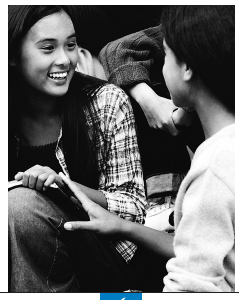

1

Programme for International Student Assessment: An Overview

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The OECD Programme for International Student Assessment (PISA) is a collaborative effort among OECD member countries to measure how well 15-year-old students approaching the end of compulsory schooling are prepared to meet the challenges of today's knowledge societies. The assessment is forward-looking: rather than focusing on the extent to which these students have mastered a specific school curriculum, it looks at their ability to use their knowledge and skills to meet real-life challenges. This orientation reflects a change in curricular goals and objectives, which are increasingly concerned with what students can do with what they learn at school.

PISA surveys take place every three years. The first survey took place in 2000 (followed by a further 11 countries in 2001), the second in 2003 and the third in 2006; the results of these surveys have been published in a series of reports (OECD, 2001, 2003, 2004, 2007) and a wide range of thematic and technical reports. The next survey will occur in 2009. For each assessment, one of the three areas (science, reading and mathematics) is chosen as the major domain and given greater emphasis. The remaining two areas, the minor domains, are assessed less thoroughly. In 2000 the major domain was reading; in 2003 it was mathematics and in 2006 it was science.

PISA is an age-based survey, assessing 15-year-old students in school in grade seven or higher. These students are approaching the end of compulsory schooling in most participating countries, and school enrolment at this level is close to universal in almost all OECD countries.

The PISA assessments take a literacy perspective, which focuses on the extent to which students can apply the knowledge and skills they have learned and practised at school when confronted with situations and challenges for which that knowledge may be relevant. That is, PISA assesses the extent to which students can use their reading skills to understand and interpret the various kinds of written material that they are likely to meet as they negotiate their daily lives; the extent to which students can use their mathematical knowledge and skills to solve various kinds of numerical and spatial challenges and problems; and the extent to which students can use their scientific knowledge and skills to understand, interpret and resolve various kinds of scientific situations and challenges. The PISA 2006 domain definitions are fully articulated in *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006* (OECD, 2006).

PISA also allows for the assessment of additional cross-curricular competencies from time to time as participating countries see fit. For example, in PISA 2003, an assessment of general problem-solving competencies was included. Further, PISA uses student questionnaires to collect information from students on various aspects of their home, family and school background, and school questionnaires to collect information from schools about various aspects of organisation and educational provision in schools. In PISA 2006 a number of countries[1] also administered a parent questionnaire to the parents of the students participating in PISA.

Using the data from these questionnaires, analyses linking contextual information with student achievement could address:

- Differences between countries in the relationships between student-level factors (such as gender and social background) and achievement;
- Differences in the relationships between school-level factors and achievement across countries;
- Differences in the proportion of variation in achievement between (rather than within) schools, and differences in this value across countries;
- Differences between countries in the extent to which schools moderate or increase the effects of individual-level student factors and student achievement;

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- Differences in education systems and national context that are related to differences in student achievement across countries;
- Through links to PISA 2000 and PISA 2003, changes in any or all of these relationships over time.

Through the collection of such information at the student and school level on a cross-nationally comparable basis, PISA adds significantly to the knowledge base that was previously available from national official statistics, such as aggregate national statistics on the educational programmes completed and the qualifications obtained by individuals.

PARTICIPATION

The first PISA survey was conducted in 2000 in 32 countries (including 28 OECD member countries) using written tasks answered in schools under independently supervised test conditions. Another 11 countries completed the same assessment in 2001. PISA 2000 surveyed reading, mathematical and scientific literacy, with a primary focus on reading. The second PISA survey, conducted in 2003 in 41 countries, assessed reading, mathematical and scientific literacy, and problem solving with a primary focus on mathematical literacy. The third survey covered reading, mathematical and scientific literacy, with a primary focus on scientific literacy, and was conducted in 2006 in 57 countries. In some countries it was decided to carry out detailed analysis of some regions. In these 24 sub-national regions sufficient data were collected and quality control mechanisms implemented at a level that would permit OECD endorsement of their results. The participants in PISA 2006 are listed in Table 1.1. This report is concerned with the technical aspects of PISA 2006.

Table 1.1
PISA 2006 participants

OECD countries	Partner countries/economies
Australia	Argentina
Austria	Azerbaijan
Belgium	Brazil
Canada	Bulgaria
Czech Republic	Chile
Denmark	Colombia
Finland	Croatia
France	Estonia
Germany	Hong Kong-China
Greece	Indonesia
Hungary	Israel
Iceland	Jordan
Ireland	Kyrgyzstan
Italy	Latvia
Japan	Liechtenstein
Korea	Lithuania
Luxembourg	Macao-China
Mexico	Montenegro
Netherlands	Qatar
New Zealand	Romania
Norway	Russian Federation
Poland	Serbia
Portugal	Slovenia
Slovak Republic	Chinese Taipei
Spain	Thailand
Sweden	Tunisia
Switzerland	Uruguay
Turkey	
United Kingdom	
United States	

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FEATURES OF PISA

The technical characteristics of the PISA survey involve a number of different challenges:

- The design of the test and the features incorporated into the test developed for PISA are critical;
- The sampling design, including both the school sampling and the student sampling requirements and procedures;
- The multilingual nature of the test, which involves rules and procedures designed to guarantee the equivalence of the different language versions used within and between participating countries, and taking into account the diverse cultural contexts of those countries;
- Various operational procedures, including test administration arrangements, data capture and processing and quality assurance mechanisms designed to ensure the generation of comparable data from all countries;
- Scaling and analysis of the data and their subsequent reporting. PISA employs scaling models based on item response theory (IRT) methodologies. The described proficiency scales, which are the basic tool in reporting PISA outcomes, are derived using IRT analysis.

Box 1.1 Core features of PISA 2006

Sample size

- Nearly 400,000 students, representing almost 20 million 15-year-olds enrolled in the schools of the 57 participating countries and economies, were assessed in 2006.

Content

- PISA 2006 covered three domains: reading, mathematics and science.
- PISA 2006 looked at young people's ability to use their knowledge and skills in order to meet real-life challenges rather than how well they had mastered a specific school curriculum. The emphasis was placed on the mastery of processes, the understanding of concepts, and the ability to function in various situations within each domain.

Methods

- PISA 2006 used pencil-and-paper assessments, lasting two hours for each student.
- PISA 2006 used both multiple-choice items and questions requiring students to construct their own answers. Items were typically organised in units based on a passage describing a real-life situation.
- A total of six and a half hours of assessment items was included, with different students taking different combinations of the assessment items.
- Students answered a background questionnaire that took about 30 minutes to complete and, as part of an international option, completed questionnaires on their educational careers as well as familiarity with computers.
- School principals completed questionnaires about their schools.

Outcomes

- A profile of knowledge and skills among 15-year-olds.
- Contextual indicators relating results to student and school characteristics.
- A knowledge base for policy analysis and research.
- Trend indicators showing how results change over time.

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This report describes the above-mentioned methodologies as they have been implemented in PISA 2006. Further, it describes the quality assurance procedures that have enabled PISA to provide high quality data to support policy formation and review. Box 1.1 provides an overview of the central design elements of PISA 2006.

The ambitious goals of PISA come at a cost: PISA is both resource intensive and methodologically complex, requiring intensive collaboration among many stakeholders. The successful implementation of PISA depends on the use, and sometimes further development, of state-of-the-art methodologies.

Quality within each of these areas is defined, monitored and assured through the use of a set of technical standards. These standards have been endorsed by the PISA Governing Board, and they form the backbone of implementation in each participating country and of quality assurance across the project.

MANAGING AND IMPLEMENTING PISA

The design and implementation of PISA for the 2000, 2003 and 2006 data collections has been the responsibility of an international consortium led by the Australian Council for Educational Research (ACER) with Ray Adams as international project director. The other partners in this consortium have been the National Institute for Educational Measurement (Cito Group) in the Netherlands, Unité d'analyse des systèmes et des pratiques d'enseignement (aSPe) at Université de Liège in Belgium, Westat and the Educational Testing Service (ETS) in the United States and the National Institute for Educational Research (NIER) in Japan. Appendix 8 lists the consortium staff and consultants who have made significant contributions to the development and implementation of the project.

The consortium implements PISA within a framework established by the PISA Governing Board (PGB) which includes representation from all participating countries at senior policy levels. The PGB established policy priorities and standards for developing indicators, for establishing assessment instruments, and for reporting results. Experts from participating countries served on working groups linking the programme policy objectives with the best internationally available technical expertise in the three assessment areas. These expert groups were referred to as Subject Matter Expert Groups (SMEGs) (*see* Appendix 8 for members). By participating in these expert groups and regularly reviewing outcomes of the groups' meetings, countries ensured that the instruments were internationally valid and that they took into account the cultural and educational contexts of the different OECD member countries, that the assessment materials had strong measurement potential, and that the instruments emphasised authenticity and educational validity.

Each of the participating countries appointed a National Project Manager (NPM), to implement PISA nationally. The NPM ensured that internationally agreed common technical and administrative procedures were employed. These managers played a vital role in developing and validating the international assessment instruments and ensured that PISA implementation was of high quality. The NPMs also contributed to the verification and evaluation of the survey results, analyses and reports.

The OECD Secretariat had overall responsibility for managing the programme. It monitored its implementation on a day-to-day basis, served as the secretariat for the PGB, fostered consensus building between the countries involved, and served as the interlocutor between the PGB and the international consortium.

ORGANISATION OF THIS REPORT

This technical report is designed to describe the technical aspects of the project at a sufficient level of detail to enable review and, potentially, replication of the implemented procedures and technical solutions to

problems. It, therefore, does not report the results of PISA 2006 which have been published in *PISA 2006: Science Competencies for Tomorrow's World* (OECD, 2007). A bibliography of other PISA related reports is included in Appendix 9.

There are five sections in this report:

- *Section One – Instrument design* (Chapters 1-4): Describes the design and development of both the questionnaires and achievement tests;
- *Section Two – Operations* (Chapters 5-7): Gives details of the operational procedures for the sampling and population definitions, test administration procedures, quality monitoring and assurance procedures for test administration and national centre operations, and instrument translation;
- *Section Three – Data processing* (Chapters 8-10): Covers the methods used in data cleaning and preparation, including the methods for weighting and variance estimation, scaling methods, methods for examining inter-rater variation and the data cleaning steps;
- *Section Four – Quality indicators and outcomes* (Chapters 11-14): Covers the results of the scaling and weighting, reports response rates and related sampling outcomes and gives the outcomes of the inter-rater reliability studies. The last chapter in this section summarises the outcomes of the PISA 2006 data adjudication; that is, the overall analysis of data quality for each country;
- *Section Five – Scale construction and data products* (Chapters 15-18): Describes the construction of the PISA 2006 levels of proficiency and the construction and validation of questionnaire-related indices. The final chapter briefly describes the contents of the PISA 2006 database;
- *Appendices*: Detailed appendices of results pertaining to the chapters of the report are provided.

Notes

1. The PISA 2006 parent questionnaire was administered in Denmark, Germany, Iceland, Italy, Luxembourg, New Zealand, Poland, Portugal, Korea and Turkey, as well as in the partner countries/economies Bulgaria, Colombia, Croatia, Hong Kong-China, Macao-China and Qatar.

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Reader's Guide

Country codes – the following country codes are used in this report:

OECD countries

AUS	Australia
AUT	Austria
BEL	Belgium
BEF	Belgium (French Community)
BEN	Belgium (Flemish Community)
CAN	Canada
CAE	Canada (English Community)
CAF	Canada (French Community)
CZE	Czech Republic
DNK	Denmark
FIN	Finland
FRA	France
DEU	Germany
GRC	Greece
HUN	Hungary
ISL	Iceland
IRL	Ireland
ITA	Italy
JPN	Japan
KOR	Korea
LUX	Luxembourg
LXF	Luxembourg (French Community)
LXG	Luxembourg (German Community)
MEX	Mexico
NLD	Netherlands
NZL	New Zealand
NOR	Norway
POL	Poland
PRT	Portugal
SVK	Slovak Republic
ESP	Spain
ESB	Spain (Basque Community)
ESC	Spain (Catalonian Community)
ESS	Spain (Castillian Community)
SWE	Sweden
CHE	Switzerland
CHF	Switzerland (French Community)
CHG	Switzerland (German Community)
CHI	Switzerland (Italian Community)
TUR	Turkey
GBR	United Kingdom
IRL	Ireland
SCO	Scotland
USA	United States

Partner countries and economies

ARG	Argentina
AZE	Azerbaijan
BGR	Bulgaria
BRA	Brazil
CHL	Chile
COL	Colombia
EST	Estonia
HKG	Hong Kong-China
HRV	Croatia
IDN	Indonesia
JOR	Jordan
KGZ	Kyrgyztan
LIE	Liechtenstein
LTU	Lithuania
LVA	Latvia
LVL	Latvia (Latvian Community)
LVR	Latvia (Russian Community)
MAC	Macao-China
MNE	Montenegro
QAT	Qatar
ROU	Romania
RUS	Russian Federation
SRB	Serbia
SVN	Slovenia
TAP	Chinese Taipei
THA	Thailand
TUN	Tunisia
URY	Uruguay

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List of abbreviations – the following abbreviations are used in this report:

ACER	Australian Council for Educational Research
AGFI	Adjusted Goodness-of-Fit Index
BRR	Balanced Repeated Replication
CBAS	Computer Based Assessment of Science
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CITO	National Institute for Educational Measurement, The Netherlands
CIVED	Civic Education Study
DIF	Differential Item Functioning
ENR	Enrolment of 15-year-olds
ESCS	PISA Index of Economic, Social and Cultural Status
ETS	Educational Testing Service
IAEP	International Assessment of Educational Progress
I	Sampling Interval
ICR	Inter-Country Coder Reliability Study
ICT	Information Communication Technology
IEA	International Association for the Evaluation of Educational Achievement
INES	OECD Indicators of Education Systems
IRT	Item Response Theory
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISEI	International Socio-Economic Index
MENR	Enrolment for moderately small school
MOS	Measure of size
NCQM	National Centre Quality Monitor
NDP	National Desired Population
NEP	National Enrolled Population
NFI	Normed Fit Index
NIER	National Institute for Educational Research, Japan
NNFI	Non-Normed Fit Index
NPM	National Project Manager
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
PPS	Probability Proportional to Size
PGB	PISA Governing Board
PQM	PISA Quality Monitor
PSU	Primary Sampling Units
QAS	Questionnaire Adaptations Spreadsheet
RMSEA	Root Mean Square Error of Approximation
RN	Random Number
SC	School Co-ordinator
SE	Standard Error
SD	Standard Deviation
SEM	Structural Equation Modelling
SMEG	Subject Matter Expert Group
SPT	Study Programme Table
TA	Test Administrator
TAG	Technical Advisory Group
TCS	Target Cluster Size
TIMSS	Third International Mathematics and Science Study
TIMSS-R	Third International Mathematics and Science Study – Repeat
VENR	Enrolment for very small schools
WLE	Weighted Likelihood Estimates

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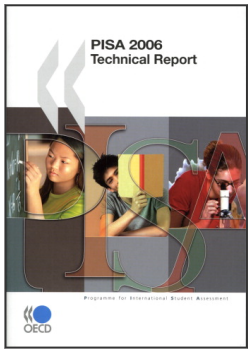

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