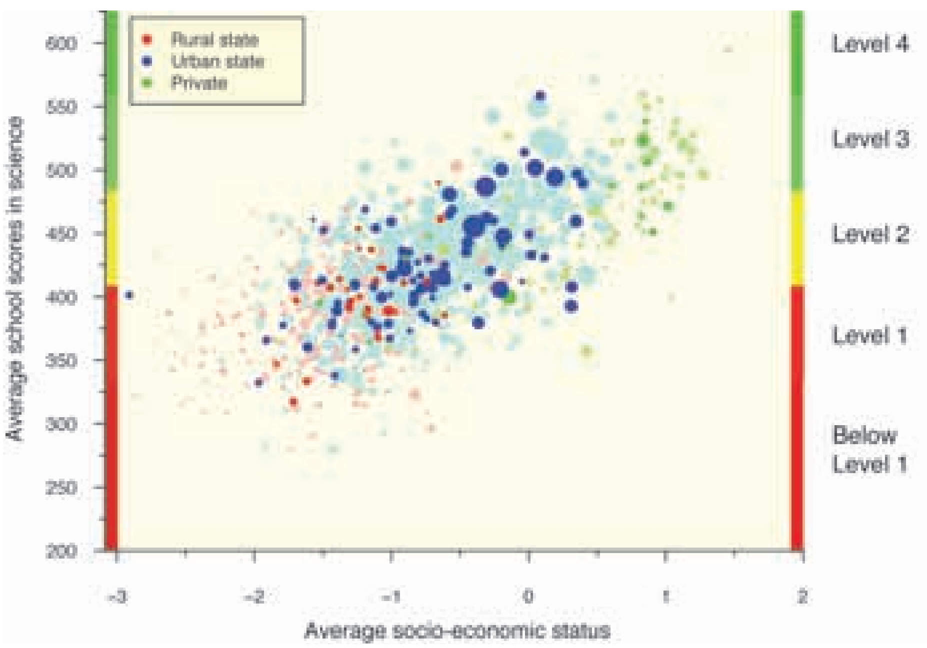
Graph 4.90

Socio-economic gradient of science performance in Mexico West, compared to Mexico



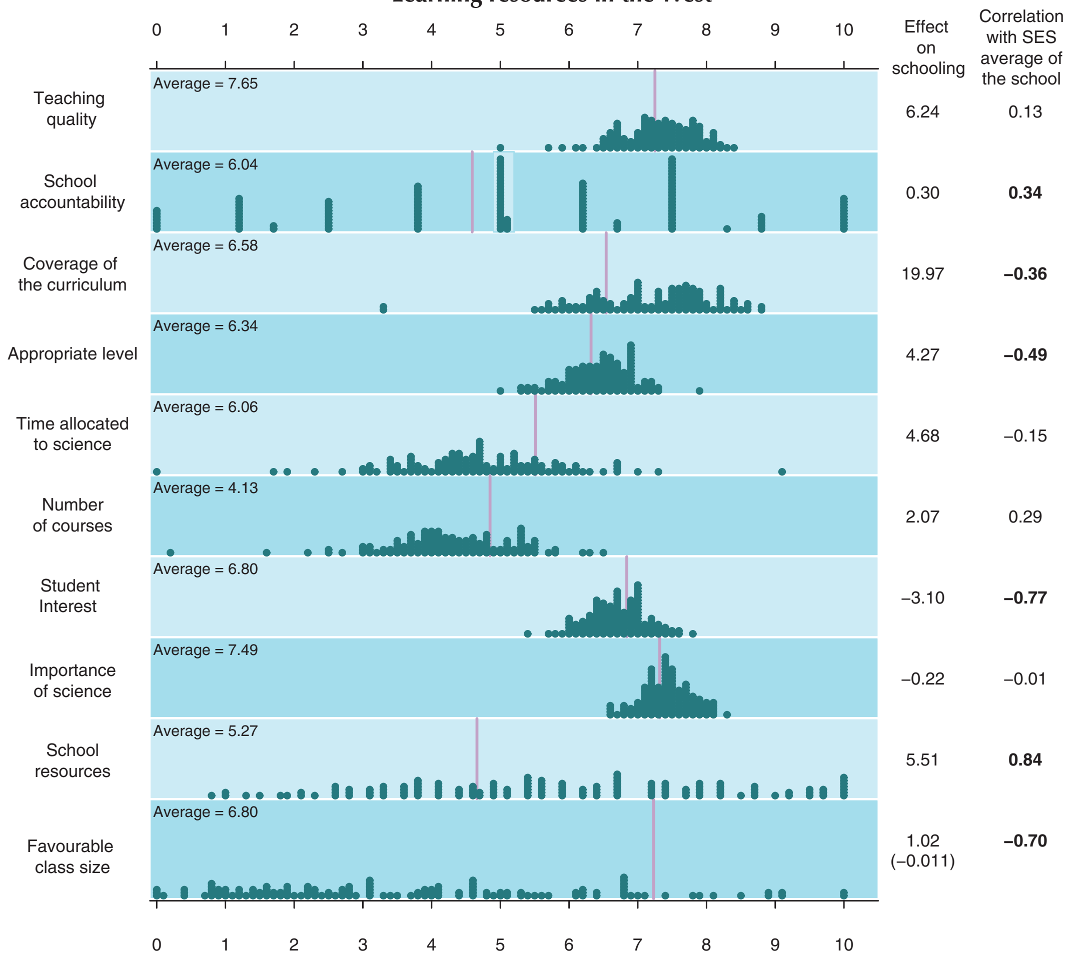
Graph 4.91

School profiles for science performance in Mexico West



Graph 4.92

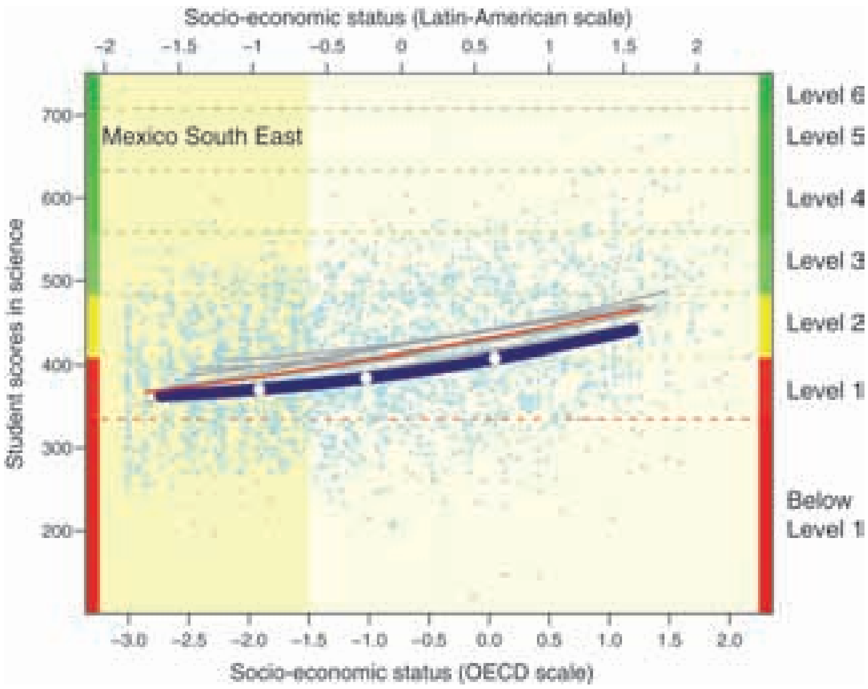
Learning resources in the West



Mexico South East

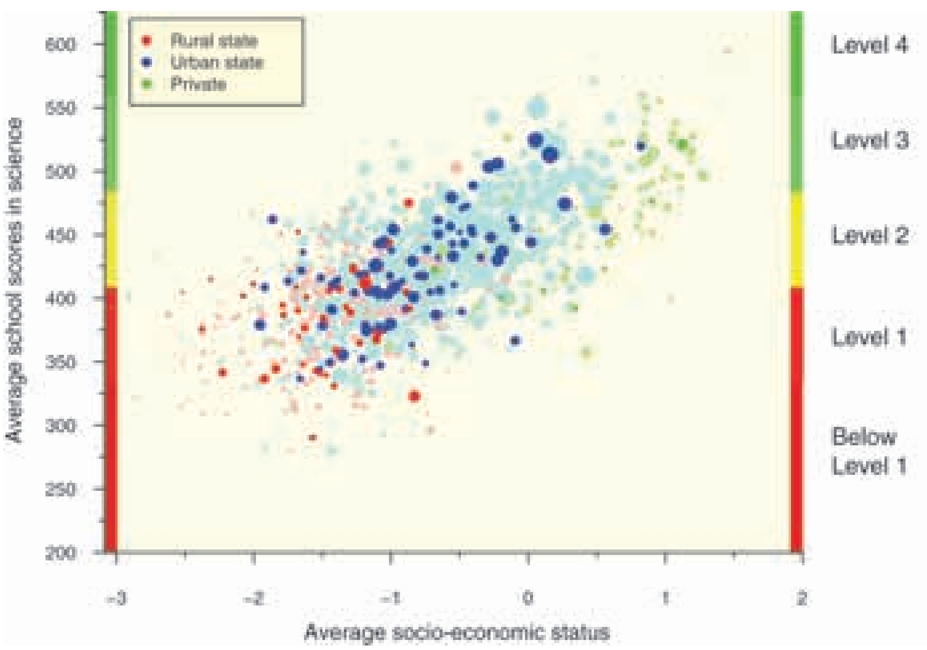
Graph 4.93

Socio-economic gradient of science performance in the South East, compared to Mexico



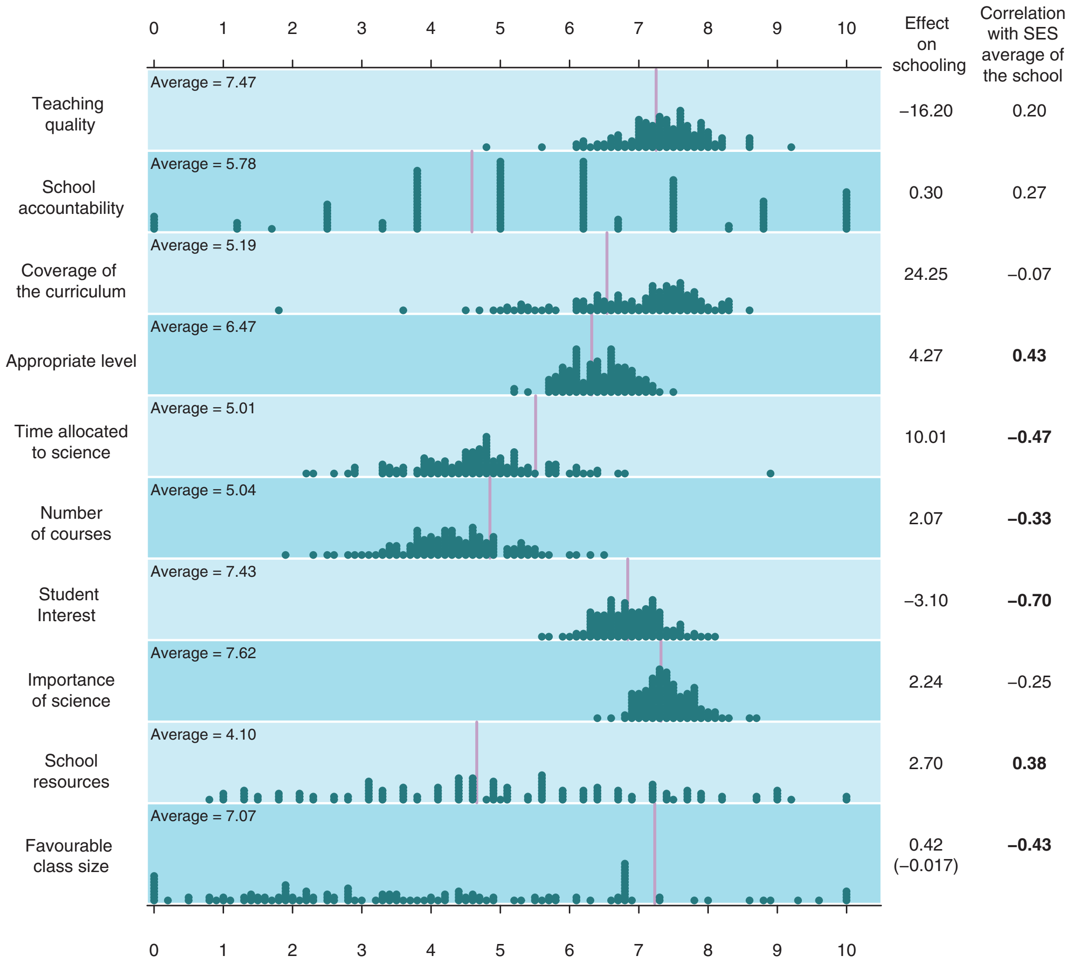
Graph 4.94

School profiles for science performance in the South East



Graph 4.95

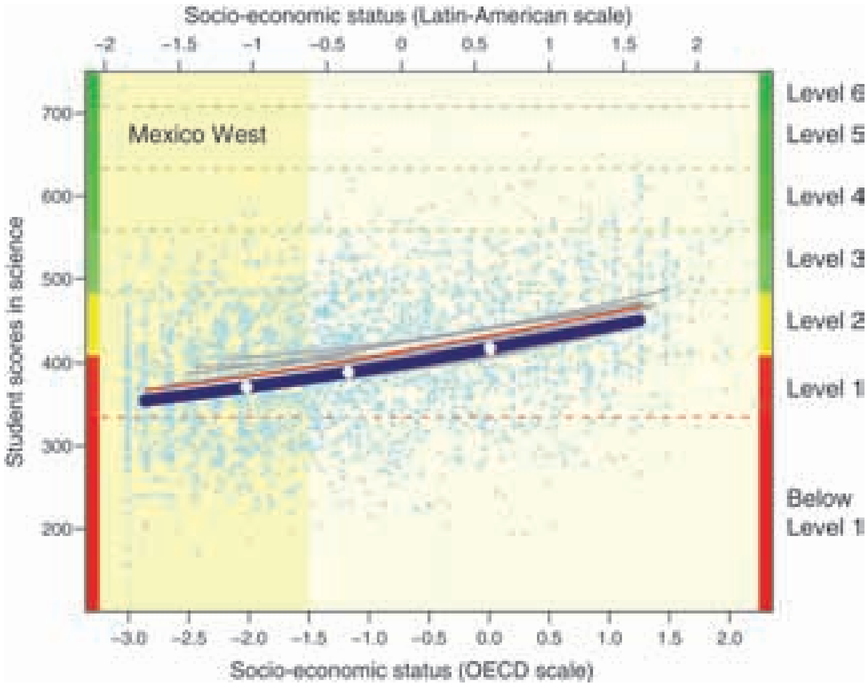
Learning resources in Mexico South East



Mexico South West

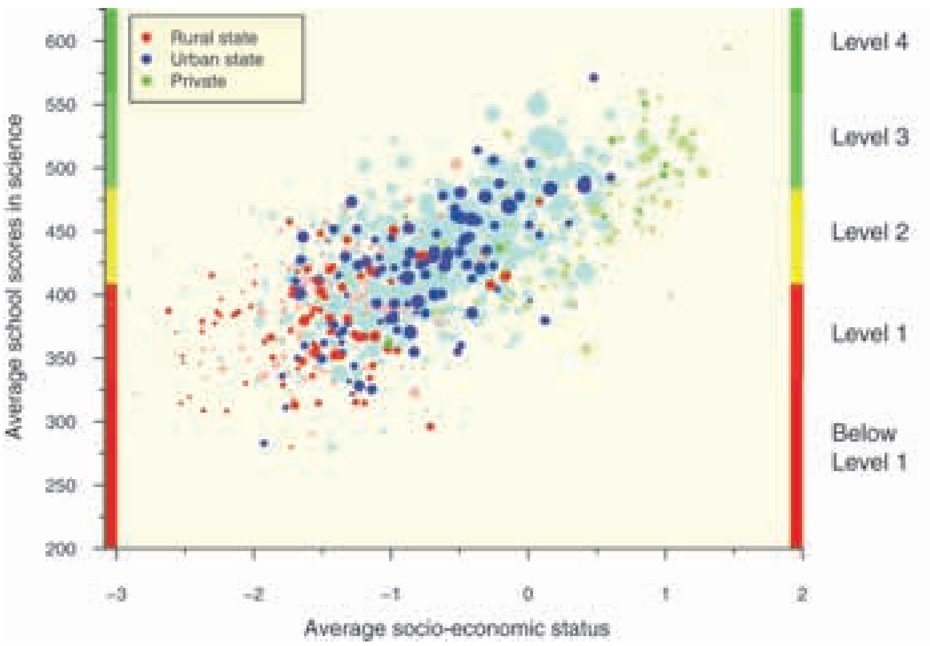
Graph 4.96

Socio-economic gradient of science performance in the South West, compared to Mexico

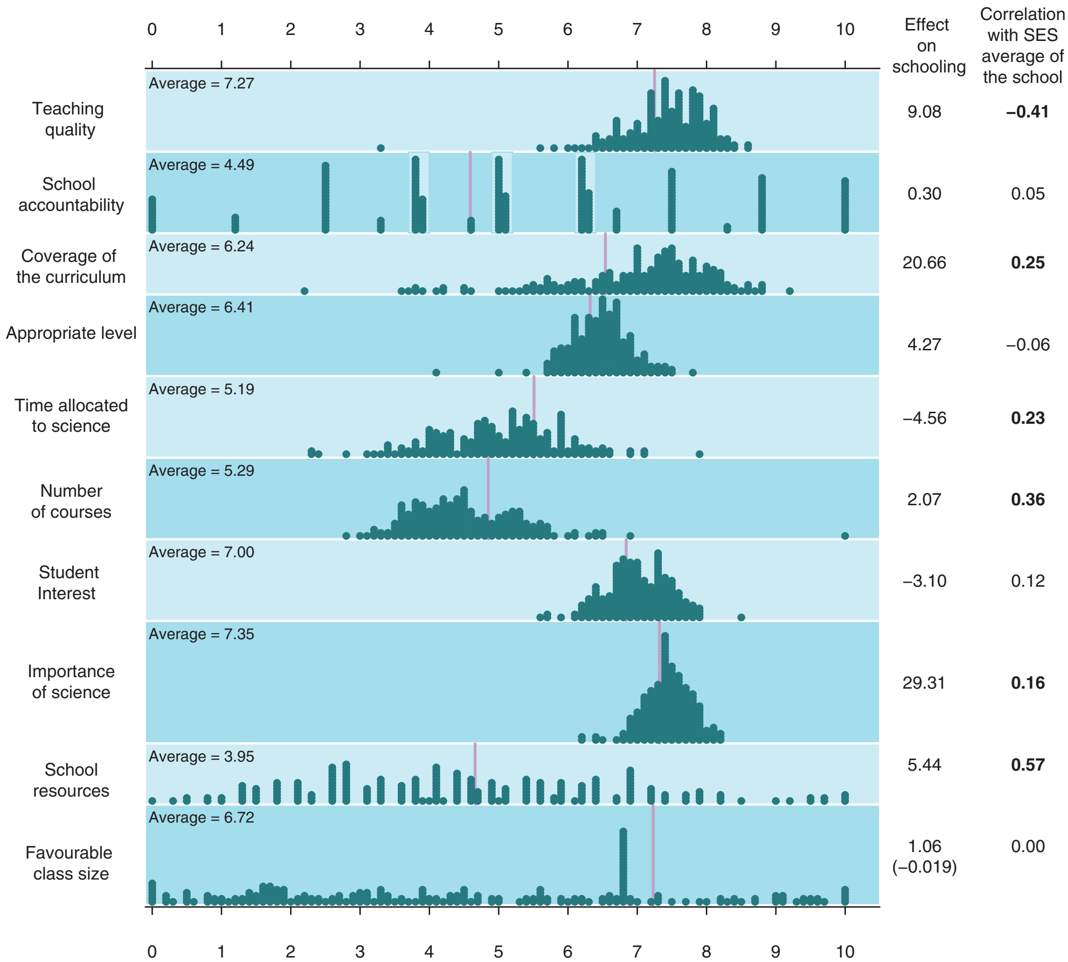


Graph 4.97

School profiles for science performance in Mexico South West



Graph 4.98
Learning Resources in the South West



SOCIO-ECONOMIC STATUS (SES) AND PERFORMANCE IN THE GIP COUNTRIES

According to the PISA international report, which is consistent with a great deal of other research, the socio-economic background of students appears to have a major impact on their academic results. The low level of between-school variance leads us to believe that the contribution of schools is relatively limited. However, a degree of caution is in order, given inadequacies in the measurement of academic factors, and the methodology generally used to assess their influence. Although there is a strong correlation between SES and proficiency levels in all countries, some show that equity and high quality are not necessarily incompatible. The strategies used to achieve this goal should be adapted to the characteristics of each country.

In most GIP countries, students' socio-economic background has a major effect on their performance. This indicator also varies considerably in the different countries participating in PISA. It is clear that students in OECD countries enjoy economic, social and cultural conditions that are far superior to GIP countries.

Not all students make exactly the same progress, given that their innate capacities and potential are not identical. Nevertheless, it may be a sign of inequity when learning varies according to family SES. Moreover, this learning imbalance is not only due to differences between children, but also reflects significant differences between schools. If school results are uneven, this may be due to the combined effect of the lack of resources at home or in the school, and signifies that society is not providing all students with the same learning opportunities.

Although GIP countries share common features in their cultures and backgrounds, SES is very different from one country to another. On the one hand, there are countries, such as Mexico and Portugal, which have greater internal socio-economic variation, and record a considerable gap between the highest and lowest SES values. On the other hand, a country like Brazil has less internal differentiation, but has the lowest recorded mean, and shows the least difference between extreme values (percentiles of 5 and 95). This indicates that its population is generally much more impoverished than those of the other countries that were compared.

It is clear that SES strongly influences the scores which students obtained in science in all GIP countries, as well as the OECD mean. However, differences can be seen in the extent of its influence.

GIP scores would improve if the mean for each country on the science scale were analysed as though SES was the same as the OECD mean. However, all countries except Spain would fail to achieve the OECD mean, which shows that low SES is not the only factor.

The international PISA report shows a bivariate regression between science performance and student SES. The highest percentages of variance in SES-linked performance are for Chile, Argentina and Uruguay (from 18.3 % to 23.3 %).

The effect of one unit on the SES index is significantly high for science scores in Uruguay, Spain and Brazil (from 30 to 34 points). This means that in these countries a rise in each unit of student SES would lead to an increase of approximately 30 points.

The strong influence of SES on student performance suggests that the educational system is failing to provide all students with appropriate and equitable learning opportunities. Improving quality and equity is one of the strongest challenges that educational systems face. PISA shows that some countries have achieved high proficiency levels equitably, insofar as results were independent of their students' backgrounds.

The socio-economic performance gradients of the students and the school profiles, which were presented throughout this chapter, clarify the overall picture for each educational system. For Latin American countries in general, the socio-economic gradient[1] is convex, that is to say, there is a differential growth rate. It is slower at the beginning (where SES has less influence on performance), and faster at the end (where it has more influence). In contrast, the gradient is linear for the OECD countries, Spain and Portugal. In the graphs of profiles, private schools in the Latin American countries[2] tend to cluster to the right of the SES axis (high socio-economic level), and in the upper part of the graph (high proficiency levels). There are few private schools in Portugal, and they are distributed among the different SES values, and in the upper part of the performance scale. In Spain, there are many private schools, with a pattern that is similar to that of Chile.

The pattern for rural schools is distinct. For most countries, with the exception of Portugal and to a lesser extent Uruguay and Brazil, they are concentrated at the lower end of the performance scale, and in the lower SES level (in the lower left quadrant of the graphs).

It is important to analyse the proportional variance of the results in each school, compared to between-school variance.

In the OECD, 33 % of variance in performance is between schools. Among GIP countries, Argentina and Chile are those which show the greatest difference in between-school student performance (53 %, which is about 1.5 times the OECD average). In Colombia, Mexico and Portugal between-school variance is less than the OECD average. This is also very much the case in Spain, where it does not reach half that level, a situation similar to that seen in Scandinavian countries. In Spain, more than in any other GIP country, it does not make a big difference whether parents send a child to one school or another. However, there are significant differences in the GIP countries.

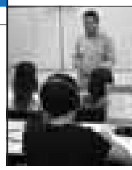
Spain has the highest values for within-school variance in performance, which is at 68 % in OECD countries. This signifies that in the same school there are students with very low performance ratings, together with other students who achieve extremely high levels. Mexico shows the lowest within-school variance.

Among GIP countries, Chile is the only one where between-school variance is greater than within-school variance. This is particularly worrying, as it means that the Chilean educational system is more inequitable, and suggests that the school which a child attends will largely determine his performance. Furthermore, the Chilean system is segregated, as the percentage of between-school variance shows that schools attend to children who are similar to each other, and very different from children at other schools. This explains why children at a school will have proficiency levels, which are much closer to their own classmates' than those of students at other schools.

This situation can be considered to be a structural component of the educational system, and can be attributed to several factors. These include the decisions taken by the families or the place of residence, and the socio-economic level of the students who enrol in schools. Other factors may include selecting and grouping policies, and streaming students according to different curricula, which distinguish between academic and vocational training. In other words, there is a «value», which the school adds to, or subtracts from, each individual student.

1. In Mexico the curve is less steep.

2. Except for Chile, where the pattern is somewhat more uniform with regard to SES and performance. (Given their number, it is likely that they are paid and subsidised private schools.)



This chapter provides graphs, which make it possible to examine the distribution of schools, based on the factors in the model that was used. Unfortunately, only two factors, generally speaking, have a significant influence on performance, and, except for *Teaching Quality,* they tend to be SES-related. It is therefore difficult to know to what extent they alone influence performance.

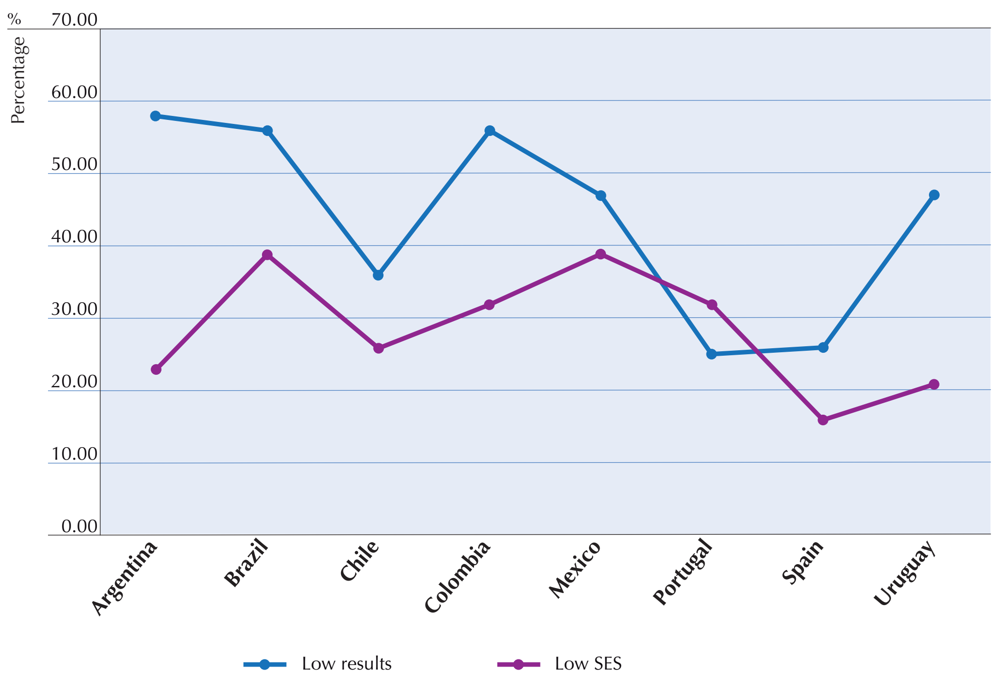
The information available makes it possible to analyse equality-equity aspects, which helps to grasp the reality of these countries.

On analysing the GIP as a whole, it can be observed that, although 25 % of the Latin-American students were classified in the category of «low SES», the percentage of these students varied considerably from one country to another. Together with this information, it can be observed that the percentage of «low level performance » (Level 1 and below) in reading[3] is close to, or exceeds 50 % throughout the region, except for Chile, Portugal and Spain (Graph 4.99).

In the same graph, the red line represents the percentage of low SES students. It shows that the figure is about 40 % in Brazil and Mexico, while in Spain it is below 20 %. In Argentina, Chile and Uruguay the rate is between 20 % and 30 %, while in Colombia and Portugal it is just over 30 %. The blue line represents the percentage of students evaluated in PISA 2006 whose performance was at Level 1 or below. In this respect, only Spain and Portugal have percentages at below 30 %. The rate for Chile is between 30 % and 40 %, and Mexico and Uruguay are at about 50 %, while Argentina, Brazil and Colombia are at about 60 %.

Graph 4.99

Percentage of students with low results in PISA and with low SES in the GIP countries



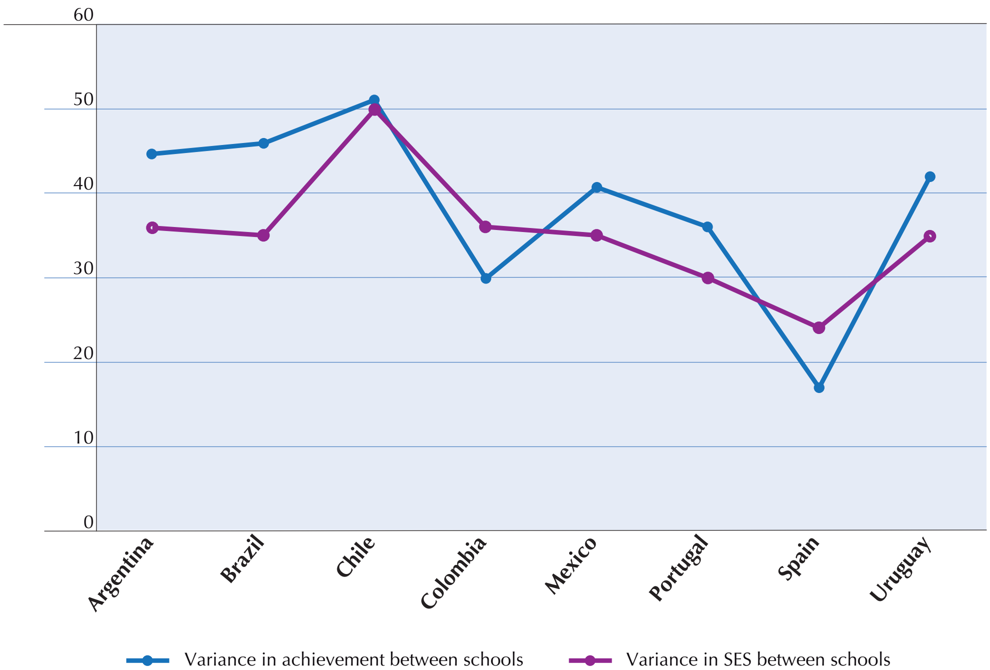
3. With regard to reading in PISA 2006.

The region has high socio-economic segregation indices, measured by the percentage of SES variance between schools. In Graph 4.100, this is represented by the red line, which shows figures of above 30 % for all Latin-American countries. The percentage for Chile is approximately 50 %, while Portugal is at 30 %, and Spain is around the OECD average (24 %).

The same graph also shows the proportion of variance in achievement levels due to between-school differences, which is over 50 % in Chile, and over 40 % in Argentina, Brazil, Mexico and Uruguay. Colombia and Portugal are close to the OECD average (36 %), while the percentage for Spain is much lower, at below 20 %.

Graph 4.100

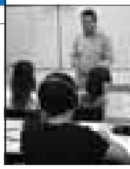
Percentage variance in SES and achievement levels between schools in the GIP countries



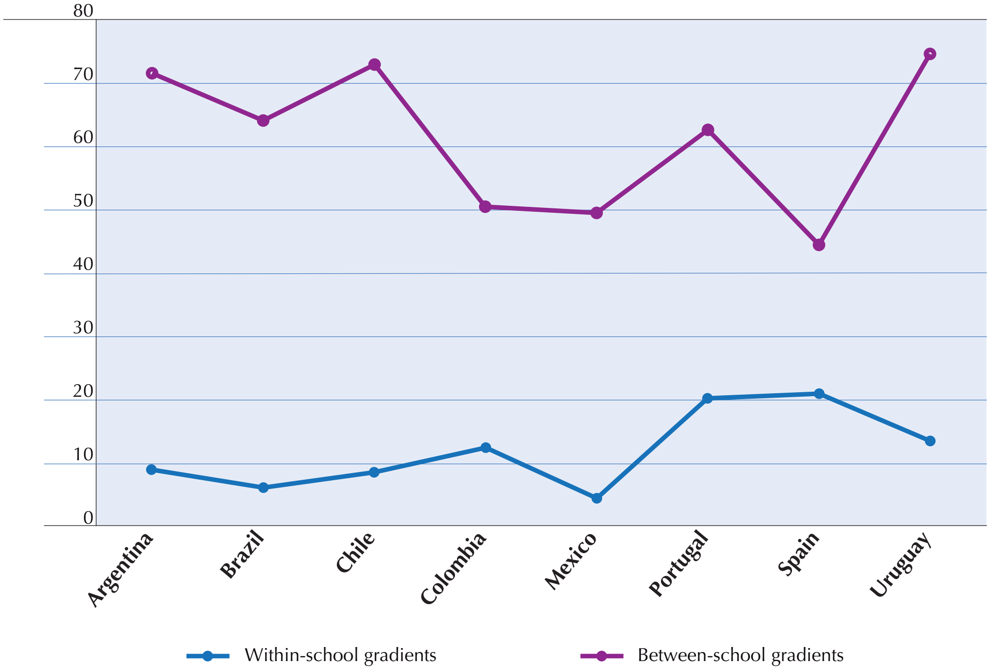
Graph 4.101 shows that the gradient of within-school regression lines for academic achievement and school SES is very low in all GIP countries (at less than 15 or even 10 points, except for Portugal and Spain, where it is close to 20). This means that SES is not strongly linked to achievement levels within each school.

However, the gradient of the between-school regression lines is very high (above 45 points for all countries, and over 70 for Argentina, Chile and Uruguay). This is evidence of significant between-school inequality in performance.

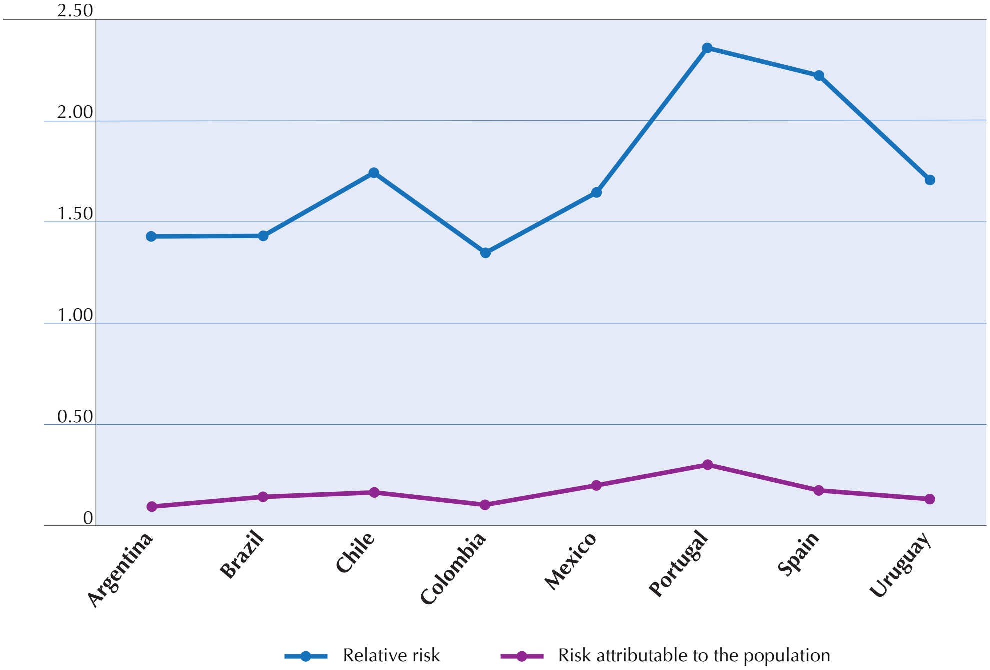
The relative risk of a low SES student having a low performance rate compared to a student with an average or high SES is 1.4 times higher in the region, and more than twice as high in Spain and Portugal. In this light, it would not be sufficient to raise the SES of the region to obtain good results. If the low SES risk factor were eliminated, calculations of the extent to which it would be possible to improve low performance («risk attributable to the population»), show that, at best, the proportion of students with low achievement rates would be reduced by about 33 % in Portugal. In other GIP countries, the proportion of students with low performance would be reduced by less than a fifth, or by 20 %.



Graph 4.101
Gradients of regression lines for within-school and between-school achievement levels and SES in the GIP countries



Graph 4.102
Relative risk and risk attributable to the population in the GIP countries



FINAL CONSIDERATIONS ON THE ANALYSIS OF RELATED FACTORS

The PISA international reports, as well as those based on assessment carried out in many national educational systems, make it possible to establish students' proficiency levels in some areas, and at given stages of their schooling. It also enables us to identify certain factors related to student performance, including variables involving family environment, and others connected to school resources and processes. These reports are valuable in enabling us to establish the pattern of within-school and between-school educational results; analyse the trends of student results; evaluate the degree of inequality in educational results as a result of ethnic status, social class or gender; and clarify to what extent student performance is linked to characteristics of the environment and the educational system.

In this chapter, using data from PISA 2006, we have tried to weigh up the performance of school systems in the Iberoamerican countries that participated in this programme. We have sought to provide some indication of why some schools are more successful than others, and analyse the implications of the results for educational policies. Nevertheless, PISA has important limitations which, should be borne in mind when interpreting the results.

Some of the limitations are related to the tests, which PISA uses to measure student performance. These have been carefully designed, drawing on the most advanced methodologies, but we must not forget the wide range of circumstances of students in participating countries, and especially their cultural diversity. This poses a major challenge in ensuring the validity of results. In particular, it should be pointed out that the tests were not designed to assess skills at very low levels. There are numerous students in most countries included in this analysis who obtained scores at below Level 1, so their scores may not be very accurate. It is likely that the real classification for these students is lower than that calculated by PISA, given that they are at the lowest level of the test or very close to it. If this were so, it would affect the shape, and level, of the gradients that were calculated.

Other limitations are related to the way in which information was obtained on environmental and school variables relating to student performance. Some of the yardsticks used by PISA to assess features of the learning model are of questionable value, as they are based on the subjective opinions of students and school principals, who answered a limited number of questions. It is not always possible to trust school principals, when they give their opinion on the adequacy of their schools' resources, or their degree of public accountability.

With regard to variables measured from the students' point of view, only two questions related to teaching quality. These were on student perceptions as to whether the teachers, and the subjects studied at school, provided them with the skills required to study for a degree in science.

The types of measurement for coverage of the curriculum, and time assigned to teaching, seem to be more satisfactory. However, the answers to the questions on student interest in science, and the importance of science, show anomalous patterns of results. While these are undoubtedly related, in part, to student performance levels, they may also be due to cultural differences.

The limitations of the data on student competencies, and environmental and school factors, clearly affect the reliability of the conclusions that we can obtain through their analysis. Other limitations are related to the analytical models.

Some studies on school effectiveness give estimates of the proportion of variance of the results of students in class, and between classes, within the same school, as well as between schools. Generally speaking,

the proportion of variance between classes is greater than the variance between schools in most countries (Scheerens, Vermeulen and Pelgrum, 1989). In the PISA studies, however, there are no data that differentiate between classes. This is a significant limiting factor, because when students answer questions about the quality of the teaching they are given, they somehow have to work out their typical experience on the basis of the different classes which they receive.

Studies that seek to detect the effect of variables in the school environment, such as class size or teaching quality, refer to the groups and prevailing school environment at the time when tests are carried out. They are based on the classes that are being given at that very moment, and the teachers in charge of those classes. However, scores in a performance test reflect the cumulative result of previous schooling, as well as environmental factors that shape the competencies of young people from birth onwards. The analyses that are made assume that the conditions and cultural characteristics of the school remain relatively stable over a period of several years, which may or may not be true.

These comments are not intended to detract from the value of PISA results. They do, however, show the need to sharpen the quality of the instruments, and the way the studies are designed. Given the limitations of all transversal investigations, we may stress the need to carry out studies which follow particular students individually over a period of time, in order to evaluate how they develop competencies, and thus be able to detect the *added value* contributed by the school.

It should be added that international studies, which are invaluable in enabling educational systems to be compared with each other, cannot meet all the requirements of decision makers. This is why each country needs to develop its own assessment projects, as well as participating actively in these assessments.

APPENDIX

Table 4.1 shows the results of the hierarchical linear models (HLM) of all the countries that participated in PISA 2006. Two models were calculated, one examining the bivariate relationships between science performance and each school factor; and another, using the same model, which includes the 10 school level factors that were analysed. This approach was adopted because the factors corresponding to school level are inter-related. The schools where students claim to have received schooling at a level that matched their ability, for example, also tend to have students with a higher level in science; the correlation is 0.61 in OECD countries. Bivariate results provide an index for how important a factor is itself. The multivariate results of the complete model help to identify the most important factors, using a set of control variables.

In the complete hierarchical model (the last column in Table 4.1), analysis makes it possible to ascertain whether the estimated coefficients vary significantly between countries. Where this occurs, it is indicated by adding a C as a superscript ([c]) to the corresponding value. The results of the table show that, with the exception of one factor, *school accountability*, all the others vary between countries. This means, for example, that the coefficient of the factor *teaching quality* may be different in Mexico, compared to other Latin American countries. The effects connected to student gender and socio-economic status also show significant variation between countries. For this reason, HLM models were calculated at two separate levels for each Latin American country. The results are given in table 4.2.

Table 4.1
Results of the HLM regression with a model which specifies the schooling effects on all the countries participating in PISA 2006

	Bivariate relationships	Complete hierarchical model
Teaching quality	**6.01**[C]	**−7.82**[C]
School accountability	**2.53**[C]	**0.52**
Coverage of the curriculum	**24.18**[C]	**13.53**[C]
Appropriate level	**6.83**[C]	**−6.34**[C]
Time allocated to science	**22.74**[C]	**16.77**[C]
Number of science courses	**7.57**[C]	**2.33**[C]
Student interest	**20.59**[C]	**8.33**[C]
Importance for students	**27.42**[C]	**5.84**[C]
School resources	**4.69**[C]	**1.90**[C]
Size of linear class	**2.09**[C]	**0.77**[C]
Size of quadratic class	**−0.065**[C]	−0.02[C]
Girls		**−6.65**[C]
Socio-economic status		**16.51**[C]

Bivariate models including adjustments due to student gender and SES.
Statistically significant coefficients ($p < 0.05$) are shown in bold.
The coefficients that varied significantly between countries are given with a [c].

Table 4.2
Results of the HLM regression with a model which specifies the effect of school policies and practices by countries

	Argentina	Brazil	Chile	Colombia	Mexico	Portugal	Spain	Uruguay
School Factors								
Teaching quality	**−24.72**	**−6.60**	**0.73**	−11.48	**0.54**	**−17.34**	**−9.27**	**−8.98**
School accountability	**−0.21**	**0.67**	**0.85**	**2.47**	**0.47**	1.95	**−0.00**	**−0.20**
Coverage of the curriculum	30.60	21.96	17.57	14.96	21.58	17.80	14.81	21.18
Appropriate level	**2.02**	**−0.46**	**1.11**	**2.50**	**4.94**	**−2.83**	**4.27**	17.65
Time allocated to science	**17.20**	**17.46**	**24.32**	5.31	4.55	**19.62**	**13.94**	2.69
Number of science courses	0.11	4.22	8.41	0.72	−0.56	−5.47	−0.35	**15.48**
Student interest	1.54	−8.26	−8.68	−4.58	0.38	−0.46	**13.19**	**−11.26**
Importance for students	4.17	2.62	7.71	−12.21	4.29	**36.10**	−0.41	−3.33
School resources	**5.28**	**5.55**	0.48	**3.32**	**5.66**	2.76	1.70	1.47
Size of linear class	0.37	**1.02**	−0.58	0.60	**0.81**	**1.12**	−0.01	**0.75**
Size of quadratic class	−0.002	−0.017	0.015	−0.025	−0.008	−0.016	−0.001	**−0.026**
Student Factors								
Girls	1.06	**−9.23**	**−17.01**	**12.59**	**−13.94**	**−8.76**	**−6.28**	**−6.30**
Socio-economic status	**12.84**	**8.49**	**12.13**	**10.64**	**6.07**	**18.52**	**25.45**	**15.83**

Statistically significant coefficients ($p < 0.05$) appear in bold.

At the third level of the hierarchy, the countries, it is possible to establish whether the effects of the two lower level factors, such as student SES or the time assigned to learning, vary significantly from one country to another. In general, the effects of the factors at student level, as well as SES, vary between countries and, consequently, the results are presented separately with the socio-economic gradients for each country. However, the effects of the factors at school level do not always vary from one country to another (or between the regions in a country). When they do vary, there is generally too little statistical information to calculate the effects for each country accurately. This is because the statistical validity of tests at this level depend on schools rather than the number of students, and they usually provide an insufficient base for accurate estimates.

5

School organization and functioning and students' attitudes: perceptions of school principals, students and families

INTRODUCTION: INFORMATION AVAILABLE IN PISA ON SCHOOL ORGANISATION AND FUNCTIONING

According to the international report on the 2006 implementation, PISA studied a set of school features on the basis of three lines of research. The first focused on the organisational and management characteristics of schools (autonomy, leadership, assessment practice, parental involvement, etc.). The second brought together the studies on human resources and educational materials (student-teacher ratio, quality of the physical infrastructures in the school, educational resources, etc.). Finally, the third reviewed educational processes in the classroom (student learning opportunities, time employed in tasks, supervision of class performance, etc.).

In this chapter, we will analyse the information provided by PISA on some aspects of the schools and classrooms, in which the students acquire key competencies. These include features such as school organisation, criteria for the admission of students, degree of autonomy, the shared responsibility of management teams and educational communities, and school resources. We will also examine student attitudes to science, and parental attitudes to the functioning of schools.

The analysis of results, including related factors, in the previous chapter makes it clear how important the organisation and functioning of schools, the work of teaching teams and of each teacher, and daily work in the classroom, all are in achieving satisfactory educational results. However, it is both important and difficult to have information on these aspects of school and classroom functioning, especially if these issues are addressed exclusively through external assessment, and with PISA instruments, that is, self-completed questionnaires. As was pointed out above, PISA provides information on these questions in Chapter 5 of the international report. That information is essentially based on the questionnaires answered by the school principals and students, and, to a lesser extent, on questions put to parents.

For this reason, we have not wanted to limit this report to the analysis of the factors that were studied in the previous chapter. An attempt will now made to complement that analysis, in important areas. However, the information that is provided in this chapter needs to be approached with a certain degree of caution. Firstly, with some exceptions, not many school principals were consulted in each country. Secondly, in some educational systems teaching is carried out in a range of educational institutions throughout a student's schooling. In these cases, the current learning environment, and the data collected in PISA that contextualises student performance at the age of 15, can only partially explain student results: the role of school principals, teachers and classmates from previous years has not been taken into account. Finally, the study of school resources requires an accuracy, which may not be achieved through the questionnaires, as school principals might not have had the time or the means to collect the relevant data. At the same time, it would be important to be able to relate resources to particular students, rather than link them all to one school. We therefore need to be cautious in reviewing the data presented in the international report, and included here, and stress the importance of the aspects under discussion.

It has already been stated how difficult it is to measure educational processes in schools and classrooms through standardised external assessment instruments. However, it is also problematic to make use of the evaluations, opinions and perceptions of schools and teachers. By definition, these are rooted in each specific context, and may not provide a basis for comparison with schools, educational stages or teaching teams in the same country. They are even less likely to be of value in drawing international comparisons. In short, we are dealing with useful additional information, which can indeed shed light on results, but always needs to be handled carefully. That approach underpins this chapter of the GIP report.

In the light of these comments, we need to qualify the relationship between the results of questionnaires and student tests. In this chapter we have decided not to attempt to correlate the organisation and environment of schools with student performance levels. Subjects such as school policy on student admissions, the autonomy of school principals and boards, and available resources, as well as the perceptions of students and parents, are all discussed.

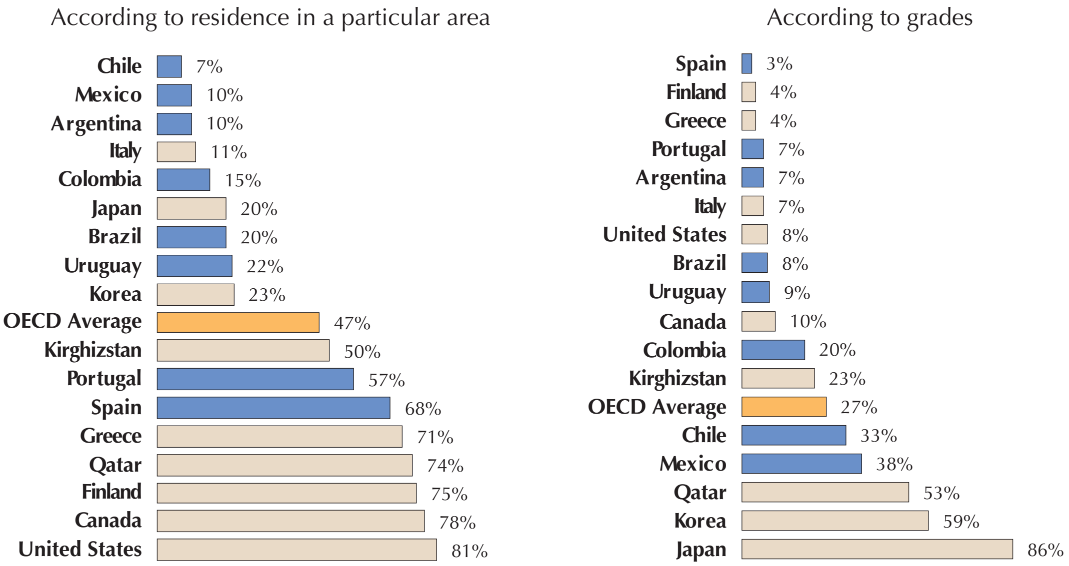
There was insufficient information to relate classroom practice to aspects of the report. However, this area is of great importance. The GIP wishes to put on record how valuable it would be for PISA to create instruments, which are better adapted to improving the information on educational processes that can be obtained through external assessment.

STUDENT ADMISSION POLICIES IN SCHOOLS

In order to establish the level of student selection required by schools, principals were asked questions on their admission policies. Below, we take into account the extent to which the following criteria were used for student admission: area of residence; student grades; the wish or need for a special programme; and whether other family members were already enrolled in the school. Among these criteria, the most striking is admission according to student area of residence. This is the most frequent criterion in OECD countries (47 % of students), followed by student grades (27 %), and the wish to have a special programme (19 %) (Graphs 5.1 and 5.2)[1].

Graph 5.1
Admission policies in schools

Percentage of students enrolled:



It can be seen that in GIP Latin-American countries, residence in a particular area is not such a decisive factor for admission as in the OECD countries. Chile is the country that least applies this criterion (7 %).

1. This refers to the students involved because the sample represents the 15-year-old students in each country, and not the schools or the teachers.

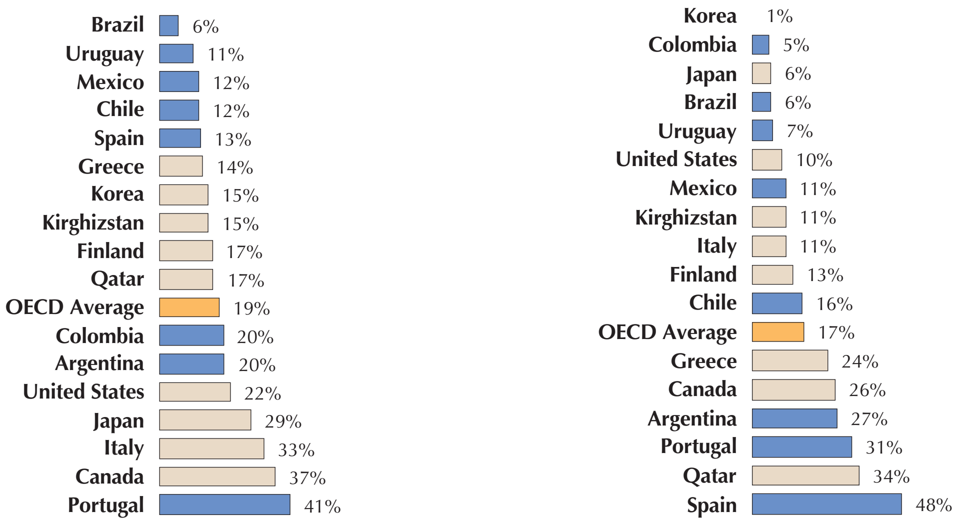
However, this criterion is the one most widely used in admitting students in Spain and Portugal, at 68 % and 57 % of all enrolled students respectively.

Students' grades are the second most common admission criterion used in schools in OECD countries (27 %). Mexico is the Iberoamerican country that uses this admission policy most, even above the OECD average (38 %), followed by Chile with 33 %. The other GIP countries are below the OECD average, and Spain, Portugal and Argentina are the countries where this criterion is least used.

Graph 5.2
Admission policies in schools

Percentage of students enrolled:

According to the wish or need for a special programme | According to the family members enrolled at the school



The wish, or need, for a student to study a specific programme is the next most common criterion used in the OECD (19 %). Portugal is the country where most students are enrolled according to this criterion (41 %). Colombia and Argentina (20 % of the students in both countries) are also above the OECD average, while this admission criterion is less frequently used in other GIP countries (approximately 10 %).

Finally, Spain is the country where the most common criterion for student admission is that other family members are enrolled in the same school. Portugal and Argentina also apply this admission criterion more frequently than the OECD countries. The other Iberoamerican countries are below this average. Colombia (5 %), Brazil (6 %) and Uruguay (7 %) are those which use it least frequently (Graph 5.2).

In general, it can be concluded that school selection of students for reasons other than residence in a particular area is not a decisive factor in the OECD, except for those that have a high percentage of private schools, and Asian countries. Among GIP countries, only Chile and Mexico attach relative importance to students' previous grades. Spain is practically alone in considering brothers and sisters attending the school to be a determining factor.

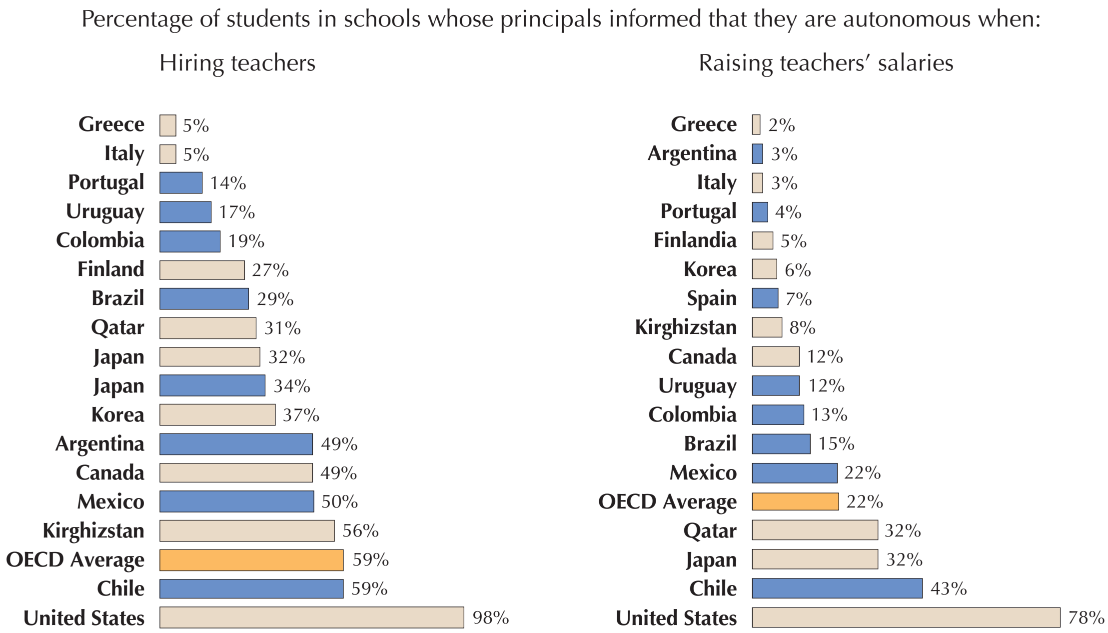
PRINCIPALS' PERCEPTIONS OF SCHOOL AUTONOMY AND THE ASSUMPTION OF RESPONSIBILITY BY THE GOVERNING BOARDS AND THE EDUCATIONAL COMMUNITY

This is one of the factors that has been best analysed by PISA. It should also be pointed out that the information provided by school principals on this subject is undoubtedly the best and most reliable source available.

PISA asks school principals about the degree of accountability, and the influence of those involved in decision-making (the school principal, the governing board, associations of school principals, parent and student associations, etc.) to measure the degree to which the educational community of a school participates in decision-making related to school management. We discuss below the autonomy of school principals in making decisions about teaching staff, the student body, teaching and the budgetary issues.

The autonomy of school principals in relation to teaching staff, in areas such as hiring and raising salaries, is more limited in GIP countries, except Chile, than in OECD countries (Graph 5.3). Where such autonomy exists, it is limited to private schools, at least in GIP countries such as Spain and Chile.

Graph 5.3
School autonomy



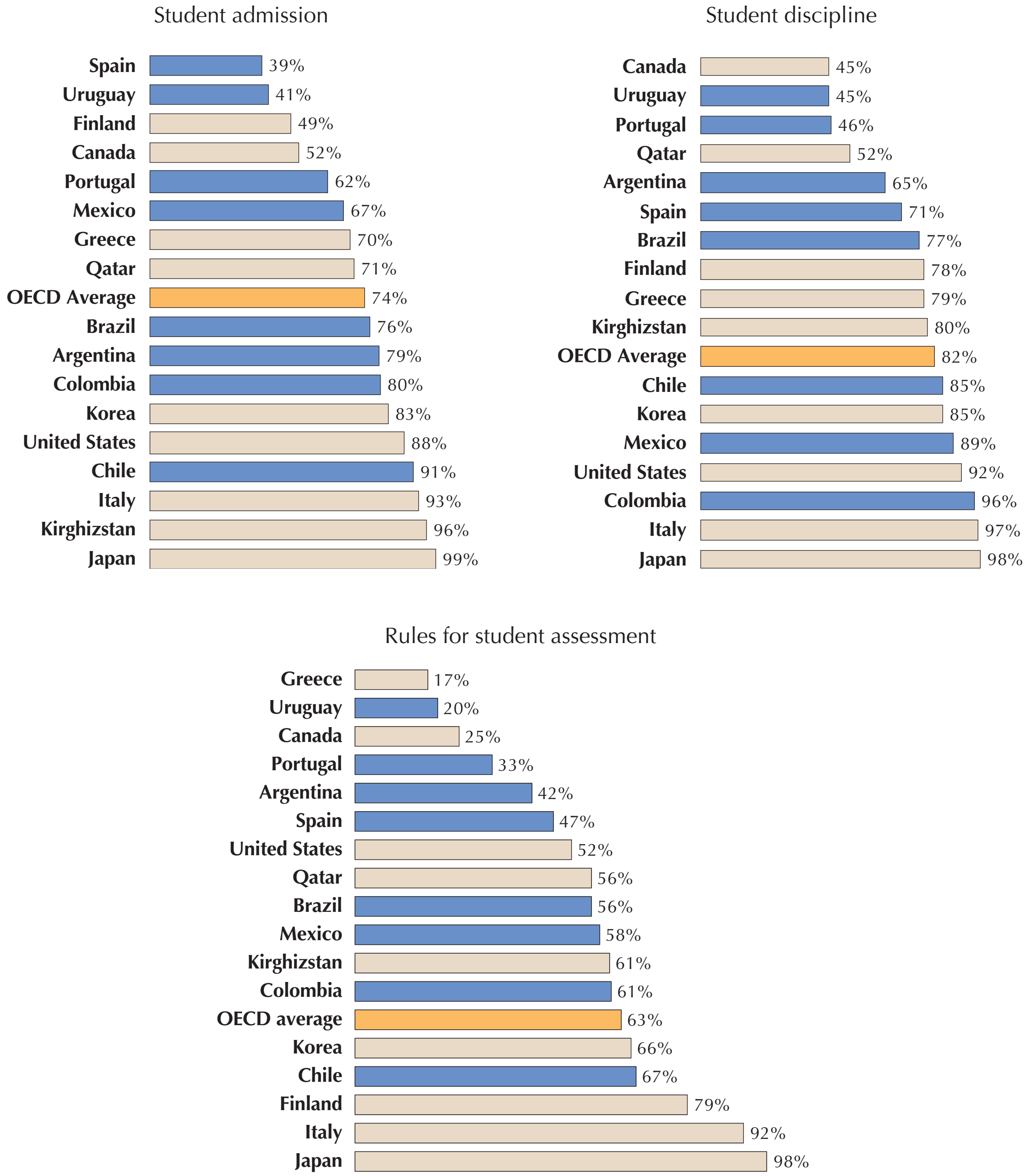
The percentage of 15-year-old students enrolled in schools whose principals state that they have important responsibilities in hiring teachers is 14 % in Portugal, 17 % in Uruguay, and 19 % in Colombia. These averages are well below those of the OECD (59 %), and Argentina (49 %). Only 3 % of Argentinean students are enrolled in schools in which the principals have the authority to raise salaries, as opposed to 22 % in OECD countries. Chile is the only country in which principals claim to have similar, or greater, autonomy in relation to teachers than the OECD average. The difference mentioned above between state and private schools is particularly noteworthy in Mexico where the principals of private schools generally have considerable autonomy, while those who head public schools have none at all.

Moreover, the structure of the Mexican educational system leads to considerable differences between the lower level secondary schools and the higher level secondary schools, where more have a higher degree of autonomy.

PISA has highlighted the significance of schools' ability to make particular decisions, and its limited influence on student results. If we consider the autonomy of school principals in hiring teachers and establish-

Graph 5.4
School autonomy

Percentage of students in schools whose principals stated that they are autonomous in relation to:



ing salary levels, situations are diverse within both GIP and partner countries. It does not appear possible to establish any conclusive relationship between the principals' decision-making authority and national scores in PISA tests, as there are results of all kinds in the cases under review.

We may compare school principals' autonomy in decision-making on issues that affect teaching staff, with those that are student-related. It appears that principals in OECD countries have more discretion on student questions (admission, discipline and evaluation) than teacher-related issues (Graphs 5.3 and 5.4). This pattern is similar in GIP countries. School principals have much greater autonomy in relation to students and their situations. Between 63 % and 82 % of the students who participated in PISA 2006 are in schools in which the principals take decisions on questions dealing with student admission, discipline and assessment.

On student admission, school principals in Brazil, Argentina, Colombia and Chile have more autonomy than the OECD average (76 %, 79 %, 80 % and 91 %, respectively, compared to 74 % in the OECD). Uruguay (41 %) and Mexico (67 %) are also below this mean. Autonomy on student admission is equivalent to the authority to select students for enrolment. In fact, countries such as Chile, Argentina and Mexico are among the countries which enrol the fewest students according to area of residence, and rely most on selection by academic performance.

82 % of OECD students attend schools where the principals have authority over student discipline. In the GIP, Chile (85 %), Mexico (89 %), and Colombia (96 %) exceed this percentage.

In the case of the establishment of assessment norms, Chile is the only country that has a higher percentage than the OECD countries (63 %). Brazil, Mexico and Colombia are below this average, but with percentages that are in a similar range (56 %, 58 % and 61 %, respectively). Uruguay (20 %) and Argentina (42 %) are significantly below these percentages.

Within GIP countries, Uruguay, Spain and Portugal have the lowest percentages in the field of autonomy for admission, discipline and student assessment. Chile and Colombia the highest percentages. However, there is no clear relationship between the autonomy of school principals and national assessment results in either GIP or partner countries.

Graph 5.5 shows the percentages for the autonomy of school principals in relation to deciding which courses are offered, and budgeting.

Only school principals in Chile (74 %) and Colombia (77 %) have greater autonomy in deciding which courses are offered than in OECD countries, where the average is 53 %. The percentage in Argentina (52 %) is close to this mean, while Mexico, Uruguay and Brazil are considerably below the OECD average (at 16 %, 18 % and 29 %, respectively).

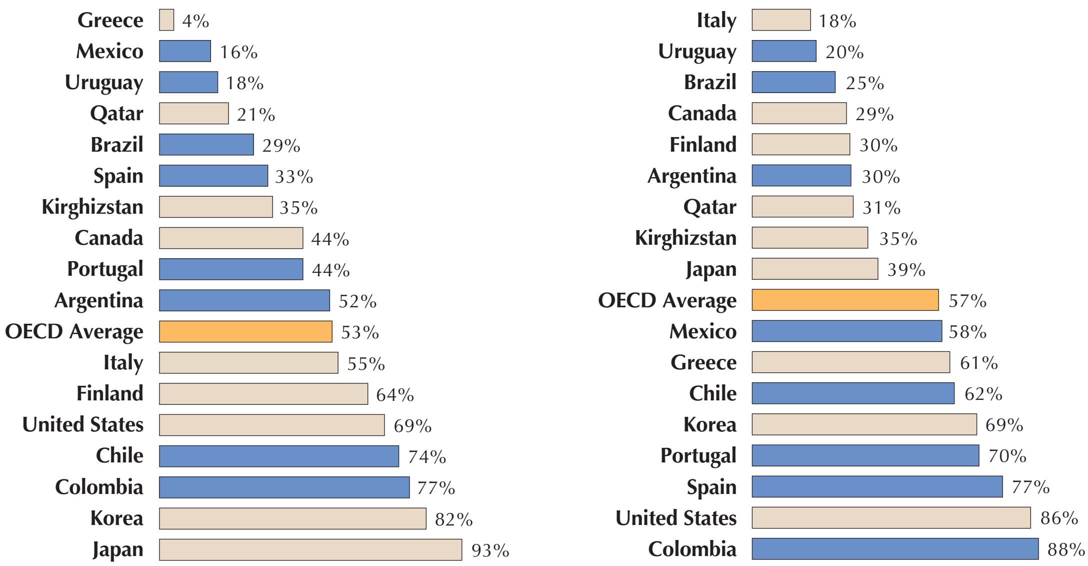
In OECD countries, 57 % of students study in schools, where the principals state that they have autonomy in budgeting. Colombia is the Iberoamerican country with the greatest autonomy in this respect (88 %). Mexico and Chile also report greater autonomy than the OECD average (at 58 % and 62 %, respectively).

In general, we can conclude that Chile is the only GIP country in which the principals invariably have greater autonomy than the OECD average (as regards teachers, students, deciding the courses that are offered, and budgeting), while Uruguay is consistently below this average. It is necessary to be extremely cautious when considering the effect the autonomy of school principals has on teaching and student results. (See the results for Finland on all graphs.)

Graph 5.5

School autonomy

Percentage of students in schools whose principals claim to have autonomy concerning:



As was pointed out above, there is no significant relationship between the different aspects of school autonomy and student performance. However, PISA has studied this relationship through a multi-level analysis, which examines all the countries in the sample. Its conclusion is that average performances are generally higher in countries in which school principals report that they have a higher degree of autonomy in most of the decision-making areas mentioned above.

The following section looks at the influence that school governing boards have on schools with regard to staffing practices, budgeting, the distribution of resources, and educational content. Once again, this discussion is based on the answers given by school principals. In OECD countries in general, school governing boards are especially involved in budgeting (62 %), and to a lesser degree in staffing practices (34 %), and in decisions on educational content (22 %). (See Graph 5.6.)

The direct role of governing boards on staffing practices (recruitment and dismissal) is very different from one GIP country to another. In Colombia, a very low percentage of 15-year-old students attend private schools where the principal declares that the governing board has a direct influence on staffing practices (6 %). In Spain and Uruguay the percentage is approximately 20 %. In Brazil, Portugal, Argentina and Mexico the percentage is above the OECD average, at approximately 40 %. Finally, the governing board has a major role in this respect in Chile (75 %).

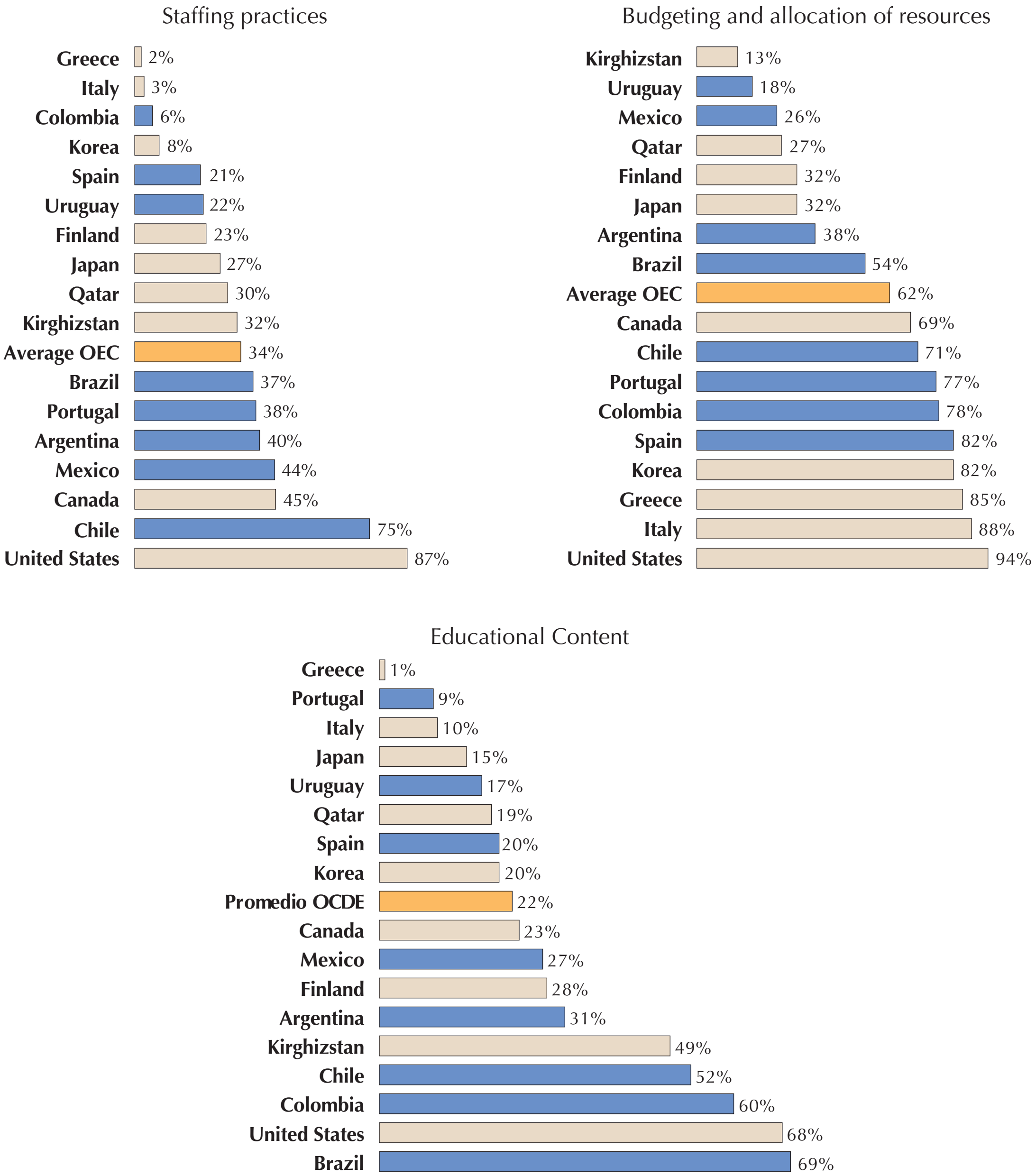
More than 70 % of students in Chile, Portugal, Colombia and Spain attend schools where the principals consider that the governing board plays an important role in budgeting, and the assignment of school resources. The percentage in Uruguay (18 %) is well below the GIP average.

Once again, we should bear in mind that, in this respect, there are significant differences between state and private schools in many educational systems.

In most GIP countries –Portugal, Uruguay and Spain are exceptions – school governing boards have greater influence on educational content than in OECD countries (22 %). Furthermore, over 50 % of students in Chile, Colombia and Brazil attend schools in which the governing board has a direct influence on the selection of educational content.

Graph 5.6
Influence of the governing board

The percentage of students in schools whose principal claims that the governing board has direct influence on:



In relation to school autonomy, we can conclude that school principals and governing boards, or councils, in GIP countries have limited autonomy on questions related to the recruitment and salaries of teachers. Autonomy is above the OECD average only in Chile. In GIP countries, governing boards have even more autonomy on staffing issues than principals do, and in several cases (notably Brazil, Argentina, Mexico and Chile), this is at levels that are above the OECD average.

Schools in the region have greater autonomy with regard to budgeting and the allocation of resources. There are considerable differences between GIP countries, except for Uruguay, Brazil and Mexico, where both principals and governing boards have a level of autonomy in budgeting, which is the same or lower than that of OECD countries. In the other countries, principals and governing boards have greater autonomy in this area than the OECD average.

In view of this, can we identify a constant factor in school autonomy in GIP countries? The answer seems to be in the negative. A calculation of the relationship between school autonomy and student performance appears to be even more problematic. On this issue, the data obtained by PISA for Iberoamerica do not allow us to conclude that there is a positive correlation between school autonomy and student performance with the same degree of confidence as for the OECD in general.

PRINCIPALS' PERCEPTIONS OF EDUCATIONAL RESOURCES IN SCHOOLS

PISA has tried to evaluate the importance of some of the main human and material resources available in the schools to provide students with effective quality education. A descriptive analysis will therefore be made of these factors and their relationship to the performance that was achieved.

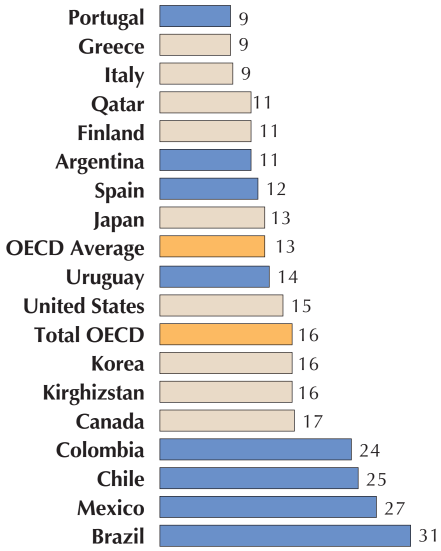
Graph 5.7 shows the ratio of students to teacher, which is an indicator of the quality of human resources in schools. This is the relationship between the total number of 15-year-old students and the number of full-time, or part-time, teachers who teach them. Portugal is the country with the best value according to this indicator (9 students per teacher), and is below the OECD average (13 students per teacher). Argentina (with 11), and Spain (with 12), also have a ratio that is better than the OECD average. The other GIP countries have much higher figures, with values of close to 30 students per teacher in the case of Mexico (27 students), and an even higher figure in Brazil (31 students).

It does not appear that conclusions can be drawn from the number of students per teacher and educational results. Nevertheless, Colombia, Chile, Mexico and Brazil do have more students per teacher than in any of the other countries considered in the review, and are at almost twice the OECD average. The other GIP countries have a student-teacher ratio that is similar to, or slightly lower than, the OECD average.

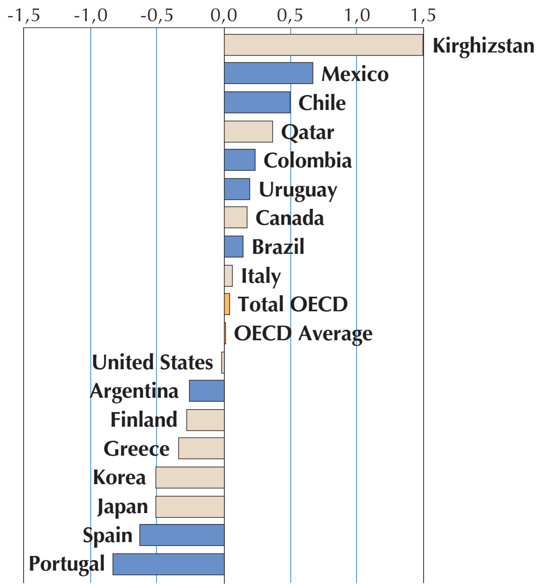
The index on personnel shortages (Graph 5.8) shows the perception the principals have of the shortage, or lack of preparation, of teachers of science, mathematics, Spanish, and other subjects. Positive values such as those of Brazil, Uruguay and Colombia (approximately 0.2) and, to a greater extent, those of Mexico and Chile (approximately 0.5) suggest that many principals consider that a shortage of qualified teachers is a hindrance to teaching in their schools. In Portugal, Spain and Argentina this index is negative, which means that the opinion of the principals is positive on this issue. It should be stressed that there are also major differences within this last group. Argentina has a shortage index close to 0, while in Spain this index is approximately -0.7. The value of this indicator for Portugal is approximately -0.9.

With regard to material resources, Graph 5.9 shows the number of computers per student in schools. All GIP countries have fewer computers (or more students per computer) than the OECD mean (6.6 students per computer). In Spain and Colombia the number of students per computer is lower than in other GIP

Graph 5.7
Student-teacher ratio



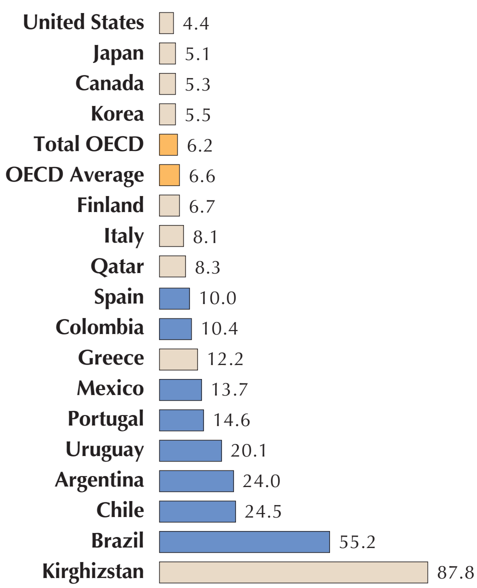
Graph 5.8
Staff shortage Index



countries – there are approximately 10 students per computer in both countries – while there are 55 students per computer in Brazil.

We have already stated above why, in this chapter, we have decided not to seek a relationship between student results and the variables under consideration. Nevertheless, there is a strong correlation here which needs to be pointed out: the relationship between the number of computers available in a school, and

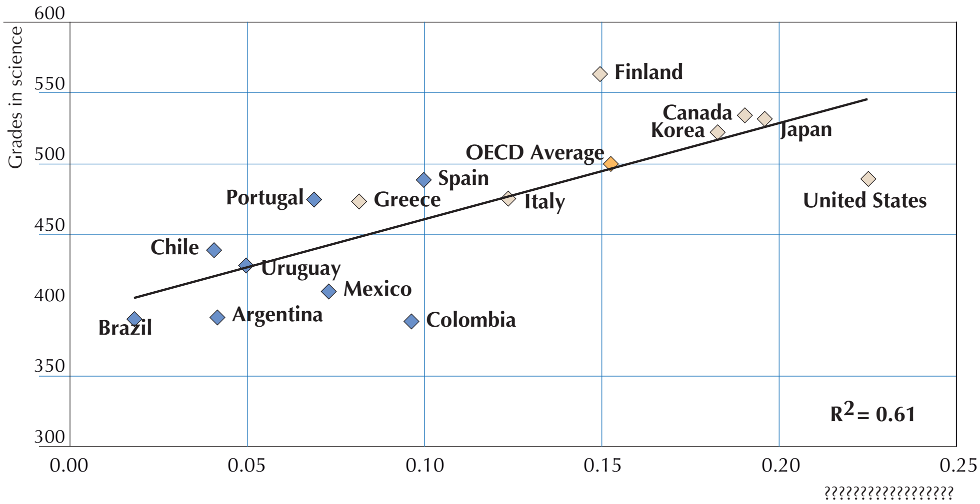
Graph 5.9
Number of students per computer



student science grades. The results show that the number of computers available per student in schools has a positive correlation with science grades, both in GIP countries and in all the other countries included in the comparison (Graph 5.10).

Graph 5.10

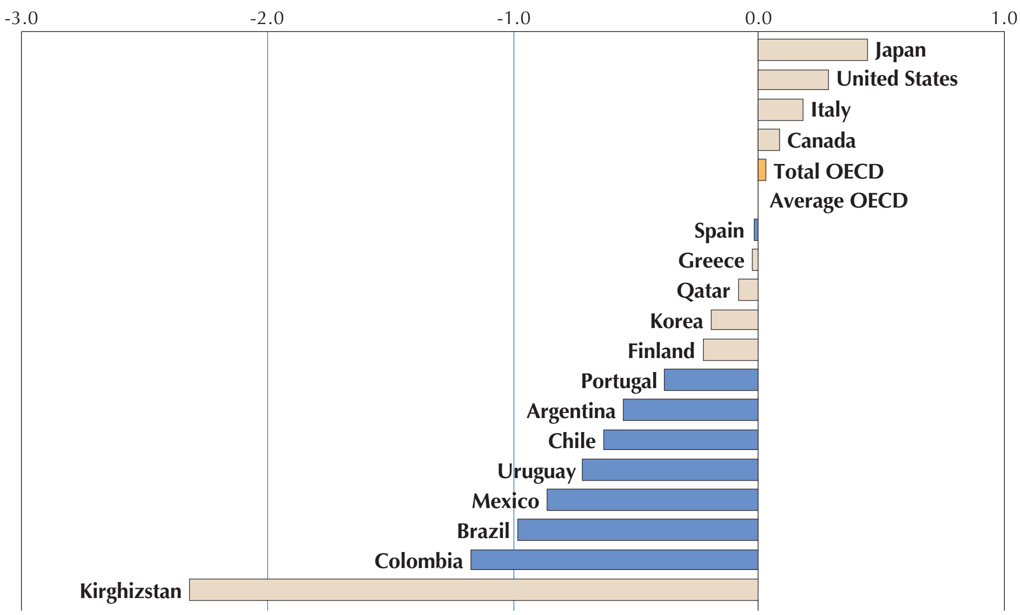
Relationship between the number of computers per student and science grades



Graph 5.11 shows the index of the quality of school educational resources. This index represents the perceptions that the principals have of the scarcity, or lack of adaptation, of the resources available to schools (audio-visual resources, library material, computer teaching programs, connection to Internet, computers for teaching, training material and equipment for science laboratories).

Graph 5.11

Index of quality of school educational resources



All the GIP countries perceive a shortage, or insufficiency, of school resources that could affect the schools' capacity to teach its students (index values lower than 0). This negative perception is very high in Colombia and Brazil, with values of approximately -1, while Spain (with an index value of approximately 0), Portugal and Argentina (approximately 0.5) have a broadly neutral perception.

STUDENTS' ATTITUDES TO SCIENCE

Firstly, it is paradoxical that there is a strong contrast between the GIP students' high level of commitment and interest, as well as the favourable attitudes that they say they have towards learning science, and the results that they actually achieve. This presupposes that commitment, interest and positive attitudes will favour learning. The positive attitudes of GIP students are greater in almost all measured aspects than those shown by the OECD students in general. Nevertheless, the results that these GIP students obtained were lower, and below the OECD average. In fact, the correlation of favourable attitudes to performance is sometimes negative in these countries. This occurs with *activities related to science*, the *personal value of science,* and *instrumental motivation towards science*. The question must then be posed, as to whether there is some cultural feature of Latin-American countries, which means that students seem to have positive attitudes to science that are not reflected in their performance in this field.

Gender differences do not always show up in the same way, or to the same extent, in GIP countries, as compared to OECD countries. As we pointed out earlier in this chapter, these aspects imply caution in analysing the results of a review of the students' own ideas about science, and how important it is to study it. The following is a breakdown of areas that have been taken into consideration.

Student engagement and interest in science

Support for scientific research

GIP students say that they draw on scientific research to explain and solve situations related to life in society (as formulated in the cues for cognitive items), to a greater extent than those from OECD countries. There were gender differences, favourable to males, in some of these countries (Spain, Portugal, Mexico and Uruguay).

Interest in learning science[2]

In this area, students from GIP countries declare a much greater interest in learning science than those from the OECD. Moreover, there is a slight gender difference in favour of males in the OECD, but there is no statistically significant difference in Spain, Portugal and Uruguay. Other Latin-American countries show strong differences in favour of females.

Relative Importance of obtaining good results in science

Students in Spain, Portugal, Argentina and Chile say that they do not feel that it is very important to have good results in science. It is the area that matters to them least, while they attach most importance to mathematics and, to a lesser extent, reading. In Mexico, Colombia and Uruguay science is the least valued area, while there is no clear difference between the other two. It appears that it would be advisable

2. This scale, like the previous one, includes items which were included in the pamphlets alongside cognitive items.

to look closely at how motivated students are to study science, although this issue goes beyond the GIP countries.

The importance that students attach to obtaining good results in the different areas varies in each country in different ways, according to gender. Both males and females attach less importance to science results. In general, males attribute more importance to the results in mathematics, and females to reading. The picture is different in Uruguay, where males give the same importance to reading and science as females. In GIP countries, except for Spain and Brazil, females are more concerned to obtain good results in science than males.

General interest in science

Once again, GIP students appear to be more interested in science (0.45) than those of the OECD (0.0). Nevertheless, Spain and Portugal show indices that do not reach 0.02, well below those of Latin America. The latter varied between 0.22 (Argentina) and 1.15 (Colombia).

Activities related to science

This index is apparently related to science grades, when they are linked without taking other variables into consideration. Its analysis seems to illustrate the peculiarities of GIP countries, as they show up in the PISA assessment of attitudes. As we have already seen, in all the attitudes considered until now, GIP countries appear to favour science more strongly than OECD countries. The index value for GIP countries is 0.50, and is slightly higher in Latin America (0.56).

This point is interesting because for each point the index of the OECD average rises, the general score for science increases by 19.4 points. In Spain, the increase is 18 points, and in Portugal it is 17. However, in most Latin-American countries science scores are reduced when this index rises. This decrease ranges from between 6 points for Mexico to 11 points for Argentina and Colombia. The exceptions are Chile, where there is a 7 point increase, and Uruguay, where there is no statistically significant variation.

Valuing science

The general value of science

The values of this index in GIP countries (0.29) are also higher than the OECD mean (0.0). This is another index that is has a positive correlation with general science scores, although there is no control of other relevant variables. When students consider that science is increasingly important for understanding the natural world and improving society and living conditions, their science performance improves. A one point difference on the index represents 28 extra points in the average OECD score. The link is also positive and significant in all GIP countries, but the «effect» is less strong (between 10 and 22 points, except in Portugal).

Personal value of science

GIP students state that they value science (0.46) higher in personal terms than those of the OECD (0.0). They say that they will use science when they are older, that science will help them to understand the world around them and relate to others, and that it is important for them. Spain is the only country that is close to the OECD average, with 0.05 points.

For each unit that this index increases, the general science score increase by 21 points in the OECD, Spain and Portugal. However, among Latin-American countries, only Mexico and Chile show slight increases in

points (3 and 8, respectively). In the other countries a change in the index is accompanied by a reduction in the points.

On the basis of the OECD mean, males attach slightly more value to science than females. In GIP countries, there are no significant gender differences, and where they exist, females have a higher index than males.

Instrumental motivation for science

Instrumental motivation for science is measured by PISA according to student opinions of the usefulness of its study insofar as it will help them to reach a higher level of achievement, find a job in the future, or study for a degree. This motivation also seems to be greater in GIP countries (0.45), than in the OECD, and only Spain approaches the OECD average, with 0.05 points. As was mentioned above, a greater value in the index does not mean higher points on the science scale in Latin-American countries. For each unit that the index rises, the OECD average increases by 18 points on the science scale. Spain increases by 20 points, and Portugal by 33. Argentina, Brazil and Colombia, on the other hand, would have fewer points by these measurements. Chile rises by 5 points, and the other two show no significant variation.

Likelihood of studying for a science degree

Students in GIP countries say they are more likely to study for a science degree than OECD students do. In both sets of countries, a higher proportion of females than males say they are likely to do so.

Self-perception in relation to science

Self-concept in science

GIP students have greater confidence (0.34) than the OECD mean, as regards their capacity to complete science tests, learn science, and understand new ideas in science. The GIP average is reduced by the value of the index in Spain, which is -0.01, but the figure for other countries varies between 0.18 and 0.75.

These values would indicate that the students feel very capable of learning. However, this is not matched by a greater number of points on the science scale, as we have repeatedly pointed out. The average of OECD countries, Spain and Portugal rises by between 26 and 28 points on the scale for each unit by which the index rises, but the average only changes significantly in three of the Latin-American countries: Mexico (6 points), Chile (19 points), and Uruguay (13 points).

Male students seem to have a higher self-concept in science than females, both in the OECD and GIP countries. The differences are not statistically significant in Mexico, Colombia and Uruguay.

Autonomy in science

This index measures the level of confidence that the students feel when they attempt to resolve specific situations in the field of science (earthquakes, environmental changes, interpretation of information from a scientific viewpoint). The GIP countries (0.05) do not show significantly greater levels of confidence in their capacities than those of the OECD. Portugal (0.21) and Uruguay (0.13) have the highest levels.

It is precisely this index, with low scores, which shows a clear and positive correlation with performance on the science scale in all GIP countries. On average, the OECD increases by 37.7 points for each unit in the index. All GIP countries also show an increase following the variation of the index. This increase is by over 30 points for Spain and Portugal, and varies between 21 and 30 points for the Latin-American countries.

Attitudes to the environment

Concerns about environmental issues

The vast majority of students participating in PISA express their concern for the environmental problems that they have heard of (air pollution, extinction of animals and plants, destruction of forests, energy depletion, nuclear waste and lack of water). Students from GIP countries (0.51) show higher levels of concern than those in the OECD. Colombia stands out as having the highest rate with 0.71 points on the index; the opposite is true of Uruguay (0.15). In all OECD countries, as well as in all those of the GIP, females show that they are significantly more concerned about the environment than males.

Although it is difficult to establish cause and effect, and it is not clear how other variables may affect this, it should be observed that in many countries there is an increase in student scientific performance when environmental concerns are greater. As measured by the OECD average, science scores rise by 6 points for each unit that this index rises. In GIP countries, the increase is considerably greater, except for Spain, (where it falls by 5 points), Portugal and Uruguay (which show no significant variation in proficiency levels). In other GIP countries, the increase is by 15 to 24 points.

Although we have already made this point, it is appropriate to acknowledge that greater concern for the environment in GIP countries represents a valuable social response to an important problem. However, this is not matched by a strengthening of the key scientific competencies in some GIP countries, and may well reflect a heightened sensitivity that has been shaped, in part, by the media.

Sensitivity and awareness of environmental issues

This index refers to the percentage of students who state that they are familiar with, or aware of, the following problems: the consequences of cutting down trees, acid rain, the greenhouse effect, nuclear waste, and the use of genetically modified organisms.

In this case GIP students appear to be much less concerned (index -0.28) than OECD students (0.0). If we only take the Latin-American countries into consideration, the index falls even lower, to -0.40.

In the OECD, the index is significantly higher for males than for females in Spain, Portugal and Chile, while there are no gender differences in the other GIP countries.

If no other variables were involved, awareness of environmental problems would show a strong correlation to science performance. Average OECD scores increase by 44 points on the science scale (0.44 standard deviation) for each unit by which the awareness index of environmental problems rises. These values are slightly lower for the GIP countries, but still broadly comparable. Countries with a lower rise in performance are Mexico (27 points on the scale), and Colombia (30 points). Apart from the two European countries, Brazil (40 points) and Chile (44 points) are the GIP countries with the highest increases.

Optimism about environmental issues

The GIP countries have a relatively low optimism index value (0.07) for environmental issues. Along with Spain (0.17), Argentina (0.15) is at an intermediate level, while Chile shows the highest level of optimism (0.29).

This index shows no gender differences in Latin-American countries.

This optimism index on environmental problems has a negative correlation with science performance. The OECD average falls by 18 points on the science scale for each unit by which the index increases. In GIP countries the average falls even more sharply, by between 20 and 33 points. It appears that much of this optimism could be due to insufficient knowledge of science, and quite possibly lack of information on this particular issue.

With regard to student attitudes to science, it can be observed that there are wide differences between the GIP and OECD countries. It is also clear that Spain and Portugal are closer to the OECD group of countries. While Mexico is part of the same organisation, it is more similar to the Latin-American countries.

Before concluding this section, we may stress the limitations of bivariate analysis. In considering only two variables, we cannot be sure that the link is not being affected by other variables that, if controlled, would contradict the initial connection. The absence of data on socio-economic level is especially problematic. This is a very important variable in performance, on which the OECD and GIP countries show considerable differences. However, this type of factor needs to be taken into account in order to maintain an in-depth investigation into performance.

Although it is difficult to identify cause and effect in attitudes to the environment and science performance, it does seem to be important to use this subject to motivate students for learning.

PARENTS' PERCEPTIONS

Only 16 out of the 57 countries participating in PISA 2006 asked parents, as well as students and school principals, to fill in questionnaires recording their perceptions of the quality of schools. Among GIP countries, only Portugal and Colombia belonged to this group of 16, obtaining answers from parents. Despite being limited in character, this information provides an additional perspective on the demands and expectations, which surround the educational system.

It emerges that parents' positive perceptions of an educational system have no direct relationship to student academic performance. Colombian parents have the best opinion of their educational system, higher than in other countries, but student performance in Colombia is generally the lowest of all GIP countries.

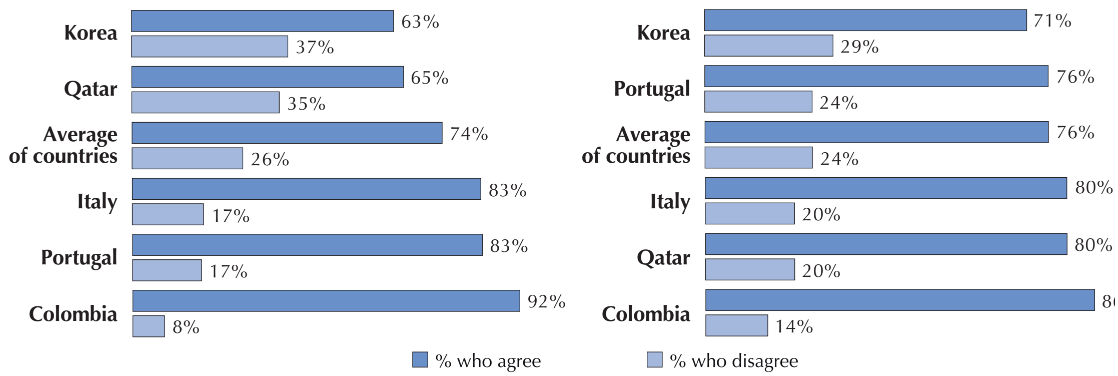
Graph 5.12

Parents' perceptions

Percentage of students whose parents «agree or disagree» with the following statements:

The school regularly provides useful information on the progress of my child

The school has high levels academic achievement



The degree of parental satisfaction in Colombia, Portugal and Italy is above the OECD average. A similar pattern can be found in the information on the extent to which schools provide regular, useful information on the progress of children. (Graph 5.12).

Graph 5.12 shows parental opinions on the level of academic achievement in schools. In Italy and Colombia, parents have positive perceptions, which are higher than those of other parents in the OECD. Similar conclusions can be drawn from information on the effectiveness of teachers, didactic approaches in the classroom, and the work of schools in furthering student progress.

In any case, although available information is scarce, it can be concluded that parent perceptions are, generally speaking, positive.

FINAL CONSIDERATIONS ON SCHOOL FACTORS AND THE PERCEPTIONS OF THE EDUCATIONAL COMMUNITY

This review of the influence of the organisation and functioning of schools in GIP countries has once again confirmed major regional differences. Moreover, we have seen the difficulty of making a clear and direct link between school factors and student levels of achievement in GIP countries. This highlights the need to carry out an in-depth study of these aspects in subsequent PISA reports, as well as other national and regional studies.

As was stated at the beginning, there is a clear absence of data, which would enable us to assess the pattern of classroom processes, and consequently, the work of teachers.

Nevertheless, it is noteworthy that in nearly all GIP countries, there are schools and students who achieve very different results, despite having very comparable social, economic and cultural environments. This suggests that schools, teaching teams, and classroom room, all play a decisive role. It is crucial that we improve our understanding of their influence, so that the process of evaluation can contribute, as directly as possible, to the understanding and improvement of educational systems.

6

Conclusions and a look at the future

This concluding chapter summarises the most significant findings on student results from the Iberoamerican countries that participated in PISA 2006, and places them in an international comparative framework.

We also feel that the information provided by PISA contributes to a deeper understanding of the functioning of our educational systems. Nevertheless, there are certain factors, apparently influencing student results, on which PISA lacks data.

PISA CONTRIBUTIONS TO THE EVALUATION AND UNDERSTANDING OF EDUCATIONAL SYSTEMS

As was explained in various sections above, and in different OECD documents, PISA 2006 set out to achieve a series of objectives. Firstly, PISA assesses the knowledge and skills acquired by 15-year-old students on the basis of their ability to extrapolate from what they have learned, and apply this knowledge to new situations and contexts. Along with this assessment of student performance, an objective and comparative evaluation of the functioning of educational systems is attempted. Moreover, PISA makes it possible to assess changes in student performance over time, with regard to the competencies that are evaluated. However, PISA's most ambitious goal is probably to provide governments with the means to evaluate the functioning of their educational systems, together with the instruments that will enable them to maintain ongoing improvements.

In its third implementation in 2006, PISA continues to offer new analytical tools, and new ways to address the results of educational systems in terms of quality and equity.

First of all, the rise in the importance of PISA has become clear through the growing number of countries involved in these surveys. In 2009 the number of participating countries reached double the figure for PISA 2000, increasing from 32 to 65. At the same time, PISA offered the groundbreaking possibility of making a reliable comparative analysis, over time, of the results for reading literacy between 2000 and 2009.

Another point worth making is the extremely positive influence of participation in international projects for measuring educational quality through evaluation systems. This was possible because of a process of reflection while the tests were being drawn up and applied by representatives of the participating countries, advisers and technical experts who were called in to prepare the assessment framework for PISA.

THE ORIGIN AND DEVELOPMENT OF THE GIP AS AN EXAMPLE OF COLLABORATION FOR THE IMPROVEMENT OF EVALUATION AND EDUCATION

The vast amount of information assembled in the PISA reports, as well as other international projects for measuring quality in education, has stimulated an increase in collective projects that seek to make fuller use of their results. These include new perspectives, and a search for new ways of making use of the data. An important example of this was the creation in 2005 of the Iberoamerican PISA group (GIP), which has several objectives, one of which was fulfilled with the completion of this report.

Firstly, the GIP report provided a comparative perspective on the results attained in PISA 2006 by the participating Iberoamerican countries. This meant framing an analysis around a group of countries with a high degree of convergence in terms of their historical, cultural, geographical, educational and socio-economic backgrounds. At the same time, an international frame of reference made it possible to clarify the situation and educational challenges of GIP countries.

Anther GIP concern is to highlight of two central themes in the study of educational systems: the quality of education and levels of social equity in relation to achievement. In the GIP report we have stressed the need to analyse both the results achieved by students in each country in terms of quality, and the pattern

of learning experiences in population groups according to the social, cultural and economic backgrounds of the students and their families. On the basis of this information, it is possible to make recommendations for educational policies that improve the quality of learning, and enhance the acquisition of competencies by students.

A third, similarly important, aspect is the concern of GIP members to promote co-operation, reflection and mutual assistance among the Iberoamerican countries participating in PISA. This assistance is proving especially valuable for the development and consolidation of national educational systems for quality evaluation, as well as in the interpretation and analysis of results.

Conclusions will be reported in the same order as this document was organised: the context of the educational systems; student performance; variables for students and schools which may be linked to academic results; and factors related to the quality of education in each of the participating countries.

EDUCATIONAL CONTEXTS IN GIP COUNTRIES

With regard to the economic and educational contexts of the countries under review, this study provides a clear picture of the considerable similarities between GIP countries, compared to other PISA countries, especially the more developed ones. This should be borne in mind when analysing the results achieved by each country in PISA 2006. While education might be considered a prerequisite for achieving improved levels of development, it is also true that greater development also creates resources that can be invested in improving the quality of the educational system.

If per capita GDP is analysed in GIP countries, production level per inhabitant is at half the level recorded in OECD countries. Moreover, the differences between GIP and OECD countries are even more striking if we consider that the European member countries of the GIP have levels of income that are greatly superior to those of the Latin American countries.

This discussion suggests that we need to widen our range of analysis for the patterns and results of educational systems. When considered in isolation, certain indicators, such as the percentage of GDP allocated to education, are quite misleading. Although GIP countries allocate a similar percentage of GDP to OECD or partner countries, there are considerable differences in expenditure per student. The cost per student is between 1,000 and 2,000 dollars in Latin American GIP countries, which rises to 6,000 dollars in European GIP countries. Cost per student is 10,000 dollars in the other countries.

Given the economic restrictions that have been mentioned, it is important to highlight the success of the GIP countries in extending educational cover. With rates similar to, or higher than, 90 % the GIP countries are close to reaching one of the main goals of the millennium: making primary education universal. This achievement underlines the need to make progress in the inclusion of children at pre-school, infant, and secondary school levels in each educational system.

The improvement of primary education should focus on raising learning quality, as well as lowering the repetition of grades and dropout levels. In some GIP countries repetition or dropout rates are at very high levels. This affects both the quality and equity of results in general, as the children who are more liable to repeat courses and withdraw from school are mainly from the more disadvantaged strata of the population.

Over recent decades, there have been strong movements to reform educational systems in the region. The aim has been to increase access to, and improve the quality of, education. These educational policies have had different approaches, both in relation to the two key aspects (quality and coverage), and also in terms of different strategies to reach this objective. On the issue of quality in particular, the number of policy-makers, aspects and processes coming together, has been so numerous that policy options multiply. As a consequence, and reflecting the contexts which shape the success or failure of policies, there have been

divergent paths to educational reform in the region, often involving quite distinct aspects, objectives and initiatives.

The importance of educational quality as an engine of social development and welfare, as well as a factor in individual advancement, has led to countries investing all their efforts in its improvement. However, with some exceptions, over the years their efforts do not seem to have produced better results, and quality indicators seem to be anchored in old practices which obstruct progress.

This is the perspective from which the GIP approaches the study of student academic results: first, an acknowledgement of weaknesses and the need to make improvements; second, a retrospective analysis of the efforts that have been made, and the achievements attained.

GIP STUDENT PERFORMANCE

The OECD mean on the science scale is 500 points. No GIP country reaches this level: the average is 426 points, and Latin American countries do not exceed 438 points.

In OECD countries, 19 % of students, on average, do not reach Level 2. According to PISA, they do not have an adequate level of competency to meet social and employment requirements successfully; or exercise the rights, liberties and responsibilities of active citizenship in the knowledge societies of the 21st century. In particular, these students confuse facts with personal beliefs when they make decisions, misinterpret key features of research, or apply incorrectly the scientific information that they receive. If we think in terms of the requirements for scientific competencies in today's world, then our countries face a testing challenge that cannot be ignored.

In GIP countries, percentages of students below Level 2 range from 19 % to 60 %. In Spain (at 19 %), and Portugal (at 24.5 %), the percentages are similar to those of the most developed countries. But the situation is extremely worrying in Latin-American countries. More than half of the students in Brazil, Colombia, Argentina and Mexico are below Level 2, while the percentage is approximately 40 % in Chile and Uruguay.

At the other extreme, 9 % of students, on average, are at the upper two levels (5 and 6) in the OECD countries. In GIP countries, this average is only 1.7 %. There are significant differences within the GIP. In Spain and Portugal the percentages are 5.8 % and 3.1 %, respectively, while in four Latin-American countries the proportion of students at these levels fails to reach 1 %. In two countries they are below 2 %.

As a Canadian study on the likelihood of young people achieving success in higher education has shown, the social and employment prospects of young people improve very considerably if they have achieved high levels of reading literacy by the age of 15. If we look at the possibilities of success for young people who reach a performance level at, or below, 1 on the PISA scale, the study shows that the likelihood of success is multiplied by 2 for students at Level 2, by 4 at Level 3, by 8 at Level 4, and by 16 at Levels 5 and 6.

The situation seems to be equally unfavourable in Iberoamerica if the sub-scales of scientific content are taken into consideration: Earth and space systems, living systems and physical systems. Nevertheless, it is noteworthy that in Spain and Portugal the results for physical systems are weaker than other areas, so this area requires more attention. Brazil, Uruguay and Colombia have poor results in Earth and space systems, but achieve higher levels in living systems. These countries could review their curricula, as well as teaching practices, in these areas. The differences in other countries are less significant, although Argentina and Chile achieve a marginally better performance in living systems, while Mexico reaches a lower level in this area.

It cannot yet be said that GIP countries are achieving quality education results that match the highest international standards, and prepare them for the challenges of a globalised world. Nevertheless, change is

filtering through. Results from PISA, and from the Second Regional Comparative and Explanatory Study, SERCE (LLECE-UNESCO, 2008), suggest that efforts to improve the situation are making encouraging headway in some countries. But the current situation is the product of underlying processes that date back to at least to the middle of the 20th century. They involved such important factors as the sharp demographic growth of some GIP countries between 1950 and 2000, and irregular economic growth during the same period, in which phases of rapid expansion alternated with stagnation. Some countries suffered from intervals of authoritarian rule, which often had devastating consequences, but not necessarily to the detriment of all features of the educational system.

Some PISA results that call our attention are related to how GIP students respond in areas such as commitment, appreciation and perceptions in science. While we might expect a direct link between these aspects and results in science, GIP students, especially the Latin American ones, show higher indices than those of the OECD in attitudes which favour learning. Yet favourable attitudes are associated negatively with performance in some cases. This happens with activities related to science, with the personal value of science, and with instrumental motivation toward science. The question then arises of whether there is some cultural aspect in Latin-American countries by which students have an apparently positive attitude toward science, that is not reflected in their performance. Young people may have lower expectations in some GIP countries, as well as a greater tendency to answer questions on attitudes with sociably acceptable replies.

EQUITY, SOCIAL, ECONOMIC AND CULTURAL CONTEXTS AND OTHER FACTORS RELATED TO THE QUALITY OF EDUCATION

The analysis of equity in results shows the importance of socio-economic gradients (SES) within, and between, schools. There is a clear relationship between students' science performance and their socio-economic level. In this light, the socio-economic level of student families is not simply an instrumental variable, which is used to establish the overall effect that student and school variables have on proficiency levels: it is an instrument of educational policy-making.

An increase in the socio-economic level of students by one point raises their science performance level by between 6 and 23 points, depending on the country. This conclusion leads us to propose five strategies to improve student results.

- Interventions focused on ***schools with low performance ratings***, prioritising assistance to students at lower levels.
- Intervention programmes focused on ***schools with low social, economic and cultural status***, which include many low performance schools.
- Compensatory programmes aimed at ***students in disadvantaged environments***, aimed at alleviating the effects of poverty on school attendance, dropout rates and results.
- General interventions, based on national or local policy decisions, intended to improve the results of ***all students***.
- Partial interventions, aimed at ***reducing segregation between* schools**, by redistributing low SES students in schools that have average performance levels.

An analysis was carried out of factors relating to student performance in the GIP countries participating in PISA 2006. Ten variables were grouped into five essential aspects: 1) teaching quality; 2) appropriate teaching level; 3) time allocated to learning; 4) student engagement, and 5) school resources.

PISA results from the GIP countries show that educational policy-makers, seeking to improve results, need to take school factors into account, as well as student families and their social environment.

The factor most clearly related to science results in the GIP countries is the degree of effective implementation of the school curriculum. First of all, this aspect is, statistically speaking, the only one that operates universally, in all countries. Secondly, it is important because academic results are greatly improved by each one-point increase in effective implementation of the curriculum. Thirdly, the nature of this influence is similar in all countries. This finding is of vital importance for the improvement of quality in education, both within each country, and also in terms of all aspects of multilateral co-operation, aimed improving the quality of education.

The study also stresses the importance of time assigned to science teaching in schools as a decisive factor in student learning. This operates in the same way as the curriculum does, insofar as it increases the learning opportunities offered by schools and educational systems to students. Lastly, school resources and class size are among the factors that have an important effect on science results. This last piece of data is interesting because of the importance of recent discussions on the influence of class size on student results. Research leads us to the conclusion that class size is only important if there are great differences, from very large sizes to much smaller ones, and if reduction in size is accompanied by changes in teaching strategies. In the GIP countries average group size is sometimes much bigger than the OECD average, which suggests that in these cases this factor may have influenced student results. Efforts to improve the situation are therefore clearly justified, but teachers should also be encourage to adopt more effective educational strategies.

LOOKING AT THE FUTURE

The preparation of this GIP_report has been extremely beneficial for all of us who have worked on it. Firstly, by co-operating with each other, we have benefited from shared technical and scientific know-how, and we have all learned a great deal. Secondly, PISA data enlarge our understanding of our educational systems, as well as taking on a wider resonance within the comparative framework that we have adopted. Thirdly – and this is also extremely important – we have identified certain types of information that are missing or incomplete in PISA, as well as in the other national and international assessments that we have worked with. It is crucial that we go on working and carrying out research in order to improve PISA, and shed more light on certain questions.

The different educational outcomes in the regions, and in Spanish Autonomous Communities, are highly instructive. In all these cases, the underlying shared features of the educational systems, such as the basic curriculum or the teachers' training background, do not appear to provide a sufficient explanation for differences in results.

Socio-economic contexts greatly influence the level of student achievement. All the regression lines taken into consideration (countries and regions) have a positive curve, that is to say, performance improves with socio-economic status. However, this is not a decisive factor: in all countries and regions there are students and schools with modest backgrounds, that achieve very good results, and vice versa. There may be factors that explain the differences in performance, sometimes very considerable, between students and schools that have similar socio-economic and cultural backgrounds. These need to be linked to schools, students and families.

This shows that it is important to improve and complete PISA, and external evaluations in general. The aim must be to offer better and more detailed information on the role played by the organisation and functioning of schools, teacher team work, and classroom processes in influencing student results. In particular, it

can highlight the added value that schools and teaching teams bring to student learning.

However, it is not possible for external assessments to solve all the issues posed by the need for improvements in the educational system. PISA confirms that it is essential to enrich our understanding of educational systems by making use of direct and applied measuring instruments within schools and classrooms, and in relation to teachers. These need to be both qualitative and quantitative, using accurate forms of measurement. The goal is to make all the elements, which can best explain school and student success, available to ambitious evaluation programmes.

Finally, we would like to draw attention to one the most important lessons that PISA can teach us, in relation to policies and measures that will produce improvements. This is the special utility of specific actions aimed at students who require support and special dedication. Schools and students, which have modest socio-economic and cultural backgrounds yet obtain excellent results, provide the best example of what can, and should, be done in these contexts. The results of this hands-on work may be far more valuable than broad declarations, policies or resources, which are unrelated to a specific context.

In conclusion, we will now list some of the challenges for the future which emerge from our analysis of the results of PISA 2006 in Iberoamerican countries.

1. External assessments need to make use of instruments, which allow us to improve our understanding, and influence student results, in the following areas:
   - classroom and school processes;
   - the functioning of teacher teams, and collective and individual teacher strategies;
   - school organisation, the autonomy of the educational community and shared responsibility in teaching;
   - involvement of those concerned with education, and especially families;
   - families and student attitudes towards learning.
2. It is essential that progress be made in the added value, which schools and teachers bring to student learning.
3. Measurement instruments must be fine-tuned so that they allow for a more accurate analysis of the most disadvantaged backgrounds, and the most varied social and economic environments.
4. In addition to broadly based policies aimed at making improvements in schools and students, it is crucial to develop specially adapted policies and actions that improve conditions in specific schools. These should also favour the learning needs of students who require certain types of support and guidance.

Finally, we should mention an improvement that has already been made in PISA 2009, as a result of a GIP proposal. This was for the inclusion of less difficult items in optional booklets, which can be used in countries whose 15-year-old students have obtained results that are well below the OECD average. This is true of the Latin American GIP countries.

In view of the high level of difficulty of most items used in PISA from 2000 to 2006, almost half of young people in GIP countries are below Level 2 in all the competencies measured by PISA. In other words, they have not developed the key competencies necessary to perform successfully in an advanced society.

As was explained above, all this is part of a serious problem which education systems cannot ignore. But in order to face it, we need to collect more information on what these students are capable of doing, and not

simply on what they cannot do. There is therefore a need for the PISA tests to cover a wider range of levels of skills, which will be fulfilled with the option that is added in 2009.

We should point out that results from countries that choose to use booklets, which contain items at lower levels of difficulty, will still be comparable with those of other participating countries. Similarly, the comparability of results over time will not be affected.

The importance of this change for PISA is considerable. We should bear in mind that many countries, that are now starting to participate in these assessments, are at levels of general and educational development, which are below those of OECD member countries, as well as some other non-OECD Asian and European countries.

References

Administración Nacional de Educación Pública. Consejo Directivo Central (2007), *Uruguay en PISA 2006: Primeros resultados en ciencias, matemática y lectura del Programa para la Evaluación Internacional de Alumnos*, Montevideo: Author.

Brookover, **W. B.**, **Schweitzer**, **J. H.**, **Schneider**, **J. M.**, **Beady**, **C. H.**, **Flood**, **P. K.** and **Wisenbaker**, **J. M.** (1978), «Elementary school social climate and school achievement», *American Educational Research Journal*, 15, pages 301-318.

Carroll, **J. B.** (1963), «A model of school learning», *Teachers College Record*, vol. 64, pages 722-733.

Consejería de Educación de Cantabria (2008), *Informe PISA 2006 Cantabria*. Santander: Author.

Consejería de Educación y Ciencia, Dirección General de Políticas Educativas y Ordenación Académica (2007), *Prime informe de la evaluación PISA 2006. Resultados en Asturias*, Oviedo: Author.

Consellería de Educación e Ordenación Universitaria. Subdirección Xeral de Inspección, Avaliación e Calidade do Sistema Educativo (2008), *PISA 2006: Informe de Galicia: competencias para el mundo do mañá*, Santiago de Compostela: Author.

Díaz Gutiérrez, **M. A.**, **Flores Vázquez**, **G.** and **Rizo Martínez**, **F.** (2007), *PISA 2006 en México,* México, D. F.: Instituto Nacional para la Evaluación de la Educación (INEE).

Fundación Santillana (2007), *Centros educativos de éxito: análisis e Investigaciónes a partir de los resultados PISA*, XXI Semana Monográfica de la Educación, Madrid: Author.

Gobierno de Aragón, Departamento de Educación Cultura y Deporte (2008), *Aragón en la Evaluación Internacional de Alumnos PISA 2006*, Huesca: Author.

Gobierno de La Rioja. Consejería de Educación, Cultura y Deporte (2008), *Evaluación Internacional PISA 2006: resultados de La Rioja,* Logroño: Author.

Gobierno de Navarra, Departamento de Educación (2007), *Evaluación Internacional PISA 2006: competencias en ciencias para el mundo del mañana. Resultados de Navarra*, Navarra: Author.

Gobierno Vasco, Instituto Vasco de Evaluación e Investigación Educativa (2007), *Primer Informe Evaluación PISA 2006: proyecto para la evaluación internacional de los estudiantes de 15 años en ciencias, matemáticas y lectura. Resultados en Euskadi*, Bilbao: Author.

Henderson, V., **Mieszkowski**, **P.** and **Sauvageau**, **Y.** (1978), «Peer group effects and educational production functions», *Journal of Public Economics*, 10, pages 97-106.

Junta de Andalucía, Consejería de Educación (2007), *Informe PISA 2006: resultados en Andalucía*, Sevilla: Author. Available at http://www.ustea.org/Educación/politicaeducativa/2007/PISA2006_Resultados Andalucia_051207.pdf.

Junta de Castilla y León, Consejería de Educación (n. d.), *Castilla y León en el Informe PISA 2006*. Available on the website. de Educación de la Junta de Castilla y Leon: http://www.educa.jcyl.es/educacyl/cm/images?idMmedia=108430.

McPherson, **A. F.** and **Willms**, **J. D.** (1987), «Beyond an atomistic model of school effects: Scottish findings», *International Review of Sociology,* 1, pages 145-184.

Ministerio da Educação, Gabinete de Avaliação Educacional (2007), *PISA 2006: Competências Científicas dos Alunos Portugueses*, Lisbon: Author. Available at http://www.gave.min-edu.pt.

Ministério da Educação, Gabinete de Estatística e Planeamento da Educação (2008), *Modernização Tecnologica do Ensino em Portugal*, Lisbon: Author.

Ministério da Educação. Gabinete de Estatística e Planeamento da Educação (2008), *Perfil do Aluno – 2006/07*, Lisbon: Author.

Ministério da Educação, Gabinete de Estatística e Planeamento da Educação (2007), *O Ensino das Ciências nas Escolas da Europa – Políticas e Investigação,* Lisbon: Author.

Ministério da Educação, Gabinete de Estatística e Planeamento da Educação (2007), *Séries Cronologicas, Alunos (1977-2006)*, Volume I & II, Lisbon: Author.

Ministerio da Educação, Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) (2008), *Programa internacional de avaliação de alumnos (PISA): resultados nacionais PISA 2006*, Brasilia: Author.

Ministerio de Educación, Ciencia y Tecnología, Direccion Nacional de la Información y Evaluación de la Calidad Educativa (2004), *Programme for International Student Assessment: Informe Nacional República Argentina*, Buenos Aires: Author.

Ministerio de Educación de Chile, Sistema nacional de medición de resultados de aprendizaje SIMCE (2008), *PISA 2006: Rendimientos de estudiantes de 15 años en Ciencias, Lectura y Matemática: Unidad de Curriculum y Evaluacion*, Santiago de Chile: Author. Available at http://www.simce.cl/fileadmin/Documentos_y_archivos_SIMCE/ PISA2006/ PISA_2006.pdf

Ministerio de Educación Nacional, Instituto Colombiano para el fomento de la Educación Superior (2008), *Colombia en PISA 2006: síntesis de resultados*, Bogotá: Author. Available at http://www.icfes.gov.co.

Ministerio de Educación, Política Social y Deporte, Instituto de Evaluación (2007a), *La lectura en PISA 2000, 2003 y 2006: marco de pruebas para la evaluación*, Madrid: Author.

Ministerio de Educación, Política Social y Deporte, Instituto de Evaluación (2007b), *PISA 2006: Programa para la Evaluación Internacional de Alumnos de la OCDE. Informe español*, Madrid: Author.

Ministerio de Educación, Política Social y Deporte, Instituto de Evaluacion (2007c), *Informe 2006: Objetivos educativos y puntos de referencia 2010*, Madrid: Author.

Murnane, **R. J.** (1981), «Interpreting the evidence on school effectiveness», *Teachers College Record,* 83, pages 19-35.

OCDE (2006), *Informe PISA 2006: competencias científicas para el mundo del mañana*, Madrid, Santillana.

Pinto-Ferreira, C. and **Serrão**, **A.** (2008), «Literacy competencies of the Portuguese students: cross-national comparison among some Mediterranean countries», in *The Performance of Education Systems in Countries and Regions*, Trento.

Pinto-Ferreira, **C.** and **Serrão**, **A.** (2008), «How do Portuguese Students Perform in Reading – Analysis of the Released Items from PISA 2000, 2003 and 2006», in *From Teaching to Learning?*, European Conference on Educational Research, Gothenburg.

Rumberger, **R. G.** and **Willms**, **J. D.** (1992), «The impact of racial and ethnic segregation on the achievement gap in California high schools», *Educational Evaluation and Policy Analysis,* 14, pages 377-396.

Rutter, **M.** (1983), «Schools effects on pupil progress: Research findings and policy implications», *Child Development,* 54 (1), pages 1-29.

Sammons, **P.**, **Hillman**, **J.** and **Mortimore**, **P.** (1995), *Key characteristics of effective schools: a review of school effectiveness research*, London, London University Institute of Education, ISEIC for OFSTED.

Scheerens, **J.** (1992), *Effective Schooling: Research, Theory, and Practice,* London, Cassell.

Scheerens, **J.**, **Vermeulen**, **C.** and **Pelgrum**, **W. J.** (1989), «Generalizability of instructional and school effectiveness indicators across nations», *International Journal of Educational Research*, 13 (7), pages 789-799.

Shavit, **Y.** and **Williams**, **R. A.** (1985), «Ability grouping and contextual determinants of educational expectations in Israel», *American Sociological Review*, 50, pages 62-73.

UNESCO (1998), *Primer estudio internacional comparativo*, Santiago de Chile.

UNESCO (2008), *Segundo estudio regional comparativo y explicativo*, LLECE, Santiago de Chile.

Willms, **J. D.** (1986), «Social class segregation and its relationship to pupils' examination results in Scotland», *American Sociological Review*, 51, pages 224-241.

Willms, **J. D.** (2006), *Learning Divides: Ten Policy Questions about the Performance and Equity of Schools and Schooling Systems*, Report for the UNESCO Institute for Statistics.

Willms, **J. D.** (2004), *Contextual Effects on Student Outcomes,* Paper presented at the Jacobs Foundation Conference on Educational Differences, Zurich.