# APPENDIX A - BACKGROUND OF PISA

## The development of PISA surveys

Decisions about the scope and nature of the assessments and the background information to be collected are made by leading experts in participating countries, with the overall project being steered jointly by governments on the basis of shared, policy-driven interests. The frameworks for assessing scientific, reading and mathematical literacy in 2006 are described in full in *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006* (OECD, 2006a). Substantial efforts and resources are devoted to achieving cultural and linguistic breadth and balance in the assessment materials. Stringent quality assurance mechanisms are applied in translation, sampling and data collection. As a consequence, the results of PISA have a high degree of validity and reliability.

Although PISA was originally created by the governments of OECD countries, 27 partner countries and economies participated in PISA 2006 in addition to the 30 OECD countries, making a total of 57 participating countries.

## The PISA student population

PISA covers students who are aged between 15 years 3 months and 16 years 2 months at the time of the assessment and who have completed at least 6 years of formal schooling, regardless of the type of institution in which they are enrolled and whether they are in full-time or part-time education, whether they attend academic or vocational programmes, and whether they attend public or private schools or foreign schools within the country. The percentage of males and females in the samples in participating countries is shown in Table A. It can be seen that in most countries the percentages of males and females were very similar. The largest difference among OECD countries was in the Czech Republic where 56.6% of students in the sample were male. Among the partner countries and economies the largest differences were in Thailand (57.4% female) and in Chile (54% male).

In addition to reviewing the gender balance in the overall sample, it is important to consider the response rates of males and females, Previous analyses (Monseur, 2005) had shown differential response rates for males and females. In several countries, the difference between male and female response rate was greater than 2%. For instance, in Portugal, the response rate for males was 82.6% and for females 87.8%. As gender was found to be correlated with performance, particularly in reading literacy, a student non-response adjustment was developed for PISA which compensated for differential grade and gender response rates. All technical details of the design and implementation of PISA are included in the technical reports which are released after the release of the initial international reports - for an example see PISA 2006 Technical Report (OECD, 2009).

## Key features of PISA 2006

### *Content*

- Although the survey also covered reading and mathematics, the main focus of PISA 2006 was science, 2006 being the first occasion on which science was the major domain.
- The PISA 2006 survey also, for the first time, sought information on students' attitudes to science by including questions on attitudes within the test itself, rather than only through a complementary questionnaire.



EQUALLY PREPARED FOR LIFE? HOW 15-YEAR-OLD BOYS AND GIRLS PERFORM IN SCHOOL – ISBN 978-92-64-06394-5 – © OECD 2009

## Table A Percentage of males and females in each participating country's sample

| | | Males | | Females | |
|---|---|---|---|---|---|
| | | Percentage | S.E. | Percentage | S.E. |
| OECD | Australia | 51 | (1.4) | 49 | (1.4) |
| | Austria | 51 | (1.8) | 49 | (1.8) |
| | Belgium | 52 | (1.4) | 48 | (1.4) |
| | Canada | 50 | (0.6) | 50 | (0.6) |
| | Czech Republic | 57 | (1.9) | 43 | (1.9) |
| | Denmark | 50 | (0.8) | 50 | (0.8) |
| | Finland | 50 | (0.8) | 50 | (0.8) |
| | France | 49 | (1.3) | 51 | (1.3) |
| | Germany | 52 | (0.9) | 48 | (0.9) |
| | Greece | 50 | (1.0) | 50 | (1.0) |
| | Hungary | 52 | (1.9) | 48 | (1.9) |
| | Iceland | 50 | (0.8) | 50 | (0.8) |
| | Ireland | 49 | (1.1) | 51 | (1.1) |
| | Italy | 50 | (1.0) | 50 | (1.0) |
| | Japan | 50 | (2.4) | 50 | (2.4) |
| | Korea | 51 | (3.0) | 49 | (3.0) |
| | Luxembourg | 51 | (0.7) | 49 | (0.7) |
| | Mexico | 48 | (1.0) | 52 | (1.0) |
| | Netherlands | 51 | (0.9) | 49 | (0.9) |
| | New Zealand | 48 | (2.1) | 52 | (2.1) |
| | Norway | 52 | (0.7) | 48 | (0.7) |
| | Poland | 50 | (0.7) | 50 | (0.7) |
| | Portugal | 48 | (0.8) | 52 | (0.8) |
| | Slovak Republic | 51 | (1.7) | 49 | (1.7) |
| | Spain | 51 | (0.7) | 49 | (0.7) |
| | Sweden | 51 | (0.8) | 49 | (0.8) |
| | Switzerland | 52 | (0.8) | 48 | (0.8) |
| | Turkey | 55 | (1.9) | 45 | (1.9) |
| | United Kingdom | 50 | (1.0) | 50 | (1.0) |
| | United States | 51 | (0.9) | 49 | (0.9) |
| | **OECD average** | 51 | (0.2) | 49 | (0.2) |
| Partners | Argentina | 47 | (1.4) | 53 | (1.4) |
| | Azerbaijan | 52 | (0.9) | 48 | (0.9) |
| | Brazil | 46 | (0.8) | 54 | (0.8) |
| | Bulgaria | 52 | (1.8) | 48 | (1.8) |
| | Chile | 54 | (1.6) | 46 | (1.6) |
| | Colombia | 46 | (1.9) | 54 | (1.9) |
| | Croatia | 50 | (1.9) | 50 | (1.9) |
| | Estonia | 51 | (0.9) | 49 | (0.9) |
| | Hong Kong-China | 49 | (1.9) | 51 | (1.9) |
| | Indonesia | 51 | (2.1) | 49 | (2.1) |
| | Israel | 50 | (1.4) | 50 | (1.4) |
| | Jordan | 50 | (1.9) | 50 | (1.9) |
| | Kyrgyzstan | 47 | (0.8) | 53 | (0.8) |
| | Latvia | 49 | (0.7) | 51 | (0.7) |
| | Liechtenstein | 46 | (2.3) | 54 | (2.3) |
| | Lithuania | 51 | (0.7) | 49 | (0.7) |
| | Macao-China | 51 | (0.8) | 49 | (0.8) |
| | Montenegro | 52 | (0.6) | 48 | (0.6) |
| | Qatar | 51 | (0.1) | 49 | (0.1) |
| | Romania | 50 | (1.8) | 50 | (1.8) |
| | Russian Federation | 48 | (1.0) | 52 | (1.0) |
| | Serbia | 51 | (1.5) | 49 | (1.5) |
| | Slovenia | 50 | (0.7) | 50 | (0.7) |
| | Chinese Taipei | 52 | (1.5) | 48 | (1.5) |
| | Thailand | 43 | (1.4) | 57 | (1.4) |
| | Tunisia | 48 | (0.9) | 52 | (0.9) |
| | Uruguay | 49 | (0.9) | 51 | (0.9) |

Source: *OECD PISA 2006 Database.*



EQUALLY PREPARED FOR LIFE? HOW 15-YEAR-OLD BOYS AND GIRLS PERFORM IN SCHOOL – ISBN 978-92-64-06394-5 – © OECD 2009



### *Methods*

- Around 400 000 students participated in PISA 2006, representing about 20 million 15-year-olds in the schools of the 57 participating countries and economies.
- Each participating student spent two hours carrying out pencil-and-paper tasks. In three countries, some students were given additional questions via computer.
- PISA contained tasks requiring students to construct their own answers as well as multiple-choice questions. These were typically organised in units based on a written passage or graphic, of the kind that students might encounter in real life.
- Students also answered a questionnaire that took about 30 minutes to complete and focused on their personal background, their learning habits and their attitudes to science, as well as on their engagement and motivation.
- School principals completed a questionnaire about their school that included demographic characteristics as well as an assessment of the quality of the learning environment at school. In 16 countries parents of the students who participated in PISA also completed a questionnaire.

### *Outputs*

- A profile of knowledge and skills among 15-year-olds in 2006, consisting of a detailed profile for science, and an update for reading and mathematics.
- Contextual indicators relating performance results to student and school characteristics.
- An assessment of students' attitudes to science.
- A knowledge base for policy analysis and research.
- Trend data on changes in student knowledge and skills in reading and mathematics.

## The PISA 2006 science assessment framework

The establishment of an assessment in PISA begins with the creation of the assessment framework. The primary benefit of developing a framework for any assessment is improved measurement. Developing a framework also improves interpretability, allowing a better understanding of how performances differ. A framework provides a common language for discussing the definition and assumptions surrounding the domain. As mentioned in the introductory section of this report, the frameworks for assessing scientific, reading and mathematical literacy in 2006 are described in full in *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006* (OECD, 2006a). Further elaboration of the reading and mathematics assessment frameworks can be found in *Measuring Student Knowledge and Skills: A New Framework for Assessment* (OECD, 1999) and *The PISA 2003 Assessment Framework - Mathematics, Reading, Science and Problem Solving Knowledge and Skills* (OECD, 2003).

In addition to the competencies and knowledge domains (which are described earlier in this report), PISA frameworks also consider context as an important element. In keeping with the PISA orientation of assessing students' preparation for future life, the PISA 2006 science questions were framed within a wide variety of life situations involving science and technology, namely: "Health", "Natural resources", "Environmental quality", "Hazards" and "Frontiers of science and technology". These situations were related to three major contexts: personal (the self, family and peer groups), social (community) and global (life across the



EQUALLY PREPARED FOR LIFE? HOW 15-YEAR-OLD BOYS AND GIRLS PERFORM IN SCHOOL – ISBN 978-92-64-06394-5 – © OECD 2009

world). The contexts used for questions were chosen in the light of relevance to students' interests and lives, representing science-related situations that adults encounter. Almost daily, adults hear about and face decisions concerning health, use of resources, environmental quality, hazard mitigation, and advances in science and technology. The science contexts also align with various issues policy makers confront.

## Development of the science items in PISA 2006

PISA items are arranged in units based around a common stimulus. Many different types of stimulus are used including passages of text, tables, graphs and diagrams, often in combination. Each unit contains up to four items assessing students' scientific competencies and knowledge. In addition, for PISA 2006 about 60% of the science units contained one or two items designed to assess aspects of students' attitudes towards science. The terms "cognitive items" and "attitudinal items" are used to distinguish these two separate types of items.

There were 37 science units, comprising a total of 108 cognitive items and 31 embedded attitudinal items, representing approximately 210 minutes of testing time for science in PISA 2006. The same amount of time was allocated to the major domain for 2003 (mathematics), although there were no attitudinal items in the 2003 assessment.

The 108 science cognitive items used in the main study included 22 items from the 2003 assessment. The remaining 86 items were selected from a large pool of newly-developed items that had been tested in a field trial conducted in all countries in 2005, one year prior to the main study.

There were four item formats employed for the science cognitive items: simple multiple-choice, complex multiple-choice, short-response, and open-constructed response. The simple multiple-choice items had four responses from which students were required to select the best answer while complex multiple-choice items presented several statements for each of which students were required to choose one of two possible responses (yes/no, true/false, correct/incorrect, etc.). Short-response items required students to construct a numeric response within very limited constraints, or only required a word or short phrase as the answer. Open-constructed response items required more extensive writing than short-response items and frequently required some explanation or justification. In the past cycles of PISA a relationship between gender and item type had been identified. Each attitudinal item required students to express their level of agreement on a four-point scale with two or three statements expressing either interest in science or support for science. Each attitudinal item was formatted distinctively and appeared in a shaded box.



EQUALLY PREPARED FOR LIFE? HOW 15-YEAR-OLD BOYS AND GIRLS PERFORM IN SCHOOL – ISBN 978-92-64-06394-5 – © OECD 2009