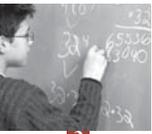


The Development of the PISA Context Questionnaires



OVERVIEW

In addition to the assessment of the achievement of 15-year-old students in reading, science, mathematics, and problem-solving skills, PISA 2003 also included the collection of information on the characteristics of students and their schools. This was done with the aim of identifying social, cultural, economic and educational factors that are associated with student performance. For this purpose student and school questionnaires were completed by the students and the principals of the sampled schools. In addition to a core student questionnaire, two internationally optional student questionnaires, the Information Communication Technology Familiarity and Educational Career questionnaires, were offered to participating countries. Using the data from these context questionnaires, analyses linking context information with student outcomes allows PISA to examine:

- Differences between countries in the relationships between student-level factors (such as gender and social background) and outcomes;
- Differences in the relationships between school-level factors and outcomes across countries;
- The proportion of variation in outcomes 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 outcomes;
- Characteristics of education systems and national contexts that are related to differences in student outcomes across countries; and
- Changes in any or all of these relationships over time.

The PGB requested that PISA 2003 portray important aspects of learning and instruction in mathematics, including the impact of learning and teaching strategies on achievement, as well as the impact of school organisation and structures in promoting active student engagement with learning. Furthermore, the PGB requested that PISA 2003 address issues related to mathematics efficacy and students' engagement, motivation and confidence with mathematics, mathematics and gender, and students' planned educational pathways. Finally, the quality of the school's human and material resources, issues of public/private control, management and funding, school level information on the instructional context and institutional structures were also considered important issues in PISA 2003.

To accomplish these goals, the following steps were taken:

- First, an organising framework was established that allowed the mapping of these policy issues against the design and instrumentation of PISA. The objective was to facilitate choosing research areas that combine policy relevance effectively with the strengths of the PISA¹ design.
- After a conceptual structure from which relevant research focus areas or themes could be established was identified, a set of criteria was developed for defining and operationalising the PGB's policy priorities within this conceptual structure.
- Third, proposals for potential thematic reports for PISA 2003 were outlined, with each proposal presenting a brief review of relevant literature, the specific policy questions the report could address, and how this would be operationalised in the PISA 2003 context questionnaires.



THE CONCEPTUAL FRAMEWORK

To facilitate a systematic approach to the organisation and prioritisation of research focus areas, the framework for the OECD education indicators (INES) was applied. The INES framework organises policy issues that might be considered in PISA by using two dimensions:

- The level of the education system to which the resulting indicators relate; and
- Whether they relate to outcomes or outputs, policy-amenable determinants of these outcomes or outputs or constraints at the respective level of the education system.

The INES framework considered four levels that related both to the entities from which data might be collected and to the recognition that national education systems are multi-levelled. The four levels are:

- The education system as a whole;
- The educational institutions and providers of educational services;
- The instructional setting and the learning environment within the institutions; and
- The individual participants in learning activities.

A differentiation between levels is not only important with regard to the collection of information, but also because many features of the education system play out quite differently at different levels of the system. For example, at the level of the students within a classroom, the relationship between student achievement and class size may be negative, if students in small classes benefit from improved contact with teachers. At the class or school level, however, students are often intentionally grouped such that weaker or disadvantaged students are placed in smaller classes so that they receive more individual attention. At the school level, therefore, the observed relationship between class size and student achievement is often positive (suggesting that students in larger classes perform better than students in smaller classes). At higher aggregated levels of education systems, the relationship between student achievement and class size is further confounded, e.g. by the socio-economic intake of schools or by factors relating to the learning culture in different countries. Past analyses, which have relied on macro-level data alone, have therefore sometimes led to misleading conclusions.

The second dimension in the organising framework further groups the indicators at each of the above levels (*i.e.* system, institutional, classroom or individual) under the following subheadings:

- *Output and outcomes of education and learning:* Indicators on observed outputs of education systems, as well as indicators related to the impact of knowledge and skills for individuals, societies and economies.
- *Policy levers and contexts:* Activities seeking information on the policy levers or circumstances that shape the outputs and outcomes at each level.
- *Antecedents and constraints:* Policy levers and contexts typically have antecedents, that is, factors that define or constrain policy. It should be noted that the antecedents or constraints are usually specific for a given level of the education system, and that antecedents at a lower level of the system may well be policy levers at a higher level (*e.g.* for teachers and students in a school, teacher qualifications are a given constraint while, at the level of the education system, professional development of teachers is a key policy lever).



This basic conceptualisation has been adapted from the conceptual framework for the Second IEA Study of Mathematics (Travers and Westbury, 1989; Travers *et al.*, 1989) and also provided a conceptual basis for the planning of context questionnaires in PISA 2000 (see Harvey-Beavis, 2002). Figure 3.1 shows the two-dimensional matrix of the four levels and the three aspects. Each cell also contains a description of data that were eventually collected in PISA 2003.

While this mapping is useful for describing the coverage of the PISA questionnaires, it is also important to supplement it with the recognition of the dynamic elements of the education system. All of the cells in the framework are linked, both directly and indirectly, and a range of important indicators that deal with the relations between the cells are central to the outcomes of PISA 2003. For example, analysing the impact of socio-economic background on student performance is directly concerned with the relationship between cells 9 and 1, and at the same time its further exploration is concerned with how data relating to cells 5 to 8 might influence this relationship.

Because PISA 2003 did not survey teachers, nor had intact classrooms as units of sampling, there are limits on the availability and relevance of data on some classroom contexts and antecedents, such as teacher characteristics and qualifications, and on classroom processes such as pedagogical practices and curriculum content (cells 2, 6 and 10). Any information on these aspects could only be collected either from students or at the school level. Therefore, the data collected on classroom processes (cell 6) refer to the classroom practices but are collected from students learning in different instructional settings across the school and can only be analysed at the student or school level.

Similarly, at the school level (cells 7 and 11), PISA focused on questions that were related to relatively broad and stable features such as school type, school structure, school resources, school climate and school management, most of which are known to have some impact on student's achievement, according to the school effectiveness literature (see Teddlie and Reynolds, 2000).

PISA 2003 did not include any activities that directly focused on collecting data at the national level as included in cells 8 and 12. A range of such data is however available from the OECD education indicators programme and can be included in the analysis of the database.

RESEARCH THEMES IN PISA 2003

To capitalise on the PISA design and to maximise the contributions PISA could make to the needs of policy makers and educators it was important to choose wisely from the wide range of possible policy-relevant research themes.

The definition and operationalisation of policy-relevant research areas for potential thematic reports was guided by the following requirements which were developed by OECD INES Network A:

- First, they had to be of enduring policy relevance and interest. A research focus area needed to have policy relevance, to capture policy makers' attention, to address their needs for data about the performance of their educational systems, to be timely, and to focus on factors that improve or explain the outcomes of education. Further, a theme had to be of interest to the public, since it is this public to which educators and policy makers are accountable.
- Second, the themes were to provide an internationally comparative perspective, and add significant value beyond that which can be accomplished through national evaluation and analysis. This implies that



Figure 3.1 ■ Mapping of PISA 2003 data to conceptual grid

	Column 1	Column 2	Column 3
	Outputs and outcomes of education and learning	Policy levers and contexts	Antecedents and constraints
Individual participants in education and learning	<p><i>Cell 1: Individual outcomes</i> <i>Student test data collected in 2003:</i></p> <ul style="list-style-type: none"> - Reading, mathematics and science literacy - Problem-solving skills <p><i>Student Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - Self-related cognitions in mathematics (self-efficacy, self-concept) - Motivational factors: interest in and enjoyment of mathematics - Educational expectations 	<p><i>Cell 5: Policy levers and contexts relating to individuals</i> <i>Student Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - Students' perception of school (student/teacher relations, sense of belonging, attitudes toward school) - Learning strategies and preferences - Instrumental motivation to learn mathematics - Emotional factors (mathematics anxiety) - Instructional time - Study time in mathematics and other subjects (homework, extension/remedial, tutoring, out-of-school classes, other activities) 	<p><i>Cell 9: Antecedents and constraints at the level of individuals</i> <i>Student Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - Home possessions - Parental education - Parental occupation - Family structure - Country of birth - Language spoken at home - Age and gender - Grade and study programme - Prior education (pre-schooling, entry age, retention)
Instructional settings	<p><i>Cell 2: Outputs and outcomes at the level of classrooms/ instructional settings</i></p>	<p><i>Cell 6: Policy levers and contexts at the level of classrooms/ instructional settings</i> <i>Student Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - Disciplinary climate in mathematics lessons (student perceptions) - Teacher support in mathematics lessons (student perceptions) - Use of textbooks in mathematics lessons (student perceptions) - Classroom size (student perceptions) 	<p><i>Cell 10: Antecedents and constraints at the level of classrooms/ instructional settings</i></p>
Education service providers	<p><i>Cell 3: Outputs and outcomes at the level of institutions</i> <i>Data available in 2003:</i></p> <ul style="list-style-type: none"> - Aggregates of cell 1 (literacy scores, motivation and self-related cognitions) 	<p><i>Cell 7: Policy levers and contexts at the level of institutions</i> <i>School Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - School resources (quality of human, educational and material resources, teacher and computer availability) - Admittance and grouping policies - Curricular practices (mathematics activities, student assessment, retention, instructional time, monitoring of teachers) - School climate (student/teacher behaviour, student/teacher morale) 	<p><i>Cell 11: Antecedents and constraints at the level of institutions</i> <i>School Questionnaire data collected in 2003:</i></p> <ul style="list-style-type: none"> - The type of school, its source of funding, its location and size (students and grade levels) - Language background of students - Responsibilities for decision making <p><i>Student Questionnaire data aggregated to the school level:</i></p> <ul style="list-style-type: none"> - Socio-economic background of students (intake)
The education system as a whole	<p><i>Cell 4: Outcomes at the level of the education system</i> <i>Data available in 2003:</i></p> <ul style="list-style-type: none"> - System-level aggregates of cell 1 - Equity related outcomes 	<p><i>Cell 8: Policy levers and contexts at the national level</i> <i>Data available in 2003:</i></p> <ul style="list-style-type: none"> - System-level aggregates from cell 7 - OECD data 	<p><i>Cell 12: Macro-economic and demographic context</i> <i>Data available in 2003:</i></p> <ul style="list-style-type: none"> - System-level aggregates from cell 7 - OECD data



themes needed to be both relevant (that is, of importance) and valid (that is, of similar meaning) across countries.

- Third, there had to be consistency in approach and themes with PISA 2000.
- Fourth, the implementation of a research focus area had to be technically feasible and appropriate within the context of the PISA design. That is, the collection of data about a subject needed to be technically feasible in terms of methodological rigour and the time and costs (including opportunity costs) associated with data collection.

The following proposals for thematic reports were elaborated for PISA 2003 in accordance with the priorities established by the PGB and the criteria outlined above:

- *School characteristics, organisation and structure*: PISA 2003 provided an opportunity to explore some key variables that might cause variance between schools. These variables were grouped into variables related primarily to the structure of schooling (ability grouping, segregation of schools, management and financing, school resources, size and location) and those related to the instructional context within schools (learning time, student support policies, school and classroom climate).
- *Teaching and learning strategies*: Theoretical and empirical research on teacher instructional practices, student learning strategies and the impact of such variables on student achievement is extensive. Given the design of PISA, which does not include a classroom level of analysis, priority was given to dimensions that might reasonably be considered as being pervasive characteristics of either the instructional context or of students' learning strategies.
- *Student engagement with mathematics*: Students' engagement with learning is crucial for the acquisition of proficiency, and is also an important outcome of education. Students' engagement refers to both students' active involvement in learning, and to students' beliefs about their own ability to succeed in a subject, motivation to learn a subject and emotional relationship with a subject, as well as their choice of learning strategies for a subject. This theme covers the following aspects of engagement with mathematics: Self-related cognitions, motivational preferences, emotional factors and behaviour-related variables.
- *Mathematics and gender*: Gender differences in achievement are ongoing equity related concerns in OECD countries, and as such, are central to PISA. Given the focus of PISA 2003 on mathematics this theme addresses gender differences in mathematics literacy, differences in mathematics-related attitudes and self-cognitions, and career expectations.
- *Students' educational career*: One of the challenges faced by educational systems is to ensure that, although learning takes place in collective settings (schools, classrooms), the individual needs of learners are served in an efficient way. This theme addresses issues related to how educational systems shape educational careers of students and to what extent they influence students' career expectations.
- *Use of and access to technology*: This theme is linked to the ICT familiarity international option and addresses issues such as the availability of ICT at schools, the students' familiarity (use, self-confidence and attitudes) and the role of ICT in the instructional context.
- *Family background and student performance*: Educational outcomes are influenced by family background in many different and complex ways. In particular, the socio-economic status of families has been consistently found to be an important variable in explaining variance in student achievement. This theme addresses the impact of socio-economic background, ethnicity (language and immigrant background) and family structure on student performance.



In the elaboration of these research areas, variables or constructs were identified which needed to be included in the context questionnaires. Table 3.1 details the major constructs and variables identified as important within each of these research themes. Some of these constructs or variables form the core of the questionnaire material, which remains unchanged across PISA cycles. The core component comprises questions about basic school or student characteristics and the students' socio-economic background.

Table 3.1 ■ Themes and constructs in PISA 2003

Research theme	Constructs (or variables)
School characteristics, organisation and structure	School size, location and funding Language background and school policies Quality of school resources (staff, educational material) Admittance policies Ability grouping Assessment practices Activities to promote engagement with mathematics Teacher morale Student morale Teacher behaviour Student behaviour Mathematics teacher agreement or dissent School autonomy in decision making Influence on decision making by school-related groups
Teaching and learning strategies	Learning strategies (memorisation, control, elaboration) Learning style preferences (co-operative, competitive) Classroom climate (disciplinary climate, teacher support)
Student engagement with mathematics	Mathematics self-efficacy Mathematics self-concept Mathematics anxiety Interest in and enjoyment of mathematics Instrumental motivation to learn mathematics Study time in mathematics
Mathematics and gender	Gender
Students' educational career	Pre-school attendance School entry age Grade repetition Expected educational level Retention rate at school
Use and access to technology	Use of and experience with computers Types of ICT use (Internet/entertainment, programme use) Self-confidence in ICT (routine, Internet, high-level) Attitudes toward computers Source of ICT knowledge Availability of computers at school
Family background and student performance	Immigrant background Language use Home possessions (cultural, educational) Parental occupation Parental education Family structure



THE DEVELOPMENT OF THE CONTEXT QUESTIONNAIRES

The development of questionnaire material was guided by the PGB priorities and their elaboration in the conceptual framework. Some of the questionnaire items used in PISA 2000 were retained: some because they were considered as a core part of the context questionnaires and will be included in each cycle, others because they were important for the analyses proposed as part of the research focus areas.

However, many of the constructs or variables were new, and were developed during the two years prior to the assessment. The new questionnaire material was developed in co-operation with international experts, the OECD and national centres.

After an initial phase of piloting questionnaire material in a few participating countries, to look at qualitative as well as some quantitative aspects of item responses, a final draft version of the material was presented to national centres. After extensive consultations with national centres, international centres and the OECD, two different student questionnaire versions and a school questionnaire were administered in a field trial in all participating countries. Each questionnaire version included, in addition to a set of common items, different questions plus common questions trial-tested with a different item format.

The questionnaires were trialled together with the achievement test in 2002 in all participating countries. The data analysis of the field trial data included the following steps:

- An examination of non-response and response patterns for the questionnaire items;
- A comparison of different item formats between the two versions of the questionnaire;
- Exploratory and confirmatory factor analysis to review the dimensional structure of questionnaire items and to facilitate the selection of constructs and items;
- An analysis of cross-country validity of both dimensional item structure and item fit (student-level data only); and
- A review of scaling properties for scaled items, using classical item statistics and IRT models.

Analyses of the field trial data were carried out in the second half of 2002 and a proposal of final questionnaire material for the main study was developed based on these results. The final selection of questionnaire material was made after an extensive review and consultations with national centres, international experts and the OECD. The selection process was principally based on the following criteria:

- Scaling properties of items used to measure constructs;
- Predictive validity of constructs;
- Cross-cultural appropriateness of the material; and
- Priority judgements about constructs and items in accordance with questionnaire framework and the policy issues set by the PGB.



THE COVERAGE OF THE QUESTIONNAIRE MATERIAL

Student Questionnaire

In the main study the student questionnaire was administered after the assessment and it took students about 35 minutes to complete. The questionnaire covered the following aspects:

- *Student characteristics*: Grade, study programme, age and gender.
- *Family background*: Family structure, employment status of parents, occupation of parents, education of parents, home possessions, number of books at home, country of birth for student and parents, language spoken at home.
- *Educational background of student*: Pre-schooling, primary school starting age, grade repetition, expected education, attitudes toward school in general.
- *Student reports related to the school*: Reasons for selecting school, student-teacher relations, sense of belonging to school, late arrivals at school, study time for all subjects (homework, school extension courses, out-of-school classes, tutoring, other study).
- *Students' learning of mathematics*: Interest in and enjoyment of mathematics, instrumental motivation to learn mathematics, mathematics self-efficacy, mathematics self-concept, mathematics anxiety, study time for mathematics (homework, school extension courses, out-of-school classes, tutoring, other study) and learning strategies in mathematics (memorisation, elaboration and control strategies).
- *Students' lessons in mathematics*: Instructional time (mathematics, overall), preference for learning situations (competitive, co-operative), classroom climate (teacher support, disciplinary climate).

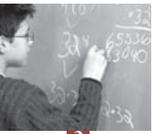
School Questionnaire

The main study school questionnaire was administered to the school principal and took about 20 minutes to complete. It covered a variety of school-related aspects:

- *School characteristics*: Community size, enrolment, ownership, funding and number of grade levels at school.
- *The school's resources*: Instructional time, quality of resources (staffing, educational material, infrastructure) and computers available at school.
- *The student body*: Student admittance criteria, student morale, language background of students, student behaviour and grade repetition.
- *Teachers in the school*: Staffing, monitoring of teachers, principal perceptions of consistent and shared goals among mathematics staff, teacher morale and teacher behaviour.
- *Pedagogical practices of the school*: Activities to promote student learning of mathematics, ability grouping, student assessments, use of assessments and foreign language courses.
- *Administrative structures within the school*: Responsibilities for decision making at school and bodies influencing decision making at school.

International options

As in PISA 2000, additional questionnaire material was developed and offered as international options to participating countries. In PISA 2003, two international options were available: the ICT Familiarity questionnaire and Educational Career Questionnaire.



Educational Career Questionnaire

The inclusion of an optional Educational Career questionnaire was due to the fact that not all of the participating countries expressed interest in this particular research area. National centres were allowed to select any of the items included in this questionnaire for inclusion without having to administer all of the questions. The completion of this questionnaire took about two minutes and covered the following aspects:

- *Past educational career:* Missing of school at primary and lower secondary level, change of school at primary and lower secondary level, change of study programme.
- *Present educational settings:* Difficulty level of current mathematics course or lessons, teacher marks in mathematics.
- *Expected occupation.*

Information Communication Technology Questionnaire

The Information Communication Technology (ICT) questionnaire consisted of questions regarding the students' use of, familiarity with, and attitudes towards ICT. ICT was defined as the use of any equipment or software for processing or transmitting digital information that performs diverse general functions, whose options can be specified or programmed by its user. The questionnaire was administered to students after the international student questionnaire (sometimes combined within the same booklet) and it took about five minutes to complete. It covered the following aspects:

- *Use of ICT:* Availability of computers, students' experience with computers and location of use, frequency of ICT for different purposes;
- *Affective responses to ICT:* Self-confidence with ICT (routine, Internet and high-level programming tasks), attitudes towards computers; and
- *Learning of ICT:* Sources of students' ICT and Internet knowledge.

National questionnaire material

National centres could decide to add national items to the international student or school questionnaire. Insertion of national items into the student questionnaire had to be agreed upon with the international study centre during the review of adaptations, due to context relatedness. Adding more than five national items was considered as a national option. National student questionnaire options, which took less than ten minutes to be completed, could be administered after the international student questionnaire and international options. If the length of the national options exceeded ten minutes, national centres were requested to administer their national questionnaire material in follow-up sessions.

THE IMPLEMENTATION OF THE CONTEXT QUESTIONNAIRES

In order to ensure that all questions were understood by 15-year-old students and school principals in all participating countries, it was necessary to adapt parts of the questionnaire material from the international source version to the national context. Such adaptations had to be carefully monitored so that the comparability of the collected data was not jeopardised. This is particularly important with questions that relate to the educational system such as educational levels, study programmes or certain school characteristics which differ in terminology across countries.



To achieve maximum comparability, a process was implemented during which each adaptation was reviewed and discussed by the international study centre and national study centres. To facilitate this process, national centres were asked to complete a questionnaire adaptation spreadsheet (QAS, see Appendix 8), where adaptations to the questionnaire material were documented.

Each adaptation had to be reviewed and agreed upon before the questionnaire material could be submitted for translation verification and the final optical check (see Chapter 5). The QAS also contained information about additional national questionnaire material and any deviation from the international questionnaire format, as well as the corresponding variable names in the national database, which was submitted after data collection.

Prior to the review of questionnaire adaptations, national centres had been asked to complete Study Programme Tables (SPT, see Appendix 5) in order to document the range of different study programmes that are available for 15-year-old students across participating countries. This information was used as a codebook to collect these data from school records and also assisted the review of questionnaire adaptations.

Information on parental occupation and the students' expected occupation was collected through open-ended questions. The responses were then coded according to the International Standard Classification of Occupations (ISCO) (ILO, 1990). Once occupations had been coded into ISCO, the codes were re-coded into the International Socio-Economic Index of Occupational Status (ISEI) (Ganzeboom *et al.*, 1992), which provides a measure of the socio-economic status of occupations comparable across the countries participating in PISA.

The International Standard Classification of Education (ISCED) was used as a typology to classify educational qualifications and study programmes. The ISCED classification was used to obtain comparable data across countries. Whereas this information was readily available for OECD member countries,² for partner countries extensive reviews of their educational systems in co-operation with national centres were necessary to map educational levels to the ISCED framework (see Appendix 6).

Notes

- 1 The questionnaire framework was not published by the OECD but is available as a project working document TAG(0303)4.doc
- 2 Partner countries are non-OECD member countries that participate in PISA.

