Second Information Technology in Education Study

SITES 2006 Technical Report

Edited by
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1. Technical Overview of SITES 2006

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1.1 Overview

The International Association for the Evaluation of Educational Achievement (IEA) has been conducting comparative studies for 50 years. SITES 2006 is the fifth wave of surveys related to information and communication technology (ICT), a wave that IEA started with its Computers in Education Study (two studies with data collection in 1989 and 1992), followed by the Second Information Technology in Education Studies (SITES), comprising SITES Module 1 (SITES-M1) and SITES Module 2 (SITES-M2).

SITES 2006 is an ambitious and demanding study, involving complex procedures for drawing samples, collecting data, and analyzing and reporting findings. The technical implementation of SITES 2006 resembles, to a large extent, the procedures used in IEA's past and present student achievement studies, such as TIMSS and PIRLS. However, the adult target populations, for instance, imply certain operational consequences and necessities. The SITES 2006 technical report therefore provides full documentation of the methodological and analytical implementation of the study, which produced the international database underlying the international report (Law, Pelgrum, & Plomp, 2008). To ensure that researchers can work effectively with the study's findings and data as well as confidently replicate the procedures used to produce the international report, the technical report is complemented by the SITES 2006 user guide (Brese & Carstens, 2009), which describes the structure, content, and proposed usage of the international database. The combination of all three publications consequently allows analysts to confidently replicate procedures and to accurately undertake new analyses in areas of special interest.

SITES 2006 has been managed by a consortium consisting (at the international level) of the University of Twente in Enschede, the Netherlands, the University of Hong Kong, the IEA Data Processing and Research Center (DPC) in Hamburg, Germany, and the IEA Secretariat in Amsterdam, the Netherlands. The international coordinating center (ICC) was located at the University of Twente. A steering committee and a sampling referee assisted this consortium. At the national level, the daily coordination of the study has been carried out by national research coordinators (NRCs), data managers, and their national center research staff. Appendix A gives the names and addresses of the key personnel involved in each of these functions.

The remainder of this chapter contains an overview of the main characteristics of SITES 2006. These are further elaborated in the subsequent chapters with respect to the technical, methodological, and analytical implementation of the study.

1.2 Background and Aims

Before IEA embarked on the SITES program in the late 1990s, it had already conducted two surveys on the use of computers in education. The first—Computers in Education (CompEd)—collected school-level data in 1989 in 22 education systems (18 countries and four provinces or regions) and was reported by Pelgrum and Plomp (1991, 1993). The second CompEd study, with data collection in 1992, had a longitudinal component to allow for study of the rapid developments in this area. It also included a student component, the first international Functional Information Technology (FIT) test, as well as questionnaires for students and teachers (Pelgrum, Janssen Reinen, & Plomp, 1993).

The SITES program, consisting of several modules, aims to foster our understanding of how ICT affects the way students learn in schools. The first module of SITES (SITES-M1), which was a school-based survey conducted in 1997, looked at the readiness of schools to integrate use of ICT in teaching and learning (Pelgrum & Anderson, 2001). This module was followed in 2001 by SITES-M2, which concerned 174 case studies of innovative pedagogical practices. The study examined and compared the characteristics of innovative pedagogical practices that employed technology as well as the factors associated with such innovations in different countries (Kozma, 2003). SITES 2006, the third project in this series, sought to identify what pedagogical practices teachers and schools of different education systems were applying and how they were using ICT in these practices. SITES 2006, designed as a survey of representative samples of schools (providing Grade 8 education) and of teachers of mathematics and science, focused on the following research questions:

- What are the pedagogical practices adopted in schools and how is ICT used in them?
- What and how is ICT used in specific situations where ICT has been used relatively extensively within the pedagogical practice?
- What teacher, school, community, and system factors are associated with different pedagogical approaches and ICT use, and can an explanatory model be identified?
- What system factors are associated with different pedagogical approaches and ICT use?

The study aimed to produce (i) international comparisons of various indicators, (ii) ICT in education policy recommendations, and (iii) in-depth analysis of how ICT influences teaching and learning processes.

1.3 Conceptual Framework Overview

The focus of SITES 2006 is on what happens in the classroom and how ICT is used in it. Consistent with the conceptual frameworks adopted in the previous two SITES studies (see Kozma, 2003; Pelgrum & Anderson, 2001), SITES 2006 takes the view that ICT-using pedagogical practices are part of the overall pedagogical practices of the teacher. For teachers, the reasons why and the ways in which they use ICT in the classroom are underpinned by their overall pedagogical vision and competence. However, pedagogical practices are not determined solely by the characteristics of the teachers, such as their academic qualifications and ICT-competence, but also by school- and system-level factors. While we can expect students' learning outcomes to be influenced by the pedagogical practices they experience, we need to acknowledge that the outcomes (whether perceived or actual) influence teachers' subsequent pedagogical decisions. This is because teacher-, school-, and system-level factors often have to change—or be changed—to accommodate the expected or actual impact of pedagogical practices on students.

Figure 1.1 presents the overall conceptual framework for the study. The concepts used in SITES 2006 relate to the four research questions for the study (see Section 1.2). To address these concepts, several sub-questions, deriving from different sources, were developed. These included:

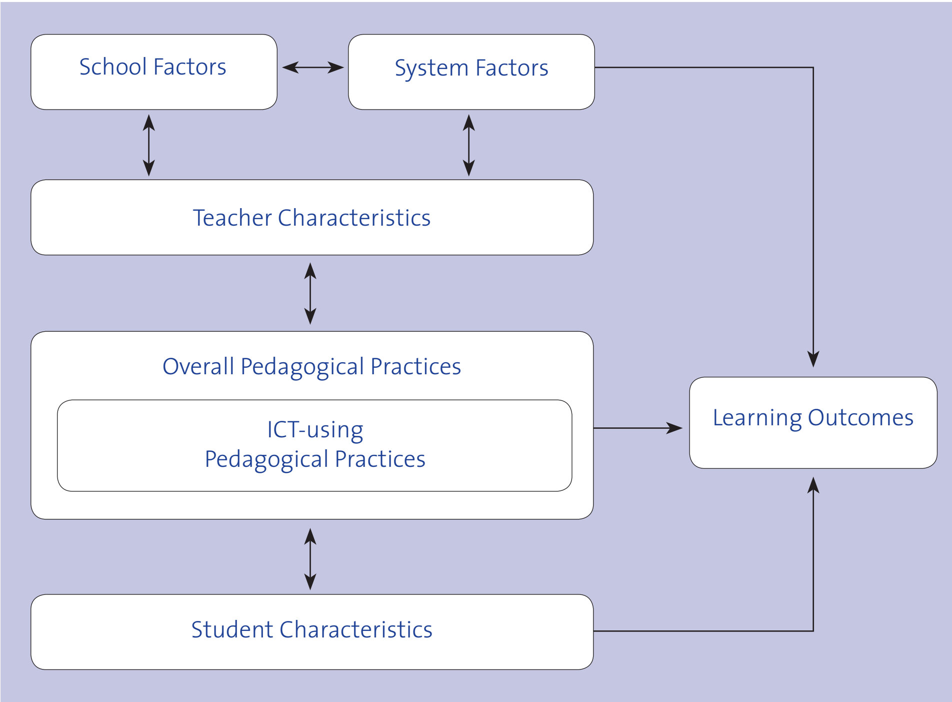
- Policy issues and concerns
- Findings from SITES-M2
- Recent national surveys and other research outcomes (see Chapters 3 and 4).

The study developed four questionnaires to collect information relevant to these concepts at system, school, and teacher level. Indicators for each of the concepts were thus operationalized in the questionnaire items.

Although this chapter provides a broad overview of the SITES 2006 framework, the respective chapters of the report describe in greater detail the conceptual elaboration, key reference literature, and the development process for each of these questionnaires. Thus:

- System level—national context questionnaire (Chapter 2)
- School level—principal and technical questionnaire (Chapter 3)
- Teacher level—teacher questionnaire (Chapter 4).

Figure 1.1: Overall Conceptual Framework for SITES 2006



1.4 Participating Education Systems

In total, 22 education systems from around the world participated in SITES 2006 (see Table 1.1). Of these, 15 had participated in SITES-M1.

Table 1.1: Education Systems Participating in SITES-M1 and SITES 2006

Education System	SITES–M1 Participation	SITES 2006 Participation
Alberta, Canada		•
Catalonia, Spain		•
Chile		•
Chinese Taipei	•	•
Denmark	•	•
Estonia		•
Finland	•	•
France	•	•
Hong Kong SAR	•	•
Israel	•	•
Italy	•	•
Japan	•	•
Lithuania	•	•
Moscow, Russian Federation		•
Norway	•	•
Ontario, Canada		•
Russian Federation	•	•
Singapore	•	•
Slovak Republic		•
Slovenia	•	•
South Africa	•	•
Thailand	•	•

1.5 Target Populations and Sample

SITES 2006 targeted a population of schools offering education to students at the SITES target grade, namely Grade 8, as well as mathematics and science teachers who were teaching this target grade within these schools. By default, a stratified probability sample of 400 schools (providing Grade 8 education) and two mathematics and two science teachers per participating school in each participating education system was selected.

Chapter 6 provides the technical details of the sampling design as well as population definitions. Chapter 10 gives information about the realized samples, sampling weights, and participation rates. Various appendices on sample allocation and stratification complement both chapters.

1.6 Instruments, Translation, and Verification

In addition to the questionnaire designed to collect national context information from the NRCs, the study included three other questionnaires. These were administered respectively to (i) school principals, (ii) school-based ICT coordinators, and (iii) mathematics and science teachers. These instruments were made available in international English to the NRCs, who were then responsible for translating them into their national language(s).

The IEA Secretariat organized a translation verification program that required professional translators to check the national versions against the English version (see Chapter 5 for details), both for the field trial phase as well as for the main study. This process was followed by a lay-out verification (again see Chapter 5), which was intended to check for any deviations from the international questionnaire layout and visual appearance.

1.7 Survey Operations and Data Collection

In 2005, the participating education systems adapted and translated the instruments, which were field-trialed in September and October 2005. The main data collection took place from February to May 2006 in the northern hemisphere and from August to November 2006 in the southern hemisphere.

The guidelines for these operations were documented in detail in manuals developed by the IEA Data Processing and Research Center (see Chapter 7). A specific feature of SITES 2006 is that it is the first IEA study to apply online data collection (ODC) as an international option, although countries and schools can use paper-and-pencil data collection as well. The ODC methodology worked well during the field trial (Brečko & Carstens, 2007; Carstens, Brese, & Brečko, 2007) and most of the participating countries elected to use it as the principal method of data collection during the main study. Chapter 8 presents the details.

Because a number of education systems experienced substantial problems with securing high levels of school and teacher participation, extended data collection periods were granted to nine systems. This process involved close consultation between the respective NRCs and the ICC. In these systems, data were collected from schools and teachers during the first few weeks of the following school year, but these respondents were asked to answer the questionnaire for the situation relating to the previous school year. As mentioned in Section 7.9, there were no indications that this extension option resulted in substantial response bias.

1.8 Data Processing, Analysis, and Reporting

After the data collection, the NRCs submitted data files (conforming to the international record layout) to the IEA DPC, where an intensive data cleaning took place. Chapter 9 describes this process in detail.

Next, the statistics, analysis, tables, and figures for the SITES 2006 international report were produced, with the authors taking into account the hierarchical structure of both the sample and the data. During this phase, tables and figures were generated and the calculation rules for composites were defined. As this was a phase prone to errors, the NRCs checked the outcomes several times over against their knowledge of the database and the national context. Extensive checks of the data analysis scripts took place in parallel under the auspices of the IEA DPC's Research and Analysis Unit.

The data analysis consisted of a descriptive part and an analytical part. For the description, tables and figures were created for single as well as composite items. The item-level statistics mainly concerned percentages and mean values that were estimated using the sampling weights added to the databases. The jackknife procedure was used to calculate standard errors (see Chapter 10); factor and reliability analyses were conducted for the composite indicators (see Chapter 11). Chapter 12 describes the standards and rules for reporting. Initial analyses were run within as well as between levels in order to address the third research question (see Section 1.2).

The international report for SITES 2006 (Law et al., 2008) presents the outcomes of the descriptive and analytical parts. Descriptive information regarding the national context, the school level, and the teacher level is followed by the outcomes of initial explorations using correlation and multilevel analyses. The final part of the report offers reflections and policy-relevant recommendations.

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2. National Context Questionnaire Development

Ronald E. Anderson
Tjeerd Plomp

2.1 Overview

National or country aspects sometimes account for elements of the education system and educational processes. The national context questionnaire (NCQ) was designed and administered to all national research coordinators (NRCs) in order to explore these possibilities.

This chapter begins by describing the structure and content of the questionnaire. This section is followed by a description of the data collection, coding, indicator development, and other items pertaining to the analysis.

2.2 Questionnaire and Analysis Framework

The NCQ addressed four principal topics:

- Education system structure and responsibilities
- Teacher preparation and pedagogy
- Recent changes in ICT and pedagogical policies
- System-wide policies and practices relating to the use of ICT.

Table 2.1 lists the final questionnaire items divided into these four groups. The questionnaire includes both open-ended and multiple-choice questions.

Given the emphasis of the SITES 2006 survey and its conceptual framework, the NCQ focused on system-related contextual variables, which were categorized into four spheres: (i) demographics, (ii) educational structure, (iii) pedagogy, and (iv) ICT. These variables were conceived as attributes of each education system or its associated regions (countries or provinces). Pedagogy and ICT in learning are, of course, processes occurring primarily at the classroom level. However, we can consider the general trends or patterns associated with these processes as characteristics of the overall system.

In addition to the questionnaire data, the analysis included demographic data obtained largely from the United Nations Development Programme or UNDP (2006). Other data sources included the Canadian Council on Social Development (2006), the Ministry of Education Taiwan (2007), and the UNESCO Institute for Statistics (2004). Most of the demographic statistics obtained were for the countries or provinces in the year 2004; however, a few were for the year 2003. These were the most recent reliable statistics that could be obtained in 2007. While the analysis utilized over 100 variables, the number of cases was only 22 (i.e., the number of education systems participating in SITES 2006). The analysis in the international report is therefore constrained to a single level—the education system level.

Table 2.1: Content of the SITES National Context Questionnaire (NCQ)

Question	Content Number	Description
A. Education System Structure and Other Characteristics		
1	Centralization	Government level at which policies on structure (overall organization) made
2	Centralization	Government level at which examinations implemented
3	Centralization	Government level where teacher certification requirements set
4	Centralization	Government level of main funding source for public schooling
5	Centralization	Share of schools at target grade funded by state or regional level
6	Centralization	Share of schools at target grade funded by local or district level
7	Centralization	Government level at which examinations implemented
8	Centralization	Government level where curriculum determined
9	Special education	Share of schools at target grade classified as "special education schools"
10	Target grade	Criteria for promotion from the target grade
11	Target grade	Number of subjects in target grade with standards; inclusion of mathematics, science, or mother tongue in standards
12	Target grade	System requirement for mathematics at target grade
13	Target grade	Mathematics emphasis on mastery, real life, communication, and ICT
14	Target grade	System requirement for science at target grade
15	Target grade	Science emphasis on mastery, real life, communication, and ICT
B. Teacher Preparation		
16	Teacher preparation	Degree requirements for teacher certification
17	Teacher preparation	ICT-specific requirements for teacher certification
18	Teacher preparation	Target grade teacher requirements for in-service or professional development
19	Teacher preparation topics	Government subsidizes in-service or other professional development on ICT
C. Change in Past Five Years		
20	Changes in last five years	Five-year trends in ICT spending, pedagogy, and assessment
21	Changes in last five years	Five-year trends different in target-grade schools?
22	Changes in last five years	Five-year trends different in mathematics and science?
D. System-wide Policies and Practices on Use of ICT		
23	ICT policies and practices	National or system-wide policy?
24	ICT policies and practices	Components (goals and policy types) of national ICT policy
25	ICT policies and practices	Approach to managing software and hardware
26/27	Language an obstacle	Is language an obstacle in ICT use for teaching and learning?
28	ICT skills program	Does system's target grade have program for ICT-related skills?
29	ICT and pedagogy	Does program include ICT with specific pedagogies?
30	21st-century skills policy	Does system have program for 21st-century skills?
31	Websites on ICT in education	List websites on ICT in education
32	Other relevant matters	Are there other relevant features of the education system?

2.3 Administration, Coding, and Missing Data

The NCQ was administered online to the NRCs of the participating education systems. The data collection period was September to December, 2006. The final data file was taken on 20 December 2006, by which time all of the NRCs had completed many if not all of the items. Estonia and Slovenia did not answer a number of questions in the second half of the questionnaire, but otherwise the responses were adequately thorough. Both countries later clarified their answers to most of the questions to form a reliable basis for analysis and reporting.

For each question the response alternatives were implicitly coded into numeric codes starting with “1” for the first category or checkbox, “2” for the second, and so forth. If responses to a question or question part were missing, then a code value of “9” was generally assigned. The exception was with two- or three-digit fields, in which case a “99” or a “999” was assigned.

The IEA Data Processing and Research Center (DPC) provided an initial data file in Excel format, coded as described above, and a final SPSS data file that included, after communication with the respective NRC and a review of the draft tables, augmented and supplemented data. Instances of non-response show as a “.” in the tables of Chapter 3 of the international report.

The full questionnaire with variable names can be obtained with the SITES 2006 data files and user guide. A version of the questionnaire without variable names is available as an online appendix to the international report at http://www.sites2006.net/appendix.

2.4 Indicator Development and Analysis

Table 2.2 lists the indicators used in the analysis. The first eight indicators are named with the letter “u” and the remaining named with the letter “q”. The eight “u” indicators were taken from the *Human Development Report 2006*, obtained from the UNDP (2006), except for those countries for which there were no available data. The data were based on 2004 information unless otherwise noted.

The remaining indicators are either original responses to the NCQ questionnaire or composites of these. The composites are all sum scores, except for one indicator, q4, which is based on an examination of the responses to Questions 4, 5, and 6. Responses to these questions determined if funding for education within each system came primarily from central sources, at the national or the provincial level, or from less centralized sources (i.e., lower, local levels).

The NCQ contained a qualitative component, which meant that the statistical procedures used for the school and teacher components were not appropriate for this component. Because of the nature of the sample and the variables, the analysis consisted mostly of univariate and bivariate tabulations. In a few instances, sum scores were calculated by simply adding the responses to several items.

Table 2.2: Definitions for Indicators Used in the Analysis

Indicator Name	Indicator Label
(u1)	Total population in millions
(u2)	Percentage of population in urban areas
(u3)	Gross domestic product (GDP) per person in US$
(u4)	Inequality measured by subtracting the income of bottom 10% from top 10% in US$
(u5)	Cellphone users are the number of users per 1,000 population in 2003
(u6)	Internet users are the number of users per 1,000 population in 2003
(u7)	"Education level" adds together the country literacy rate with the rate of gross enrolment from primary through tertiary systems
(u8)	"Educ.$" is the total public spending for education divided by the GDP
(q4)	Central funding combines responses from three NCQ questions (4, 5, & 6) by coding yes if the primary funding source was national or provincial; otherwise, it was coded no. Non-responses were coded "."
(q7)	Central control of curriculum components was based on question NCQ7. This item was coded yes if the country had central or provincial control of three or four curricular components, but coded no if control was over one or two components only
(q10)	Criteria for promotion of students in target grade to next grade: a = national examination; b = school internal examination; c = oral and/or written examinations throughout the school year; d = portfolio of student work; e = other
(q11)	Number of subjects with attainment standards for target grade (NCQ111): none; all school subjects; only some subjects
(q16)	Selection of teacher certification requirement options: 1 = postsecondary diploma and/or certification in education field; 2 = any postsecondary degree; 3 = any postsecondary degree plus certificate in education; 4 = other; 5 = requirements defined at local level only
(q17)	ICT-specific requirements for certification: a = none; b = technical competence; c = subject teaching with ICT; d = ICT-based pedagogy; e = others; f = requirements defined at local level only
(q18)	Sum of in-service or professional development components required of teachers (out of seven), based upon question NCQ181, items a–g
(q19)	Government subsidy of in-service or professional development for teachers in: a = ICT skills; b = use of ICT in subjects; c = use of ICT in administration; d = use of ICT for new approaches in learning
(q20a)	The Index of Increased Spending for ICT is the sum of a series of seven questions that asked if each of seven types of ICT spending had decreased or increased in the past five years (NCQ201, items b–h)
(q20j)	Increased New Pedagogical Practices is the sum of the series of six questions that asked if each of seven aspects of non-traditional practices had decreased or increased during the past five years (NCQ201, items j–o). Item 201 was not included in this scale
(q24)	Number of ICT Policy Aspects is the sum of 11 questions (NCQ24) on each of 11 components (items a–k) of ICT policy
(q25)	Provision of Hardware/Software is directly derived from the choices to question NCQ25, which asked schools how they fund and acquire their hardware and software
(q26)	Language as an ICT Obstacle is directly derived from NCQ26
(q28)	ICT Skills at Target Grade is based on the answers to NCQ28 about the presence of a system-wide program on students' ICT-related skills
(q29)	The Number of New Pedagogies Using ICT sums responses to question NCQ29 (items b–f)
(q30)	21st-century Skills Policy is the answer to question NCQ30, which focused on the presence or otherwise of system policy documents mentioning the promotion of 21st-century skills

Note: See Tables 3.1–3.4 of Chapter 3 of the SITES 2006 international report (Law, Pelgrum, & Plomp, 2008), pp. 44–55.

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3. School-level Questionnaire Development

Willem Johan Pelgrum

3.1 Overview

Two questionnaires were used at the school level. The first questionnaire, the "principal questionnaire," was for school principals. The second, the "technical questionnaire," was for persons, usually ICT coordinators, conversant with technology aspects at the school.

This chapter describes the overall framework, the development process, and the final content of the school-level questionnaires.

3.2 Concepts Addressed in the School-level Questionnaires

Although, according to the conceptual framework presented in Chapter 1, the concepts at the school level were primarily intended for explanatory purposes, many of the school-level indicators had a descriptive value in themselves. For instance, the school-level data allow calculation of indicators concerning the availability of hardware (e.g., the student–computer ratio). These indicators have been, for many years, the core of ICT surveys and are of high political interest. However, as stated in Chapter 1, the school-level concepts in particular were intended to provide an explanatory context for the teacher-level concepts. Table 3.1 contains an overview of the concept-domains addressed in the two school-level questionnaires.

Several sources constituted the basis for conceptualizing and operationalizing the school-level indicators. Among them were:

- *The teacher questionnaire:* operationalizations of indicators on vision, support, and organization and management mirror comparable indicators used in the teacher questionnaire. (See Chapter 4 for the rationale and literature references that constituted the background of the teacher questionnaire.)
- *Previous assessments regarding ICT at the international level* (Pelgrum & Anderson, 2001) *as well as at the national level* (e.g., the Dutch ICT monitor: Sontag, van Haaf, van der Linden, & Meijs, 2004): In particular, indicators regarding ICT infrastructure were copied from SITES–M1 and, where needed, updated in order to reflect the latest technology innovations (e.g., electronic whiteboards). The indicator on the presence of lifelong learning was also copied from SITES-M1.
- *Previous research on ICT in education:* BECTA (e.g., Jones, 2004; Scrimshaw, 2004) was a good source in terms of allowing summaries of earlier research findings (e.g., Bradley & Russell, 1997; Cuban, 1999; Lee, 1997; Pina & Harris, 1993) with regard to technical support, amount and quality of teacher training, willingness to change, and school leadership.

Table 3.1: Concepts Addressed in the School-level Questionnaires

Concept(s)	Description
Infrastructure	• Availability of ICT hardware (types of computers, local area network, internet connections, electronic whiteboards, etc.) • Availability of ICT software (general and subject-specific software, learning management systems, assessment tools, etc.) • Infrastructure needs • Problems
Pedagogical practice	• Extent to which lifelong learning practices are present in the school
Vision	• The vision of the school management with regard to pedagogy and ICT and covering three dimensions: traditional, lifelong learning (LLL), and connectedness
Staff development	• Encouragement extended to or requirements for teachers to acquire knowledge and skills with regard to pedagogical practices and the use of ICT • Priorities that school leadership gives to acquiring competencies • Ways that teachers in the school have acquired knowledge and skills for using ICT in teaching and learning • Availability (school-based and/or externally) of ICT-related courses
Support	• Persons involved in providing support and time-expenditure • Extent to which pedagogical support is available for teachers • Extent to which technical support is available for teachers
Organization and management	• Role of principals in initiating changes • Decisionmaking responsibilities • Management of change • Stimulation of cooperation between teachers • Promotion of alternative assessment practices

- *Theories about educational change:* for example, Fullan (1993).
- *The needs and expertise of the NRCs:* during the concrete elaboration and operationalization of the instruments, NRCs offered valuable suggestions for wording of questions and answer options, based on their experiences in this domain of the study and their cultural background.

The concepts that were operationalized in the school questionnaires constituted the basis for the construction of statistical indicators. These are described in more detail in Chapter 11.

3.3 Questionnaire Development Process

Construction of the school-level questionnaires involved several steps:

i) The initial (draft) version was developed by the consortium led by the University of Twente on the basis of the project description included in the original tender.

ii) The draft version was distributed to the NRCs to review in February 2005, well ahead of the first NRC meeting. This scheduling meant that the NRCs could study both the conceptual framework and the corresponding draft school-level questionnaires. During the meeting, participants contributed additional concepts, examples of operationalizations, and improvements to the proposed questions.

iii) The draft version for the field trial took into account the suggestions made during the NRC review and was subsequently reviewed and commented on by the members of the consortium and the steering committee in April 2005.

iv) The resulting comments and suggestions were used to inform preparation of the second draft for the field trial, and this draft was also sent to the NRCs for review. The draft was accompanied with background documents describing in detail the actions taken in relation to the suggestions made at the first NRC meeting.

v) After the field trial text had been copyedited (this work was organized by the IEA Secretariat) and laid out by the IEA DPC, the final version of it was sent to the NRCs in May 2005 for translation, followed by national and international translation verification, international layout verification, and field trial data collection.

vi) The draft version for the main study was revised on the basis of field trial data available in October/November, 2005. The consortium then performed exploratory data analysis, including, but not limited to, the inspection of distributions, analysis of missing data, factor analyses, reliability analyses, and initial correlation analyses. The consortium identified and proposed, after consulting with the SITES steering committee, a list of main findings and changes per questionnaire item. The main study draft and the list were made available to the NRCs and intensively discussed during the second NRC meeting in December 2005.

vii) The main study questionnaires were discussed and finalized by the consortium and steering committee, who took into account, wherever possible, the feedback and discussions from the NRC meeting. The questionnaires were sent to the NRCs in January 2006 after copyediting by the NRC of the Province of Alberta, Canada, and formatting and final layout by the IEA DPC.

viii) As shown in the description above, the instrument development was a collaborative process in which the consortium took the lead by creating a first version of the questionnaires and in which the NRCs and the steering committee consecutively played an essential role during the further development and finalization on the basis of the conceptual framework.

Table 3.2 summarizes the key dates and activities of this development.

Table 3.2: Overview of the Instrument Development Process for the School-level Questionnaires

Dates	Activities
September to November 2004	• Initial item development
December 2004	• First steering committee meeting
February to April 2005	• First NRC meeting (Enschede, the Netherlands) • Second steering committee meeting • Revision of school-level questionnaires based on input received from NRCs
May to August 2005	• Finalization of questionnaires for the field trial • Field trial instruments to NRCs for translation and subsequent operations
August to October 2005	• Field trial (17 countries)
November to December 2005	• Analysis of field trial results and draft recommendations on revision of questionnaires for NRC meeting
December 2005	• Second NRC meeting (Phuket, Thailand) • Third steering committee meeting • Review of field trial findings and finalization of recommendations on main study instruments
January 2006	• Finalized MS questionnaires to NRCs

3.4 Contents of the Main Study School-level Questionnaires

The final version of the questionnaire for school principals contained 34 questions, covering 222 variables. The final version of the technical questionnaire contained 19 questions, addressing 115 variables. On the basis of the field trial results and feedback, the consortium estimated that the questionnaires would take approximately 30 to 45 minutes to complete.

Table 3.3 contains a description of the content of the questionnaire for school principals, while Table 3.4 contains a description of the content of the questionnaire for ICT coordinators.

Table 3.3: Content of the Main Study Questionnaire for School Principals

Question Number	Question Content	Description
1	Presence of pedagogical practices	Twelve statements about pedagogical practices Note: this question overlaps with SITES-M1
2	Pedagogical vision	Ten statements related to pedagogical goals
3	ICT vision	Ten statements about the importance of ICT use
4	Organization: cooperation	Five statements about the school leadership's encouragement of ICT use
5	Organization: school policy	Twelve statements about policy actions taken by the school
6	Infrastructure: priorities	Eleven statements about priorities for infrastructure
	Staff development: priorities	Staff development, and organizational measures to stimulate ICT use
7	Organization: change management	Eleven statements related to several aspects of change management (re-allocating workloads, internal communication)
8	Organization: change management	Eleven statements about the extent to which the school leadership promoted active ways of student learning
9	Organization: change management	Nine statements about the extent to which the school leadership undertook action to promote internal communication
10	Organization: change management	Four statements about the extent to which the school leadership encouraged cooperation among teachers (inside and outside the school)
11	Organization: change management	Eight statements about the extent to which the school leadership encouraged the use of traditional and alternative forms of assessment
12	Staff development: requirements	Ten statements about competency areas in which teachers are encouraged or required to acquire knowledge and/or skills
13	Staff development: needs of school leaders	Ten statements about priority areas in which the school leadership needs to acquire competencies
14	Support: pedagogical	Types of persons who provide (frequency) pedagogical support
15	Support: pedagogical	Statements about extent to which pedagogical support is available for six different teaching/learning activities
16	Infrastructure: obstacles Staff development: obstacles Other obstacles	Extent to which school leaders perceive 15 obstacles as seriously hindering the school's capacity to realize its pedagogical goals

Table 3.3: Content of the Main Study Questionnaire for School Principals (contd.)

Question Number	Question Content	Description
17	Organization: grouping	Four statements about extent to which students are grouped in the school
18	Organization: flexibility	Five statements about extent to which student groups are fixed and/or flexible
19	School characteristics: size	Number of boys and girls enrolled in the school
20	School characteristics: grade coverage	The highest and lowest grades in the school
21	School characteristics: urbanization	Area in which the school is located
22	School characteristics: absenteeism	Percentage of students absent on a typical school day
23	School characteristics: student body	Percentage of native speakers at school
24	School characteristics: experience of innovation	Recent involvement of school in six types of innovation
25	School characteristics: locus of control	Inquiry about the primary responsible agency/person (four options) for six decisionmaking areas
26	Principal background: innovation involvement	Eight statements about the involvement of the school principal in initiating change
27	Principal: experience	Number of years of experience of the school principal
28	Principal: age	Age of the principal (five intervals)
29	Principal: gender	Gender of the principal
30	Principal: funding involvement	Four statements about the principal's involvement in raising ICT-funds for school
31	Principal: use of ICT	Frequency with which the principal personally used a computer
32	Principal: use of ICT	Ten statements about the type of activities for which the principal used a computer
33	Principal: home access	Question about access to computer at home
34	Principal: home use	Two statements about how principal used the computer at home

Table 3.4: Content of the Main Study Questionnaire for ICT Coordinators

Question Number	Question Content	Description
1	Use of ICT: number of years	Number of years school has been using ICT for teaching and learning
2	Use of ICT: stage	Where school fits within five stages of ICT introduction
3	Use of ICT: subjects	Frequency of use by students of ICT in six school subjects
4	Infrastructure: software Infrastructure: hardware types	Inquiry about need for and availability of seven software types, four hardware types, and mail accounts for teachers and/or students
5	Infrastructure: quantity	Open questions about number (for students in grade range and total, for teachers only, administration only) and type of computers (internet-connected, LAN-connected, multimedia) available in the school
6	Infrastructure: quantity	Number of laptops in the school

Table 3.4: Content of the Main Study Questionnaire for ICT Coordinators (contd.)

Question Number	Question Content	Description
7	Infrastructure: sundries	Number of PDAs, graphic calculators, smart-boards, and beamers available in the school
8	Infrastructure: student-owned	Percentage of students bringing their own PDAs, graphic calculators, and laptops to school
9	Infrastructure: location	Location of computers
10	Organization: maintenance	Types of persons involved in maintenance
11	Staff development: availability	Types of channels (list of 10) through which staff development takes place
12	Staff development: providers	Internal and/or external availability of seven types of courses
13	Characteristics of respondent	Which of six positions the respondent holds
14	Characteristics of respondent	Duties (list of six) of respondent
15	Support: availability	Number of hours per week by eight different types of person
16	Support: availability	Eleven statements about teaching/learning activities for which a certain extent of technical support is available
17	Obstacles	See principal questionnaire item 16
18	Coordinator: home access	Question about respondent's access to computer at home
19	Coordinator: home use	Two statements about how technology coordinator uses computer

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4. Teacher Questionnaire Development

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4.1 Overview

A key focus of the SITES 2006 survey has been to gain an overall understanding of teaching and learning practices at the lower secondary level in schools around the world, how ICT is used in them, and what factors are associated with various pedagogical practices and ICT use. The SITES research consortium assumed that pedagogical practices and ICT use in a specific curriculum context (i.e., for a given subject at a particular level in a specific classroom) are affected by teachers' characteristics, school-level factors, and system-level factors, as well as by the characteristics of the students involved. It is also assumed that the pedagogical practices and the students' characteristics interact to give rise to different learning outcomes. Teachers' pedagogical practices and the use of ICT in them therefore lie at the heart of the study.

The core component of the teacher questionnaire was designed to collect information about these practices as well as to identify the system factors associated with different approaches and ICT use. The last part of the teacher questionnaire (Section VIII) was designed to examine in-depth descriptions from teachers of their satisfying experiences when using ICT in "micro-pedagogical contexts." This exploratory part of the study was conducted as an international option; its design and findings are reported in full in Chapter 7 of the international report (Voogt, 2008).

This chapter focuses on the design and development of the core component of the teacher questionnaire, that is, Sections I to VII.

4.2 Concepts Addressed in the Teacher Questionnaire

An important purpose of SITES has been to investigate the characteristics of teachers' pedagogical practices and ICT use, as well as how these are related. The SITES-M2 findings indicated that curriculum goals, the roles played by teachers (as reflected by their practices), and the roles played by students relative to their learning practices are the three aspects most indicative of the pedagogical approach of the teacher.

Three sets of *core indicators* on pedagogical orientation were therefore developed, namely the curriculum goal orientation, the teacher practice orientation, and the student practice orientation. These indicators were constructed on the basis of the teachers' responses to questions on the relative importance of a range of curriculum goals and the relative frequency of occurrence for a range of teacher and student activities respectively. In addition, for each item on the list of teacher and student activities, teachers were asked to indicate whether ICT had been used in those activities. This latter set of responses was used to compute two further sets of *core indicators* for the pedagogical orientation of (respectively) teacher and student practices involving ICT use. An additional core indicator was whether the teacher had actually used ICT at all with the target class within the school year during which the survey was conducted.

To provide a comprehensive picture of classroom situations, in addition to the core indicators, further survey questions were designed in the teacher questionnaire to provide indicators on

- The methods of organizing teaching and learning
- The location and time when teaching and learning occurred
- The learning resources (including traditional and digital) used
- Assessment practices
- Whether ICT had been used with the target class.

Those teachers who had used ICT with the target class were asked to assess the perceived impact of pedagogical ICT use on themselves and on their students. Teachers were also asked about the degree of priority the school accorded use of ICT in their teaching in the following academic year. These indicators are referred to as *supplementary indicators*.

Several personal and contextual factors can influence teachers' pedagogical ICT use. Personal factors include:

- Demographic background (age, gender, academic and professional qualification, and professional experience)
- Technical competence and competence in using ICT for pedagogical purposes
- Teaching philosophy/pedagogical beliefs and rationale for using ICT.

Contextual factors include:

- Teachers' reported availability and participation in ICT-related professional development activities
- Teachers' perceptions of obstacles to using ICT in their teaching
- Teachers' perceived presence of a community of practice in their respective schools.

Indicators derived from the questions relating to these personal and contextual factors provide *explanatory indicators* for the study because they aid the development of an explanatory model for teachers' pedagogical ICT use.

One important assumption underpinning the design of the study is that teachers' decisions on which forms of ICT to use in their teaching and how to use these depend not only on the school subject taught but also on the characteristics of the students they teach. Hence, the research consortium considered it very important in terms of questionnaire design that when the teachers answered the questions related to the core and supplementary indicators, they were quite clear that their answers had to refer to a specific class that they were teaching in the school year during which the survey was conducted. A target class accordingly was identified for each of the teachers sampled in the study (also see Section 4.3), and the teacher questionnaire was developed so that it began with questions about the target class. These questions included demographic information (number of students in the class, gender mix, academic track, percentage of absenteeism, and percentage of students who are native speakers of the language of instruction), students' ICT skills, and students' access to ICT outside of the school.

Table 4.1 summarizes the core supplementary and explanatory indicators that constitute the framework for the teacher questionnaire. The design of the teacher questionnaire was also informed by an extensive literature review of various national and international studies on teachers' practices using ICT. Table 4.1 therefore also provides the key references that informed the development of the questionnaire.

Table 4.1: Summary of Indicators, Concepts, Key Literature, and Question Numbers in the Core Component of the Main Study Teacher Questionnaire

Type of Indicators	Concepts		Key Literature	Question Number
Core	Curriculum goal orientation		Becker and Anderson (1998); Kozma and McGhee (2003); Law et al. (1999, 2003)	8
	Teacher practice orientation		Henke et al. (1999); Kozma and McGhee (2003); Law et al. (2003); Mullens and Gayler (1999)	14
	Student practice orientation		Kozma and McGhee (2003); Law et al. (1999, 2003)	16
Supplementary	Organization of teaching and learning activities	Teaching methods	Kozma and McGhee (2003); Law et al. (2003)	9
		Separation of teachers and learners in spatial locations and time for teaching and learning activities	Law et al. (2003)	10, 11, 12, & 13
	Learning resources and ICT used		Kozma and McGhee (2003); Law et al. (1999, 2003)	17
	Assessment practices		Henke et al. (1999); Kozma and McGhee (2003); Law et al. (2000, 2003)	15
	Impact of ICT use on teachers and students		Becker and Anderson (1998); Law et al. (2003)	19, 20
Explanatory	Teacher characteristics	Technological and pedagogical competence	Becker and Anderson (1998); Law et al. (1999)	21
		Teacher's pedagogical vision of ICT use in near future	Law et al. (1999)	22
	Teacher perceptions of contextual factors	Obstacles to ICT use as perceived by teachers	Becker and Anderson (1998); Law et al. (1999)	23
		Participation and intention to attend professional development activities	Becker and Anderson (1998); Law et al. (1999)	24
		Presence of various aspects of community of practice in school	Dexter and Anderson (2002); Dexter, Seashore, and Anderson, (2002); Geijsel et al. (2001)	25, 26, 27, & 28
	Student characteristics	Demographic information about the target class: class size, gender mix, curriculum track, absenteeism, mother tongue in relation to medium of instruction, contact hours per week, and students' ICT skills	n/a	1–7

The remainder of this section gives a detailed description of the key aspects of the design for the main components of the teacher questionnaire.

4.2.1 Pedagogical Practice and ICT Use

SITES 2006 built on the design considerations and findings of the previous two SITES modules in developing a framework for categorizing and comparing pedagogical practices. The terms "emerging paradigm" and "innovative practices" embody a strong focus on change. One important aspect of change in this context concerns the policy goals that underpin the system-level support given to ICT use in schools. While these goals may differ across countries because of different priorities given to educational goals, one common goal that has emerged in recent years in many policy documents/education master plans is the use of ICT to support national education reform efforts aimed at preparing students for the challenges of the 21st century (Pelgrum & Law, 2003).

As the world moves toward a global and knowledge-based economy, many societies are experiencing changes in the ability profile of their human resources (Riel, 1998). The reform goals of these societies now focus less on learners' specific knowledge and/or skills and more on their metacognitive and affective qualities (see, for example, Danish Ministry of Education, 1997; Education and Manpower Bureau HKSAR, 1998; Singapore Ministry of Education, 1997). Metacognitive qualities include creative thinking, lifelong learning abilities, and ability to cooperate and communicate. Affective qualities include a sense of social responsibility, which encompasses value judgments and behavioral norms in cyberspace, and readiness to understand other cultures and lifestyles.

4.2.2 Emergent Practices and Pedagogical Approaches

When considering the existing literature on ICT in education and how ICT use in an industrialized society differs from that in an information society, we have at hand several ways of describing the desired features of classrooms in the 21st century.

SITES-M1 and SITES-M2 used the term *emerging pedagogy* (as opposed to *traditionally important pedagogy*) to describe the consensus on desirable learner characteristics and learning contexts that seem to be emerging. These include students' increasing autonomy in determining learning goals and learning strategies, and the presence of more open-ended authentic problem contexts for enquiry-based learning and learning in collaborative teams. Both the SITES-M1 and SITES-M2 results (Kozma, 2003; Law, Chow, & Yuen, 2005; Law, Yuen, Ki, Li, & Lee, 2000; Mioduser, Nachmias, Tubin, & Forkosh-Baruch, 2003; Pelgrum & Anderson, 1999) indicated that significant changes had taken place in the roles played by teachers and learners in some of the innovative practices. Classrooms that had leveraged the potentials of ICT to foster the development of 21st-century skills in students tended to be student-centered rather than teacher-centered (as seen in traditional classrooms). These classrooms also tended to be relatively well connected to people outside of the classroom/school walls (thus less isolated than previously), and the learning process tended to contribute more often to productive outcomes, such as solving authentic problems. The SITES-M1 and SITES-M2 surveys were designed and conducted against the backdrop of a general desire to realize the above broad reform goals.

Based on the above review, the SITES consortium considered it appropriate to move on from the dichotomy used in SITES-M1 and to use more specific categorizations of pedagogical practices in the SITES 2006 survey. In the final SITES 2006 instrumentation, pedagogical practice characteristics were categorized into three pedagogical practice orientations: *traditionally important, lifelong learning,* and *connectedness*.

Traditionally important takes the same definition as that used in the SITES-M1 study. *Lifelong learning* and *connectedness* are both associated with those practice characteristics that aim to develop students' abilities to meet the challenges of life in the 21st century as described in many of the education policy documents calling for system-wide reforms in curriculum and pedagogy that have appeared since the mid 1990s. However, these two terms differ in their emphases. *Lifelong learning* is concerned more with the development of students' interests and capacity to make collaborative inquiries on authentic problems; the *connectedness* orientation concerns linking students and teachers with peers and experts outside of the school walls.

4.2.3 Key Aspects for Understanding and Describing Pedagogical Practices

When designing the questions in the teacher questionnaire, the development team had to determine which of these would produce data indicating 21st-century-oriented teaching and which would produce data signifying traditional teaching. In analyzing the SITES-M2 international cases, Law et al. (2003, 2005) identified six dimensions along which the ICT-using innovative practices could be compared in terms of their extents of innovativeness. Of these, three were considered most indicative of the pedagogical paradigm of a teaching practice:

- Curriculum goals
- Teacher practices (teachers' roles)
- Student practices (students' roles).

These three dimensions were thus selected as *core indicators* for SITES 2006. In addition, questions were designed to gather data for the more factual, "observable" features of pedagogical practices, that is, the methods used to organize learning and teaching, and the learning resources and assessment practices ICT used. These, the team determined, could be analyzed to provide *supplementary indicators* for teachers' pedagogical practices.

4.2.4 ICT Use in Pedagogical Practices

One research area of particular interest within SITES 2006 is what impact, if any, integration of ICT in the teaching and learning process has on the pedagogical orientation and other aspects of teachers' practice. To explore this matter, two sets of responses were solicited from SITES respondents via four questions related to teaching and learning practices:

- Teacher practices, planning and regulation, execution (teachers' roles)
- Student practices (students' roles)
- Methods of organizing teaching and learning
- Assessment practices (types of assessment).

One set of responses, Part A, concerns the frequency with which certain activities take place. The other set of responses, Part B, determines if ICT is used in such activities. Figure 4.1 provides an excerpt from the items on teacher practice in order to illustrate the design of the related question.

Figure 4.1: Excerpt from Question 14 of the Teacher Questionnaire to Illustrate the Two Parts to the Question

14. In your teaching of the target class in this school year:
(a) How often do you conduct the following?
(b) Do you use ICT for these activities?
Please mark only one choice for each of the two parts in each row.

		(a) How often do you conduct the following?				(b) ICT used?	
		1 Never	2 Sometimes	3 Often	4 Nearly always	1 No	2 Yes
A	Present information/demonstrations and/or give class instructions ...	☐	☐	☐	☐	☐	☐
B	Provide remedial or enrichment instruction to individual students and/or small groups of students ...	☐	☐	☐	☐	☐	☐
C	Help/advise students in exploratory and inquiry activities ...	☐	☐	☐	☐	☐	☐

Chapter 11 describes the development of the scales for pedagogical approach and for comparing the impact of ICT on pedagogical approach.

4.3 Target Class and Sequencing of the Questionnaire Components

To ensure that respondents would be made aware of the meaning of the target class and when they needed to answer with reference to the target class, several design features were implemented.

- The cover page of the teacher questionnaire stated a specific, randomly selected Grade 8 target class that the teacher needed to think about when answering the question. Identification of the target class also provided the subject context (mathematics or science) that the teacher had to think about.
- The beginning of the teacher questionnaire provided a passage for respondents that read as follows: "When a question refers to the 'target class,' please think only about the class/course you are teaching in this school year that is specified on the cover page. You will answer all questions with reference to the teaching of the subject (domain) that is specified on the cover page in this class."
- The first section of the teacher questionnaire (i.e., Section I) asked respondents about student characteristics for the target class, followed by sets of questions on goals, practices, resources, and perceived impact of ICT use.
- Questions about teachers' personal characteristics and their perceptions of contextual factors were placed in the last section of the core part of the teacher questionnaire (i.e., Section VII). The reason for this placement was that these questions were not specific to the target class.

4.4 Questionnaire Development Process

The development of the SITES 2006 teacher questionnaire took place from September 2004 to January 2006, parallel to the development of the school-level questionnaires (see Chapter 3). Because the SITES surveys had not previously included a teacher component, portions of the 2006 questionnaire had to be newly developed. To support and inform this process prior to the field trial, a pilot test of the teacher questionnaire was carried out in Hong Kong in late 2004, and selected items were administered to a convenience sample of teachers in 12 countries as part of an online data collection (ODC) try-out in April 2005 (see Section 8.5).

The developmental work was undertaken by a research team from the Centre for Information Technology in Education, University of Hong Kong (CITE), led by Nancy Law, with input from the international study consortium members, the steering committee members, and the NRCs.

Starting from September 2004, intensive development work took place at CITE to develop the first draft instrument. The main design challenge at the beginning stage of instrument development involved exploring and determining if questions that would yield reliable scale scores on pedagogical orientations as described in Section 4.2 above could be developed for all participating systems.

Given the time constraints on the study, it was not possible to conduct an international pilot testing. To ensure that there would be a reasonably good set of questionnaire items for international field trialing, about 85 teachers in Hong Kong were invited to complete the pilot instrument, which included 23 questions in eight sections, with respect to a specific class they were teaching at the time. The data collected from the pilot test was analyzed to check if the reliabilities for the intended scale items met the necessary statistical requirements. The preliminary result was positive, and the data were used by the CITE team to refine the instruments. Further details about the scale development work at this stage are reported in Chapter 11.

The proposed field trial teacher questionnaire was discussed and modified alongside the school-level questionnaire during the first NRC meeting in order to arrive at a consistent and integrated set of instruments. After copy-editing and final layout for both the print and online versions, the final field trial questionnaires were sent to NRCs in May 2005 for translation, translation verification, and layout verification. The NRCs also received at this time a summary of all changes made to the draft instrument as a result of the discussions at the first NRC meeting.

The field trial was conducted from August to October 2005, and the resulting data were used for the following four purposes:

- To check whether the three core indicators (curriculum goals, teacher practice, and student practice) yielded statistically reliable scales;
- To identify which core, supplementary, and explanatory indicators demonstrated good psychometric properties and a high likelihood of contributing to a good model of pedagogical practice and ICT use;
- To consolidate and refine the questionnaire in terms of linguistic clarity and length; and
- To provide a concrete set of data for exploring the kinds of analyses to be conducted and reported in the main study.

The 43 questions that addressed the 314 variables in the field trial teacher questionnaire covered eight sections: (I) target class; (II) curriculum goals; (III) teacher practices; (IV) student practices; (V) learning resources and technology infrastructure; (VI) impact of ICT use; (VII) demographic information about teachers and the schools in which they worked; and (VIII) one specific teaching experience that used ICT (international option).

The sections on target class information and on one specific ICT-using teaching experience were added after the first steering committee and NRC meetings. Nearly 1,900 teachers from schools in 17 education systems participated in the field trial. The descriptive statistics were checked in order to identify problematic items. Analysis was also conducted to identify the optimal selection for constructing scales with the minimum number of items. The field trial analysis results were presented and discussed during the second NRC meeting held in December 2005, in Phuket, Thailand.

To ensure a high completion rate, the instrument development team agreed that none of the main study instruments must take longer than 40 minutes for the respondents to complete. The field trial instrument was slightly longer than the anticipated length of the final teacher questionnaire so as to provide statistical information for the selection of the final items. Based on the field trial results, the team not only reduced the number of questions from 43 to 41 but also substantially reduced the number of items in some of the questions in order to shorten the questionnaire. The team also decided that the section on one specific ICT-using teaching experience would become an international option to be placed at the end of the questionnaire.

The final version of the main study teacher questionnaire was made available to NRCs in January 2006. Table 4.2 summarizes the dates and activities associated with its development.

Table 4.2: Overview of the Questionnaire Development Process for the Teacher Questionnaire

Dates	Activities
September to November 2004	• Initial item development • Pilot test (Hong Kong)
December 2004	• First steering committee meeting
February to April 2005	• First national research coordinators' (NRCs) meeting (Enschede, the Netherlands): review of study framework and instruments • Second steering committee meeting • Revision of teacher questionnaire based on input received from NRCs
April 2005	• Try-out of selected items for ODC (online data collection), 12 countries
May to August 2005	• Finalization of questionnaire for the field trial
	• Field trial instruments to NRCs for translation and subsequent operations
August to October 2005	• Field trial (17 countries)
November to December 2005	• Analysis of field trial results and draft recommendations on revision of questionnaire for NRC meeting
December 2005	• Second NRC meeting (Phuket, Thailand) • Third steering committee meeting • Review of field trial findings and finalization of recommendations on main study instruments
January 2006	• Finalized MS questionnaire to NRCs

4.5 Contents of the Main Study Teacher Questionnaire

The final teacher questionnaire consisted of eight sections containing 41 questions and collecting data on 271 variables. The development team estimated that respondents would need approximately 30 to 40 minutes to complete the questionnaire. Table 4.3 presents a summary of all questions in the final instrument. The questionnaire wording was generic enough to suit both teachers of mathematics and teachers of science, although the actual subject context for teachers was clearly identified on the front page of the questionnaire.

Table 4.3: Questions in the Core Component of the Main Study Teacher Questionnaire

Question Number	Section	Question Content	Description
1	I	Class size	Number of students in the target class
2	I	Gender mix of the class	Whether the target class is attended by boys only, girls only, or both genders
3	I	Curriculum track	Whether the target class is in academic track, vocational track, or with no tracking
4	I	Absenteeism	Approximate percentage of students absent from target class on a typical school day
5	I	Language of instruction	Approximate percentage of students in the target class whose native language is the language of instruction
6	I	Class contact hours	Hours of scheduled class time per week teacher spends on teaching the target class mathematics/science
7	I	Students' ICT skills	Proportion of students in the target class who have competence in various ICT skills: word-processing, database software, spreadsheet, presentation software, application of multimedia, email, internet, graphic calculator, and data-logging tools
8	II	Curriculum goals	Teacher's perception about the importance of various curricular goals. This question yielded three core indicators on curriculum goal orientation: "traditionally important," "lifelong learning," and "connectedness"
9a	III	Teaching methods	Frequency with which teacher carries out various teaching and learning activities during the target class's scheduled learning time
9b	III	ICT use in teaching method	Whether ICT is used when various teaching and learning activities take place
10	III	Separation of teacher/ learners	How often the teacher and students are separated in spatial location when instruction takes place
11	III	Separation of teacher/ learners	How often students are separated relative to one another in spatial location when participating in planned learning activities
12	III	Separation of teacher/ learners	How often students' learning activities take place outside of scheduled school hours
13	III	Separation of teacher/ learners	How often the teacher provides feedback to students in the target class outside of scheduled school hours
14a	III	Teacher practices	Frequency with which various teaching activities take place. This question yielded the three core indicators for teacher practice orientation
14b	III	ICT use in teacher practices	Whether ICT is used when the various teaching activities take place. Responses to this component of the question yielded the core indicators for ICT-using teacher practice orientation
15a	III	Assessment practices	Whether the teacher uses various assessment methods when assessing students' performance
15b	III	ICT use in assessment	Whether the teacher uses ICT when carrying out the different kinds of assessment
16a	IV	Student practices	Frequency with which students participate in various activities. This question yielded the three core indicators for student practice orientation
16b	IV	ICT use in student practice	Whether students use ICT when participating in various activities. Responses to this component of the question yielded the core indicators for ICT-using student practice orientation

Table 4.3: Questions in the Core Component of the Main Study Teacher Questionnaire (contd.)

Question Number	Section	Question Content	Description
17	V	Learning and ICT resources used	How often the teacher incorporates various learning resources and tools when teaching his/her target class
18	VI	Whether ICT has been used with the target class	Whether ICT is used at all with the target class. This question was a core indicator as well as a screening question for questions applicable only to ICT-using teachers
19	VI	Perceived impact of ICT on self	The teacher's perception of the extent of various impacts of ICT use on himself/herself
20	VI	Perceived impact of ICT on students	Teacher's perception of extent of various impacts of ICT use on students
21	VII	Teacher self-reported ICT skills	Teacher's self-reported levels of confidence in accomplishing various general and pedagogical uses of ICT
22	VII	Teacher vision of ICT use in the near future	Teacher's priorities for different pedagogical uses of ICT within the next two school years
23	VII	Obstacles to ICT use	Whether teacher had experienced various obstacles to ICT use when teaching
24	VII	Course participation in ICT-related professional development	Whether teacher had participated in or would like to attend various types of ICT-related professional development activities
25	VII	Presence of community of practice in school	Teacher's perceptions of extent to which school staff hold a shared vision
26	VII	Presence of community of practice in school	Teacher's perception of extent to which school staff experience shared participation in decisionmaking
27	VII	Presence of community of practice in school	Teacher's perceptions of extent to which teachers engage in professional collaboration in the school
28	VII	Presence of community of practice in school	Teacher's perceptions of extent to which various kinds of support are available in the school
29	VII	Computer access at home	Whether teacher has access to a computer at home
30	VII	Uses of computer at home	Whether teacher uses his/her home computer for teaching-related activities and/or connecting to the internet
31	VII	Teacher's age	The age group the teacher belongs to
32	VII	Teacher's gender	Teacher's gender
33	VII	Teacher's academic qualification	Highest level of education attained by the teacher
34	VII	Teacher's academic qualification	Whether the teacher has a Bachelor's degree in mathematics and/or science
35	VII	Teacher's professional qualification	Whether the teacher has a teaching license or a certificate
36	VII	Teacher's teaching experience	Number of years of experience teacher has in teaching mathematics or science (select appropriate range)

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5. Translation, National Adaptation, and Verification

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5.1 Overview

The international version of the SITES 2006 questionnaires was developed and prepared in English by the SITES 2006 consortium with contributions from the NRCs. The questionnaires were subsequently translated by the participating countries into their languages, 18 in total (see Table 5.1). The translation process was designed to ensure the best possible translation quality and appropriate adaptation for the national context while ensuring international comparability.

Each country was expected to follow the procedures for the translation of questionnaires into the national language(s) and cultural context(s). The guidelines were provided to all NRCs in the *SITES 2006 Survey Operations Manual* (IEA DPC, 2006), prepared by the IEA Data Processing and Research Center (DPC) in collaboration with the SITES consortium and elaborated at the NRC meetings.

The translated and/or adapted questionnaires were checked in a rigorous process of translation verification and adaptations review. This process was intended to confirm, through direct comparisons, that the translated materials were equivalent to the international versions, and it was managed by the IEA Secretariat in Amsterdam, the Netherlands, which cooperated with Lionbridge Inc. (London, Dublin, and Brussels) to verify the translations for each of the education systems. Verified instruments were then returned to the NRCs with suggestions for changes and improvements. In addition, the international coordinating center (ICC) reviewed and noted any discrepancies between the layout of the translated instruments and the international version, and gave final approval for printing and administering the materials.

Each participating education system was asked to submit materials for verification before the field trial and before the main data collection. This two-stage process allowed each system to be assured of a set of translated materials that had been reviewed on two separate occasions and had the assistance of diagnostic statistics, which were used to identify and remedy mistranslated questions before the main data collection.

All SITES 2006 participants complied well with the requirements for translation and national adaptation verification of the survey instruments. Language verification was conducted twice for a majority of the participants: (i) before the field trial, and (ii) before the main data collection. In the case of the two Canadian provinces (Alberta and Ontario) and South Africa, which joined SITES 2006 late, the verification was conducted only before the main data collection.

Table 5.1: Languages Used for the SITES 2006 Instruments

Education System	Language	Questionnaires/Cover Letters		
		Teacher	*Principal*	*Technical*
Alberta, Canada	English	•	•	•
Catalonia, Spain	Catalan	•	•	•
Chile	Spanish	•	•	•
Chinese Taipei	Traditional Chinese	•	•	•
Denmark	Danish	•	•	•
Estonia	Estonian	•	•	•
	Russian	•	•	•
Finland	Finnish	•	•	•
	Swedish	•	•	•
France	French	•	•	•
Hong Kong SAR	Traditional Chinese	•	•	•
Israel	Hebrew	•	•	•
Italy	Italian	•	•	•
Japan	Japanese	•	•	•
Lithuania	Lithuanian	•	•	•
Moscow, Russian Federation	Russian	•	•	•
Norway	Bokmål	•	•	•
Ontario, Canada	English	•	•	•
	French	•	•	•
Russian Federation	Russian	•	•	•
Singapore	English	•	•	•
Slovakia	Slovak	•	•	•
Slovenia	Slovene	•	•	•
South Africa	English	•	•	•
Thailand	Thai	•	•	•

5.2 Translating and Adapting the SITES 2006 Instruments

5.2.1 *Survey Languages*

The majority of the SITES 2006 participating systems used only one language for administering the survey. Three participants—Estonia, Finland, and Ontario (Canada)—used two languages each. The translation/adaptation process for these countries required careful checking to ensure that both versions of the national instruments were equivalent. The NRCs were advised to involve, during preparation of the national instruments, a special reviewer—a person familiar with both languages—to check the comparability of the two versions.

5.2.2 *Instruments to be Translated*

For SITES 2006, the materials requiring translation included:

- The teacher questionnaire
- The principal questionnaire
- The technical questionnaire.

To meet the needs of an education system electing to collect data online and in paper mode, the cover letters (equivalent to the first two pages of the questionnaire) prepared for teachers, school principals, and ICT coordinators also required translation.

Education systems administrating the questionnaires in English did not have to translate the instruments but were required to adapt the international English of the original versions to the variant of English appropriate for their country, including any necessary cultural adaptations.

5.2.3 Translator and Reviewer

Each SITES 2006 participant was advised to appoint a team of two persons to work on the translation and adaptation of the instruments: a translator and a reviewer.

Translators were expected to have an excellent knowledge of both English and the target language, and—if possible—experience in the educational context of the survey as well as some familiarity with survey development in general. Reviewers (who were also expected to have an excellent knowledge of both English and the target language) were required to be well experienced with the country's educational context.

After the instruments had been translated and adapted, the reviewer checked the quality of the translation and if the translation was appropriate for the target populations and context. The NRC then analyzed the reviewer's suggestions and incorporated them into the translation, as he or she deemed necessary. In situations in which more than one translator and one reviewer worked on the national version of the instruments, additional checking was required to ensure consistency of the translation/adaptation within and across the instruments.

5.2.4 Translation and Adaptation Guidelines

To ensure that appropriate translations and adaptations were made during production of the SITES 2006 questionnaires, the ICC provided basic guidelines for these processes in the *SITES 2006 Survey Operations Manual* (IEA DPC, 2006). The translator's task was defined as preparing a translation that accorded with the rules of the target language as well as the country context and ensuring that the translation had the same meaning as the source text.

The major guidelines to assess the *quality* of translation were:

- Translations should have the same register (language level, degree of formality) as the source text;
- Translated passages should employ correct grammar and usage (for example subject/verb agreement, prepositions, verb tenses);
- Translated passages should neither clarify, omit, nor add information;
- Translated passages should employ equivalent qualifiers and modifiers, in the order appropriate for the target language;
- Idiomatic expressions should be translated appropriately, not necessarily word for word; and
- Spelling, punctuation, and capitalization in the target text should be appropriate for the target language and the country/cultural context.

In general, the translators were asked to pay particular attention to the following:

- Finding words and phrases in the target language that were equivalent to those in the international version;
- Making sure that the essential meaning of the text did not change;
- Making sure that the translated questionnaires asked the same questions as those in the international version and that national adaptations were made appropriately; and
- Being aware of possible changes in the layout of the instruments due to translation.

For countries administering the SITES 2006 questionnaires in English, these guidelines were applicable to any changes made to adapt the international version to the national context.

A limited number of national adaptations were required for the SITES 2006 questionnaires. These included a national school definition, the target grade name, and the percentage of students who were native speakers of the language of instruction. Information that had to be replaced with the nationally appropriate term on a mandatory basis was presented in carets (< >).

Participating systems could remove questions or options not applicable to their particular system. If considered necessary, they could also add possible national questions and additional categories. All changes had to be thoroughly documented and, in the case of additional categories, recording instructions were required.

The NRCs were cautioned that changes made when preparing the national version of the instruments would potentially increase the likelihood of errors and might eventually cause loss of data in the international database.

5.2.5 Documenting National Adaptations

NRCs were required to use "national adaptation forms" to document all adaptations made to the international questionnaires. The forms had to be completed and reviewed at various stages of the preparation of national instruments. Version I was completed during the internal translation/adaptation and review process and sent (together with the translated/adapted questionnaires) for translation verification (see below). After the language verification, the NRCs updated the forms to reflect any changes resulting from it and sent Version II as well as the instruments destined for layout verification to the ICC (see below). Version III, the final version of the questionnaires, was sent to the IEA DPC as a documentation of national adaptations (see Chapter 9).

The national adaptation forms, supplied as electronic documents, included detailed instructions on how to complete the form at each stage of the national instruments preparation. Appendix D provides a list of adaptations made by study participants.

5.3 International Translation/Adaptation Verification

Once the survey questionnaires had been translated, adapted, and reviewed, they and the national adaptation forms were submitted to the IEA Secretariat for language verification by the independent language specialist selected in cooperation with Lionbridge Inc.

The international language verifiers for SITES 2006 were required to have the target language as their first language, to have formal credentials as translators working in English, to be educated at university level, and (if possible) to live and work in the country for which the verification was carried out (or be in close contact with this country).

5.3.1 Translation Verification Process

The international translation verifiers received general information about the study and the design of the instruments together with a description of the translation procedures used by the national centers. They also received detailed instructions for reviewing the instruments and registering deviations from their original version.

The primary task of the language verifiers was to evaluate the accuracy of the translation and the adequacy of the national adaptations (reported in the national adaptation forms). The instructions given to verifiers emphasized the importance of maintaining the meaning and complexity level of the questions included in each of the questionnaires. Specifically, verifiers had to ensure the following:

- The translation had not affected the meaning or difficulty of the text;
- The questions had not been made simpler or more complex when translated/adapted;

- No information had been omitted from or added to the translated text;
- The questionnaires contained all correct questions and answer options; and
- The national adaptation forms reflected all adaptations incorporated into the national test instruments.

The verifiers documented any errors or suggested changes directly in the submitted Microsoft® Word documents, using the "Track Changes" and "Insert Comments" features of the application. Verifiers were also asked to suggest—if necessary—an alternative that would improve the comparability (i.e., the equivalence between the adapted version and the international source version) and to provide an overall evaluation of the translation, its accuracy, and its cultural relevance.

To help NRCs understand the comparability of the translated text with the international version, verifiers were asked to assign a "severity code" to any deviations. The codes, which ranged from 1 *(major change or error)* to 4 *(acceptable change)*, signaled the following:

1—*major change or error:* Examples included incorrect order of choices, omission of question or response option, incorrect translation resulting in the answer being suggested by the question, an incorrect translation that changed the meaning or level of complexity of the question, and incorrect order of the questions.

2—*minor change or error:* Examples included spelling errors that did not affect comprehension, misalignment of margins or tabulations, inappropriate changes in font or font sizes, and discrepancies in the headers and footers of the document.

3—*suggestion for alternative:* The translation may have been adequate, but the verifier suggested a different wording.

4—*acceptable change:* The change was acceptable and appropriate but was not documented in the national adaptation forms.

The translation/adaptation verification feedback was sent to the national centers so that the NRCs could review the suggestions of the translation verifiers and revise the instruments accordingly. The NRCs were also asked to complete the "translation verification summary form," which required them to comment on those suggestions made by verifiers that they decided not to implement even if those suggestions had been marked as a major change or error (severity code 1).

5.3.2 Results of the Translation/Adaptation Verification

Although the verification of translations and national adaptations produced a good or very good quality of the national versions prepared by the SITES 2006 participants, verifiers of all languages found errors and suggested improvements. The errors included:

- *Translation:* mistranslations, inaccurate translations, "word by word" translations
- *National adaptations:* improper terminology, inconsistencies in adaptations
- *Punctuation and capitalization:* not appropriate for the target language
- *Grammar:* use of English sentence structure inappropriate for target language
- Missing words and typographical errors.

The NRCs were expected to review the feedback they received from the international verifiers and to implement changes if they accepted the suggestions. With a few exceptions, the NRCs accepted all or almost all such suggestions. The major objects of disagreement were some adaptations (especially terminology used in the educational settings), proposed synonyms, language register, and use of foreign (English) terms. Rejected suggestions were documented so they could be used during interpretation of unusual results, and thereby determine if the results could be explained in terms of errors in the translation or adaptation of the survey instruments.

5.4 International Layout Verification

After translation, adaptation, and verification, and before the participants could use the national version of the international instruments, one last quality assurance step—layout verification—took place at the University of Twente, the Netherlands. This step involved reviewing each questionnaire in its print-ready form. The ICC compared each of the translated and adapted questionnaires with the international version, documenting discrepancies between the two. The checks consisted of:

- Appropriate question numbering
- Same number of answer options in the national and international versions
- Consistent formatting (fonts, bold/italics, indenting, etc.)
- Existence of answer instructions in each question
- Appropriate referencing and skip instructions after filter questions
- Availability of return instructions
- Appropriate grade (range) referencing.

Any deviations discovered were communicated to the NRCs, and revised versions of the instruments were re-checked until all problems were solved satisfactorily. Overall, this phase of quality control proved to be very useful. Although there were a few countries where, during the first step of layout verification, no deviations were discovered, in many countries revisions were needed. The seriousness of deviations that were discovered ranged from relatively minor to very serious and can be summarized as follows:

- *Minor deviations, such as:*
  - Missing periods (and/or question marks) at the end of sentences
  - Answer alternatives not lining up consistently
  - Indenting of text not optimal
  - Too much space between stem of question and answer instruction
  - Missing lines in a table.
- *Major deviations, such as:*
  - Page breaks in questions
  - Empty pages
  - Inconsistent font sizes
  - Answer boxes too small
  - Yellow highlights (put in place to signal NRCs to pay special attention) not removed
  - Wrong numbering of questions
  - Wrong numbering of answer options
  - No or incorrect translation of footers
  - Certain words not translated (e.g., "NA" as abbreviation of "Not Applicable")
  - Inconsistent answer instructions
  - Missing date for return of questionnaires
- *Serious deviations (which would lead to loss of data):*
  - Answer options missing
  - Missing or misleading answer instructions
  - Incorrect referencing in filter questions
  - Incorrect grade-range or target-grade specifications.

Irrespective of the seriousness of the deviations, the NRCs revised the instruments until all problems were solved. In most cases, they completed this work in a few days, but in some cases more iterations (3+) were needed to resolve inconsistencies and deviations.

Reference

SITES 2006 International Coordinating Center (2006). *SITES 2006 survey operations manual.* Hamburg: IEA Data Processing and Research Center (DPC).

6. Sampling Design

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6.1 Overview

A key element of the quality of any international comparative study is the selection of quality samples. Only properly selected and representative samples can yield unbiased, accurate, and internationally comparable survey estimates. SITES 2006 collected data at two levels:

- The school level, through (i) a school principal questionnaire, and (ii) a ICT coordinator questionnaire
- The classroom level, through a teacher questionnaire.

Student achievement surveys such as the Progress in International Reading Literacy Study (PIRLS) and the Trends in International Mathematics and Science Study (TIMSS) also collect information at the school level and at the teacher level, but mainly or exclusively for explaining the variability of student performance. In other words, such surveys are primarily interested in the student population, which means the teacher population cannot be modeled directly. In contrast, the SITES research objectives imply that data and results are reported at the school level and at the teacher level. Therefore, it defines two target populations: (i) the school population, and (ii) the teacher population.

The sampling design had to be optimized to ensure accuracy of the survey estimates at both levels. A sampling design that would have led to sacrificing the accuracy of the estimates at one level for the accuracy of the estimates at the other level would have been incompatible with the project's purposes.

This chapter describes the sampling design of the SITES study. It consists of (a) the definition of the target populations, (b) the school and within-school exclusions, and (c) the sampling design. Sampling in SITES 2006 was a primary responsibility of the IEA Data Processing and Research Center (DPC) in Hamburg, Germany.

6.2 Target Population Definitions

6.2.1 School Population

> *The international-desired* ***school target population*** *is defined as all schools where students are enrolled in the target grade, that is, in the grade that represents eight years of schooling, counting from the first year of ISCED Level 1.*

In most education systems, Grade 8 corresponds to the eighth grade of compulsory education. Compulsory education usually starts with the first year of Level 1 of the International Standard Classification of Education (ISCED) (UNESCO Institute for Statistics, 2006).

The definition of the desired target school population for SITES 2006 differs slightly from the desired target population implemented during the school data collection for SITES-M1 (Pelgrum & Anderson, 1999). However, in most systems, the 2006 target grade was similar to the target grade used for the Module 1 data collection. It was also consistent with the definition of the TIMSS desired target population, and therefore it is possible to link, at the system level, the results of both surveys.

All schools of all educational sub-systems that involved students learning full-time and part-time in the appropriate target grade were part of the international-desired target population. Schools that did not contain the target grade were, by definition, excluded from the study. In simple terms, the international-desired school target population was designed to provide full coverage of schools attended by target grade students in an education system.

6.2.2 Teacher Population

*The SITES 2006 **mathematics teacher target population** is defined as all teachers of mathematics teaching in the target grade (i.e., in the grade that represents eight years of schooling, counting from the first year of ISCED Level 1) in the school year in which the survey is conducted.*

*The SITES 2006 **science teacher target population** is defined as all teachers teaching science (or, depending on the education systems, teaching biology, physics, chemistry, and earth science, if appropriate) in the target grade (i.e., in the grade that represents eight years of schooling, counting from the first year of ISCED Level 1) in the school year in which the survey is conducted.*

This definition implies the exclusion (from the international-desired target population) of teachers who may have taught in the target grade in previous school years (but not in the school year of the SITES 2006 survey), or teachers who might have taught in the target grade in subsequent school years (but not in the school year of the SITES survey).

The research team considered it necessary to separate the mathematics teacher and the science teacher populations, because of the likelihood of some teachers teaching both subjects in a school.

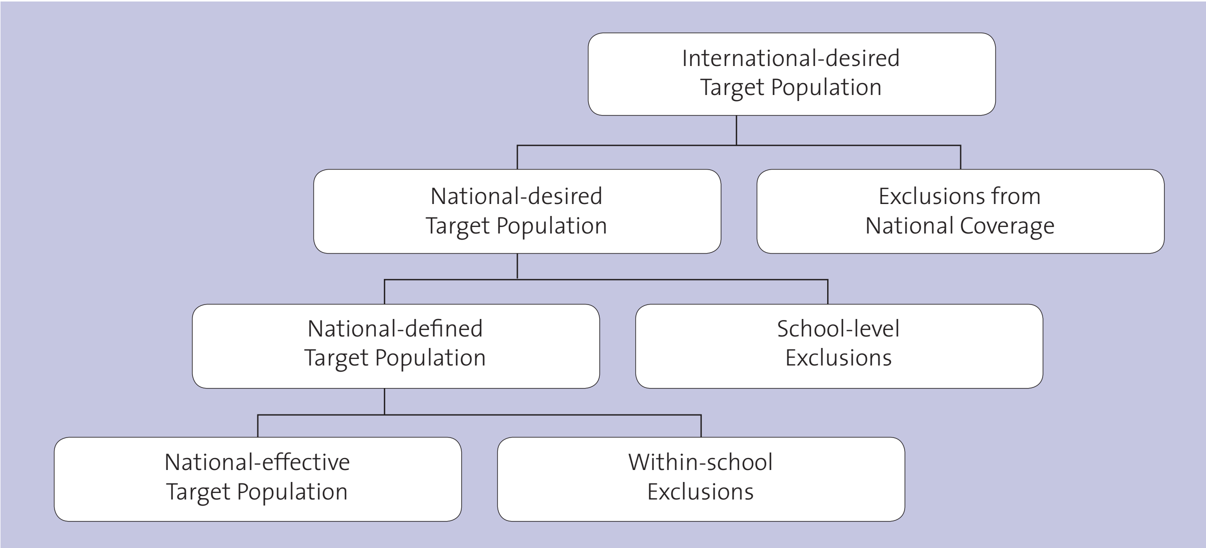
6.3 Exclusions

The final sampling design contained the following concepts:

- The international-desired population;
- The national-desired population, that is, the international-desired target population minus exclusions from the national coverage (see Section 6.3.1);
- The national-defined population, that is, the national-desired target population minus school-level exclusions (see Section 6.3.2); and
- The national-effective population, i.e., the national-defined population minus the within-school exclusions (see Section 6.3.3).

Figure 6.1 illustrates these different concepts.

Figure 6.1: International and National-desired Populations, National-defined Population, and Exclusions



By definition, there is no difference between the national-defined target population and the national-effective target population of schools.

6.3.1 Exclusion from the National Coverage

The participating education systems were encouraged to provide complete national coverage in their national-desired target population. However, the research team recognized that political, organizational, and/or operational reasons could make it extremely difficult for some systems to meet this objective. Consequently, systems were allowed to reduce their national coverage by removing a geographical region, an educational sub-system, or even a language group.

In case of reduced coverage, the national-desired target population differed from the international-desired target population and therefore no longer represented the entire national school system. Appendix B reports exclusions from the national-desired target populations per system.

6.3.2 School Exclusions

Schools were excluded for the following reasons:

- They were teaching only mentally or functionally disabled students;
- They were geographically inaccessible;
- They were extremely small in size; or
- They offered a curriculum, or school structure, radically different from the mainstream education system.

School exclusion categories are reported per system in Appendix B.

6.3.3 Within-school Exclusions

Instances where teachers were teaching only mentally or functionally disabled students required a procedure for excluding these teachers within a sampled school. Thirteen education systems used this option. For example, because of the special structure of the education system in Finland, many of the country's lower secondary school teachers teach exclusively to special education students. As a result, 7.3% of Finland's mathematics teachers and 4.1% of the country's science teachers were excluded. The percentage of excluded teachers within schools in the other systems ranged from 0.1% to 2.0%.

Table 6.1 gives the exclusion rates for schools and the un-weighted exclusion rates for the mathematics and the science teachers within these schools.

Table 6.1: Exclusion Rates in SITES 2006

Education System	School-level Exclusions (% of Students)	Within-school Exclusions (% of Mathematics Teachers)	Within-school Exclusions (% of Science Teachers)
Alberta, Canada	1.4	1.0	1.0
Catalonia, Spain	0.6	0.2	0.1
Chile	0.0	0.2	0.0
Chinese Taipei	0.9	2.0	0.8
Denmark	1.3	0.9	0.8
Estonia	3.1	0.0	0.1
Finland	2.4	7.3	4.1
France	1.5	0.1	0.0
Hong Kong SAR	3.6	0.0	0.0
Israel	11.3	2.0	1.0
Italy	0.0	0.0	0.0
Japan	0.0	0.0	0.0
Lithuania	2.2	0.0	0.0
Moscow, Russian Federation	0.2	0.5	0.1
Norway	0.7	1.2	0.0
Ontario, Canada	3.9	1.2	0.6
Russian Federation	1.1	0.0	0.0
Singapore	0.0	0.0	0.0
Slovak Republic	0.0	1.4	0.5
Slovenia	0.2	0.0	0.0
South Africa	0.0	0.0	0.0
Thailand	4.6	0.0	0.0

6.4 School Sample Design

International surveys in education usually proceed in two steps. First, a sample of schools is selected from a complete list of schools containing the population of interest. Then, a simple random sample of students, classes, or teachers is drawn within the selected schools. In the literature, such sampling design is usually called *two-stage sampling*. Broadly speaking, schools can be selected with equal or unequal probabilities. Both options were discussed during the development of the SITES 2006 sampling design.

Selecting schools with equal probability would have given every school the same chance to be included in the survey. However, because SITES 2006 selected a small number of teachers within sampled schools, selecting schools with equal probability would have generated a large variability in the selection probability of the teachers. Within a sampled school, the probability of selection of a teacher at a school with 20 mathematics teachers would be five times smaller than the probability of selection of a teacher in a school with four mathematics teachers. Such variability in the probabilities of selection generally results in less accurate estimates of statistics for the intended target population.

Use of a *probability proportional to size* (PPS) design leads to a school with 20 teachers being five times more likely to be selected than a school with four teachers.

But within a sampled school, the probability of a teacher being selected is inversely proportional to the number of teachers. Therefore, selecting schools with probabilities proportional to their size and selecting a fixed number of teachers with equal probabilities within sampled schools minimizes the variability of the total selection probability of the teachers.

Thus, a PPS design would be appropriate for SITES if the project focused on the teacher population alone. However, because SITES collected and reports data at two levels—at the school level and at the teacher level—a PPS sample design would have generated a large variability of the school selection probability and, consequently, a large, and undesirable, variability of the school weights.

To meet the conflicting requirements of a school survey and a teacher survey, the SITES 2006 research team implemented a sample design that involved the following:

- Stratifying the school sample frame according to the school size;
- Selecting, within an explicit school-size stratum, schools with an equal probability of selection; and
- Selecting, within sample schools, teachers with an equal probability of selection.

The following sections describe in more detail the sampling procedures implemented for the school sample and for the teacher samples.

6.4.1 Explicit Stratification

Before sampling takes place, schools are stratified within the sampling frame. Stratification consists of grouping schools into strata according to some grouping, or stratification, variables. Stratification is generally used for the following reasons:

- To improve the efficiency of the sample design, thereby making survey estimates more reliable;
- To apply different sample designs, such as disproportionate sample allocations, to specific groups of schools, such as states or provinces; and
- To ensure representation of specific groups within the target population in the sample.

Examples of stratification variables include:

- School size (large, medium, small)
- Regions (states, provinces)
- Urbanization (rural areas, urban areas)
- Socioeconomic status (low, medium, high)
- School types (public, private)
- School programs (primary, elementary, secondary).

Appendices B and C list the explicit stratification variables used in the participating school systems.

6.4.2 Size Stratification

As mentioned above, school size was the most important explicit stratification variable for SITES 2006. Size stratification is therefore always used as the last level of explicit stratification. Thus, with SITES, size strata were formed within each of the other explicit strata that the NRCs proposed.

The idea behind having size strata is to avoid grouping schools that overly differ in size in the same stratum. This approach allowed the SITES research team to better control the variability of school and teacher weights and consequently to achieve more reliable estimates. Because teachers within large schools have a lower probability of selection than teachers within small schools, the combined teacher probability of selection is smaller in large schools than is the combined teacher probability of selection within small schools.

This variability of selection is also reflected in the teacher weights. Grouping schools in size strata makes it possible to select:

- More large schools, thus increasing their probability of selection; and
- Fewer small schools, thus decreasing their probability of selection.

The difference in selection probability between large schools and small schools provides partial compensation for the variability associated with selection probability of teachers within schools.

The size stratification method was developed by Marc Joncas of Statistics Canada, Ottawa (personal communication).

For SITES 2006, the formation of size strata consisted of four steps, described in Sections 6.4.2.1 to 6.4.2.4. Section 6.4.4 provides an example of the stabilization of the weights.

6.4.2.1 Step 1: School Sample Size Allocation per Explicit Strata

To create size strata, one needs a measure of size (MOS) for each school in the school sampling frame. For SITES 2006, optimal MOS would have been the number of mathematics teachers and science teachers teaching in the target grade during the school year of the survey. However, because this situation is never or rarely possible, the systems participating in the study were encouraged to use as MOS the number of students enrolled in the target grade. This MOS gives an indication of the number of eligible teachers in each listed school.

Possible school MOS, in decreasing order of suitability, were:

- Student enrolment in the target grade;
- Average student enrolment per grade, that is, total student enrolment divided by the number of grades in the school;
- Number of classrooms in the target grade; and
- Total student enrolment.

Current enrolment data, however, are rarely available at the time schools are sampled. Therefore, with SITES 2006, the MOS in the school sample frame represented the school enrolment of a previous school year. The quality of a sampling frame depends, to a large extent, on the accuracy of the MOS available. Systems were therefore encouraged to use the latest data available.

If a national center did not require over-sampling, the school sample size per explicit stratum was equal to:

$$n_i = \frac{n}{2}\left(\frac{N_i}{N} + \frac{MOS_i}{MOS}\right),$$

where

- N is the number of schools in the system, and N_i is the number of schools in the explicit stratum i;
- n is the number of schools in the sample and n_i is the number of schools to be sampled in the explicit stratum i; and
- MOS is the total number of students in the target grade across schools in the system and MOS_i is the total number of students in the target grade across schools in the explicit stratum i (or any other measure of size used by the system).

As can be seen, the formula is a compromise between an allocation that is proportional to the number of schools and an allocation that is proportional to the number of students (and thus probably for teachers).

6.4.2.2 Step 2: Definition of the Size Strata per Explicit Stratum

Size strata need to be created within each explicit stratum. The number of size strata per explicit stratum depends on n_i , that is, the number of schools available to sample in the explicit stratum. The following algorithm describes how the number of size strata was determined:

- If up to 14 schools were to be sampled in the explicit stratum, no size strata were created;
- If between 15 and 24 schools were to be sampled in the explicit stratum, two size strata were created;
- If between 25 and 34 schools were to be sampled in the explicit stratum, three size strata were created;
- If between 35 and 44 schools were to be sampled in the explicit stratum, four size strata were created;
- If more than 45 schools were to be sampled, five size strata were created.

6.4.2.3 Step 3: Allocation of Schools per Size Stratum within an Explicit Stratum

Schools in the explicit stratum were allocated to their respective size strata. Within these size strata, schools were sorted according to their implicit stratification variable and by their measure of size (MOS), that is, in most systems, the number of students in the target grade.

6.4.2.4 Step 4: School Sample Size Allocation per Size Strata

The number of schools to be sampled within each size stratum is equal to:

$$n_{ij} = \frac{n}{2}\left(\frac{N_{ij}}{N_i} + \frac{MOS_{ij}}{MOS_i}\right),$$

where

- N_i is the number of schools in the explicit stratum i, and N_{ij} is the number of schools in the size stratum j within the explicit stratum i;
- n_i is the number of sampled schools in the explicit stratum i, and n_{ij} is the number of sampled schools in the size stratum j within the explicit stratum i; and
- MOS_i is the total number of students in the target grade across schools in the explicit stratum i, and MOS_{ij} is the total number of students in the target grade across schools in the size stratum j within the explicit stratum i.

6.4.3 Implicit Stratification

Implicit stratification consists of sorting the school sampling frame by a set of implicit stratification variables. This type of stratification, which was very effective for the school sample selection method implemented in SITES 2006, is a very simple way of ensuring a strictly proportional sample allocation of schools across all implicit strata. It can also lead to improved reliability of survey estimates, provided the implicit stratification variables being considered are known to have a significant between-strata variance component. Finally, as will be discussed later, implicit stratification ensures that replacement schools are similar in some respect to sampled schools.

Appendices B and C set out the implicit stratification variables used in the participating school systems.

6.4.4 Example for Stabilization of Weights due to Size Stratification

The following student-level example demonstrates the efficiency with which the sampling design minimizes the weight variability. Let us suppose that, in a fictitious study about students, a system decided to group schools within the four following explicit strata: (i) private rural, (ii) private urban, (iii) public rural, and (iv) public urban. Based on this system's school frame, 100 schools need to be sampled and 35 students per sampled school selected. Table 6.2 presents the number of schools per explicit stratum, their respective number of students, the school sample size based on the above algorithm, and the school and student probabilities of selection.

Table 6.2: School Allocation and Probabilities of Selection According to the SITES Design

Explicit Stratum	Number of Schools	Number of Students	School Sample Size	School Selection Probability	Average Student Probability within School	Combined Student Probability
Private rural	100	10,000	17.5	0.175	0.350	0.061
Private urban	100	20,000	22.5	0.225	0.175	0.039
Public rural	100	30,000	27.5	0.275	0.117	0.032
Public urban	100	40,000	32.5	0.325	0.088	0.028

The ratio between the largest and the smallest school probabilities of selection is equal to 0.325 divided by 0.175, that is, 1.86. Similarly, the ratio between the largest and the smallest combined student probabilities of selection is equal to 0.061 divided by 0.028, that is, 2.15. Table 6.3 presents the same results in the case of a proportional allocation to the number of schools. Table 6.4 presents the same results in the case of a proportional allocation to the number of students.

Table 6.3: School Allocation and Probabilities of Selection According to a Proportional Allocation to the Number of Schools

Explicit Stratum	Number of Schools	Number of Students	School Sample Size	School Selection Probability	Average Student Probability within School	Combined Student Probability
Private rural	100	10,000	25	0.25	0.350	0.088
Private urban	100	20,000	25	0.25	0.175	0.044
Public rural	100	30,000	25	0.25	0.117	0.029
Public urban	100	40,000	25	0.25	0.088	0.022

Table 6.4: School Allocation and Probabilities of Selection According to a Proportional Allocation to the Number of Students

Explicit Stratum	Number of Schools	Number of Students	School Sample Size	School Selection Probability	Average Student Probability within School	Combined Student Probability
Private rural	100	10,000	10	0.1	0.350	0.035
Private urban	100	20,000	20	0.2	0.175	0.035
Public rural	100	30,000	30	0.3	0.117	0.035

The proportional allocation to the number of schools guarantees no variability of probabilities at the school level but generates a larger variability at the student level (the ratio is equal to 0.088/0.022, i.e., 4). Inversely, the proportional allocation to the number of students guarantees no variability of probabilities at the student level but generates a larger variability at the school level (the ratio is equal to 0.4/0.1, i.e., 4.).

Because the number of teachers per schools is expected to closely correlate with the number of students per school, this example clearly illustrates the compromise used in the SITES 2006 sampling design to minimize the variability of the probabilities and weights at the school level and at the teacher level.

6.5 School Sample Selection

The sample selection method used was systematic sampling with equal selection probability within each size stratum. In the sampling frame, the schools in each size stratum were listed in order of the implicit stratification variables. Within the implicit strata, the schools were sorted by school size. After this, each school had a fixed rank number in the sampling frame. A sampling interval was then computed within each size stratum. This sampling interval was equal to:

$$SI_{ij} = \frac{N_{ij}}{n_{ij}} \ ,$$

where
N_{ij} is the number of schools in the size stratum *j* within the explicit stratum *i* ; and n_{ij} is the number of sampled schools in the size stratum *j* within the explicit stratum *i*.

The first school was sampled by choosing a random number between 0 and SI_{ij}, the sampling interval. The school whose rank in the list was equal to or larger than this number was sampled. By adding the sampling interval to the first random number, the second school was identified in the same way. This process of repeatedly adding the sampling interval to the previous selection number resulted in a school sample of the required size.

The default school sample size in SITES 2006 was 400 schools per participating system. In systems with many small schools, the sample size had to be increased to ensure a teacher sample size large enough to allow all the data analyses that the SITES 2006 consortium intended to perform.

6.6 Replacement Schools

With any survey in education, it is not always possible to obtain the participation of all sampled schools. Avoiding the resulting sample size losses requires a mechanism to identify *a priori* replacement schools for non-participating sampled schools. Another perhaps more important reason for identifying replacement schools *a priori* is to avoid the haphazard use of alternate schools as replacements, which may amplify response biases. Although this approach does not necessarily avoid non-response bias, it does appear to minimize the potential for bias. Furthermore, this approach is conceptually a more elegant means of accommodating a low participation rate than is over-sampling.

With SITES 2006, each sampled school in the main study was assigned two replacement schools in the sampling frame according to the following algorithm: the school immediately following the sampled school was the first replacement school of the sampled school and the school immediately preceding any sampled school was the second replacement school of the sampled school. The use of implicit stratification variables, and the subsequent ordering of the school sampling frame by size, ensured that any sampled school's replacements had stratification characteristics similar to those of the sampled school.

However, in small systems, replacement schools could not be identified for all sampled schools. Therefore, some sampled schools that refused to participate were not replaced.

6.7 Teacher Sampling Design

Sampled and participating schools had to complete two "teacher listing forms," one for the mathematics teachers and one for the science teachers. All teachers from the appropriate target grade in a sampled school had to be recorded on these forms. In schools where science was being taught as individual subjects (i.e., biology, physics, chemistry, earth science), any teacher teaching any one of these subjects was listed only once on the *science teacher listing form*. For example, if physics, biology, and earth science were being taught in a school, all the teachers of the three subjects were entered on the same list. If a teacher was teaching both physics and biology, he or she was entered only once on the *science teacher listing form*. However, the fact that he or she was teaching two subjects was also recorded in the listing on this form. Finally, a teacher teaching both mathematics and science in the target grade was entered on both teacher listing forms; the teacher identification numbers on both forms made it possible to link one form to the other.

With the teacher listing forms, the school coordinators were also requested to estimate the percentage of mathematics teachers and science teachers that might be considered as ICT-using teachers. ICT-using teachers were defined as teachers who use computers (or an equivalent) at least once a year with their students for teaching/learning purposes. "Equivalent" as used here means machines offering the same functionalities as a computer, for example, some personal digital assistants (PDAs), terminals connected to a server, and so on.

The data from the teacher listing forms, once returned to the national center, were recorded in the within-school sampling software WinW3S (see Section 7.3) provided by the IEA DPC. Completion of this work was followed by selection of a teacher sample.

The first step of the selection process consisted of determining the number of teachers to be sampled in a particular school. The teacher sample size related to the percentage of ICT users. Thus:

- Two teachers per subject for any school with an estimated percentage between 76 and 100;
- Three teachers per subject for any school with an estimated percentage between 51 and 75;
- Four teachers per subject for any school with an estimated percentage between 1 and 50; and
- Two teachers per subject for any school with an estimated percentage of 0.

These within-school sample sizes were considered as minimal requirements unless the sampled school counted fewer than two or three teachers, depending on the percentage of ICT-using teachers. Systems were, however, allowed to sample more teachers than specified under these minimal requirements.

The next step was to select the teachers according to a systematic random sample procedure.

In a large number of the systems participating in the SITES 2006 survey, many teachers were teaching both mathematics and science. These teachers are referred to from here on as "double subject teachers."

For the field trial, the mathematics teacher sample and the science teacher sample were drawn independently within schools. For the main study, the research team decided to link the random numbers of both teacher listing forms in order to reduce the number of teachers being selected twice.

The following example (see also Figure 6.2) illustrates this approach. Let us suppose that a particular school participating in SITES 2006 had eight mathematics teachers and eight science teachers, and of these 16 teachers, four were teaching both subjects. In this instance, it would be vitally important for the teachers teaching both subjects to be listed on the top of both lists, after which the teachers only teaching one subject would be listed. It would also be important in this situation to guarantee that the order of the double subject teachers is identical in both teacher lists. (These two aims were achieved in SITES 2006 through automatic sorting prior to sampling within the WinW3S software.)

To continue the example: the sampling interval for both lists is equal to 8/4=2. Supposing that the random number for mathematics was 0.2., then, as described above, the sampled mathematics teachers would be the teachers with numbers 1, 3, 5, and 7. Because the school had combined teachers, the procedure links the random numbers as follows:

- Where the random number for the mathematics list is lower than or equal to 0.5, the random number for the science list is the mathematics random number plus 0.5;
- Where the random number for the mathematics list is higher than 0.5, the random number for the science list is the mathematics random number minus 0.5.

In the above example, the random number for mathematics is 0.2, so the random number is equal to 0.2 + 0.5 = 0.7. The sampled teachers for science would then be:

- (0.7*2) + 1 = 2.4, that is, 2
- 2.4 + 2 = 4.4, that is, 4
- 4.4 + 2 = 6.4, that is, 6

6.4 + 2 = 8.4, that is, 8.
As can be seen, the outcome is no overlapping for the double subject teachers.

Figure 6.2: Example of the Within-school Sampling Procedure

Mathematics List		Science List	
1	Teacher A	1	Teacher A
2	Teacher B	2	Teacher B
3	Teacher C	3	Teacher C
4	Teacher D	4	Teacher D
5	Teacher E		
6	Teacher F		
7	Teacher G		
8	Teacher H		
		5	Teacher I
		6	Teacher J
		7	Teacher K
		8	Teacher L

However, the efficiency of the procedure can be reduced if the sampling interval is not identical for both lists. In this situation, it is still possible for a teacher to be selected for both the mathematics sample and the science sample. When this occurs, *and only* when this occurs, a double sampled teacher is replaced by a double subject teacher not selected for both samples. If no replacement teachers are identified, the double sampled teachers are invited to fill in the mathematics and the science teacher questionnaires. This was the procedure followed for SITES 2006.

Finally, the teacher questionnaire explicitly asked the teacher to refer to a particular class, identified as the "target class," when answering some of the questions. However, there were teachers who were teaching more than one classroom in the target grade. Allowing teachers to self-select which class to refer to would have introduced a bias of unknown magnitude, as the teachers could have, for example, selected the class in which they most often used ICT. The classes taught at the target grade by a particular teacher were therefore listed on the teacher listing forms. It was subsequently important that the NRCs randomly selected the class the teacher had to refer to. In practice, the random selection of the target class was performed by WinW3S, the IEA DPC software designed to sample teachers and target classes within sampled schools.

6.8 Quality Control

The IEA DPC selected nearly all of the school samples for SITES 2006. The only school sample to be selected by a local SITES team was the school sample for Japan. The sample was then verified at the DPC and found to be correct and acceptable.

The NRCs were responsible for providing a complete and comprehensive school sampling frame with a suitable measure of size. The suitability of this frame was checked by systematic comparison of the data with frames of preceding surveys as well as with census data.

The details of the national sampling plans were discussed with NRCs. Every attempt was made to implement the best possible sample design, particularly with respect to the most efficient method of stratification. Any deviations from the international sample design had to be approved by the sampling referee.

After sample selection, the school samples underwent a systematic checking procedure. Each sampling step was thoroughly documented so that the randomness of the selection could be proven. This documentation was sent to the NRCs for review.

Within-school sampling was performed using the WinW3S software, which ensured that all within-school sampling quality criteria were enforced. Any deviation detected from the within-school sampling procedures led to annotation of the results in the international report.

References

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7. Survey Operations and Procedures

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7.1 Overview

The SITES 2006 data collection was carried out locally by the participating education systems once they received standards, guidelines, and detailed procedures for all survey activities from the IEA SITES consortium. Data collection was a demanding exercise involving administration of school and teacher questionnaires in, on average, 400 schools per education system. Conducting a successful data collection called for close cooperation between the international consortium and experts, the NRCs, the within-school liaison personnel (referred to as "school coordinators") and, eventually, the respondents.

The SITES 2006 survey operations procedures were derived from procedures successfully applied in TIMSS 2003, PIRLS 2006, and other IEA studies. However, due to the specific target population and the aims of the study, the survey operations in SITES 2006 differed considerably from those employed in student-level studies. Most importantly, SITES 2006 targeted adult populations of school principals, ICT coordinators, and teachers. Additionally, the administration was neither organized in fixed-time sessions nor supervised by external administrators. The schools selected for SITES and the designated respondents within the schools—for the most part, teachers—typically received either the paper questionnaires or invitations to access the online version (see Chapter 8) via standard mail. This situation made securing the participation of sampled and designated individuals and monitoring progress particularly challenging, and meant that adequate procedures and approaches needed to be in place to prevent problems.

This chapter describes the survey operations for collecting the data. It includes the responsibilities of the NRCs and school coordinators, the procedure for sampling and tracking teachers within schools, and the steps involved in administering the principal, technical, and teacher questionnaires and preparing the materials for data entry.

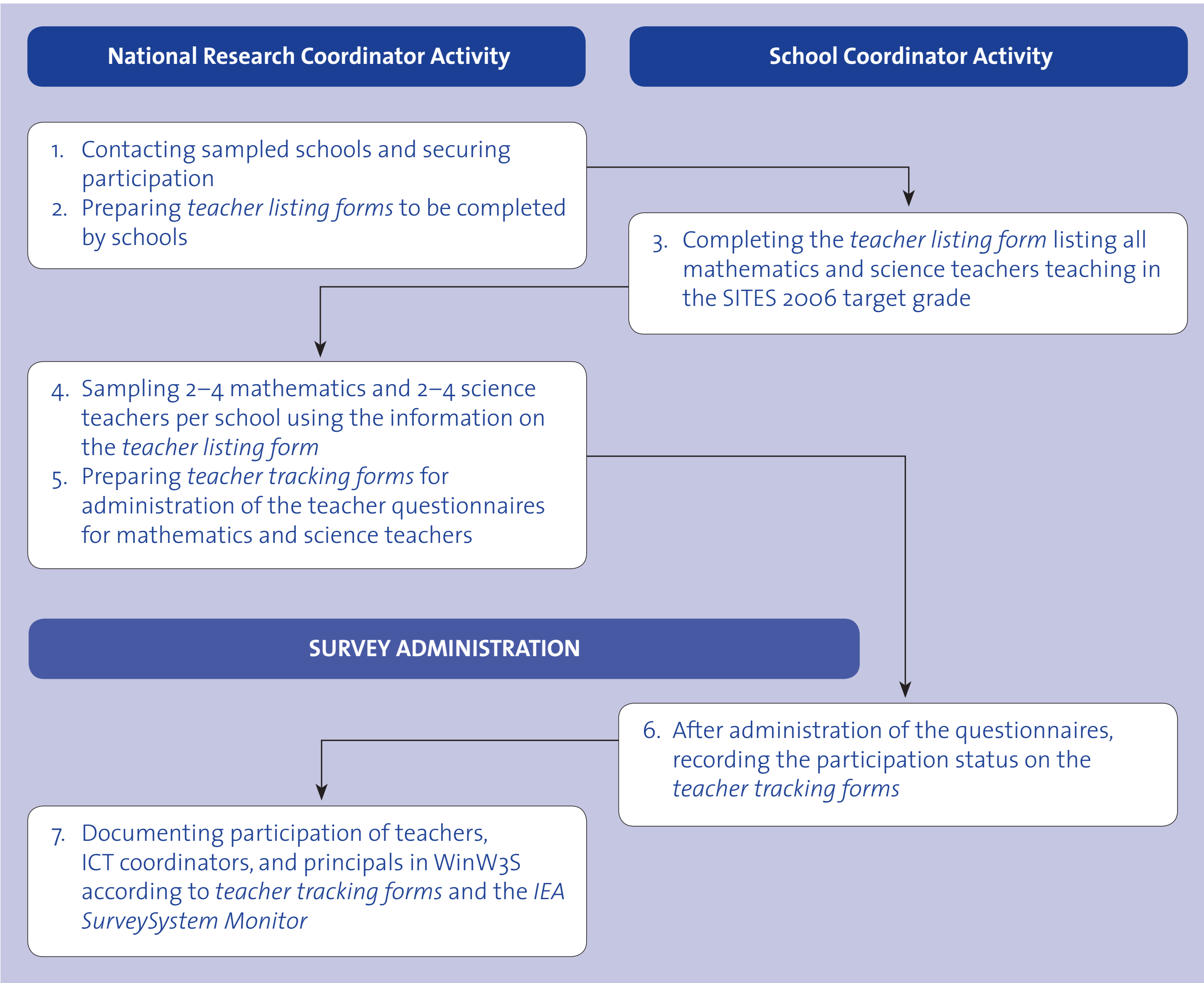
7.2 National Research Coordinator and School Coordinator Responsibilities

The NRC was the key person with ultimate responsibility for collecting data for the SITES 2006 survey according to internationally agreed procedures and specifications. NRC responsibilities in other areas were outlined in earlier chapters of this report. The following sections focus on administration of the survey in participating schools. Specifically, they describe the procedures for sampling and tracking teachers within sampled schools, and for organizing the administration of the questionnaires.

On receiving the school sample information from the sampling team at the IEA DPC (see Chapter 6), the NRCs began contacting the designated schools to secure their participation. If a sampled school was unable or unwilling to participate in the survey, the NRC concerned contacted the first replacement school and asked for participation. If this school declined participation, the NRC contacted the second replacement school. After agreeing to participate, each school was asked to identify a "school coordinator"—a person who would remain in contact with the national center and carry out all SITES-2006-related school-level tasks. The coordinator was usually a teacher or other school staff member, who ideally was not participating in the study, or he or she was an outsider appointed by the NRC. In either case, the NRC was responsible for ensuring that the school coordinator became familiar with their responsibilities as detailed in the *SITES 2006 School Coordinator Manual* (IEA DPC, 2006c).

Figure 7.1 presents the major activities completed at the national center under the supervision of the NRC and at the school by the school coordinator before and after survey administration. These activities were supported by the WinW3S software, which automatically produced all necessary forms, lists, and labels, and assisted NRCs in keeping track of the status of their survey as described in the next sections.

Figure 7.1: NRC and School Coordinator Activities



7.3 Operational Manuals and Software

NRCs received the following set of procedural manuals detailing all aspects of the data collection:

- The *SITES 2006 Sampling Manual* (IEA DPC, 2006a) defined the SITES 2006 target populations and sampling goals and described the procedures for the sampling of schools.
- The *SITES 2006 Survey Operations Manual* (IEA DPC, 2006b) was the essential handbook for the NRC. It described in detail all of his or her expected activities and responsibilities, from the moment the SITES international instruments arrived at the national center to the moment the checked and verified data files and accompanying documentation were submitted to the IEA DPC.
- The *SITES 2006 School Coordinator Manual* (IEA DPC, 2006c) described the activities of the school coordinator—the person in the school responsible for organizing the SITES survey administration— from providing information about target population teachers to the time the completed materials were returned to the national center. This manual was subject to translation.
- The *SITES 2006 Data Management Manual* (IEA DPC, 2006d) provided the NRC with instructions for entering and verifying the data as well as for the general use of software (see below).

The IEA DPC supplied each NRC with three software packages to assist him or her with the data collection and to ensure uniform procedures:

- The *Within-school Sampling Software* (WinW3S) served as a survey administration tool. WinW3S helped NRCs list and randomly sample teachers and target classes in each selected school, prepare forms to keep track of the sampled individuals, print labels for the personalization of questionnaires, and monitor the progress of the administration. The software stored all tracking information in a database so that this information could be used later to extract participation status, compute sampling weights, and verify the integrity of the sampling procedure.
- The *Data Entry Manager* (WinDEM) enabled national center staff to adapt codebooks, capture and edit the SITES 2006 data through keyboard data entry, and perform a range of validity checks on the entered data prior to submission. The WinDEM database includes codebooks for each of the SITES 2006 questionnaires, providing all information necessary to produce data files for each instrument in a standard international format (see Chapter 9).
- The *IEA SurveySystem* was used for converting the text pages in the paper questionnaires to online questionnaires (see Chapter 8) and delivering these to respondents.

The installation and use of each software package is described in detail the *SITES 2006 Data Management Manual* (IEA DPC, 2006d). In addition to receiving the manual, NRCs and their data managers received hands-on training in the use of these software packages from staff at the IEA DPC during a data management seminar held before the field trial in June 2005.

7.4 Survey Forms and Identification Numbers

Survey tracking forms were provided for tracking the participation of schools and, more importantly, for listing, sampling, and tracking teachers. The school coordinator's tasks included listing information about all mathematics and science teachers in the target grade, their possible exclusion from the survey, and information about all classes or courses taught in the target grade. The school coordinator was also required to estimate the percentage of teachers using ICT for their teaching.

To record the information, SITES 2006 utilized "teacher listing forms." If teachers taught both mathematics and science to at least one class in the target grade, teachers were listed twice, once on the mathematics listing form and once on the science listing form. The information from these forms was entered into WinW3S at the national center, after which the random within-school teacher sample was drawn using the software. After sampling, national centers generated the "teacher tracking forms" on which all sampled mathematics and science teachers were listed. The teacher tracking forms were sent to schools, so that school coordinators knew to whom to distribute the instruments.

It was essential that both tracking forms were completed accurately because they determined the eligible population and which questionnaire was given to which teacher. The tracking forms were used to facilitate data collection, record information essential to the computation of estimation weights, evaluate the quality of the sampling, and evaluate the quality of sampling within schools as well as the administration of the survey. All tracking forms were retained for review by staff at the IEA DPC. Appendix E of this report provides example forms.

Based on the four-digit school IDs assigned by the IEA DPC sampling team, the WinW3S software created hierarchical identification numbers that uniquely identified principals (four digits), ICT coordinators (six digits), and teachers (eight digits). The teacher IDs clearly identified teachers for mathematics and for science.

7.5 Administration of Questionnaires

Each school principal was required to complete one "principal" questionnaire, and the ICT coordinator was assigned a "technical" questionnaire. Each teacher listed on the teacher tracking form was assigned a "teacher" questionnaire. Because there were no separate questionnaires for mathematics and science teachers, the labels attached to each questionnaire clearly identified both the subject domain (mathematics or science) as well as the reference/target class context in which teachers were asked to complete the questionnaire (see Sections 4.3 and 6.7 for details).

For each participating school, the NRC prepared a package containing all paper questionnaires and/or cover letters (see Chapter 8) for online administration, the teacher tracking form, and any other relevant materials prepared for briefing the school coordinators, for example, leaflets or letters of endorsement from ministries or unions. A set of labels and/or prepaid envelopes/parcels addressed to the national center was usually included to facilitate the return of the survey materials.

School coordinators were then responsible for organizing the administration within the schools as follows:

- Checking the materials when they arrived from the national center to ensure that there was one questionnaire corresponding to each teacher listed on the teacher tracking form;
- Distributing the principal questionnaire for paper administration or the principal cover letter for online administration to the principal of the school;
- Distributing the technical questionnaire for paper administration or the technical cover letter for online administration to the school's ICT coordinator;
- Distributing the teacher questionnaires for paper administration or the teacher cover letters for online administration to the designated teachers as listed on the teacher listing forms;
- Ensuring that the questionnaires were completed within the set administration period and reminding respondents to complete their questionnaires, if necessary;
- Recording teacher participation information on the corresponding forms;

- Communicating to the national center any relevant information or obstacles about the administration in the school, especially any problems affecting teacher participation; and
- Returning the completed and any unused instruments and the *completed* teacher tracking forms to the national center.

7.6 Monitoring of Online Participation

School coordinators were responsible for recording the return status of the paper questionnaires on the teacher tracking form. For the online questionnaires, school coordinators made an indication on the tracking form only if a teacher was assigned an online questionnaire. Tracking the completion status of all online questionnaires was done at the national center using the IEA SurveySystem Monitor component (see Chapter 8). The real-time status of all respondents who had already started filling in the questionnaire was monitored on a secure web page. If any teacher, school principal, or ICT coordinator expected to participate was not listed in the monitor, the NRC could ask school coordinators to follow up with the individual(s) concerned.

After survey administration, national center staff copied the participation information from the IEA SurveySystem Monitor reports into WinW3S in order to record the participation status there.

7.7 Material Receipt and Preparing for Data Entry

In the period immediately following the administration of SITES 2006, the major NRC tasks included retrieving, collating, and verifying the integrity of the school materials. On receiving the survey materials from schools, the NRCs completed the following tasks:

- Checked that the complete and appropriate questionnaires were received for every teacher listed on the teacher tracking form;
- Verified that all identification numbers on all paper instruments were accurate and legible;
- Cross-checked that the participation status recorded on the teacher tracking form matched the availability of questionnaires, the information on the paper questionnaires, and the information in the online monitor; and
- Followed-up on schools that had not returned all the survey materials or for which forms were missing, incomplete, or otherwise inconsistent.

At the national center, all necessary information about schools, ICT coordinators, and teachers were recorded in WinW3S. This information included the return status of the questionnaires. NRCs then organized the paper questionnaires and corresponding forms for data entry (see Chapter 9).

7.8 Field Trial of Instruments and Procedures

All of the above-mentioned procedures were field-trialed in the majority of participating education systems.[1] In spring 2005, this field trial survey was conducted to test the survey instruments, software, forms, and corresponding procedures. For this purpose, a sample of 25 schools was drawn in most education systems with the teacher-level sampling following the steps outlined in Chapter 6 of this report.

As a result of the field trial, the instruments, the procedures, and the software were refined and improved where needed for the main study. In addition, valuable feedback was provided by individual NRCs, especially regarding strategies and best practices for

1 Alberta (Canada), Ontario (Canada), and South Africa did not participate in the field trial. This was because the decision to participate in SITES 2006 was taken only after the field trial period ended.

achieving high response rates and clearing the survey project with regional authorities or gaining support from labor unions.

The field trial also yielded results about the feasibility of the online data collection (ODC) in SITES 2006. A spilt-half design was used to compare data collected online and on paper and to guide decisions about the further use of the online and paper administration modes in a mixed-mode setting during the main study. Chapter 8 details the SITES 2006 ODC.

7.9 Main Study Data Collection Periods

As noted earlier in this report, administration of the SITES 2006 survey took place between March and June 2006 in the northern hemisphere and between September and October 2006 in the southern hemisphere.

Because a number of education systems experienced substantial problems with securing high levels of school and teacher participation, mainly due to a situation of "survey fatigue" (IEA PIRLS 2006 and OECD PISA 2006 coincided with IEA SITES 2006 and many national evaluation and assessments in many countries), a catch-up data collection period was granted in parallel to the southern hemisphere timeline in nine northern hemisphere education systems: Alberta (Canada), Catalonia (Spain), Denmark, Estonia, Finland, Hong Kong SAR, Israel, Norway, and Ontario (Canada). While the magnitude of the generally few additional cases did not allow for strong statistical investigation, explorations and reports concluded that no substantial response bias occurred because of the extension periods.

7.10 Survey Activities Questionnaire

After the data collection, NRCs were requested to complete the *survey activities questionnaire* to report their experiences during the administration and to collect important information about adherence to international procedures. This questionnaire was set up by the IEA DPC and administered online to NRCs immediately on completion of the data collection activities. The questions pertained to problems or unusual occurrences, if any, with respect to selecting the sample, securing school participation, translating or preparing the instruments, administering the questionnaires in the schools, and/or creating and checking the data files.

Responses to the survey activities questionnaire were carefully reviewed by the international consortium as a basis for data processing, cleaning, and analysis. The questionnaire responses did not yield major or critical problems and hence it was deemed unnecessary to take any special action with respect to the reported obstacles and the adjudication of data.

Many NRCs confirmed that achieving high and acceptable response rates was a major challenge during the administration, mostly due to the nature of a survey in which respondents, in most cases, were able to withdraw from it on a voluntary basis.

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8. Online Data Collection

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8.1 Overview

During planning for this third module of SITES, the research consortium decided that computer and internet technologies should be employed to assess ICT-related indicators and measures via two methodologically innovative components: (i) a computer- or web-based ICT skills assessment administered to students; and (ii) web-based questionnaires (Anderson & Plomp, 2001). Although the student component was eventually dropped due to operational obstacles, IEA confirmed its willingness to explore the feasibility of online data collection (ODC), stressing that the thematic background of SITES 2006 made the study a good candidate for employing survey technology similar to the technologies and tools used in pedagogical contexts under focus in SITES.

The consortium expected that Grade 8 mathematics and science teachers would be receptive to using ICT as a more convenient, interesting, or simply "up-to-date" mode of survey administration. The consortium also expected that the online mode would offer operational benefits, lower the individual and overall response burden, and significantly reduce paper handling and data-entry costs for national centers. Moreover, the online mode was expected to yield a more accurate and reliable international database. Finally, ODC was seen not only as a means of conducting and supporting research, but also as an object of research itself, in terms of addressing the question of what constitutes the characteristics of a working ODC system, as used in an international comparative survey (compare, for example, Couper, 2000, and Dillman & Bowker, 2001).

Several of the countries participating in SITES 2006 had used ODC; for most of them, the administration of electronic questionnaires to schools and teachers had become commonplace and routine. However, until the time of this study, large-scale educational surveys at the international level were based entirely on paper questionnaires. If this new experience were to be successful, it had to meet the standards that IEA had established for its studies (Martin, Rust, & Adams, 1999). This chapter hence provides information on the conceptual considerations, the procedures, and the resulting staged technical implementation. A second important concern presented in this chapter centers on the question of whether the different data-collection modes would introduce effects and biases into the data that could influence (adversely or otherwise) meaningful statistical analyses.

8.2 Conceptualization and Mixed-mode Considerations

To correctly sequence work steps and to ensure comparability of data, paper versions of the three questionnaire types used in SITES 2006 had first to be finalized in terms of translation and layout verification, even if the expectation was that all or nearly all of the data would be collected online. From these final paper versions, the questionnaires were converted for the online mode followed by final optical and textual verification. The electronic versions of the SITES questionnaires could only be filled in via the internet. No other options were allowed, such as sending pdf documents via email or printing out the online questionnaires and mailing them to the national center.

In addition to procedural considerations, the design had to address certain technical issues. Respondents needed only an internet connection and a standard internet browser. No additional software was required to fill in the questionnaire (see "Technical Implementation" below). Because the focus of SITES 2006 was on pedagogical use of ICT and not on computer literacy, the terminology used and technical hurdles were carefully considered and implemented in a way that reduced, to the very minimum, the computer skills respondents needed to access and answer the questions.

Because SITES 2006 was conducted using a mixed-mode design, data from different collection modes had to be merged to a single set within and across systems. Consequently, potential sources of error originating from the use of the two parallel modes had to be controlled for and reduced as much as possible to ensure uniform and comparable conditions across modes as well as countries. The design established several general similarities, and questionnaires in both modes were self-administered and equally situated in the visual domain, in contrast to mixed-mode surveys that simultaneously employ self-administered questionnaires and telephone or face-to-face interviews. Moreover, respondents were identified by the same sample design, contact to respondents was established by similar means, and data from both modes were collected over the same period of time. Great care was taken to present questions in ways that are easy to read on screen and self-explanatory to complete.

The navigational paradigm for the online questionnaire was designed to be as similar as possible to that of the paper questionnaires. Respondents could use "next" and "previous" buttons to navigate to an adjacent page, similar to flipping physical pages. In addition, the implementation of a "table of contents" mirrored the capability of opening a specific page or question of a paper questionnaire. While most respondents followed the sequence of questions directly, the two features allowed respondents to skip or omit questions just as they would have if answering a self-administered paper questionnaire. To further ensure the similarity of the two sets of instrumentation, responses to the online questionnaires were neither made mandatory nor evaluated in detail (e.g., using hard validations).

However, certain differences in the representation of the two modes remained. Rather than presenting multiple questions per page, the online questionnaire was presented question by question because of the complexity associated with the large number of questions. While the visual or sensory impression of the length and burden of a paper questionnaire can be estimated easily, the online questionnaires attempted to offer this through a "table of contents" that listed each individual question and progress counters. Multiple-choice questions were implemented with standard HTML "radio buttons." While it was possible for respondents to change the answer to any other option, it was not possible for them to uncheck the answer completely as they could in the paper questionnaires by crossing out (cancelling) a given answer. The consortium acknowledged the possibility to add extra "don't know" or "cancel" categories to all such questions, but took a balanced decision against it because the level of "cancelled" responses typically observed, including in the SITES 2006 field trial, was extremely low or negligible.

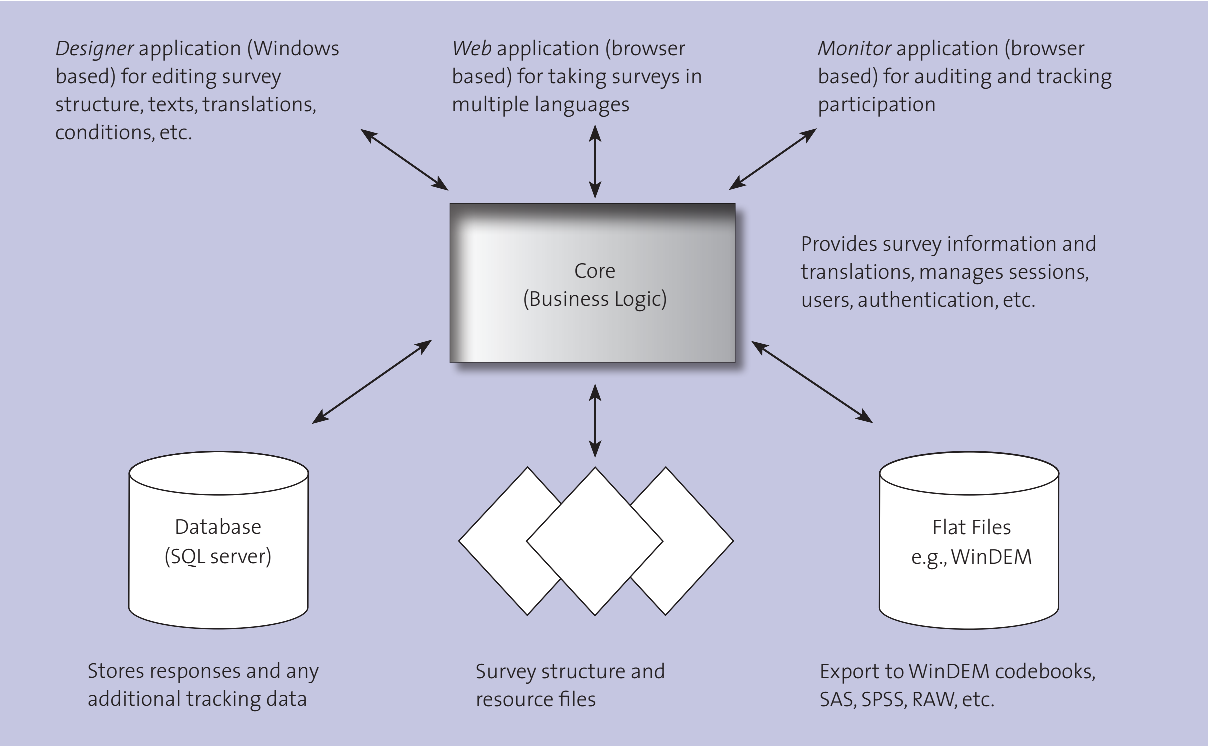
Overall, a near-identical representation between modes (Denscombe, 2006) was achieved, an accomplishment that enabled the yielding of identically structured and comparable data.

8.3 Technical Implementation

After addressing the procedural requirements and methodological necessities and constraints, the consortium determined a plan for implementation. No single "off-the-shelf" solution could be found that would satisfy all survey operations and requirements, most importantly in the areas of (i) decentralized translation, adaptation, and documentation, (ii) mixed-mode data collection and subsequent data processing, and (iii) minimal prerequisites on the side of respondents' or schools' computers. In mid 2004, the consortium accordingly delegated to the IEA DPC and its software unit the task of developing a suitable software (later coined the "IEA SurveySystem").

The IEA SurveySystem is a hierarchical model of a survey that stores and manages all questionnaire-related information, including text passages, translations, and adaptations, verification rules, variable names, and information for data management (see Figure 8.1). The SurveySystem's consolidation of metadata in a single set of files that the SITES 2006 national and international centers could easily send to one another over the internet allowed for a consistent way of managing the localized online versions of the questionnaires.

Figure 8.1: Architectural Overview of the SurveySystem



To serve the different usage scenarios, three distinct components of the SurveySystem were developed. The *Designer* was used to create, delete, disable, and edit survey components (e.g., questions and categories) and their properties. It allowed for translation of all text passages in the existing national paper questionnaires and additional system texts, and it included a complete web server to verify and test-drive the survey exactly as if under live conditions. The *Designer* also supported the export of codebooks to IEA's generic data-entry software WinDEM to allow for isomorphic data entry of online and paper questionnaires.

The *Web* component was a compiled application that served questionnaires in HTML format to the respondents for completion from within standard internet browsers.

Given the overall goal of securing the maximal possible coverage, no respondents were to be excluded because of incompatible browsers or disabled features. Because computer literacy was likely to vary greatly among groups of respondents, the design sought a balance between minimally desirable capabilities and simplicity. This achievement was especially important, as requirements in terms of connection speed, available software (browsers), and modem and processing speed were identified as crucial obstacles during initial discussions and the review of literature (see, for example, Reips, 2002). In this sense, the approach taken in SITES 2006 (selected aspects below) was similar to that of the "respondent-friendly design" explicated by Dillman, Tortora, and Bowker (1998).

In detail, the output was tested to assure (near) identical representation at minimum screen sizes in all supported browsers, which minimally were required to support HTML 4.0 (a standard since 1998), the "dir" attribute for bi-directional Unicode text, and cascading style sheets for basic formatting. With the exception of the welcome screen, graphics were not used. The extremely few users with browsers that did not meet this requirement received a translated list of supported browsers and information on contacting their national center. The *Web* component made use of plain HTML controls only and therefore did not require "fancy" technologies such as cookies, JavaScript, Flash, and/or pop-ups.

Finally, the web-based *Monitor* component allowed national centers to audit participation in real-time. It also allowed the centers to follow up schools in the case of incomplete or not-returned questionnaires in a similar way to that used for administration of the paper questionnaires.

All systems were programmed on the basis of Microsoft's .NET framework because of its robustness and excellent support for multilingual (Unicode) and internet applications in general. The live systems were hosted on dedicated high-performance servers rented from a reliable and experienced solution provider in Germany. Appropriate measures were taken to secure the data, and these were further strengthened by a professional security audit conducted by an external organization to verify the final setup. The IEA DPC developed backup and disaster recovery strategies and constantly monitored the systems for permanent availability during the data-collection period.

8.4 Operations

After they had successfully passed the translation and layout verifications (see Chapter 5), the national centers used the SurveySystem Designer software to convert the questionnaires for the online mode. In addition to being sent the software, the national centers received the international English survey files prepared by the consortium. The IEA DPC provided detailed documentation as well as corresponding training as part of a data management seminar for this task. The conversion to the online mode was based on the concept of "cultures," a certain language within a certain cultural context. For example, instrumentation for "Estonian in Estonia" and "Russian in Estonia" had to be prepared separately. Because the translation was already verified and fixed for the paper questionnaires, this conversion was mainly a copy-and-paste procedure. In addition to the questionnaire passages, certain translations were needed exclusively for online purposes, such as texts on the welcome screen and on navigation buttons or for error messages. Before submitting the files to the IEA DPC, the national centers were required to perform an optical side-by-side comparison using the integrated preview component.

After receiving from the national centers the files containing all structural information, translations, and national adaptations needed to run the online survey, staff at the IEA DPC performed a comprehensive optical question-by-question check for differences between the online and paper versions as an additional quality control measure prior to uploading a country's survey. Any detected deviations, such as mistakes in copying passages into the correct location, were reported back to the national centers. The online questionnaires were approved and made accessible only after any remaining issues had been resolved satisfactorily, thereby ensuring an isomorphic representation of questions in both modes.

To limit the administrative burden and required school communication, the decision on whether to assign the online or the paper questionnaire as a default to respondents was initially taken at the national center and was based on prior experience gained from participation in similar surveys and the SITES field trial. In most of the systems, the default mode was set at the school level. Every respondent of any such school—the principal, the ICT coordinator, and the sampled teachers—were assigned to the same mode, online or paper. In other countries, the default mode was alternatively set at the questionnaire level, so that all respondents of the same group (principals, ICT coordinators, and teachers) received the questionnaire in the same mode. However, the NRCs were required to take into account the mode that a specific school or individual preferred. The NRCs also had to ensure that every respondent assigned to the online mode by default had the option to request and complete a paper questionnaire regardless of the reasons for not being willing or able to answer online.

To ensure confidentiality, every respondent received individual login information. The national centers sent this information, along with general information on how to access the online questionnaire, to respondents in the form of "cover letters." In line with the procedures for the paper questionnaires, the information was distributed to the designated individuals via the school coordinator. During the administration period, respondents could log in and out as many times as needed and resume answering the questionnaire at the question they had last responded to in their previous session. Answers were automatically saved whenever respondents moved to another question, and respondents could change any answer at any time before completing the questionnaire. During administration, support was given by the national center, which, in turn, could contact the IEA DPC if unable to solve the problem locally.

National centers were able to monitor the responses to the online questionnaires in real-time and to send reminders to those schools where people had not responded in the expected period of time. School coordinators could then be asked to follow up with the individuals concerned.

Although education systems using the online mode in SITES 2006 faced parallel workload and complexity before and during the data collection, they had the benefit of a reduction in workload afterwards. Because answers to online questionnaires were already in electronic format, and responses were stored on servers maintained by the IEA DPC, there was no need for separate data entry.

In summary, the procedures that were necessary to support ODC alongside the conventional paper-and-pencil track were designed in such a way that little or no changes were required with respect to the tried-and-true survey operations typically employed in IEA surveys. The main challenges were to cater for isomorphic versions of the instrumentation in both modes, to reliably administer the resulting mixed-mode survey, and to subsequently integrate the two data sources. The overall conclusion is that SITES 2006 was successful in achieving this.

8.5 Staged Development, Implementation, and Evaluation

The introduction of ODC technology and methodology in SITES 2006 took place in a gradual and careful way. The ODC component was launched in three main phases—a technical try-out, the field trial, and the main survey.

The first phase (1), the technical try-out with 12 participants in May 2005, sought to collect basic experience and to locate and eliminate basic technical problems with respect to languages, the conversion of instruments from paper to online, scripts and script direction (e.g., Hebrew), and browser compatibility. In general, this phase was highly successful in identifying key requirements and defining further development.

The second phase (2), the field trial in autumn 2005 with 16 out of the 18 participants, made use of a feature-complete ODC system developed on the basis of the technical try-out findings. Prior to the field trial, NRCs were asked whether they intended to use ODC for the main data collection. If they did, these systems were obliged to field-trial the ODC procedures as well.

The largest part of the evaluation was based on the findings and outcomes of the field trial, especially in terms of any new procedures developed. While producing a working technical and procedural solution was, of course, a key prerequisite, the evaluation of the online approach in SITES 2006 was based on existing evidence (where applicable and appropriate in general), but required separate investigation to reflect the unique SITES 2006 characteristics by addressing two key questions:

- *Key Question 1—feasibility:* Investigate whether ODC methodology and procedures can work in the context of an international IEA study.
- *Key Question 2—validity:* Analyze whether the two modes (online and paper and pencil) yield comparable data, thus allowing the implementation of both modes in and across countries.

The following list contains selected elements of the evaluation of the feasibility:

- There were no observed or reported problems with respect to translation, conversion, and representation of advanced scripts (such as Thai, Chinese, and Hebrew) or script-direction (right-to-left writing) during preparation and administration of either the field trial or the main study.
- On average, conversion and verification required two to three person days per language version, equivalent to one day per questionnaire, with additional time needed to communicate and resolve the few and far between differences identified during the thorough side-by-side comparison of instruments at the IEA DPC. All such problems were resolved successfully before administration.
- During administration, no major problematic behavior of servers (e.g., unplanned down-time or hacking) or users' browsers was observed or reported for the approximately 26,000 questionnaires in the main study.
- For the field trial, the review of server log files showed that, in relation to all online-administered questionnaires, no more than 0.1% of users attempted to access the web application with outdated browsers; a similar magnitude was observed during the main study.
- The SITES 2006 procedures required paper questionnaires to be used in case respondents refused or simply were not in a position to participate online, for example, because of lacking infrastructure. Unfortunately, during the field trial, the distribution of these fall-back paper questionnaires seemed not to have worked for some systems. The consortium regarded the need to reliably record and manage the demand for paper instead of online questionnaires as highly important. The procedures were discussed with the NRCs, who firmly monitored the successful application during the main data collection.
- National centers reported making extensive use of the monitor application to facilitate follow up of non-respondents.
- Eventually, the integration and subsequent cleaning and processing strategies were adjusted to reflect the online data source, but did not constitute an obstacle in respect to quality. In all cases, manually entered datasets and data from the online mode

structurally matched 100%. That is, within any one participating system, both modes used the exact same variable and coding scheme.

- There were no indications or reports that reluctance or even resistance on the part of schools to participate in the survey or the subsequent willingness of individual respondents to fill in the questionnaire related to the mode of administration itself, in this case "online." In some of the participating systems, difficulties in securing acceptable school participation rates were instead due to a general atmosphere of "survey" or "educational reform fatigue."

Overall, the majority of procedures and tasks, supported by manuals and direct support via email, went as intended, even though, for some areas, more attention and allocation of time and resources were required than originally expected, for instance, for cross-checking questionnaire wording and structure.

Evaluating whether the paper and online modes yielded comparable data was a more complex process (Brečko & Carstens, 2007). For the purpose of comparison, a split-sample design at school level was implemented during the field trial (with a typical sample size of 25 schools combined within each system). Statistical analyses were conducted and included—but were not limited to—the investigation of response rates, drop-out, indicator reliability, and the mode independence of nominal as well as interval measures.

There were no evident substantial differences between the data derived from paper and the data derived from the online mode that would reduce the ability to merge these sets of data and to make joint analyses. Issues were identified in terms of drop-out, which were partially rooted in the preliminary character of the field trial instruments. The level of drop-out was negligible or fairly limited in the two shorter school-level questionnaires. The level was substantial, although not critical, in the significantly longer teacher questionnaire. Adequate measures, in this case the reduction of overall length, were implemented for the main study.

The consortium hence decided to recommend the further use of ODC during the main study where possible and desired. Accordingly, in this third and final phase in April/May 2006 (northern hemisphere) and August/September 2006 (southern hemisphere), ODC was offered as an international option, making SITES 2006 the first IEA study—and the first in the history of international comparative educational assessments—to make ODC an integral component of its framework and operations.

8.6 Main Study Participation and Mode Distribution

While nearly all of the participating systems expressed at least some interest in using the online mode as either the default for data collection (with paper-and-pencil questionnaires as a mandatory fall-back) or for only selected schools, regions, or individuals, 17 of the 22 participating systems implemented ODC, usually as the default mode for collecting data, after taking into account its suitability for their local context. The consortium recommended that the decision accord with the level of confidence that each system had in regard to using the online mode, based on factors such as the within-country computer and internet penetration, poor online response rates in previous surveys, and (most importantly) the outcomes of the mandatory field trial. One participant was advised to refrain from using ODC given unfavorable experiences in previous similar designs in the past and in the field trial. The remaining four participants (Chinese Taipei, Japan, Ontario (Canada), and South Africa) decided not to use ODC because of feasibility concerns. Estonia and Finland administered the survey in two languages each, resulting in a total of 19 sets of instrumentation.

Table 8.1 provides the distribution of paper and online questionnaires in all participating education systems. The distributions for principals, ICT coordinators, and science teachers were highly similar within each system. It is noteworthy that a number of systems managed to collect all data entirely using online questionnaires yet did not compromise coverage.

Table 8.1: Extent to which Paper and Online Administration Modes Were Used for Mathematics Teacher Questionnaires during the Main Study

Education System	Paper	Online
Chinese Taipei	100.0%	0.0%
Japan	100.0%	0.0%
Ontario, Canada	100.0%	0.0%
South Africa	100.0%	0.0%
France	78.9%	21.1%
Russian Federation[a]	58.9%	41.1%
Denmark	30.0%	70.0%
Slovenia	26.6%	73.4%
Chile	12.4%	87.6%
Moscow, Russian Federation[a]	10.1%	89.9%
Slovak Republic	7.1%	92.9%
Hong Kong SAR	6.2%	93.8%
Catalonia, Spain	2.4%	97.6%
Italy	1.2%	98.8%
Finland	0.9%	99.1%
Alberta, Canada	0.0%	100.0%
Estonia	0.0%	100.0%
Israel	0.0%	100.0%
Lithuania	0.0%	100.0%
Norway	0.0%	100.0%
Singapore	0.0%	100.0%
Thailand	0.0%	100.0%
Average	28.9%	71.1%

Note:
[a] The table reflects the questionnaire modes as indicated in the international database. Certain schools from the Moscow and Russian Federation samples contributed to one another's estimates (see Chapter 10). At the time of data collection, however, all data for the Moscow region were collected online and all data for the Russian Federation were collected via paper questionnaires.

Table 8.2 provides an overview of the mode distribution for completed questionnaires in (i) all education systems, and (ii) in those systems that used ODC during the main data collection. As can be seen, the proportion of paper versus online mode was highly consistent across questionnaire types, for example, for principals and ICT coordinators. The 17 countries that opted to use ODC actually administered the vast majority of the questionnaires (about 88%) in that mode. Overall (i.e., in all 22 systems), about 72% of the international data available to SITES 2006 originated from online questionnaires.

Table 8.2: Extent to which Online and Paper Questionnaires Were Used by all Participating Education Systems (left) and by Systems Opting for ODC (right)

Questionnaire	All systems (22)		Systems using ODC (17)	
	Paper	Online	Paper	Online
Principal	27.9%	72.1%	11.9%	88.1%
Technical	27.6%	72.4%	11.5%	88.5%
Mathematics teacher	28.9%	71.1%	13.0%	87.0%
Science teacher	28.7%	71.3%	12.9%	87.1%
Average	28.3%	71.7%	12.3%	87.7%

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9. Creating and Checking the International Database

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9.1 Overview

Creating the SITES 2006 international database (IDB) and ensuring its integrity required close coordination between and cooperation among the project and sampling staff at the IEA Data Processing and Research Center (DPC) and the SITES 2006 international coordinating center (ICC), as well as with the national research coordinators (NRCs). The primary goals were to ensure that all national information in the international database conformed to the international data structure and coding scheme, that any national adaptations to questionnaires were reflected appropriately in the codebooks and the corresponding documentation, and that all variables used for international comparisons were indeed comparable across all education systems. Quality control measures were applied throughout the process.

This chapter describes the data-entry and verification tasks undertaken by the national centers, the integration of data from the paper and online administration modes, the data-editing and database-creation procedures implemented by the IEA DPC in collaboration with the international consortium, and the steps taken at all involved centers to confirm the integrity of the international database.

9.2 Data Entry and Verification at National Research Centers

Each SITES 2006 national research center was responsible for transcribing the information from the three types of questionnaires (principal, technical, and teacher) administered to the samples of schools and teachers into computer data files. The IEA DPC supplied national centers with the Windows Data Entry Manager software (WinDEM) and corresponding documentation in the *SITES 2006 Data Management Manual* (IEA DPC, 2006). In addition, the IEA DPC held a four-day data management seminar in Hamburg, Germany, in June 2005, on software, procedures for national adaptations, and rules and procedures for data entry. The seminar was specifically targeted at the person within the national team responsible for data management and liaising with the IEA DPC.

The responses from the principal, technical, and teacher questionnaires were entered into data files created from internationally predefined codebooks, which contained information about the names, the lengths, the locations, the labels, the valid ranges (for interval/ratio measures) or valid values (for nominal/ordinal questions), and the missing codes for each variable in each of the three questionnaire types. Before data entry could commence, data managers were required to adapt the codebook structure to reflect any adaptations made to the national questionnaire versions, for example, a nationally added category. These adapted codebooks then served as templates for creating the corresponding data-entry file(s).

In general, the national centers were instructed to discard any unused or empty questionnaires, and to enter any questionnaire that contained at least one (1) valid response. To ensure consistency across education systems, the basic rule for data entry in WinDEM required national staff to enter data "as is" without any interpretation, correction, truncation, or cleaning. The resolution of any inconsistencies remaining after the stage of data entry was delayed until the stage of data "cleaning" (see below).

The general rules for data entry were as follows:

- Responses to categorical questions were generally coded as "1" if the first option (checkbox) was used, "2" if the second option was marked, and so on.
- Responses to "check-all-that-apply" questions were coded as either "1" (checked) or "2" (not checked).
- Responses to numerical or scale questions (e.g., school enrolment) were entered also "as is," that is, without any correction or truncation, even if the value was outside of the originally expected range, for example, if an ICT coordinator reported that he or she spent 80 hours a week on ICT-related support.
- Likewise, responses to filter questions and filter-dependent questions were entered exactly as filled in by the respondent, even when the information provided—however obvious—was logically inconsistent.
- If responses were not given at all, were not given in the expected format, were ambiguous, or were in any other way conflicting (e.g., two options in a multiple-choice question were selected), the corresponding variable was coded as "omitted or invalid."
- Unlike other IEA surveys concerned with measures of student achievement, SITES 2006 did not use a code to identify "not administered" questions, for example, those that were misprinted. Also, in these infrequent cases, the "omitted or invalid" code was used.

In a parallel step to that for the questionnaire data entry, the data manager at each national center used the information from the teacher tracking forms (see Chapter 6) to verify the completeness of the materials. Participation information, for example, whether the concerned teacher left the school permanently between the time of sampling and the time of the actual administration, was entered in the WinW3S within-school sampling software (see Chapter 6).

In order to check the reliability of the data entry within the education system, national centers were required to have at least 40 completed principal questionnaires, at least 40 technical questionnaires (school level), and at least 100 teacher questionnaires entered twice by different staff members as early as possible during the data capture period. This procedure allowed data managers and the IEA DPC to identify possible misunderstandings or mishandlings of data-entry rules and to initiate appropriate reactions, for example, the re-training of staff. The acceptable level of disagreement between the originally entered and the double-entered data was established at 1% or lower. The margin of error observed for all education systems participating in the SITES 2006 main data collection was well below this threshold.

Before sending the data to the IEA DPC for further processing, national centers were responsible for carrying out mandatory verification steps on all entered data and for undertaking corrections as necessary. The corresponding routines were included in the WinDEM program, mainly in order to identify invalid data, but also to check the consistency among records. For example, data files were checked for duplicate identification codes or data outside the expected valid range or the values defined as valid. Data managers were required to review the corresponding reports and to resolve any inconsistencies and, where possible, correct problems by looking up the original survey questionnaires.

While the IEA DPC strongly encouraged every education system to use the WinDEM software for data entry to meet all standards and rules, a few participating education systems used a different data-entry system, such as one routinely used by an external survey company. However, these systems were nonetheless required to conform to all specifications established in the international codebooks and to verify their data using the same consistency checks as defined within the WinDEM software. Data entry in France and Japan was completed outside of WinDEM, but submitted in the internationally required format together with evidence of the accuracy and reliability of the data entry as it would have been if produced by the international procedures.

In addition to the data files described above, national centers were requested to provide detailed data documentation to the IEA DPC. This material included hard copies or electronic scans of all original teacher tracking forms, electronic copies of the national versions of all questionnaires, the final national adaptation forms (NAFs), and a report on data-capture activities collected as part of the survey activities questionnaire (SAQ).

9.3 Data Checking, Editing, and Quality Control at the IEA DPC

Once the data were submitted to the IEA DPC, a process generally referred to as "data cleaning" commenced. The main objective of the process was to ensure that the data adhered to international formats, that information from principals, ICT coordinators, and teachers could be linked across different survey files, and that the data accurately and consistently reflected the information collected within each education system. The IEA DPC went to great lengths to ensure that the data received from the SITES 2006 participants were of high quality and internationally comparable. The foundation for quality assurance was laid before the data first arrived at the IEA DPC through the provision of software designed to standardize a range of operational and data-related tasks.

- The WinW3S software performed the within-school sampling operations, adhering strictly to the sampling rules defined by SITES 2006. The software also created all necessary listing/tracking forms and stored any school- or teacher-specific information, such as gender and participation status.
- The WinDEM software enabled entry of all questionnaire data in a standard, internationally defined format. The software also included a range of checks for data verification.

A complex study such as SITES 2006 requires a correspondingly complex data-cleaning design. To ensure that programs ran in the correct sequence, that no special requirements were overlooked, and that the cleaning process was implemented independently of the persons in charge, the following steps were undertaken.

- Before being used with real data, all data-cleaning programs were thoroughly tested using simulated data sets containing, as much as possible, expected problems and inconsistencies.
- All incoming data and documents were registered in a database. The date of arrival was recorded, along with any specific issues meriting attention.
- All national adaptations and all detected deviations from the international data structure were recorded in a "national adaptation database" and verified against the structure and content of the data itself. (The reports from this process are available for data analysts in Appendix D.)
- The cleaning was organized according to strict rules applied to all national data sets so that deviations in the cleaning sequence were impossible.
- All systematic or manual corrections made to data files were implemented in SAS and recorded in specific cleaning reports for consortium and NRC review.

- Once the data cleaning was completed for an education system, all cleaning checks were repeated from the beginning to detect any problems that might have been inadvertently introduced during the cleaning process itself.

9.3.1 Import, Documentation, and Structure Check

Data cleaning began with an analysis of the submitted data-file structures and a review of data documentation consisting of the teacher tracking forms. Most education systems submitted all required documentation along with their data, which greatly facilitated the data checking. The IEA DPC contacted those systems that returned incomplete data and/or documentation.

Next, all available codebooks and data were imported from the source files and combined into SAS databases. Again, each questionnaire type corresponded to one SAS database and one SAS codebook file. In this step, both the data originating from paper questionnaires as well as online questionnaires were combined and checked for structural agreement (see Chapter 8 on online data collection). The data from both administration modes were structurally equivalent and also made use of the same valid and missing codes in all cases. The early combination of these data in the import stage ensured that data resulting from both administration modes were fed through the same data-processing systems and checks as described in the remainder of this chapter.

The first checks implemented at the IEA DPC looked for differences between the international file structure and the national file structures. As described above, some countries made structural adaptations to the questionnaires; the extent and nature of such changes differed greatly across education systems. While some systems administered the questionnaires without any changes, except for translations and necessary cultural adaptations, others inserted questions or options within existing international variables or added entirely new national variables. Given the associated risk of deviating from the international data structure, NRCs wishing to make such changes were required to follow certain strict rules to allow unequivocal integration of nationally adapted variables for international comparison.

In general, the extent of adaptations made to the international questionnaires was fairly low compared to other IEA surveys. Where necessary, the IEA DPC modified the record layout and/or values to ensure that the resulting data were internationally comparable. For instance, additional national options in multiple-choice questions were recoded in such a way that they adhered to the international code scheme.

The NRCs and data managers received detailed reports on any identified structural deviation together with documentation on how the IEA DPC resolved the deviations. In the case of national adaptations, data were recoded back to the required international values, and national variables were created to hold the original values for later use in national reports. In a few cases, data were not available for certain variables because the corresponding question was not administered nationally (see Appendix D). In most of these cases, usually in the case of "tracked" school systems (Question 3 of the teacher questionnaire), data were systematically recoded to a particular value agreed with the NRC. There was only one case in which data had to be removed from the international database, and this was because the information was no longer internationally comparable.

9.3.2 Identification Variable and Linkage Cleaning

To identify, track, and document each participant and each corresponding questionnaire in a survey, each record in a data file needs to have a unique identification number. The existence of records with duplicate ID numbers in a file implies an error of some kind. In SITES 2006, if two records shared the same ID number, and contained exactly the same data, one of the records was deleted and the other remained in the database. If the records contained different data (apart from the ID numbers) and it was impossible to identify which record contained the "authentic" data, and if consultations with the NRC did not resolve the matter, both records were removed from the database. The IEA DPC deleted data in a very small number of cases only. In addition, only a tiny number of records present in both the paper and the online data files were identified.

In SITES 2006, data collected at the school level were recorded in two files—the principal file and the technical file. It was crucial that the records from these files could be linked together correctly, that is, 1:1. In addition, the school-level data were linked to the multiple teacher-level records for that school, that is, 1:n. In both cases, the linkage was implemented through a hierarchical ID numbering system and was cross-checked against the tracking forms and corrected where necessary. A special requirement in SITES 2006 was to identify teachers teaching science as well as mathematics. These teachers were consequently listed and, in a few cases, sampled for both populations. Secondary identification variables had earlier been used to link the records for both questionnaires from the same data-entry file. Therefore, if only one of the two assigned questionnaires was returned, for instance, in the mathematics context, all person-related variables, independent of the subject or target class context, such as age or gender, were copied to the corresponding empty record, in this example to the science teacher file, to allow for more precise population estimates during the analysis stage.

Further ID cleaning focused on consistent tracking of information between the data used for listing, sampling, and tracking in WinW3S and the actual responses in the questionnaire. Where necessary, variables pertaining to the teachers' gender, year of birth, exclusion status, and participation status were verified and checked against the original paper teacher tracking forms.

Where applicable and possible, close cooperation with the national center was sought to resolve any ID or linkage inconsistencies. For this purpose, NRCs and data managers received standardized reports comprising each identified inconsistency. Once the ID, linkage, participation, and exclusion information was finalized, data were transferred to the IEA DPC sampling unit and used to calculate participation rates, exclusion rates, and, finally, estimation sampling weights.

9.3.3 Resolving Inconsistencies in Questionnaire Data

After each data file was matched to the international standard, as specified in the international codebooks, a series of standard cleaning rules were applied to the files. This process was conducted through use of software (developed at the IEA DPC) that can identify and, in many cases, automatically correct, inconsistencies in data. Details about all implemented cleaning checks and procedures and any actions applied to the data were given to the national centers as part of a comprehensive data-processing documentation and were explained during the third NRC meeting in April 2007.

Filter questions, which appear in certain positions in the questionnaires, were used to direct the respondent to a particular question or section of the questionnaire. Filter questions and their dependent questions were treated automatically in most cases. If the filter question contained a value and the dependent questions were validly skipped, dependent variables were coded as "logically not applicable." If a response to a filter question was either omitted or equivalent to "no," thereby marking the dependent questions as not applicable, and yet the dependent questions were answered in an unambiguous pattern, the filter question was recoded to the equivalent of "yes" or "applicable."

Split variable checks were applied to questions where the responses were coded into several variables. For example, Question 26 of the principal questionnaire listed a number of developments and asked principals to mark whether they played a particular role in them by checking "yes." Occasionally, principals marked the "yes" boxes but left the "no" boxes unchecked, resulting in "omitted" values in the data file. Because, in these cases, it could be assumed that the unmarked boxes actually meant "no," the corresponding variables were imputed accordingly. Similar rules were applied to partially answered "check-all-that-apply" questions, for example, Question 12 from the technical questionnaire, or partially answered numerical questions, for example Question 7 of the technical questionnaire. In some cases, the SITES 2006 questionnaires called for even more complex recoding rules, for instance, in so-called multi-matrix questions with yes/no lists that were also used as filter questions (e.g., Question 15, teacher questionnaire).

Finally, variables within and across data files were verified against one another to identify and resolve inconsistent response patterns or multivariate outliers. For example, Question 5(a) in the technical questionnaire asked for the total number of computers available in the school, while 5(e) asked for the number of computers connected to the internet. Clearly, the number given for 5(e) should not have exceeded the number given for 5(a). Question 1 of the teacher questionnaire (class enrolment) was another example in which the IEA DPC attempted to identify implausibly high values.

The number of inconsistent and implausible responses in the data files varied from system to system, but no national data were completely free of inconsistent responses. Each problem was recorded in a database, identified by a unique problem number along with a description of the problem and the action taken by the program or by the staff of the IEA DPC. Issues that could not be corrected using systematic rules were reported back to the NRC so that original data-collection instruments and tracking forms could be checked to trace the source of the inconsistency. Wherever possible, staff at the IEA DPC suggested a solution and asked the NRCs either to accept it or to propose an alternative. Data files then were updated to reflect the solutions agreed on. Both systematic corrections as well as those apparent on a case-by-case level were applied directly in SAS program syntax and carried out automatically for each cleaning run.

Where the NRC could not solve problems by inspecting the instruments and forms or could not suggest a satisfying solution or explanation, final cleaning rules were defined by the ICC, usually by recoding data (e.g., computer counts) using auxiliary information. In some instances in which a clear and unambiguous decision was not possible, for instance with respect to the number of students in a class, the data remained in the files unchanged, reflecting previous IEA practices. Users of the international database were cautioned in the user guide to review any concerned variable prior to analysis and to exclude cases deemed to be inappropriate or implausible.

9.3.4 Handling of Missing Data

During the SITES 2006 data entry using WinDEM at the national centers, two types of entries were possible: valid data values and missing data values. Data-entry staff were able to assign either the valid values or a value for "omitted/invalid." Later, at the IEA DPC, additional missing values were applied to the data to be used for further analyses and to differentiate different response behaviors.

In the international database, five missing codes were used:

- *Omitted/invalid (9):* The respondent had a chance to respond to the question, but did not do so or provided an invalid response. The value was also assigned in extremely rare cases where questions were misprinted or otherwise not legible.
- *Not administered (8):* The respondent was not administered the actual question, item, or option because it was removed from the national version. He or she had no chance to read and answer the question.

- *Not reached (7):* This code indicated variables not reached by the respondents at the end of a questionnaire, usually due to a lack of time (drop out). The value was assigned during data processing only.
- *Logically not applicable (6):* The respondent answered a preceding filter question in a way that made the following dependent questions not applicable to him or her. This value was assigned during data processing only.

9.4 Interim Data Products

Building the SITES 2006 international database was an iterative process in which the IEA DPC provided the consortium and the NRCs with a new version of data files whenever a major step in data processing was completed. This process guaranteed that the NRCs had a chance to review their data and to run their own plausibility and statistical checks to validate the data. The data products that were sent out by the IEA DPC to the consortium and to each NRC included both data files as well as data summaries. All interim data were made available to the consortium whereas each education system received its own data only.

The first version was sent to the consortium and the NRCs as soon as the data could be regarded as "clean" relative to identification codes and linkage issues. Once weights and information-facilitating variance estimation became available (see Chapter 10), these were added to the principal and teacher data files. The IEA DPC sent out a third version once the majority of background cleaning issues had been resolved and final updates to the data files implemented. These files, which enabled the NRCs to replicate the results presented in the first draft chapters of the international report, were also used in an initial international database (IDB) training held by IEA DPC staff during the third NRC meeting in Frascati, Italy, in April 2007.

Summary tables containing unweighted univariate statistics for all questionnaire variables were provided for each participating education system. For categorical variables, which represent the majority of variables in SITES 2006, the percentages of respondents choosing each of the response options were displayed. For numeric or scale variables, various descriptive measures were reported. These included the minimum, the maximum, the mean, the standard deviation, the median, the mode, percentiles, and quartiles. For both types of variables, the percentages of missing information due to respondents omitting or not reaching a particular question were reported. These summaries were used for an in-depth review of the data at the international as well as the national level in terms of plausibility, unexpected response patterns, conspicuous profiles of an education system, and so on.

9.5 Building the International Database (IDB)

All interim data products were placed in the structure used during data entry: thus, one file for the principal data, one file for the ICT coordinator data, and one file for teacher data, and with each presented separately for each participating education system. However, both the principal and the ICT coordinator responses related to the school level and matched each other 1:1 (see Chapter 3). Because weights were calculated only once for each school (see Chapter 10), these two files were consequently merged to form a combined school-level data file comprising the responses from the principal as well as from the ICT coordinator. The teacher data-entry file contained responses from two independently sampled populations of mathematics and science teachers to simplify data entry and logistics. Because these teachers belonged to two independent populations and because the weighting for these two groups was done separately and independently (see Chapter 10), analysis of combined mathematics and science teacher data was neither meaningful nor statistically possible. To reflect this situation, the interim data entry file for teachers was split into two files for the final international database, one for mathematics teacher data and one for science teacher data, with each including its own sampling weights.

A second key difference between the interim data products and the draft and final (public use) databases is the fact that the former included one record for each sampled unit (school or teacher) even if the questionnaire was not returned or returned empty. The draft and final IDB included only those records that satisfied the SITES 2006 sampling standards. Data from respondents who either did not participate or did not pass adjudication (e.g., because the within-school participation was not sufficient) were removed at the final stage.

For the draft and final IDB, the data cleaning at the IEA DPC ensured that information coded in each variable was, in fact, internationally comparable, that national adaptations were reflected appropriately in all concerned variables, that questions not internationally comparable were removed from the database (see Appendix D), and (eventually) that all entries could be successfully linked across levels. The IDB incorporated all national data files and was prepared in raw, SAS, and SPSS format.

Following the data release policy agreed between each NRC and the IEA, a draft IDB that included data from all education systems was made available to each NRC in early January 2008 prior to the publication of the international report in spring 2008. The data release policy granted freedom to publish any national results at any time (as long as appropriate reference to the IEA was made), but obliged countries to delay the publishing of any analysis involving more than their own data (e.g., comparisons of education systems) until after publication of the international report. The public-use IDB was supplemented by full documentation, national context data (see Chapter 2), and a detailed user guide.

The SITES 2006 IDB is a unique resource for policymakers and analysts. It contains data from representative samples of schools and Grade 8 mathematics and Grade 8 science teachers from 22 education systems around the world. The database is fully documented in the *SITES 2006 User Guide* (Brese & Carstens, 2009).

References

Brese, F., & Carstens, R. (Eds.). (2009). *SITES 2006 user guide for the international database.* Amsterdam: International Association for the Evaluation of Educational Achievement.

SITES 2006 International Coordinating Center (2006). *SITES 2006 data management manual*. Hamburg: IEA Data Processing and Research Center (DPC).

10. Sampling Weights and Participation Rates

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10.1 Overview

This chapter provides detailed information on why and how sampling weights were calculated. It also gives an overview of the (un-weighted and weighted) participation rates of schools, teachers, principals, and ICT coordinators. The method of variance estimation used in SITES 2006 also is explained. Special characteristics of the samples for the participating education systems and details about sample implementation can be found in Appendix B.

10.2 Within-school Participation Requirements

When teacher participation rates within a school are small, the risk of having responding teacher(s) who are not typical of the entire body of teachers in the school strengthens. Within-school participation requirements were therefore set up to prevent possible non-response bias.

A school was regarded as participating if:

- It returned the principal questionnaire or the technical questionnaire and at least two teacher questionnaires (regardless of the subject domain); or
- It returned at least 50% of the teacher questionnaires (regardless of the subject domain).

A teacher from a participating school was considered as participating if he or she returned a questionnaire and provided a valid response to at least one of the questions. Similar requirements were set for principals and ICT coordinators. Schools where these participation requirements were not met were regarded as non-participating, and none of the questionnaires submitted from teachers, principals, or ICT coordinators of these schools was used for data analysis.

10.3 Calculating Sampling and Estimation Weights

The SITES 2006 sampling design required the use of sampling weights for data analysis. As described in Chapter 6, schools in different explicit strata had different selection probabilities, which made it more likely for large schools than small schools to be selected for SITES 2006. Teachers from different schools also had different selection probabilities. As a result, the participating schools and teachers did not always represent the same numbers of schools and teachers in the population. This fact had to be accounted for by the use of sampling weights, which correctly reflected the different selection probabilities.

In addition to this, the willingness of schools and teachers to participate in SITES 2006 differed from one school to another. To reduce the potential bias introduced by school and teacher non-response, sampling weights had to be adjusted for both school and teacher non-response.

This situation led to two distinct sets of sampling weights for SITES 2006: (i) a final school weight consisting of a basic school weight and a school non-response adjustment factor; and (ii) a final teacher weight consisting of the final school weight just mentioned, a basic teacher weight, and a teacher non-response adjustment factor.

All analyses in the SITES 2006 international report were conducted using these weights. (All secondary analyses of the SITES 2006 database should be performed with weighted data only.) These weights and their components are described in the following sections.

10.3.1 Basic School Weight (wgtfac1)

The basic school weight, defined as the inverse of the school selection probability, is labeled *wgtfac*1. For each school *k* in explicit stratum *i*, the basic weight is given by:

$$wgtfac1_{ik} = \frac{N_i}{n_i} ,$$

where N_i is the number of schools in the explicit stratum *i*, and n_i is the number of sampled schools from that stratum.

10.3.2 School Non-response Adjustment (wgtadj1)

Given that some schools refused to participate in SITES 2006, it was necessary to adjust the above basic weights to account for the loss of sample size due to unit non-response. In an attempt to minimize potential bias due to non-response, adjustment factors were calculated within distinct groups of schools, called non-response adjustment cells. These cells were formed at the implicit stratum level (see Section 6.4.3). When there was no implicit stratification, these cells were built at the explicit stratum level (see Section 6.4.1). When there were fewer than five participating schools within a cell, or when the adjustment factor was larger than 2, cells were collapsed with other cells that had similar characteristics until the number of participating schools within the resulting cell was five or higher and the adjustment factor less than 2.

The school non-response adjustment factor *wgtadj*1 is defined as follows for each responding school *k* within non-response adjustment cell *j* in stratum *i*:

$$wgtadj1_{ijk} = \frac{n_{ij}^{s} + n_{ij}^{r1} + n_{ij}^{r2} + n_{ij}^{nr}}{n_{ij}^{s} + n_{ij}^{r1} + n_{ij}^{r2}} ,$$

with $n^{s}{}_{ij}$ being the number of originally sampled schools that participated, $n^{r1}{}_{ij}$ and $n^{r2}{}_{ij}$ the number of first and second replacement schools (see Section 6.6), respectively, that participated, and $n^{nr}{}_{ij}$ the number of schools that did not participate in response group *j* of explicit stratum *i*.

Ineligible schools (no Grade 8 students), closed schools, and schools belonging to the exclusion categories were ignored in the non-response adjustment cells.

10.3.3 Final School Weight (schwgt)

The final school weight (*schwgt*) is the product of *wgtfac*1 and *wgtadj*1 as indicated here:

$$schwgt_{ijk} = wgtfac1_{ijk} \times wgtadj1_{ijk}$$

where each participating school *k* is in response group *j* of explicit stratum *i*. This weight was used for all data analyses involving variables relating to the school principal and the ICT coordinator and presented in the international report.

10.3.4 Second Stage Teacher Weight (wgtfac2)

Teacher weight factors were calculated separately and independently for mathematics teachers and for science teachers. The following account explains the process for mathematics teachers only, given that the calculation of science teacher weights is performed in the same way.

The basic teacher weight (second stage teacher weight) is defined by the inverse of the selection probability of the teacher within the sampled school. For each sampled teacher l of school k, the basic teacher weight is given by:

$$wgtfac2_{ikl} = \frac{M_{ik}}{m_{ik}},$$

where M_{ik} is the number of mathematics teachers in the school k (that were not excluded before sampling) and m_{ik} is the number of sampled mathematics teachers in that school.

10.3.5 Teacher Non-response Adjustment (wgtadj2)

Due to small within-school sample sizes, the research consortium deemed it preferable not to implement the teacher non-response adjustment at the school level, but instead to implement it at the school non-response adjustment cell level. In other words, school and teacher non-response adjustments were performed at the same level (see Section 10.3.2 above).

Within each adjustment cell j of explicit stratum i, the teacher non-response adjustment factor $wgtadj2$ is given by:

$$wgtadj2_{ijkl} = \frac{\sum_{sample} wgtfac2_{ijkl}}{\sum_{participants} wgtfac2_{ijkl}},$$

where $wgtfac2_{ijkl}$ is the basic teacher weight for teacher l in school k of explicit stratum i; and the numerator is summed over all sampled teachers whereas the denominator is summed over participating teachers only.

Teachers who had left school permanently after sampling, or teachers who were found to be part of the group of excluded teachers, were omitted from this equation. Some systems reported teachers being temporarily absent, for example on maternity leave or sick leave. To obtain correct estimations of the teacher population size, these teachers were included in the teacher non-response adjustment calculations.

10.3.6 Final Teacher Weight (totwgt)

The final teacher weight, denoted as *totwgt* (total weight), is the product of four weight factors, which are also included in the international database: *wgtfac*1, *wgtadj*1, *wgtfac*2, and *wgtadj*2. The weight *totwgt* was used for all data analyses involving teacher-related variables in the SITES 2006 international report.

Note that it is neither meaningful nor recommended to group together data from mathematics teachers and science teachers for analytical purposes. The combined data set cannot represent a population of teachers who teach "mathematics, science, or both." In many SITES 2006 systems, some teachers taught both mathematics and science. If both data sets had been (or are) combined, these teachers would have been over-represented. Some teachers filled in SITES 2006 questionnaires for mathematics and for science, so their input to the combined data was doubled. Some other teachers taught mathematics and science, but were only sampled for one of the two subjects. Being part of two teacher sampling frames, they had a higher probability of being selected than did teachers who taught only one subject. Consequently, analysis for the mathematics and the science teachers had to (and must always) be done separately.

10.3.7 System-specific Issues

- *Italy:* In Italy, mathematics and science classes are taught simultaneously by the same teacher. Therefore, the teacher sample selection and the weight calculation for SITES 2006 were not done separately by subject. This meant that the *totwgt* variable added up to the estimated number of "mathematics and science" teachers for this system. However, half of the teachers were asked to fill in the questionnaire with regards to teaching mathematics, while the other half were asked to do it with regards to teaching science. The data for both groups were analyzed separately in the international report.
- *Russian Federation:* In Russia, regions were selected as a first sampling stage. Therefore, each school weight was multiplied by a region weight factor that reflected the probability of selecting any one region.

10.4 Calculating School and Teacher Participation Rates

Weighted and un-weighted participation rates were calculated at school and teacher levels to facilitate the evaluation of data quality and the risk of potential biases due to higher levels of non-response.

10.4.1 Un-weighted Participation Rates

The un-weighted school participation rate is given by dividing the total number of participating schools (as defined by the requirements described in Section 10.2) by the number of sampled and eligible schools. This rate was calculated twice: once based on the originally sampled schools only, and once in order to include the replacement schools.

The un-weighted teacher participation rate is given by the number of teachers in the participating schools divided by the number of teachers who were sampled and eligible in the participating schools. This calculation was performed separately for the mathematics and the science teachers.

The un-weighted participation rate for principals is given by the number of principals in the participating schools divided by the number of participating schools. The un-weighted participation rate for ICT coordinators was calculated in a similar manner. Table 10.1 shows the un-weighted participation rates for all participating systems.

10.4.2 Weighted Participation Rates

The participation rates were also calculated using the school and teacher weights described above. In general, the difference between the un-weighted and the weighted participation rates was small. Table 10.2 shows the weighted participation rates for all participating systems.

Table 10.1: Un-weighted Participation Rates in SITES 2006

Education System	School Participation Rate before Replacement (%)	School Participation Rate after Replacement (%)	Math Teacher Participation Rate (%)	Science Teacher Participation Rate (%)	Principals (%)	ICT Coordinators (%)
Alberta, Canada	73	75	83	80	67	57
Catalonia, Spain	85	89	94	91	96	92
Chile	77	88	93	93	94	95
Chinese Taipei	97	100	97	97	99	100
Denmark	55	66	80	80	80	74
Estonia	53	53	78	76	85	73
Finland	67	74	86	83	86	90
France	52	63	85	82	89	82
Hong Kong SAR	67	71	76	79	76	90
Israel	92	94	85	86	85	86
Italy	76	92	89	89	90	94
Japan	79	99	97	96	100	100
Lithuania	72	73	90	87	87	90
Moscow, Russian Federation	100	100	99	99	100	100
Norway	53	61	80	81	75	75
Ontario, Canada	82	82	93	94	97	86
Russian Federation	99	99	99	99	99	100
Singapore	100	100	98	98	92	99
Slovak Republic	90	98	97	96	97	96
Slovenia	91	91	93	91	90	94
South Africa	90	91	90	90	99	91
Thailand	80	93	97	96	96	96

10.5 Meeting the SITES 2006 Sampling Standards

Calculation of the participation rates was followed by an assessment of the quality of the sampling implementation. Based on the school and teacher participation rates, each system was assigned to a category indicating the quality of the sample implementation. In some systems, issues other than response rate requirements made it necessary to advise the readers of the international report or the users of the international database (IDB) that they should interpret the study results with caution.

Table 10.2: Weighted Participation Rates in SITES 2006

Education System	School Participation Rate before Replacement (%)	School Participation Rate after Replacement (%)	Math Teacher Participation Rate (%)	Science Teacher Participation Rate (%)	Principals (%)	ICT Coordinators (%)
Alberta, Canada	72	75	84	81	65	53
Catalonia, Spain	84	89	94	91	96	92
Chile	76	87	94	93	94	94
Chinese Taipei	96	100	97	97	99	100
Denmark	55	66	79	78	79	73
Estonia	53	53	78	76	85	74
Finland	68	76	86	84	86	90
France	50	61	86	83	88	81
Hong Kong SAR	67	71	76	80	76	90
Israel	91	93	85	88	85	87
Italy	76	92	90	90	90	94
Japan	79	99	97	96	100	100
Lithuania	70	72	91	88	88	89
Moscow, Russian Federation	100	100	99	99	99	100
Norway	50	60	80	81	75	73
Ontario, Canada	82	82	94	94	96	86
Russian Federation	99	99	99	99	99	100
Singapore	100	100	97	96	92	99
Slovak Republic	89	98	97	96	97	96
Slovenia	91	91	93	92	90	94
South Africa	90	91	90	90	99	90
Thailand	79	92	98	97	97	96

10.5.1 *Participation Categories*

At the school level, four categories were defined.[2] Meeting the criteria based on either the un-weighted or the weighted participation rates was deemed sufficient to reach a specific participation category.

- *Category 1:* The school data were fully adjudicated if the school participation rate before replacement was at least 85%.
- *Category 2:* The school data were classified in Category 2 if the school response rate before replacement was at least 50% and if the response rate after replacement was at least 85%.
- *Category 3:* The school data were classified in Category 3 if the school response rate before replacement was at least 50% and if the response rate after replacement was at least 70%.
- *Category 4:* The school data were classified in Category 4 if the system failed to reach either a response rate of 50% before replacement or a response rate of 70% after replacement (or both).

2 Note that Categories 1 and 2 are similar to the TIMSS and PIRLS sampling standards.

Unlike school-level data, teacher-level data are affected by two factors: school participation and teacher participation. In SITES 2006, the teacher-level participation categories were assigned independently for mathematics teachers and for science teachers. The categories were defined as follows:

- *Category 1:* The teacher data were fully adjudicated if the school data were classified in Category 1 and the mathematics (science) teacher response rate was at least 85%.
- *Category 2:* The teacher data were classified in Category 2 if the school data were classified in Category 2 and the mathematics (science) teacher response rate was at least 85%.
- *Category 3:* The teacher data were classified in Category 2 if the school data were classified in Category 1, 2, or 3 and the mathematics (science) teacher response rate was at least 70%.
- *Category 4:* The teacher data were classified in Category 4 if the school data were classified in Category 4 or if the participation rate of the mathematics (science) teachers was under 70%.

Relative to this definition, the teacher-level participation categories could only be equal to or worse than the school-level categories in each system. However, the teacher-level participation rates never led to downgrading a system from a school-participation category to a lower teacher-level category because, in general, the within-school participation was higher than the school participation. Table 10.3 shows the participation categories for all SITES 2006 systems.

The categorization affected the presentation of the data in the SITES 2006 international report. Systems that fell into Categories 2 and 3 were assigned footnotes. Systems in Category 4 were reported in separate tables or graphs because of doubts over whether their data were comparable to the data of the other systems.

10.5.2 System-specific Issues

In some systems, parts of the survey administration differed slightly from the SITES 2006 standard procedures:

- *Israel:* In Israel, independent orthodox schools did not participate in SITES 2006. As a result, a substantial part of the school population was not represented. This situation was explained in a footnote in the teacher tables and graphs of the international report.
- *Japan:* In Japan, teacher participation data were collected after survey administration. Because of the likelihood of the participation rates and the non-response adjustments being a little inaccurate as a result of this procedure, this situation was footnoted in the teacher tables and graphs.
- *Alberta, Canada:* In the province of Alberta, Canada, less than 70% of the school-level questionnaires in the participating schools were returned. Because this return rate had the potential to slightly bias the school-level results, this situation was explained in a footnote in the tables and graphs containing school-level data.
- *Alberta (Canada), Lithuania, Russian Federation (including Moscow), South Africa, and Thailand:* In these systems, some or all schools did not correctly select the target class according to the definition of target class (see Section 6.7). The IEA Technical Executive Group (TEG) therefore decided that the teacher data from these systems should be reported in separate tables or graphs.

Table 10.3: Participation Categories in SITES 2006

Education System	Participation Category
Alberta, Canada	3
Catalonia, Spain	1
Chile	2
Chinese Taipei	1
Denmark	4
Estonia	4
Finland	3
France	4
Hong Kong SAR	3
Israel	1
Italy	2
Japan	2
Lithuania	3
Moscow, Russian Federation	1
Norway	4
Ontario, Canada	3
Russian Federation	1
Singapore	1
Slovak Republic	1
Slovenia	1
South Africa	1
Thailand	2

10.6 Estimating Sampling Variance

In SITES 2006, the sampling design involved stratified multi-stage cluster sampling. In this kind of design, the standard errors of the population estimates cannot be estimated by using simple textbook formulae. In SITES 2006, the standard errors were estimated using the jackknife repeated replication technique (JRR) based on established procedures in TIMSS 2003 (Gonzalez, Galia, Arora, Erberber, & Diaconu, 2004).

The general use of JRR entails systematically assigning pairs of schools to sampling zones, and randomly selecting one of these schools to have its contribution doubled and the other to have its contribution zeroed, so as to construct a number of "pseudo-replicates" of the original sample. The statistic of interest is computed once for the original sample and once again for each pseudo-replicate sample. The variation between the estimates for each of the replicate samples and the original sample estimate is the jackknife estimate of the sampling error of the statistic.

10.6.1 Constructing Sampling Zones for Variance Estimation

Application of the JRR technique used in SITES 2006 necessitated pairing the sampled schools and assigning them to a series of groups known as sampling zones. This was done by working through the list of sampled schools in the order in which they were selected and assigning the first and second schools to the first sampling zone, the third and fourth schools to the second zone, and so on.

In total, 100 zones were used. When 100 zones had been completed, the process was continued by assigning the next pair of schools to the first sampling zone, the next pair to the second sampling zone, and so on. In an ideal case of 400 participating schools, each zone would have consisted of four schools. Usually, some zones consisted of fewer than four schools. In systems with large school samples, some zones consisted of more than four schools.

Paired schools had to belong to the same explicit stratum. Situations involving an odd number of schools in an explicit stratum translated into having one zone with only one school assigned. In practice, this meant that the variance contribution of that zone came from the difference between that school mean and the system mean by opposition to the difference between the schools within a zone. However, because of the repeated assignment of schools to the pairs described above, zones with only one school were very rare.

10.6.2 Computing the Sampling Variance Using the JRR Method

The JRR algorithm used in SITES 2006 assumes that there are 100 sampling zones within each system. To compute a statistic *t* from the sample for a system, the formula for the JRR variance estimate of the statistic *t* is given by the following equation:

$$Var_{JRR}\,(t) = \sum_{h=1}^{100} \left[t(J_h) - t(S) \right]^2$$

The term $t(S)$ corresponds to any weighted or un-weighted statistic for the whole sample; the element $t(J_h)$ denotes the same statistic using the h^{th} jackknife replicate. This is computed using all cases except those in the h^{th} zone of the sample. If there are two units in the h^{th} zone, all cases associated with one randomly selected school in the zone are removed, and the elements associated with the other unit in the zone are included twice. If there are four units in the h^{th} zone, all cases associated with the two randomly selected schools in the zone are removed, and the elements associated with the other two units in the zone are included twice.

The computation of the JRR variance estimate for any statistic in SITES 2006 required the computation of the statistic 101 times for any given system: once to obtain the statistic for the full sample, and 100 times to obtain the statistics for each of the jackknife replicates (J_h).

10.6.3 System-specific Issues

Some systems had a somewhat different design.

- *Russian Federation:* In the Russian Federation, a design with one additional sampling stage was implemented. First, a sample of regions was selected with selection probabilities proportional to size of the region. Second, schools were selected within these regions (see Appendix B for details). For variance estimation, sampled regions were paired. In regions that were large enough to be selected with certainty, the sampled schools were paired.
- *Singapore:* A census of schools was conducted in Singapore.
- *Alberta (Canada) and Finland:* In the Province of Alberta, Canada, and in Finland, some of the schools were selected for SITES 2006 with certainty. The assignment of teachers to variance strata was adapted to the fact that these schools were part of every possible school sample. This process involved assigning paired teachers instead of paired schools to the variance strata.

10.7 Quality Control

Various measures were taken to ensure the correctness of the sampling weights, participation rates, and variance estimates. Among other checks, the following were performed for all sets of weights in the participating systems.

- At the school level, the sum of the final school weights was checked to ensure it added up to the estimated number of eligible schools in the participating system, that is, the number of schools in the sampling frame minus the sum of *wgtfac*1 of any ineligible schools.
- For the teacher weights, the following checks were performed:
  - The sum of *wgtfac2* of the sampled teachers represented the number of teachers (that were not excluded before sampling) in the schools.
  - The sum of the product (*wgtfac*2 x *wgtadj*2) for the participating teachers added up to the sum of *wgtfac*2 of the sampled eligible teachers.
- For the mathematics teachers, the variable *totwgt* had to add up to the estimated number of SITES 2006-eligible mathematics teachers in the participating system. For the science teachers, *totwgt* had to add up to the estimated number of SITES 2006-eligible science teachers in the participating system. A check was conducted to ensure these estimates were plausible according to the available information.

These quality criteria were always met. As a final quality check, the weights were calculated independently by both authors of this chapter. No deviations were found.

Reference

Gonzalez, E. J., Galia, J., Arora, A., Erberber, E., & Diaconu, D. (2004). Reporting student achievement in mathematics and science. In M. O. Martin, I. V. S. Mullis, & S. J. Chrostowski (Eds.). (2004). *TIMSS 2003 technical report* (pp. 275–307) Boston, MA: TIMSS & PIRLS International Study Center.

11. Scale and Indicator Construction for the School and Teacher Levels

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11.1 Overview

In quantitative studies, scale and composite indicators are often preferred to indicators derived from single-item responses because they provide improved stability and reliability for important constructs. This chapter reports on the design and development of scale indicators used in the core component of the teacher questionnaire and the two school-level questionnaires.

Confirmatory factor analysis (CFA) is widely recognized as a rigorous statistical technique to use to construct measurement models for confirming or disproving hypothesized underlying latent variable structures (Byrne, 1998). CFA has been used extensively in studies across different fields, such as psychology, marketing, and career counseling (e.g., Byrne, 1989; Harvey, Billings, & Nilan, 1985; Kumar & Sashi, 1989; Marsh, 1985; Thacker, Fields, & Tetrick, 1989). This methodology was adopted in the pre-pilot and field trial phases involving the development of the key indicators in the teacher questionnaire because it provides a better estimate of scale quality, which is important at the instrument design stage. A brief description of the teacher questionnaire data-scaling methodology is reported in Section 11.2. The quality indicators from the CFA for the field trial teacher questionnaire data are reported in the section following.

For the main study data, Cronbach's alpha reliability scores were reported for scale indicators in both the teacher and school questionnaires in order to reflect the quality of the indicators reported in the international report. These are reported in Section 11.4 onwards.

11.2 Scaling Methodology

The first step in constructing a CFA model is to determine the specific link between the construct and its latent factors. Normally, exploratory factor analysis is conducted on data collected from the items pertaining to the construct to identify the likely number of latent factors and their constituent items (Joreskog & Sorbom, 1993). Based on findings from the exploratory factor analysis, CFA can be conducted to check on the robustness of the factor model. Goodness of fit statistics to evaluate the robustness of a CFA model commonly include the following: root mean square error of approximation (RMSEA), developed by Steiger (1990); comparative fix index (CFI), developed by Bentler (1990); and non-normed fit index (NNFI), developed by Bentler and Bonett (1980). A model with a RMSEA lower than 0.1 and both a NNFI and a CFI larger than 0.9 is generally taken as statistically validated (Diamantopoulos & Siguaw, 2000; Kelloway, 1998).

For each latent factor, the factor loading of its component items should be checked to see if there is (are) any dominating item(s). If there is no dominating item, the indicator score of a latent factor can be taken as the mean of its respective component items; if there is (are) dominating item(s), the indicator score is the factor score.

CFA is a more demanding method and requires more time and resources to implement. Scale indicators are often constructed based on prior theoretical or empirical studies without being validated through CFA. Under such circumstances, reliability is taken as a measure of scale quality. IEA's *Technical Standards for IEA Studies* (Martin, Rust, & Adams, 1999) recommends annotating and interpreting with caution any reliability below 0.7. In order not to make the questionnaire overly long, some of the scales ended up with only three items, which makes it difficult to achieve such a high reliability. Some commentators argue that a Cronbach's alpha value above 0.5 is satisfactory (see, for example, Nunnally, 1978). In SITES 2006, a reliability of 0.5 or above was adopted as a "marginally" acceptable quality measure for a scale indicator.

The CFA method was adopted in the analysis of the pilot test and field trial data for the construction of a number of scale indicators in the teacher questionnaire. The details of this process are reported in Section 11.3. It is important to point out that the validity of scale indicators as psychometric constructs can differ across countries/systems due to socio-cultural, linguistic, and other contextual differences. Hence, it is desirable to check the quality of the scale indicators for each system to ensure that these indicators can be used for international comparison. Because of the small sample size of the field trial data for each participating system, the CFA was conducted on the entire international data set. In finalizing the indicators for use in the international report of the SITES 2006 main study, Cronbach's alpha reliability scores for each of the indicators were computed for each participating system to ensure that the scale indicators were valid at the system level and could thus be used for comparative purposes.

11.3 CFA Results for Potential Scale Indicators from Teacher Questionnaire Field Trial Data

Only 17 of the 22 systems participating in the main study took part in the field trial. About 1,850 completed teacher questionnaires were collected. Exploratory factor analyses were conducted on data collected from the field trial on questions pertaining to the following seven sets of scale indicators: curriculum goal orientation, teacher practice orientation, student practice orientation, impact of ICT use on teachers themselves and on students, vision for ICT use in the future, and the presence of a community of practice in the school. Items for these indicators were developed based on the theoretical and empirical considerations described in Chapter 4. The CFA was conducted to ensure that the designed questions yielded scales with conceptual and statistical validity. We note here that the CFA was conducted on the pooled set of data collected from both the mathematics and the science teachers because the research consortium considered that these constructs were unlikely to have different factor structures for the two populations of teachers. Table 11.1 provides a summary of the CFA results.

Based on the RMSEA, CFI, and NNFI indices for each set of scale indicators listed in Table 11.1, it is clear that all the scales met the required statistical requirements for validation. In order to reduce the length of the questionnaire, we decided to reduce the number of items in each of the pedagogical orientation indicators to three. Hence, for those indicators with more than three items, we performed judgmental and statistical examinations to eliminate the items with, for example, lower correlation with the other items in the same scale.

It is important to note here that all three of the pedagogical orientation scales (curriculum goals, teacher practice, and student practice) yielded four factors that had good conceptual alignment with one another. However, the analysis of the final main study data found substantial differences across systems in terms of the factor structure for these three scales. A three-factor structure was therefore found to be more satisfactory for the purpose of international cross-system comparisons. This structure is reported in detail in a later section.

Table 11.1: Summary of the Key CFA Results for Seven of the Scales in the Field Trial Teacher Questionnaire

Scale Label (Field Trial Question Number)	*N*	RMSEA	CFI	NNFI	Factors	Field Trial Item Number Reliability
Curriculum goal orientation (T8)	1,434	0.083	0.96	0.95	1. Traditionally important goals (academic achievement)	A, B, C, D (0.61)
					2. Student-centered goals	E, F, G (0.59)
					3. Goals about inquiry	H, I, J (0.75)
					4. Goals about connectedness	K, L, M (0.78)
Teacher practice orientation (T15)	1,418	0.079	0.96	0.94	1. Traditionally important instruction	A, B, C, D (0.61)
					2. Student-centered pedagogy	E, F, G (0.71)
					3. Support collaborative inquiry	H, I, J (0.79)
					4. Support liaison for connectedness in learning	K, L, M (0.73)
Student practice orientation (T17)	1,339	0.062 (S8 deleted)	0.96	0.95	1. Traditionally important learning	A, B, C, D (0.60)
					2. Student-centered learning	E, F, G (0.64)
					3. Self-directedness/inquiry	I, J, K, L (0.74)
					4. Collaboration and learning from others	M, N, O (0.71)
ICT impacts on teacher (T19)	1,392	0.049	0.99	0.99	1. Empower teaching	A, B (0.85)
					2. Monitor student	C, D (0.86)
					3. Collaboration	E, F (0.75)
					4. Work easier	G, H (0.79)
					5. Negative	I, J (0.76)
ICT impacts on students (T20)	1,346	0.11	0.97	0.96	1. Traditionally important	A, B (0.86)
					2. Collaborative inquiry	E, F, G (0.90)
					3. ICT	H, I (0.70)
					4. Negative	K, L (0.89)
Vision for ICT use in near future (T35)	1,402	0.078	0.97	0.96	1. Traditionally important instruction	A, B (0.43)
					2. Student-centered	C, J (0.46)
					3. Inquiry	D, E, F (0.78)
					4. Collaboration	H, I (0.76)
Community of practice (T39–42)	1,324	0.069	0.97	0.96	1. School vision (T39)	A, B, C, D, E (0.88)
					2. Decisionmaking (T40)	A, B, C, D, E (0.85)
					3. Professional collaboration (T41)	A, B, C, D, E (0.73)
					4. Support to teacher (T42)	A, B, C, D, E (0.80)

In addition to the indicators listed in Table 11.1, two further sets of scale indicators on "teacher planning" and "teacher belief" were included in the field trial as explanatory indicators. However, these indicators showed low correlation with the pedagogical orientation indicators, and no significant statistical difference in their basic descriptive statistics emerged across systems. These two sets of scales thus had less value as explanatory indicators and were discarded from the teacher questionnaire for the main study in order to reduce the length of the instrument.

During their second meeting, the NRCs carefully reviewed the item statistics and analysis results for the exploration of scale indicators. In addition to deleting unsatisfactory or non-informative items, the NRCs revised the wording of some questions to improve clarity.

11.4 Scale Indicators in the Core Component of the Main Study Teacher Questionnaire

As mentioned earlier, we needed to ensure that the reliabilities of the scale indicators were acceptable when computing these separately for each of the participating systems in the final analysis and the reporting of the main study. The reliabilities for the various indicators are summarized in Tables 11.2 to 11.16. As is evident, most of the indicators showed good reliabilities across all of the participating systems. The main exception was with the three sets of pedagogical orientation indicators, which showed large differences in their reliability scores for different systems. In addition, a three-factor model showed higher consistency across systems than a four-factor model found relative to an analysis of the entire set of international field-trial data. The three-factor model still comprised the two factors with items for the *traditionally important* and *connectedness* orientations. However, the third factor comprised all of the items in the *student-centered* and *collaborative-inquiry* orientations. We therefore decided that a three-factor model would best suit the final analysis (see also Section 4.2.2). Based on the content of the items, those of us attending the third NRC meeting labeled this factor *lifelong learning*. We also established that the reliability of the indicator for *lifelong learning curriculum goal orientation* across systems would be more consistent if we included only four rather than six items in the computation.

In addition to considering the reliability coefficients reported for each participating education system, we computed a cross-system reliability coefficient, called the "international alpha on adjudicated systems," on equally weighted data from those systems that satisfied the sampling standards and adhered to the administration procedures. These Cronbach's alpha values are included in this technical documentation to provide an additional aid to interested readers as well as to researchers wishing to undertake secondary analysis to assess the reliability and validity of scale indicators for cross-system comparisons. Because of potential item bias in those systems where non-response might not be random or completely random, that is, potentially related to the variable of interest, systems that did not satisfy the sampling standards or did not adhere to the final teacher sampling stage were not considered in the computation of international alpha. For the same reason, the international report does not include international scale score averages or means.

11.4.1 Curriculum Goal Orientation

Question 8 of the teacher questionnaire asked: "In your teaching of the target class in this school year, how important is it for you to achieve the following goals?" Respondents were asked to select a response from four choices—"not at all," "a little," "somewhat," and "very much"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the curriculum goal orientation. Three indicators were computed: *traditionally important* (8B, 8E, and 8K), *lifelong learning* (8D, 8G, 8H, and 8I), and *connectedness* (8C, 8J, and 8M).

The reliabilities of these indicators are shown in Table 11.2. We can see that for *lifelong learning* and *connectedness*, the reliabilities for all the systems were quite satisfactory (above 0.5) in both subjects, with *lifelong learning* being the highest, exceeding 0.6 in every case. For the *traditionally important* indicator, a number of the systems' reliabilities fell below 0.5, but were still above 0.4 in every case.

Table 11.2: Reliabilities for the Curriculum Goal Orientation Indicators for both Mathematics Teachers and Science Teachers

Flags	Education System	Goal—Traditionally Important			Goal—Lifelong Learning			Goal—Connectedness		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.607	0.632	3	0.684	0.699	4	0.672	0.696	3
1	Chile	0.435	0.549	3	0.721	0.755	4	0.648	0.526	3
	Chinese Taipei	0.629	0.671	3	0.745	0.767	4	0.606	0.697	3
2	Finland	0.491	0.570	3	0.736	0.677	4	0.598	0.631	3
2	Hong Kong SAR	0.648	0.577	3	0.759	0.740	4	0.738	0.645	3
4	Israel	0.439	0.515	3	0.731	0.710	4	0.725	0.704	3
1	Italy	0.587	0.609	3	0.745	0.739	4	0.639	0.663	3
1, 3	Japan	0.584	0.536	3	0.622	0.636	4	0.657	0.625	3
2	Ontario, Canada	0.479	0.545	3	0.649	0.710	4	0.588	0.611	3
	Singapore	0.443	0.542	3	0.798	0.801	4	0.798	0.733	3
	Slovak Republic	0.523	0.518	3	0.672	0.681	4	0.621	0.626	3
	Slovenia	0.474	0.517	3	0.687	0.680	4	0.726	0.684	3
	International alpha on adjudicated systems	**0.592**	**0.618**	**3**	**0.772**	**0.766**	**4**	**0.692**	**0.672**	**3**
	Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.504	0.459	3	0.711	0.768	4	0.699	0.682	3
#	Denmark	0.580	0.604	3	0.647	0.673	4	0.613	0.564	3
#	Estonia	0.513	0.539	3	0.665	0.708	4	0.538	0.559	3
#	France	0.481	0.472	3	0.709	0.649	4	0.607	0.606	3
†, 2	Lithuania	0.586	0.628	3	0.739	0.760	4	0.692	0.718	3
†	Moscow, Russian Federation	0.517	0.485	3	0.696	0.703	4	0.639	0.636	3
#	Norway	0.532	0.433	3	0.687	0.679	4	0.651	0.594	3
†	Russian Federation	0.496	0.468	3	0.632	0.687	4	0.658	0.667	3
†	South Africa	0.614	0.637	3	0.833	0.796	4	0.730	0.682	3
†, 1	Thailand	0.606	0.635	3	0.785	0.814	4	0.706	0.723	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.2 Teacher Practice Orientation

Question 14 of the teacher questionnaire asked: "In your teaching of the target class in this school year, how often do you conduct the following?" Respondents were asked to select a response from four choices—"never," "sometimes," "often," and "nearly always"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the teacher practice orientation. Similar to the situation with the curriculum goal orientation, three sets of indicators were identified: *traditionally important* (14A, 14E, and 14G), *lifelong learning* (14B, 14C, 14D, 14F, 14H, and 14K), and *connectedness* (14I, 14J, and 14L).

Table 11.3 shows the reliabilities for these indicators. As is evident, the reliabilities for all the systems were satisfactory (above 0.5) for the *lifelong learning* and *connectedness* indicators among the mathematics and the science teachers, with *lifelong learning* emerging as the best indicator (exceeding 0.6). Results varied across systems for the *traditionally important* indicator, with some systems falling below 0.5 for both subjects. None of the reliabilities for systems meeting the standards for international comparison was lower than 0.4.

Table 11.3: Reliabilities for the Teacher Practice Orientation Indicators for both Mathematics Teachers and Science Teachers

Flags	Education System	TP—Traditionally Important			TP—Lifelong Learning			TP—Connectedness		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.588	0.633	3	0.752	0.725	6	0.579	0.579	3
1	Chile	0.724	0.702	3	0.837	0.838	6	0.698	0.697	3
	Chinese Taipei	0.684	0.669	3	0.800	0.798	6	0.649	0.680	3
2	Finland	0.463	0.483	3	0.644	0.673	6	0.570	0.614	3
2	Hong Kong SAR	0.586	0.541	3	0.729	0.750	6	0.728	0.687	3
4	Israel	0.611	0.639	3	0.752	0.811	6	0.679	0.682	3
1	Italy	0.559	0.582	3	0.804	0.796	6	0.610	0.571	3
1, 3	Japan	0.431	0.397	3	0.687	0.692	6	0.657	0.673	3
2	Ontario, Canada	0.517	0.534	3	0.714	0.738	6	0.659	0.710	3
	Singapore	0.591	0.596	3	0.760	0.769	6	0.701	0.660	3
	Slovak Republic	0.444	0.459	3	0.754	0.708	6	0.601	0.605	3
	Slovenia	0.465	0.516	3	0.735	0.760	6	0.585	0.648	3
	International alpha on adjudicated systems	**0.586**	**0.576**	**3**	**0.805**	**0.815**	**6**	**0.712**	**0.712**	**3**
	Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.604	0.631	3	0.719	0.735	6	0.638	0.587	3
#	Denmark	0.401	0.342	3	0.730	0.777	6	0.681	0.694	3
#	Estonia	0.401	0.389	3	0.788	0.811	6	0.563	0.703	3
#	France	0.438	0.397	3	0.638	0.709	6	0.600	0.650	3
†, 2	Lithuania	0.603	0.535	3	0.786	0.789	6	0.629	0.712	3
†	Moscow, Russian Federation	0.383	0.392	3	0.764	0.796	6	0.659	0.656	3
#	Norway	0.338	0.408	3	0.650	0.677	6	0.671	0.617	3
†	Russian Federation	0.325	0.272	3	0.709	0.718	6	0.561	0.632	3
†	South Africa	0.682	0.669	3	0.827	0.812	6	0.776	0.756	3
†, 1	Thailand	0.566	0.691	3	0.847	0.850	6	0.657	0.722	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.3 Student Practice Orientation

Question 16 of the teacher questionnaire asked: "In your teaching of the target class in this school year, how often do your students engage in the following activities?" Respondents were asked to select a response from four choices—"never," "sometimes", "often," and "nearly always"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the student practice orientation. The initial design also had three sets of indicators: *traditionally important* (16A, 16C, and 16H), *lifelong learning* (16B, 16D, 16E, 16F, 16I, and 16J), *and connectedness* (16G, 16K, and 16L).

The reliabilities for the *lifelong learning* and *connectedness* indicators shown in Table 11.4 all had acceptable reliability values above 0.5. However, we could not find any combination of the three items "complete worksheets, exercises," "work on the same learning materials at the same pace and/or sequence," and "answer tests or respond to evaluations" that would yield even a marginally acceptable scale for the *traditionally important* student practice orientation. This was because half of the systems had reliabilities lower than 0.4. On further inspecting the descriptive statistics for these three items, we found that the item "complete worksheets, exercises" had the highest overall mean and also the highest mean score across most of the participating systems.

We also found that the other two items, "work on the same learning materials at the same pace and/or sequence" (A) and "answer tests or respond to evaluations" (H), showed extremely low or even negative correlation with the item "complete worksheets, exercises" (C) among the countries that showed low reliabilities for this intended scale of three items. Based on these explorations, we selected the mean score for the item "complete worksheets, exercises" (C) for use as an indicator for *traditionally important* student practice in further analysis involving this concept in this study.

11.4.4 Self-reported Impact of ICT Use on Teachers

Question 19 of the teacher questionnaire asked: "To what extent do you agree that the use of ICT has had the following impacts on you?" Respondents were asked to select a response from four choices—"not at all," "a little," "somewhat," and "a lot"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the self-reported impact of ICT use on teachers. Table 11.5 and Table 11.6 contain the reliabilities for the scale indicators. All together, there were six indicators in this category, only four of which were scale indicators comprising two or more items: *empower teaching* (19B, 19D, and 19F), *monitor students* (19C and 19E), *collaboration* (19G and 19H), and *negative impacts* (19J, 19K, and 19L). The indicators for *ICT skills* (19A) and *administrative efficiency* (19I) were single items only.

As can be seen in Table 11.5 and Table 11.6, the reliabilities presented were all relatively high and greater than 0.5 in all cases for both the mathematics and the science teachers.

Table 11.4: Reliabilities for the Student Practice Orientation Scale Indicators for both Mathematics Teachers and Science Teachers

Flags	Education System	SP—Lifelong Learning			SP—Connectedness		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science	
	Catalonia, Spain	0.675	0.656	6	0.639	0.507	3
1	Chile	0.808	0.802	6	0.812	0.729	3
	Chinese Taipei	0.737	0.746	6	0.714	0.695	3
2	Finland	0.521	0.634	6	0.479	0.765	3
2	Hong Kong SAR	0.769	0.791	6	0.843	0.814	3
4	Israel	0.775	0.793	6	0.703	0.747	3
1	Italy	0.704	0.727	6	0.669	0.585	3
1, 3	Japan	0.681	0.672	6	0.814	0.603	3
2	Ontario, Canada	0.741	0.753	6	0.741	0.638	3
	Singapore	0.787	0.787	6	0.795	0.833	3
	Slovak Republic	0.660	0.631	6	0.562	0.630	3
	Slovenia	0.614	0.625	6	0.677	0.651	3
	International alpha on adjudicated systems	**0.748**	**0.765**	**6**	**0.744**	**0.717**	**3**
Systems not satisfying participation standard or not adhering to survey administration procedure							
†, 2	Alberta, Canada	0.679	0.692	6	0.643	0.709	3
#	Denmark	0.637	0.726	6	0.506	0.558	3
#	Estonia	0.648	0.640	6	0.676	0.696	3
#	France	0.643	0.523	6	0.574	0.556	3
†, 2	Lithuania	0.717	0.757	6	0.685	0.686	3
†	Moscow, Russian Federation	0.714	0.701	6	0.677	0.701	3
#	Norway	0.682	0.632	6	0.595	0.510	3
†	Russian Federation	0.682	0.712	6	0.601	0.671	3
†	South Africa	0.802	0.810	6	0.833	0.833	3
†, 1	Thailand	0.816	0.846	6	0.792	0.796	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.5: Reliabilities for the Scale Indicators on Self-Reported Impact of ICT Use on Teachers (Mathematics)

Flags	Education System	ICT Impact on Teacher– Empower Teaching		ICT Impact on Teacher– Monitor Student		ICT Impact on Teacher– Collaboration		ICT Impact on Teacher– Negative Impact	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.681	3	0.646	2	0.617	2	0.628	3
1	Chile	0.827	3	0.822	2	0.740	2	0.618	3
	Chinese Taipei	0.817	3	0.689	2	0.808	2	0.785	3
2	Finland	0.777	3	0.760	2	0.699	2	0.760	3
2	Hong Kong SAR	0.719	3	0.605	2	0.658	2	0.827	3
4	Israel	0.707	3	0.711	2	0.710	2	0.708	3
1	Italy	0.768	3	0.736	2	0.602	2	0.735	3
1, 3	Japan	0.664	3	0.635	2	0.576	2	0.706	3
2	Ontario, Canada	0.783	3	0.793	2	0.694	2	0.733	3
	Singapore	0.806	3	0.748	2	0.787	2	0.788	3
	Slovak Republic	0.612	3	0.617	2	0.491	2	0.569	3
	Slovenia	0.752	3	0.710	2	0.747	2	0.722	3
	International alpha on adjudicated systems	**0.808**	**3**	**0.765**	**2**	**0.738**	**2**	**0.736**	**3**
	Systems not satisfying participation standard or not adhering to survey administration procedure								
†, 2	Alberta, Canada	0.775	3	0.704	2	0.702	2	0.806	3
#	Denmark	0.711	3	0.721	2	0.494	2	0.759	3
#	Estonia	0.729	3	0.700	2	0.654	2	0.679	3
#	France	0.733	3	0.789	2	0.591	2	0.636	3
†, 2	Lithuania	0.811	3	0.676	2	0.710	2	0.729	3
†	Moscow, Russian Federation	0.693	3	0.536	2	0.764	2	0.693	3
#	Norway	0.672	3	0.793	2	0.624	2	0.747	3
†	Russian Federation	0.752	3	0.715	2	0.745	2	0.629	3
†	South Africa	0.931	3	0.854	2	0.910	2	0.853	3
†, 1	Thailand	0.870	3	0.859	2	0.787	2	0.714	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.6: Reliabilities for the Scale Indicators on Self-reported Impact of ICT Use on Teachers (Science)

Flags	Education System	ICT Impact on Teacher– Empower Teaching		ICT Impact on Teacher– Monitor Student		ICT Impact on Teacher– Collaboration		ICT Impact on Teacher– Negative Impact	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.742	3	0.699	2	0.637	2	0.667	3
1	Chile	0.793	3	0.780	2	0.749	2	0.572	3
	Chinese Taipei	0.791	3	0.781	2	0.717	2	0.772	3
2	Finland	0.796	3	0.783	2	0.721	2	0.753	3
2	Hong Kong SAR	0.716	3	0.638	2	0.717	2	0.827	3
4	Israel	0.744	3	0.784	2	0.730	2	0.718	3
1	Italy	0.783	3	0.667	2	0.640	2	0.704	3
1, 3	Japan	0.642	3	0.558	2	0.696	2	0.749	3
2	Ontario, Canada	0.780	3	0.758	2	0.601	2	0.712	3
	Singapore	0.674	3	0.741	2	0.707	2	0.765	3
	Slovak Republic	0.603	3	0.604	2	0.629	2	0.500	3
	Slovenia	0.762	3	0.768	2	0.747	2	0.706	3
	International alpha on adjudicated systems	**0.792**	**3**	**0.772**	**2**	**0.729**	**2**	**0.726**	**3**
Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.774	3	0.768	2	0.741	2	0.731	3
#	Denmark	0.739	3	0.814	2	0.681	2	0.791	3
#	Estonia	0.672	3	0.735	2	0.486	2	0.598	3
#	France	0.716	3	0.685	2	0.544	2	0.570	3
†, 2	Lithuania	0.806	3	0.805	2	0.767	2	0.740	3
†	Moscow, Russian Federation	0.711	3	0.609	2	0.699	2	0.671	3
#	Norway	0.618	3	0.782	2	0.628	2	0.773	3
†	Russian Federation	0.749	3	0.699	2	0.737	2	0.620	3
†	South Africa	0.910	3	0.911	2	0.900	2	0.789	3
†, 1	Thailand	0.856	3	0.795	2	0.773	2	0.739	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.5 *Impact of ICT Use on Students as Perceived by Teachers*

Question 20 of the teacher questionnaire asked: "To what extent has the use of ICT impacted on your students in the target class in the following areas?" Respondents were asked to select a response from five choices—"decreased a lot," "decreased a little," "no impact," "increased a little," and "increased a lot"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the ICT impact on student orientation. Table 11.7 and Table 11.8 include the reliabilities for the indicators on teacher-perceived impact of ICT use on students. In total, there were eight indicators in this category, four of which were non-scale indicators comprising only one item: *ICT skill* (20H), *learn at own pace* (20I), *achievement gap* (20K), and *socioeconomic divide* (20O) (one item). The scale indicators were *traditionally important* (20A and 20N), *inquiry skills* (20C, 20D, and 20E), *collaboration* (20F and 20G), and *affective impact* (20B, 20J, 20L, and 20M).

The reliabilities (Tables 11.7 and 11.8) were all greater than 0.5 for the two indicators *inquiry skills* and *collaboration* in all participating systems, which was statistically acceptable. The reliabilities for *traditionally important* impact and *affective* impact were greater than 0.5 in most systems. Of the systems that met the participation requirement and followed the required administrative procedures, three had reliabilities below 0.5 for the affective impact scale. In these three countries—Catalonia, Finland, and Slovenia—the reliabilities were above 0.45, except for science teachers in Slovenia. The reliabilities were even less satisfactory for the *traditionally important* impact. Finland, Hong Kong SAR, Israel, Japan, and Slovenia had reliabilities below 0.5 for both teacher populations. Hence, for further secondary analysis, this indicator should be used only for those systems that have acceptable reliabilities.

Table 11.7: Reliabilities for the Scale Indicators on (Mathematics) Teacher-perceived Impact of ICT Use on Students

Flags	Education System	ICT Impact on Teacher–Traditionally Important		ICT Impact on Student–Inquiry Skills		ICT Impact on Student–Collaboration		ICT Impact on Student–Affective Impact	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.553	2	0.683	3	0.768	2	0.481	4
1	Chile	0.691	2	0.824	3	0.867	2	0.736	4
	Chinese Taipei	0.511	2	0.762	3	0.753	2	0.572	4
2	Finland	0.397	2	0.546	3	0.504	2	0.488	4
2	Hong Kong SAR	0.467	2	0.676	3	0.838	2	0.589	4
4	Israel	0.363	2	0.799	3	0.791	2	0.709	4
1	Italy	0.604	2	0.702	3	0.773	2	0.714	4
1, 3	Japan	0.453	2	0.786	3	0.744	2	0.652	4
2	Ontario, Canada	0.503	2	0.714	3	0.718	2	0.662	4
	Singapore	0.610	2	0.795	3	0.789	2	0.675	4
	Slovak Republic	0.601	2	0.696	3	0.694	2	0.538	4
	Slovenia	0.475	2	0.534	3	0.768	2	0.450	4
	International alpha on adjudicated systems	**0.624**	**2**	**0.754**	**3**	**0.801**	**2**	**0.708**	**4**
	Systems not satisfying participation standard or not adhering to survey administration procedure								
†, 2	Alberta, Canada	0.595	2	0.748	3	0.738	2	0.665	4
#	Denmark	0.345	2	0.642	3	0.549	2	0.541	4
#	Estonia	0.581	2	0.727	3	0.787	2	0.531	4
#	France	0.583	2	0.577	3	0.756	2	0.580	4
†, 2	Lithuania	0.599	2	0.691	3	0.853	2	0.615	4
†	Moscow, Russian Federation	0.683	2	0.761	3	0.865	2	0.501	4
#	Norway	0.504	2	0.624	3	0.519	2	0.341	4
†	Russian Federation	0.568	2	0.743	3	0.785	2	0.573	4
†	South Africa	0.846	2	0.948	3	0.923	2	0.919	4
†, 1	Thailand	0.608	2	0.895	3	0.862	2	0.723	4

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.8: Reliabilities for the Scale Indicators on (Science) Teacher-perceived Impact of ICT Use on Students

Flags	Education System	ICT Impact on Teacher–Traditionally Important		ICT Impact on Student–Inquiry Skills		ICT Impact on Student–Collaboration		ICT Impact on Student–Affective Impact	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.585	2	0.681	3	0.711	2	0.406	4
1	Chile	0.625	2	0.790	3	0.820	2	0.744	4
	Chinese Taipei	0.594	2	0.764	3	0.789	2	0.677	4
2	Finland	0.290	2	0.657	3	0.573	2	0.444	4
2	Hong Kong SAR	0.373	2	0.752	3	0.767	2	0.599	4
4	Israel	0.483	2	0.778	3	0.721	2	0.662	4
1	Italy	0.563	2	0.706	3	0.764	2	0.718	4
1, 3	Japan	0.446	2	0.698	3	0.592	2	0.276	4
2	Ontario, Canada	0.549	2	0.742	3	0.748	2	0.683	4
	Singapore	0.490	2	0.766	3	0.814	2	0.668	4
	Slovak Republic	0.543	2	0.689	3	0.737	2	0.538	4
	Slovenia	0.459	2	0.724	3	0.793	2	0.344	4
	International alpha on adjudicated systems	**0.587**	**2**	**0.768**	**3**	**0.787**	**2**	**0.693**	**4**
	Systems not satisfying participation standard or not adhering to survey administration procedure								
†, 2	Alberta, Canada	0.451	2	0.713	3	0.735	2	0.644	4
#	Denmark	0.455	2	0.725	3	0.664	2	0.566	4
#	Estonia	0.425	2	0.601	3	0.745	2	0.397	4
#	France	0.609	2	0.621	3	0.607	2	0.564	4
†, 2	Lithuania	0.554	2	0.539	3	0.804	2	0.546	4
†	Moscow, Russian Federation	0.687	2	0.739	3	0.860	2	0.382	4
#	Norway	0.458	2	0.523	3	0.505	2	0.300	4
†	Russian Federation	0.605	2	0.774	3	0.855	2	0.501	4
†	South Africa	0.825	2	0.941	3	0.926	2	0.920	4
†, 1	Thailand	0.530	2	0.800	3	0.805	2	0.624	4

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.6 Priority for ICT Use in the Near Future

Question 22 of the teacher questionnaire asked: "Looking ahead to the coming two years, what priority will you give to the use of ICT in enhancing your teaching practice in the following areas?" Respondents were asked to select a response from four choices—"not at all," "low priority," "medium priority," and "high priority"—placed on a Likert-type scale. Responses to this question were used to provide indicators for pedagogical orientation of the priority areas in ICT use in the near future, while the items from this question were used to form indicators of *traditionally important* (22A, 22B, and 22C), *lifelong learning* (22D, 22E, 22F, 22G, 22H, and 22L), and *connectedness* (22I, 22J, and 22K) orientations.

The reliabilities were relatively high (see Table 11.9), all being higher than 0.65, except for the traditionally important orientation indicator for science teachers in Hong Kong, which is still statistically acceptable at 0.541.

Table 11.9: Reliabilities for the Indicators on Priority for ICT Use in the Near Future for both Mathematics Teachers and Science Teachers

Flags	Education System	Vision, Priority for ICT Use–Traditionally important			Vision, Priority for ICT Use–Lifelong Learning			Vision, Priority for ICT Use–Connectedness		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.707	0.732	3	0.834	0.846	6	0.755	0.781	3
1	Chile	0.816	0.802	3	0.869	0.877	6	0.817	0.828	3
	Chinese Taipei	0.747	0.698	3	0.812	0.801	6	0.738	0.766	3
2	Finland	0.766	0.756	3	0.831	0.823	6	0.783	0.803	3
2	Hong Kong SAR	0.654	0.541	3	0.817	0.799	6	0.785	0.760	3
4	Israel	0.851	0.762	3	0.896	0.880	6	0.841	0.821	3
1	Italy	0.807	0.799	3	0.866	0.883	6	0.814	0.813	3
1, 3	Japan	0.717	0.704	3	0.844	0.829	6	0.821	0.803	3
2	Ontario, Canada	0.685	0.652	3	0.805	0.810	6	0.743	0.776	3
	Singapore	0.704	0.668	3	0.829	0.811	6	0.801	0.791	3
	Slovak Republic	0.781	0.771	3	0.856	0.850	6	0.786	0.814	3
	Slovenia	0.756	0.746	3	0.854	0.846	6	0.762	0.791	3
	International alpha on adjudicated systems	**0.771**	**0.750**	**3**	**0.870**	**0.865**	**6**	**0.824**	**0.829**	**3**
	Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.711	0.654	3	0.830	0.818	6	0.761	0.741	3
#	Denmark	0.746	0.729	3	0.824	0.827	6	0.746	0.732	3
#	Estonia	0.754	0.757	3	0.836	0.854	6	0.686	0.721	3
#	France	0.701	0.693	3	0.819	0.823	6	0.738	0.776	3
†, 2	Lithuania	0.728	0.688	3	0.828	0.827	6	0.734	0.764	3
†	Moscow, Russian Federation	0.820	0.811	3	0.892	0.888	6	0.799	0.827	3
#	Norway	0.704	0.590	3	0.791	0.769	6	0.756	0.745	3
†	Russian Federation	0.797	0.815	3	0.880	0.890	6	0.805	0.813	3
†	South Africa	0.942	0.913	3	0.950	0.943	6	0.933	0.914	3
†, 1	Thailand	0.922	0.863	3	0.918	0.906	6	0.888	0.866	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.7 Community of Practice

Question 25 of the teacher questionnaire asked: "To what extent do the following statements about school vision apply to the staff in your school?" Question 26 asked: "To what extent do the following statements about teachers' participation in decision-making apply to you?" Question 27 asked: "To what extent do the following statements about professional collaboration among teachers apply to you?" And Question 28 asked: "To what extent do the following statements about support to teachers apply to you?" Respondents were asked to select a response from four choices (the four questions all have identical responses)—"not at all," "a little," "somewhat," and "a lot"—placed on a Likert-type scale. Responses to these questions were used to provide indicators for the community of practice orientation. These indicators were *shared vision* (25A, 25B, and

25C), *decisionmaking* (26A, 26B, and 26C), *professional collaboration* (27A, 27B, 27C, and 27D), and *support* (28A, 28B, and 28C).

Table 11.10 and Table 11.11 show that the reliabilities for these indicators in all participating systems were high at 0.5 or above for mathematics teachers, except for Chinese Taipei for the indicators *professional collaboration* and *support*, and also high at 0.5 or above for science teachers.

Table 11.10: Reliabilities for the Indicators on Community of Practice (COP), Mathematics Teachers

Flags	Education System	COP–Shared Vision		COP–Decisionmaking		COP–Professional Collaboration		COP–Support	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.846	3	0.738	3	0.521	4	0.561	3
1	Chile	0.889	3	0.767	3	0.657	4	0.647	3
	Chinese Taipei	0.761	3	0.711	3	0.477	4	0.425	3
2	Finland	0.726	3	0.745	3	0.564	4	0.561	3
2	Hong Kong SAR	0.832	3	0.750	3	0.671	4	0.677	3
4	Israel	0.829	3	0.802	3	0.565	4	0.720	3
1	Italy	0.796	3	0.707	3	0.628	4	0.529	3
1, 3	Japan	0.654	3	0.674	3	0.590	4	0.391	3
2	Ontario, Canada	0.837	3	0.731	3	0.503	4	0.646	3
	Singapore	0.854	3	0.807	3	0.641	4	0.707	3
	Slovak Republic	0.773	3	0.723	3	0.555	4	0.664	3
	Slovenia	0.775	3	0.695	3	0.545	4	0.542	3
	International alpha on adjudicated systems	**0.814**	**3**	**0.766**	**3**	**0.589**	**4**	**0.610**	**3**
Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.820	3	0.821	3	0.557	4	0.689	3
#	Denmark	0.750	3	0.773	3	0.533	4	0.540	3
#	Estonia	0.812	3	0.699	3	0.511	4	0.702	3
#	France	0.743	3	0.611	3	0.407	4	0.570	3
†, 2	Lithuania	0.814	3	0.736	3	0.626	4	0.737	3
†	Moscow, Russian Federation	0.830	3	0.803	3	0.611	4	0.661	3
#	Norway	0.776	3	0.749	3	0.447	4	0.477	3
†	Russian Federation	0.812	3	0.768	3	0.602	4	0.717	3
†	South Africa	0.856	3	0.753	3	0.645	4	0.675	3
†, 1	Thailand	0.876	3	0.822	3	0.576	4	0.696	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.11: Reliabilities for the Indicators on Community of Practice (COP), Science Teachers

Flags	Education System	COP–Shared Vision		COP–Decisionmaking		COP–Professional Collaboration		COP–Support	
		Cronbach's Alpha	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*	*Cronbach's Alpha*	*No. of Items*
	Catalonia, Spain	0.798	3	0.727	3	0.496	4	0.592	3
1	Chile	0.845	3	0.757	3	0.690	4	0.679	3
	Chinese Taipei	0.797	3	0.709	3	0.493	4	0.549	3
2	Finland	0.733	3	0.740	3	0.542	4	0.604	3
2	Hong Kong SAR	0.837	3	0.735	3	0.641	4	0.605	3
4	Israel	0.857	3	0.808	3	0.593	4	0.728	3
1	Italy	0.806	3	0.708	3	0.626	4	0.573	3
1, 3	Japan	0.706	3	0.655	3	0.624	4	0.491	3
2	Ontario, Canada	0.816	3	0.757	3	0.543	4	0.606	3
	Singapore	0.821	3	0.788	3	0.531	4	0.695	3
	Slovak Republic	0.776	3	0.746	3	0.565	4	0.628	3
	Slovenia	0.778	3	0.706	3	0.563	4	0.587	3
	International alpha on adjudicated systems	**0.812**	**3**	**0.766**	**3**	**0.576**	**4**	**0.637**	**3**
	Systems not satisfying participation standard or not adhering to survey administration procedure								
†, 2	Alberta, Canada	0.824	3	0.814	3	0.610	4	0.696	3
#	Denmark	0.771	3	0.738	3	0.554	4	0.493	3
#	Estonia	0.790	3	0.775	3	0.576	4	0.699	3
#	France	0.746	3	0.626	3	0.414	4	0.636	3
†, 2	Lithuania	0.822	3	0.734	3	0.644	4	0.701	3
†	Moscow, Russian Federation	0.824	3	0.791	3	0.652	4	0.682	3
#	Norway	0.790	3	0.758	3	0.406	4	0.560	3
†	Russian Federation	0.800	3	0.760	3	0.622	4	0.716	3
†	South Africa	0.882	3	0.766	3	0.666	4	0.733	3
†, 1	Thailand	0.870	3	0.783	3	0.559	4	0.696	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.4.8 Assessment

Question 15 of the teacher questionnaire asked: "In your teaching of the target class in this school year, do you use the following methods of assessing student performance?" Respondents were asked to select a response from two: "no" and "yes." Responses to this question were used to provide indicators for the assessment orientation. Three indicators were computed, namely, *traditionally important* (15A and 15B), *product* (15C, 15D, and 15E), and *reflection/collaboration* (15F, 15G, and 15H).

The reliabilities of these indicators are shown in Table 11.12. We can see that the reliabilities for these indicators were lower than 0.5 in more than half of the instances. The reliabilities were particularly problematic in the case of *traditionally important* assessment, being essentially zero for mathematics in Estonia and science in Finland and slightly negative for mathematics in Ontario (Canada), Slovenia, Alberta (Canada), and Denmark. Instead of being constructed on the basis of the nature of the assessment methods, the three composite indicators were empirically grounded on psychometric measures of scale validity. The indicator for *traditionally important* assessment was particularly problematic, probably because, as is evident from Figure 5.11 in the international report (Law & Chow, 2008), nearly all teachers reported use of these two types of assessment (by virtue of being traditionally important). Hence, there was very little variance in these two variables, giving rise to the very low reliabilities observed in this indicator.

Table 11.12: Reliabilities for the Assessment Orientation Indicators for both Mathematics Teachers and Science Teachers

Flags	Education System	Assessment—Traditionally Important			Assessment—Product			Assessment—Reflection Collaboration		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.225	0.380	2	0.504	0.404	3	0.325	0.237	3
1	Chile	0.526	0.699	2	0.420	0.245	3	0.534	0.439	3
	Chinese Taipei	0.194	0.290	2	0.580	0.611	3	0.461	0.464	3
2	Finland	0.295	0.000	2	0.601	0.552	3	0.374	0.453	3
2	Hong Kong SAR	0.520	0.594	2	0.653	0.634	3	0.596	0.481	3
4	Israel	0.383	0.587	2	0.550	0.531	3	0.602	0.583	3
1	Italy	0.411	0.582	2	0.373	0.236	3	0.444	0.427	3
1, 3	Japan	0.209	0.421	2	0.449	0.460	3	0.461	0.489	3
2	Ontario, Canada	-0.010	0.663	2	0.736	0.494	3	0.534	0.472	3
	Singapore	0.607	0.797	2	0.680	0.706	3	0.542	0.591	3
	Slovak Republic	0.315	0.402	2	0.265	0.229	3	0.329	0.264	3
	Slovenia	-0.026	0.147	2	0.574	0.520	3	0.308	0.395	3
	International alpha on adjudicated systems	**0.253**	**0.455**	**2**	**0.600**	**0.531**	**3**	**0.495**	**0.450**	**3**
Systems not satisfying participation standard or not adhering to survey administration procedure										
†, 2	Alberta, Canada	-0.017	0.394	2	0.702	0.512	3	0.449	0.447	3
#	Denmark	-0.017	0.272	2	0.513	0.556	3	0.416	0.425	3
#	Estonia	0.000	0.169	2	0.467	0.489	3	0.338	0.298	3
#	France	0.714	0.456	2	0.466	0.545	3	0.271	0.322	3
†, 2	Lithuania	0.422	0.269	2	0.514	0.524	3	0.407	0.391	3
†	Moscow, Russian Federation	0.115	0.225	2	0.523	0.403	3	0.565	0.472	3
#	Norway	0.669	0.645	2	0.601	0.300	3	0.551	0.496	3
†	Russian Federation	0.069	0.130	2	0.434	0.321	3	0.391	0.445	3
†	South Africa	0.875	0.938	2	0.518	0.567	3	0.580	0.467	3
†, 1	Thailand	0.732	0.731	2	0.371	0.314	3	0.545	0.595	3

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Because assessment has both a formative and a summative role in the educational process, the kinds of assessment used and the importance given to each by a teacher was likely to be guided by policies at the school level and beyond. The use of written tests and examinations in assessment is prevalent not only because it is traditionally important but also because it is likely to be a matter decided at the national, regional, and/or school level rather than an autonomous decision on the part of the teacher. Given the special role of assessment in education, it is understandable that assessment practice indicators with high face validity may still not be able to achieve the reliability needed to form a good scale. In view of these observations, we advise future studies to pay special care to the reporting of assessment practices. We also suggest, for the reasons already given, that it may be preferable to report item-level statistics rather than a composite indicator.

11.4.9 Teachers' ICT Competence

Question 21 of the teacher questionnaire asked: "To what extent are you confident in accomplishing the following?" Respondents were asked to select a response from four choices—"not at all," "a little," "somewhat," and "a lot"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the teacher's ICT competence orientation. Two sets of indicators were identified—*general ICT competence* (21A, 21B, 21C, 21D, 21E, 21F, 21G, and 21H) and *pedagogical ICT competence* (21I, 21J, 21K, 21L, 21M, 21N, and 21P).

The reliabilities of these indicators, shown in Table 11.13, were very high for all the systems (above 0.8 in all cases) for both indicators and for both populations of teachers. This outcome indicates that the two ICT-related teacher-competence indicators form strong scale indicators.

11.4.10 Professional Development

Question 24 of the teacher questionnaire asked: "Have you participated in any of the following professional development activities? If no, would you wish to attend?" Respondents were asked to select a response from three choices—"no, I do not wish to attend," "no, I would like to attend if available," and "yes, I have"—placed on a Likert-type scale. Responses to this question were used to provide indicators for the professional development orientation. Two sets of indicators—*technical* (24A, 24B, 24C, 24D, and 24G) and *pedagogical* (24E and 24F)—with three sub-categories (no, want to, and yes) were identified.

The reliabilities of these indicators are shown in Table 11.14 and Table 11.15. The reliabilities for all the systems were satisfactory (almost all exceeded 0.6), with some approaching as high as 0.9 for both indicators and for both mathematics and science teachers. This outcome denotes that these three indicators are acceptable as scale indicators.

11.4.11 Obstacles in Using ICT in Teaching

Question 23 of the teacher questionnaire asked: "Do you experience the following obstacles in using ICT in your teaching?" Respondents were asked to select a response from "no" and "yes," placed on a binary scale. Responses to this question were used to provide indicators for *obstacles to ICT use in teaching*. Three sets of indicators were identified: *school* (23A, 23B, 23J, 23K, and 23L), *teachers* (23C, 23D, 23E, 23H, and 23I), and *students* (23F and 23G).

Table 11.13: Reliabilities for the Competence Orientation Indicators for both Mathematics and Science Teachers

Flags	Education System	General ICT Competence			Pedagogical ICT Competence		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science	
	Catalonia, Spain	0.903	0.882	8	0.915	0.916	7
1	Chile	0.917	0.899	8	0.926	0.923	7
	Chinese Taipei	0.911	0.911	8	0.926	0.908	7
2	Finland	0.910	0.902	8	0.915	0.914	7
2	Hong Kong SAR	0.916	0.884	8	0.938	0.921	7
4	Israel	0.934	0.916	8	0.933	0.933	7
1	Italy	0.914	0.907	8	0.924	0.920	7
1, 3	Japan	0.869	0.853	8	0.907	0.900	7
2	Ontario, Canada	0.840	0.834	8	0.899	0.891	7
	Singapore	0.865	0.857	8	0.911	0.902	7
	Slovak Republic	0.923	0.932	8	0.934	0.932	7
	Slovenia	0.900	0.887	8	0.915	0.902	7
	International alpha on adjudicated systems	**0.905**	**0.897**	**8**	**0.922**	**0.918**	**7**
Systems not satisfying participation standard or not adhering to survey administration procedure							
†, 2	Alberta, Canada	0.834	0.865	8	0.887	0.898	7
#	Denmark	0.878	0.898	8	0.908	0.911	7
#	Estonia	0.897	0.883	8	0.916	0.909	7
#	France	0.878	0.861	8	0.899	0.876	7
†, 2	Lithuania	0.926	0.934	8	0.928	0.933	7
†	Moscow, Russian Federation	0.940	0.940	8	0.948	0.942	7
#	Norway	0.836	0.869	8	0.882	0.891	7
†	Russian Federation	0.912	0.919	8	0.922	0.921	7
†	South Africa	0.956	0.956	8	0.967	0.962	7
†, 1	Thailand	0.923	0.932	8	0.945	0.941	7

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

The reliabilities of these indicators are shown in Table 11.16. The reliabilities for all the systems for both mathematics and science teachers were generally acceptable, with only a few instances falling below 0.5. We note, however, that the teacher-related obstacles had particularly high reliabilities (all above 0.68) among the three indicators for obstacles teachers experience when trying to use ICT in their teaching.

Table 11.14: Reliabilities for the Technical Professional Development Orientation Indicators for both Mathematics and Science Teachers

Flags	Education System	Technical PD–No			Technical PD–Want to			Technical PD–Yes		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.696	0.679	5	0.616	0.660	5	0.667	0.635	5
1	Chile	0.808	0.774	5	0.776	0.715	5	0.743	0.703	5
	Chinese Taipei	0.769	0.787	5	0.755	0.779	5	0.770	0.795	5
2	Finland	0.747	0.721	5	0.685	0.673	5	0.730	0.700	5
2	Hong Kong SAR	0.848	0.840	5	0.817	0.777	5	0.846	0.813	5
4	Israel	0.792	0.774	5	0.758	0.733	5	0.769	0.700	5
1	Italy	0.739	0.770	5	0.699	0.712	5	0.637	0.655	5
1, 3	Japan	0.821	0.804	5	0.774	0.732	5	0.760	0.753	5
2	Ontario, Canada	0.723	0.702	5	0.689	0.642	5	0.732	0.740	5
	Singapore	0.731	0.738	5	0.720	0.714	5	0.740	0.694	5
	Slovak Republic	0.756	0.733	5	0.634	0.622	5	0.599	0.604	5
	Slovenia	0.702	0.694	5	0.709	0.667	5	0.704	0.668	5
	International alpha on adjudicated systems	**0.769**	**0.760**	**5**	**0.736**	**0.719**	**5**	**0.734**	**0.718**	**5**
Systems not satisfying participation standard or not adhering to survey administration procedure										
†, 2	Alberta, Canada	0.762	0.732	5	0.708	0.668	5	0.731	0.759	5
#	Denmark	0.723	0.743	5	0.658	0.648	5	0.672	0.681	5
#	Estonia	0.666	0.625	5	0.650	0.585	5	0.658	0.534	5
#	France	0.706	0.703	5	0.698	0.651	5	0.594	0.641	5
†, 2	Lithuania	0.708	0.756	5	0.618	0.640	5	0.684	0.680	5
†	Moscow, Russian Federation	0.756	0.731	5	0.656	0.627	5	0.559	0.630	5
#	Norway	0.703	0.710	5	0.679	0.629	5	0.702	0.693	5
†	Russian Federation	0.721	0.763	5	0.624	0.683	5	0.506	0.575	5
†	South Africa	0.849	0.867	5	0.867	0.863	5	0.850	0.809	5
†, 1	Thailand	0.912	0.922	5	0.807	0.813	5	0.740	0.752	5

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.15: Reliabilities for the Pedagogical Professional Development Orientation Indicators for both Mathematics and Science Teachers

Flags	Education System	Pedagogical PD–No			Pedagogical PD–Want to			Pedagogical PD–Yes		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.644	0.665	2	0.591	0.630	2	0.601	0.587	2
1	Chile	0.691	0.776	2	0.632	0.754	2	0.627	0.744	2
	Chinese Taipei	0.721	0.584	2	0.583	0.570	2	0.578	0.623	2
2	Finland	0.662	0.726	2	0.600	0.672	2	0.532	0.653	2
2	Hong Kong SAR	0.792	0.772	2	0.758	0.733	2	0.761	0.768	2
4	Israel	0.644	0.712	2	0.696	0.701	2	0.700	0.742	2
1	Italy	0.550	0.669	2	0.546	0.567	2	0.591	0.532	2
1, 3	Japan	0.726	0.733	2	0.709	0.667	2	0.694	0.723	2
2	Ontario, Canada	0.623	0.598	2	0.622	0.567	2	0.686	0.650	2
	Singapore	0.617	0.616	2	0.691	0.681	2	0.758	0.631	2
	Slovak Republic	0.610	0.613	2	0.485	0.511	2	0.495	0.478	2
	Slovenia	0.620	0.645	2	0.568	0.611	2	0.560	0.599	2
	International alpha on adjudicated systems	**0.653**	**0.674**	**2**	**0.623**	**0.646**	**2**	**0.637**	**0.661**	**2**
	Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.560	0.635	2	0.611	0.613	2	0.559	0.681	2
#	Denmark	0.568	0.529	2	0.630	0.594	2	0.626	0.671	2
#	Estonia	0.547	0.567	2	0.646	0.674	2	0.659	0.685	2
#	France	0.644	0.485	2	0.626	0.493	2	0.641	0.577	2
†, 2	Lithuania	0.601	0.604	2	0.566	0.672	2	0.582	0.726	2
†	Moscow, Russian Federation	0.755	0.727	2	0.676	0.698	2	0.668	0.742	2
#	Norway	0.729	0.771	2	0.609	0.631	2	0.594	0.644	2
†	Russian Federation	0.615	0.703	2	0.600	0.700	2	0.583	0.730	2
†	South Africa	0.825	0.743	2	0.837	0.833	2	0.813	0.846	2
†, 1	Thailand	0.941	0.922	2	0.787	0.783	2	0.729	0.724	2

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

Table 11.16: Reliabilities for the Obstacles Orientation Indicators for both Mathematics and Science Teachers

Flags	Education System	Obstacles–School			Obstacles–Teachers			Obstacles–Students		
		Cronbach's Alpha		*No. of Items*	*Cronbach's Alpha*		*No. of Items*	*Cronbach's Alpha*		*No. of Items*
		Math	Science		Math	Science		Math	Science	
	Catalonia, Spain	0.567	0.579	5	0.752	0.759	5	0.623	0.610	2
1	Chile	0.567	0.612	5	0.786	0.760	5	0.507	0.483	2
	Chinese Taipei	0.624	0.603	5	0.770	0.697	5	0.649	0.541	2
2	Finland	0.494	0.520	5	0.744	0.782	5	0.430	0.416	2
2	Hong Kong SAR	0.757	0.784	5	0.753	0.765	5	0.741	0.784	2
4	Israel	0.622	0.635	5	0.754	0.757	5	0.664	0.650	2
1	Italy	0.613	0.582	5	0.767	0.772	5	0.606	0.499	2
1, 3	Japan	0.560	0.484	5	0.777	0.756	5	0.712	0.663	2
2	Ontario, Canada	0.617	0.614	5	0.789	0.790	5	0.474	0.418	2
	Singapore	0.664	0.709	5	0.789	0.745	5	0.669	0.644	2
	Slovak Republic	0.499	0.513	5	0.738	0.751	5	0.514	0.573	2
	Slovenia	0.442	0.482	5	0.683	0.710	5	0.557	0.545	2
	International alpha on adjudicated systems	**0.603**	**0.611**	**5**	**0.765**	**0.760**	**5**	**0.603**	**0.573**	**2**
	Systems not satisfying participation standard or not adhering to survey administration procedure									
†, 2	Alberta, Canada	0.588	0.622	5	0.752	0.764	5	0.586	0.505	2
#	Denmark	0.581	0.576	5	0.710	0.758	5	0.467	0.559	2
#	Estonia	0.546	0.539	5	0.737	0.757	5	0.563	0.442	2
#	France	0.446	0.510	5	0.783	0.742	5	0.501	0.499	2
†, 2	Lithuania	0.479	0.516	5	0.690	0.695	5	0.591	0.616	2
†	Moscow, Russian Federation	0.540	0.571	5	0.781	0.763	5	0.636	0.573	2
#	Norway	0.473	0.420	5	0.718	0.729	5	0.512	0.523	2
†	Russian Federation	0.510	0.523	5	0.700	0.698	5	0.483	0.514	2
†	South Africa	0.645	0.649	5	0.759	0.744	5	0.782	0.745	2
†, 1	Thailand	0.694	0.699	5	0.787	0.791	5	0.798	0.725	2

Note:
Section 12.3.1 in this report provides an explanation of the flags reported in the first column of this table.

11.5 Scale Indicator in the School-level Questionnaires

As explained in Chapter 1 and further elaborated in Chapter 3, the following conceptual domains were addressed at the level of schools: "pedagogical practice," "vision," "infrastructure," "staff development," "support," and "organization and management."

The items that were used for collecting information about each of these domains were, for the major part, reported in the main report of SITES 2006 (Law, Pelgrum, & Plomp, 2008). As is shown in Chapter 12, this reporting consisted of showing the results for single items as well as for composites based on a linear combination of responses from multiple items that were hypothesized to address an underlying construct. Evidence for the appropriateness of these statistical operations was collected during the field trial as well as during the processing of data from the main run.

The following composite indicators were based on the school-level data:

- *Pedagogical practice indicator (presence of LLL pedagogy):* Section 11.5.1 shows the reliabilities for this indicator.
- *Vision indicators:* With regard to the vision of school leaders, three indicators were specified in the conceptual framework: vision with regard to lifelong learning practices, to connectedness, and to traditional pedagogical practices. Moreover, factor analyses led us to conclude that a vision regarding ICT use relative to lifelong learning could be identified. This indicator, we determined, reflected the extent to which school principals encouraged teachers to use ICT for lifelong learning activities. The reliabilities for each of these indicators are shown in Sections 11.5.2 to 11.5.5.
- *Infrastructure indicators:* The infrastructure indicators that were described in the main report concerned student:computer ratios, student:internet-computer ratios, and the extent to which different types of software are available in schools. The reliabilities of each of these indicators are described in Sections 11.5.6 and 11.5.7.
- *Staff development indicators:* Two indicators were constructed for staff development: (i) the extent to which teachers were required to acquire knowledge and skills in a number of areas; and (ii) the extent to which school leaders gave priority to acquiring competencies in the area of change management. The reliabilities are reported in Sections 11.5.8 and 11.5.9.
- *Support indicators:* Two indicators were created for the extent to which support was available for teachers. These were technical support and pedagogical support. The reliabilities are shown in Sections 11.5.10 and 11.5.11.

When combining the results from single items into a composite score, it is important to ask to what extent the items are internally consistent. To shed light on this question, the following sections contain an overview of the reliabilities (across as well as within systems) for each of the composites from the list above, as computed in SPSS. In the following sections, we refer to questions from the principal and technology coordinator questionnaires. These questionnaires can be found as an online appendix at http://www.sites2006.net/appendix.

In addition to the reliability coefficients reported for each participating education system, a cross-system reliability coefficient called the "international alpha on adjudicated systems" was computed on equally weighted data from those systems that satisfied the sampling standards. These Cronbach's alpha values are included in this technical documentation to aid not only interested readers but also researchers wishing to undertake secondary analysis to assess the reliability and validity of scale indicators for cross-system comparisons. Because of potential item bias in those systems where non-response might not have been random or completely at random, that is, potentially related to the variable of interest, we did not consider in our computation of international alpha those systems not satisfying the sampling standard. For the same reason, the international report does not include international scale score averages or means.

11.5.1 *Pedagogical Practice*

The main focus of SITES-M1, SITES-M2, and SITES 2006 was on pedagogical practices in relation to ICT. Because Module 1 consisted of a school-level survey only, the research consortium deemed it important that Module 1 collect from school principals estimates of the pedagogical approaches practiced in their respective schools. Although, in SITES 2006, these estimates could be collected more directly via teachers, the consortium decided to include some of the items from Module 1 again in order to investigate changes over time. Question 1 (items A–F) of the principal questionnaire was used (answer options: 1 = not at all, 2 = to some extent, 3 = a lot) as the vehicle by which to conduct comparisons between SITES-M1 and SITES 2006.

Table 11.17 shows the reliabilities that were observed across and within countries for this set of items.

Table 11.17: Reliabilities of the Indicator "Presence of Lifelong Learning Practices"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.496	6
	Catalonia, Spain	0.512	6
1	Chile	0.579	6
	Chinese Taipei	0.635	6
2	Finland	0.452	6
2	Hong Kong SAR	0.611	6
4	Israel	0.548	6
1	Italy	0.531	6
1	Japan	0.555	6
2	Lithuania	0.553	6
	Moscow, Russian Federation	0.546	6
2	Ontario, Canada	0.610	6
	Russian Federation	0.480	6
	Singapore	0.694	6
	Slovak Republic	0.476	6
	Slovenia	0.414	6
	South Africa	0.658	6
1	Thailand	0.676	6
	International alpha on adjudicated systems	**0.567**	**6**
	Systems not satisfying sampling standards		
#	Denmark	0.454	6
#	Estonia	0.359	6
#	France	0.304	6
#	Norway	0.403	6

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

As can be inferred from Table 11.17, the reliabilities for the indicator of the presence of lifelong learning practices ranged from low to fair only. Because these reliabilities were not very high, we advise readers to exercise caution when interpreting the results in the main report. We also note that in the final report the changes between 1998 and 2006 are shown separately for each item so that readers can gain a complete picture of changes at the level of individual items.

11.5.2 *Lifelong Learning Pedagogical Vision*

The items C–G from Question 2 of the principal questionnaire were used to create an indicator of the lifelong learning pedagogical vision of school leaders. This indicator was expressed in terms of the mean score across these items (values: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree).

Table 11.18 contains (per country) the reliability indices for this scale. As can be observed, the reliabilities for this indicator were quite good (above .70 for almost all education systems).

Table 11.18: Reliabilities of the Indicator "Lifelong Learning Pedagogical Vision"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.745	5
	Catalonia, Spain	0.774	5
1	Chile	0.847	5
	Chinese Taipei	0.834	5
2	Finland	0.756	5
2	Hong Kong SAR	0.786	5
4	Israel	0.814	5
1	Italy	0.804	5
1	Japan	0.681	5
2	Lithuania	0.754	5
	Moscow, Russian Federation	0.819	5
2	Ontario, Canada	0.809	5
	Russian Federation	0.809	5
	Singapore	0.755	5
	Slovak Republic	0.759	5
	Slovenia	0.695	5
	South Africa	0.842	5
1	Thailand	0.823	5
	International alpha on adjudicated systems	**0.803**	**5**
	Systems not satisfying sampling standards		
#	Denmark	0.726	5
#	Estonia	0.766	5
#	France	0.784	5
#	Norway	0.743	5

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.3 *Connectedness Pedagogical Vision*

To create an indicator of the school's vision regarding pedagogical connectedness, we used two items (H and I) from Question 2 of the principal questionnaire. We expressed this indicator in terms of the mean score across these items (values: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree).

The reliabilities for this indicator are shown in Table 11.19. For most education systems, the reliabilities for this indicator were generally quite high, but in some systems they were only moderate.

Table 11.19: Reliabilities of the Indicator "Connectedness Pedagogical Vision"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.678	2
	Catalonia, Spain	0.725	2
1	Chile	0.842	2
	Chinese Taipei	0.692	2
2	Finland	0.626	2
2	Hong Kong SAR	0.644	2
4	Israel	0.711	2
1	Italy	0.678	2
1	Japan	0.511	2
2	Lithuania	0.609	2
	Moscow, Russian Federation	0.739	2
2	Ontario, Canada	0.597	2
	Russian Federation	0.796	2
	Singapore	0.719	2
	Slovak Republic	0.650	2
	Slovenia	0.705	2
	South Africa	0.738	2
1	Thailand	0.703	2
	International alpha on adjudicated systems	**0.721**	**2**
	Systems not satisfying sampling standards		
#	Denmark	0.508	2
#	Estonia	0.574	2
#	France	0.697	2
#	Norway	0.508	2

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.4 *Traditional Pedagogical Vision*

Two items—A and B in Question 2 of the principal questionnaire—were available to us when creating an indicator of the school's traditional pedagogical vision. We expressed this indicator in terms of the mean score across these items (values: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree).

The reliabilities for this indicator are shown in Table 11.20. Although this indicator comprised only two items, the reliabilities for most education systems were quite satisfactory, but only moderate for the others.

Table 11.20: Reliabilities of the Indicator "Traditional Pedagogical Vision"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.654	2
	Catalonia, Spain	0.636	2
1	Chile	0.699	2
	Chinese Taipei	0.734	2
2	Finland	0.619	2
2	Hong Kong SAR	0.671	2
4	Israel	0.650	2
1	Italy	0.621	2
1	Japan	0.529	2
2	Lithuania	0.635	2
	Moscow, Russian Federation	0.627	2
2	Ontario, Canada	0.642	2
	Russian Federation	0.667	2
	Singapore	0.679	2
	Slovak Republic	0.583	2
	Slovenia	0.470	2
	South Africa	0.718	2
1	Thailand	0.668	2
	International alpha on adjudicated systems	**0.647**	**2**
	Systems not satisfying sampling standards		
#	Denmark	0.641	2
#	Estonia	0.581	2
#	France	0.625	2
#	Norway	0.622	2

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.5 *Lifelong Learning ICT Vision*

Here, we were able to create an indicator of an ICT-related vision for lifelong learning from items C–F and H from Question 3 of the principal questionnaire (values: 1 = not at all, 2 = a little, 3 = somewhat, 4 = a lot).

We expressed this indicator in terms of the mean score across these items. As is evident from Table 11.21, the reliabilities for this indicator were all quite high.

Table 11.21: Reliabilities of the Indicator "School Leaders' Visions on the Importance of ICT for Lifelong Learning"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.806	5
	Catalonia, Spain	0.834	5
1	Chile	0.893	5
	Chinese Taipei	0.856	5
2	Finland	0.767	5
2	Hong Kong SAR	0.848	5
4	Israel	0.881	5
1	Italy	0.852	5
1	Japan	0.806	5
2	Lithuania	0.819	5
	Moscow, Russian Federation	0.780	5
2	Ontario, Canada	0.864	5
	Russian Federation	0.792	5
	Singapore	0.847	5
	Slovak Republic	0.724	5
	Slovenia	0.752	5
	South Africa	0.975	5
1	Thailand	0.854	5
	International alpha on adjudicated systems	**0.881**	**5**
	Systems not satisfying sampling standards		
#	Denmark	0.787	5
#	Estonia	0.805	5
#	France	0.892	5
#	Norway	0.785	5

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.6 Student:Computer Ratio and Student:Internet-computer Ratio

These indicators consisted of a ratio of two variables, respectively the number of students divided by the number of computers available to students at the grade range targeted in SITES 2006. We found that it was not possible to calculate a reliability index for these indicators, although it appeared from earlier use of them (in SITES-M1) that the results would be quite plausible when compared with other surveys measuring student:computer ratios.

11.5.7 Software Availability

We calculated an indicator of infrastructure-software availability by counting the number of items (total = 13) that the technical questionnaire respondents checked (on Question 4) as "available." Our next step was to calculate the percentage of the total number of items in this question.

For most education systems, the reliabilities for this indicator of infrastructure-software availability were relatively satisfactory, as is shown in Table 11.22. They nonetheless varied across education systems, ranging from moderate (e.g., Singapore) to high (e.g., Thailand and South Africa).

Table 11.22: Reliabilities of the Indicator "Software Availability"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.612	13
	Catalonia, Spain	0.670	13
1	Chile	0.764	13
	Chinese Taipei	0.645	13
2	Finland	0.583	13
2	Hong Kong SAR	0.585	13
4	Israel	0.785	13
1	Italy	0.662	13
1	Japan	0.686	13
2	Lithuania	0.744	13
	Moscow, Russian Federation	0.809	13
2	Ontario, Canada	0.633	13
	Russian Federation	0.757	13
	Singapore	0.527	13
	Slovak Republic	0.623	13
	Slovenia	0.623	13
	South Africa	0.883	13
1	Thailand	0.824	13
	International alpha on adjudicated systems	**0.833**	**13**
	Systems not satisfying sampling standards		
#	Denmark	0.623	13
#	Estonia	0.606	13
#	France	0.711	13
#	Norway	0.547	13

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.8 *Teacher Training Requirements*

This indicator was based on items A–J of Question 12 of the principal questionnaire (values: 1 = no; 2 = yes, encouraged; 3 = yes, required).

The indicator was calculated as the percentage of items for which the answer "yes, required" was given. Table 11.23 shows the reliabilities for this indicator. As is evident, these were high for all education systems, except Italy. Here, the reliability was moderate.

Table 11.23: Reliabilities of the Indicator "Training Requirements for Teachers"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.828	10
	Catalonia, Spain	0.775	10
1	Chile	0.847	10
	Chinese Taipei	0.788	10
2	Finland	0.766	10
2	Hong Kong SAR	0.749	10
4	Israel	0.836	10
1	Italy	0.596	10
1	Japan	0.787	10
2	Lithuania	0.827	10
	Moscow, Russian Federation	0.810	10
2	Ontario, Canada	0.796	10
	Russian Federation	0.852	10
	Singapore	0.809	10
	Slovak Republic	0.770	10
	Slovenia	0.781	10
	South Africa	0.893	10
1	Thailand	0.888	10
	International alpha on adjudicated systems	**0.853**	**10**
	Systems not satisfying sampling standards		
#	Denmark	0.710	10
#	Estonia	0.781	10
#	France	0.813	10
#	Norway	0.766	10

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.9 Leadership Development Priorities

This indicator consisted of the number of items (from a total of 10) in Question 13 from the principal questionnaire that respondents checked as "high priority" divided by the total number of items. We then converted this proportion to a scale running from 0 to 100.

In Table 11.24, we can observe that the reliabilities for this indicator (based on items recoded to 1 = high priority and 0 = any other scale values) were high in almost all education systems.

Table 11.24: Reliabilities of the Indicator "Leadership Development Priorities"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.827	10
	Catalonia, Spain	0.812	10
1	Chile	0.838	10
	Chinese Taipei	0.833	10
2	Finland	0.722	10
2	Hong Kong SAR	0.693	10
4	Israel	0.832	10
1	Italy	0.837	10
1	Japan	0.653	10
2	Lithuania	0.815	10
	Moscow, Russian Federation	0.857	10
2	Ontario, Canada	0.817	10
	Russian Federation	0.894	10
	Singapore	0.831	10
	Slovak Republic	0.829	10
	Slovenia	0.692	10
	South Africa	0.896	10
1	Thailand	0.881	10
	International alpha on adjudicated systems	**0.858**	**10**
	Systems not satisfying sampling standards		
#	Denmark	0.731	10
#	Estonia	0.794	10
#	France	0.808	10
#	Norway	0.772	10

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.10 Technical Support

We used Question 16 (items A–K) from the technology coordinator questionnaire to create this indicator, which we calculated after first recoding the answer category "not applicable" to "missing." This indicator was expressed in terms of the mean score across these items (values: 1 = no support, 2 = some support, 3 = extensive support).

As is shown in Table 11.25, the reliabilities for the indicator of technical support were very high in all systems.

Table 11.25: Reliabilities of the Indicator "Technical Support"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.939	11
	Catalonia, Spain	0.943	11
1	Chile	0.959	11
	Chinese Taipei	0.928	11
2	Finland	0.906	11
2	Hong Kong SAR	0.911	11
4	Israel	0.948	11
1	Italy	0.923	11
1	Japan	0.955	11
2	Lithuania	0.890	11
	Moscow, Russian Federation	0.876	11
2	Ontario, Canada	0.941	11
	Russian Federation	0.868	11
	Singapore	0.905	11
	Slovak Republic	0.858	11
	Slovenia	0.858	11
	South Africa	0.959	11
1	Thailand	0.950	11
	International alpha on adjudicated systems	**0.936**	**11**
	Systems not satisfying sampling standards		
#	Denmark	0.895	11
#	Estonia	0.849	11
#	France	0.935	11
#	Norway	0.902	11

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

11.5.11 *Pedagogical Support*

We based this indicator on items A–F from principal questionnaire Question 15, and calculated it after first recoding the answer category "not applicable" to "missing." We expressed this indicator in terms of the mean score across these items (values: 1 = not at all, 2 = a little, 3 = somewhat, 4 = a lot).

As is evident from Table 11.26, the reliabilities for this indicator of pedagogical support were high in all education systems.

Table 11.26: Reliabilities of the Indicator "Pedagogical Support"

Flags	Education System	Cronbach's Alpha	No. of Items
2,3	Alberta, Canada	0.817	6
	Catalonia, Spain	0.876	6
1	Chile	0.869	6
	Chinese Taipei	0.863	6
2	Finland	0.826	6
2	Hong Kong SAR	0.802	6
4	Israel	0.908	6
1	Italy	0.886	6
1	Japan	0.884	6
2	Lithuania	0.844	6
	Moscow, Russian Federation	0.854	6
2	Ontario, Canada	0.862	6
	Russian Federation	0.870	6
	Singapore	0.822	6
	Slovak Republic	0.867	6
	Slovenia	0.776	6
	South Africa	0.896	6
1	Thailand	0.868	6
	International alpha on adjudicated systems	**0.878**	**6**
	Systems not satisfying sampling standards		
#	Denmark	0.827	6
#	Estonia	0.827	6
#	France	0.892	6
#	Norway	0.790	6

Note:
Section 12.2 in this report provides an explanation of the flags reported in the first column of this table.

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12. Reporting Data and Indicators

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12.1 Overview

The data from SITES 2006 were reported by Law, Pelgrum, and Plomp (2008). Their report contains the following chapters:

- Chapter 1 offers a description of the background of the study, summaries of SITES–M1 and SITES-M2, and the participating education systems.
- Chapter 2 contains a description of the conceptual framework and the research questions addressed in this study. The study design and methodology are also summarized in this chapter.
- The next four chapters (3–6) deal respectively with the findings of the study at macro, meso, and micro levels and contain information about (respectively) the system-level context (Chapter 3), school-level indicators of conditions affecting the use of ICT and pedagogy (Chapter 4), and teacher-level indicators regarding pedagogical approaches, the use of ICT, and the way these are affected by teacher characteristics, including teachers' perceptions of pertinent school-level conditions (Chapters 5 and 6).
- Chapter 7 contains information about a part of the teacher questionnaire that was included as an international option in SITES 2006. This component consisted of teachers' descriptions of their most satisfying experience with ICT use in teaching and the way they perceived the impact of that practice.
- Chapter 8 focuses on exploring relationships between school- and teacher-level indicators to determine if there is evidence that some key strategic factors commonly found in ICT-related educational policies do have an impact on teachers' pedagogical use of ICT.
- Chapter 9 contains a summary of the key findings from SITES 2006 and a discussion of the policy implications for teachers, school leaders, and policymakers.

Chapters 4 to 8 were based on data that were collected in SITES 2006 from samples of schools and teachers. The sections below offer a description of the technical details of the reporting in these chapters and refer to other chapters in this technical report that shed further light on additional details. The data in Chapter 3 were collected via a questionnaire that was administered to the national research coordinators (NRCs). These data were not processed statistically. Because the reporting consisted mainly of summarizing the responses to this questionnaire, the reporting of these data were not discussed in a separate section of this chapter.

12.2 School-level Data

The school-level data were based on two questionnaires: a questionnaire for school principals and a questionnaire for ICT coordinators (see http://www.sites2006.net/appendix and Chapter 4). Three types of displays were used for reporting the school-level data:

- *Tables and figures based on single items from the questionnaires:* These item-statistics were, in most tables and figures, expressed in terms of a percentage of respondents who marked a particular answer option. The way that these percentages were calculated is described in the main report. In all tables, jackknife standard errors (SE) were also included for each of the item statistics (see Chapter 10). For simple bar charts based on single items, the confidence intervals shown were calculated as +/- 1.96*SE. The more complex bar graphs do not contain standard errors; these can be found online at http://www.sites2006.net/appendix. This site also gives references to the table/figure numbers in the main report.
- *Tables and figures based on composites:* Composites were created from sets of variables on the basis of hypothesized constructs and evidence from factor and reliability analyses. The reliability indices for these composites are shown in Chapter 11.
- *Bivariate scatter diagrams:* Most scatter diagrams showed the country positions on two indicators that were also separately reported. Although the standard errors for the country positions are not shown in the scatter diagrams, readers can find these in the univariate tables.

Throughout the chapter on school-level data, systems are listed in two sections, in alphabetical order within section, and flagged as described in Table 12.1.

Table 12.1: Flags Used in School-level Exhibits in the International Report

System	Flags
Alberta, Canada	2,3
Catalonia, Spain	
Chile	1
Chinese Taipei	
Finland	2
Hong Kong SAR	2
Israel	4
Italy	1
Japan	1
Lithuania	2
Moscow, Russian Federation	
Ontario, Canada	2
Russian Federation	
Singapore	
Slovak Republic	
Slovenia	
South Africa	
Thailand	1
Denmark	#
Estonia	#
France	#
Norway	#

The flags in Table 12.1 follow the assignment of participation categories as described in Chapter 10. Those systems that failed to reach Participation Categories 1 though 4 were reported in the second section of the table, below a line. The meaning of these flags is explained in notes below the displays:

#	School participation rate after including replacement schools is below 70%
1	School participation rate before including replacement schools is below 85%
2	School participation rate after including replacement schools is below 85%
3	Less than 70% of the school-level questionnaires in the participating schools were returned
4	National-defined population covers less than 90% of the national-desired population.

The final section of Chapter 4 of the final report contains a display of correlations that were observed between the main indicators described in this chapter. These correlations were based upon aggregated (system-level) statistics from education systems that satisfied the sampling criteria (18 of the 22 systems). The correlation display shows only the correlations that reached statistical significance (ρ >.45).

12.3 Teacher-level Data

The descriptive statistics based on the teacher-level data from SITES 2006 were reported in three chapters. Chapters 5 and 6 contained results from the core part of the teacher questionnaire, while Chapter 7 was based on an international option part of this questionnaire.

12.3.1 Data from the Core Component of the Teacher Questionnaire

The following types of display were used to report the teacher-level data in Chapter 5:

- *Figures showing the pedagogical orientations of the mathematics and the science teachers* displayed next to each other in the form of stacked bar graphs. Five sets of these figures were displayed, three for the overall pedagogical orientation as reflected by the teachers' espoused curriculum goals, their reported teacher practices, and their reported student practices, and two for the reported ICT-using teacher practices and reported ICT-using student practices. The pedagogical orientations are core indicators designed to form scales. The item-contents of the respective scale composites are described in the international report (Law et al., 2008), while Chapter 11 of this technical report provides details regarding the reliabilities of these composites.
- *Radar diagrams with three axes representing the traditionally important, lifelong learning, and connectedness orientations* for comparing teachers' and students' practices or for comparing overall and ICT-using practices on these indicators. The interpretation of these radar diagrams is explained in the text.
- *Tables showing mean values and standard errors for items in a question:* The meaning of these values is explained below the tables.
- *A table of correlations of system-level means:* These correlations were calculated only for those education systems that satisfied the participation standard and followed all requisite administrative procedures.

In many figures and tables, the results for mathematics and science teachers are shown separately. Because of space and readability considerations, the figures do not contain standard errors. These can be found online at http://www.sites2006.net/appendix.

Chapter 6 contains descriptive statistics of teacher background data (e.g., age, gender, qualifications, self-reported competencies) and also indicators that were hypothesized to influence the teaching and learning practices of these teachers. The following formats of figures and tables were used in this chapter:

- *Univariate statistics (including standard errors), presented in tables, per education system,* for mathematics teachers and for science teachers. Due to space considerations, some univariate statistics were presented only for one population of teachers. The corresponding tables for the other teacher population can be found at http://www.sites2006.net/appendix.
- *Scatter diagrams showing the position of education systems* on two indicators.
- *Stacked bar graphs showing the percentage of each category of response* made by science teachers and mathematics teachers, and with the graphs displayed next to each other.
- *Results of logistic regression analyses* aimed at exploring relationships between the different indicators. The technical details of these analyses are explained in the main report.

In general, the chapters on teacher-level data list the participating systems in two separate sections, in alphabetical order within each section and flagged as described in Table 12.2.

Table 12.2: Flags Used in Teacher-level Exhibits in the International Report

System	Flags
Catalonia, Spain	
Chile	1
Chinese Taipei	
Finland	2
Hong Kong SAR	2
Israel	4
Italy	1
Japan	1, 3
Ontario, Canada	2
Singapore	
Slovak Republic	
Slovenia	
Alberta, Canada	†, 2
Denmark	#
Estonia	#
France	#
Lithuania	†, 2
Moscow, Russian Federation	†
Norway	#
Russian Federation	†
South Africa	†
Thailand	†, 1

The flags in Table 12.2 follow the assignment of participation categories as described in Chapter 10. Those systems that either failed to reach Participation Categories 1 through 4 or did not follow the international sampling procedures for target classes were reported in the second section of the table, below a line. The meaning of these flags is explained as notes below the displays:

#	School participation rate after including replacement schools is below 70%
†	International procedures for target-class selection was not followed in all schools
1	School participation rate before including replacement schools is below 85%
2	School participation rate after including replacement schools is below 85%
3	Teacher-participation data were collected after survey administration
4	National-defined population covers less than 90% of the national-desired population.

Some of the exhibits in the international report (Figures 6.1, 6.3, 6.4, 6.6, and 6.7) pertain to data collected in Part VII of the teacher questionnaire ("Information about You and Your School"). Questions in this part were not asked in the context of a specific target class. Although the systems are listed in two separate sections in alphabetical order within each section of these figures, they are flagged differently, as described in Table 12.3.

Table 12.3: Flags Used in Teacher-level Exhibits in the International Report without Target Class Reference

System	Flags
Alberta, Canada	2
Catalonia, Spain	
Chile	1
Chinese Taipei	
Finland	2
Hong Kong SAR	2
Israel	4
Italy	1
Japan	1, 3
Lithuania	2
Moscow, Russian Federation	
Ontario, Canada	2
Russian Federation	
Singapore	
Slovak Republic	
Slovenia	
South Africa	
Thailand	1
Denmark	#
Estonia	#
France	#
Norway	#

The flags in Table 12.3 follow the assignment of participation categories as described in Chapter 10. Those systems that failed to reach Participation Categories 1 through 4 were reported in the second section of the table, below a line. The meaning of these flags is explained as notes below the displays:

#	School participation rate after including replacement schools is below 70%
1	School participation rate before including replacement schools is below 85%
2	School participation rate after including replacement schools is below 85%
3	Teacher participation data were collected after survey administration
4	National-defined population covers less than 90% of the national-desired population.

12.3.2 Data from the International Option of the Teacher Questionnaire

Chapter 7 of the international report contains a description of a part of the teacher questionnaire that qualified as an international option, meaning that countries were not obliged to include this part of the questionnaire. This international option focused on what teachers perceived as their most satisfying experience with ICT; the questions asked regarded content and perceived impact.

The following formats of figures and tables were used in this chapter:

- *Univariate statistics (including standard errors) per education system* for mathematics teachers and science teachers presented in tables.
- *Bar graphs and stacked bar graphs showing the percentage of each category of response*(s) made by teachers.

Because of space considerations, some univariate statistics were presented for the mathematics population of teachers only, and some of the figures do not show the standard errors of the statistics. These standard errors can be found as part of the online appendices available at http://www.sites2006.net/appendix.

Chapter 7 of the international report also contains tables with statistics based on internationally pooled data (excluding the education systems that did not meet the sampling standards). The calculation of the means and standard errors for these statistics is explained below.

Suppose that θ denotes the indicator for which statistics need to be calculated on the pooled data set. Let θ_C be the indicator calculated for education system C, and $\sigma(\theta_C)$ its jackknife standard error as the square root of the jackknife variance $\sigma^2(\theta_C)$. The international mean will be:

$$\theta_{\text{int}} = \frac{1}{n} \sum_{C=1}^{n} \theta_C ,$$

where C denotes the education systems. Using the identity

$$\text{VAR(A+B)} = \text{VAR(A)+VAR(B)+2COV(A,B)},$$

the standard error of the international mean is:

$$\sigma(\theta_{\text{int}}) = \sqrt{\sigma^2(\theta_{\text{int}})} = \sqrt{\frac{1}{n^2} \sum_{C=1} \sigma^2(\theta_C)} ,$$

recognizing that the covariances are zero given the independence of the education systems. So, concretely, once a standard error per education system is calculated,

- The squared standard error for each system is calculated,
- These squares are summed (i.e., the sampling variance),
- The sum is divided by the square of the number of systems, and
- The square root of the result provides the international standard error.

12.4 Exploratory Analyses in Search of Explanations

Chapter 8 of the international report contains the results of the exploratory analyses that were conducted in order to obtain a first impression of the relationships between school- and teacher-level indicators. These analyses were based on two techniques:

1. Correlation analysis of the mean ICT-using teacher practice orientation scores at the system level with the corresponding means for some school-level factors; and
2. Multilevel analysis relating ICT-using lifelong-learning-oriented practices of a teacher with the contextual factors at the teacher's school.

These analyses were carried out only on data from those education systems that satisfied the participation standard and adhered to all requisite administrative procedures. The international report contains an introductory description of multilevel modeling as well as the details of the analysis outputs.

Reference

Law, N., Pelgrum, W. J., & Plomp, T. (Eds.). (2008). *Pedagogical practices and ICT use around the world: Findings from an international comparative study* (CERC Studies in Comparative Education). Hong Kong/Dordrecht: Comparative Education Research Centre, the University of Hong Kong/Springer.

Appendices

Appendix A: Acknowledgments

A.1 Overview

SITES 2006 was a cooperative effort of researchers, all of whom are acknowledged for their active contribution to the design and execution of the study. Below is a list of persons who were involved in the study at the international and national levels.

At the international level, the daily coordination of the study was the responsibility of the international coordinating center (ICC). The center was located at the University of Twente, the Netherlands, and was part of a coordination consortium aligned with the University of Hong Kong and the IEA Data Processing and Research Center (DPC) in Hamburg, Germany. A steering committee, a sampling referee, and the IEA Secretariat in Amsterdam, the Netherlands, assisted this consortium.

At the national level, the daily coordination of the study was carried out by national research coordinators (NRCs), data managers, and their national center research staff.

The names and addresses of the key personnel involved in each of these functions are listed below.

SITES 2006 acknowledges the research grant received from the Research Grants Council in Hong Kong (Grant No. HKU 7269/04H) to conduct the scale development work for the teacher questionnaire during (i) the piloting of the instrument in Hong Kong prior to the first NRC meeting, and (ii) the analysis of the field test data to arrive at the selection of items for the final instrument.

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Appendix B: Characteristics of the National Samples

For each education system participating in SITES 2006, this appendix describes population coverage, exclusion categories, stratification variables, and any deviations from the general SITES sampling design.

B.1 Alberta, Canada

- School-level exclusions consisted of native schools and very small schools (fewer than five students in Grade 8)
- Explicit stratification by school size
- Implicit stratification by urbanization and type of school authority, for a total of 60 implicit strata
- Ninety-eight very large and large schools selected with certainty

Table B.1: Allocation of School Sample in Alberta, Canada

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	41	0	1	32	0	0	8
Large Schools	57	0	5	37	0	0	15
Medium-size Schools	67	0	1	54	0	0	12
Small Schools	79	0	4	62	2	0	11
Very Small Schools	156	3	10	106	5	0	32
Total	**400**	**3**	**21**	**291**	**7**	**0**	**78**

B.2 Catalonia, Spain

- School-level exclusions consisted of very small schools (fewer than 20 students in Grade 8)
- Explicit stratification by school type and school size
- Implicit stratification by school district and town size, for a total of 172 implicit strata

Table B.2: Allocation of School Sample in Catalonia, Spain

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Public, Very Large Schools	35	0	1	33	0	0	1
Public, Large Schools	38	0	0	32	3	0	3
Public, Medium-size Schools	40	0	4	35	0	0	1
Public, Small Schools	44	0	3	38	2	0	1
Public, Very Small Schools	56	0	5	46	4	0	1
Private, Very Large Schools	28	0	1	25	1	0	1
Private, Large Schools	31	0	2	26	1	0	2
Private, Medium-size Schools	36	0	3	31	1	0	1
Private, Small Schools	38	0	4	32	1	0	1
Private, Very Small Schools	54	1	3	42	3	0	5
Total	**400**	**1**	**26**	**340**	**16**	**0**	**17**

B.3 Chile

- School-level exclusions consisted of very small schools (fewer than 10 students in Grade 8)
- Explicit stratification by school type, urbanization, and school size
- No implicit stratification

Table B.3: Allocation of School Sample in Chile

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Public, Rural	11	0	0	5	3	1	2
Public, Urban, Very Large Schools	43	0	3	37	3	0	0
Public, Urban, Large Schools	48	0	3	39	4	1	1
Public, Urban, Medium-size Schools	54	0	3	43	5	0	3
Public, Urban, Small Schools	63	0	2	46	5	2	8
Public, Urban , Very Small Schools	100	0	1	71	10	4	14
Semi-public, Rural	5	0	0	4	0	0	1
Semi-public, Urban, Very Large Schools	31	1	1	26	2	0	1
Semi-public, Urban, Large Schools	37	0	3	31	1	0	2
Semi-public, Urban, Medium-size Schools	41	0	0	39	2	0	0
Semi-public, Urban, Small Schools	51	0	0	45	3	0	3
Semi-public, Urban, Very Small Schools	74	0	5	56	8	2	3
Private, Rural	2	0	0	1	1	0	0
Private, Urban, Very Large Schools	7	0	0	6	1	0	0
Private, Urban, Large Schools	8	0	3	2	2	1	0
Private, Urban, Small Schools	10	0	2	5	1	1	1
Private, Urban, Very Small Schools	15	0	0	7	2	0	6
Total	**600**	**1**	**26**	**463**	**53**	**12**	**45**

B.4 Chinese Taipei

- School-level exclusions consisted of highly specific schools (arts, sports, etc.), foreign language-oriented schools, special education schools, and very small schools (one or two Grade 8 classes)
- Explicit stratification by region and school size
- No implicit stratification

Table B.4: Allocation of School Sample in Chinese Taipei

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
North, Very Large Schools	24	0	0	24	0	0	0
North, Large Schools	25	0	0	25	0	0	0
North, Medium-size Schools	28	0	0	26	1	0	1
North, Small Schools	34	0	0	33	1	0	0
North, Very Small Schools	56	0	0	51	5	0	0
Central, Very Large Schools	11	0	0	11	0	0	0
Central, Large Schools	13	0	0	13	0	0	0
Central, Medium-size Schools	13	0	0	12	1	0	0
Central, Small Schools	16	0	0	16	0	0	0
Central, Very Small Schools	27	0	0	25	2	0	0
South, Very Large Schools	17	0	0	17	0	0	0
South, Large Schools	18	0	0	18	0	0	0
South, Medium-size Schools	21	0	0	21	0	0	0
South, Small Schools	26	0	0	26	0	0	0
South, Very Small Schools	42	0	0	41	1	0	0
East, Large Schools	6	0	0	6	0	0	0
East, Medium-size Schools	7	0	0	6	1	0	0
East, Small Schools	12	0	0	12	0	0	0
Islands	4	0	0	4	0	0	0
Total	**400**	**0**	**0**	**387**	**12**	**0**	**1**

B.5 Denmark

- School-level exclusions consisted of special education schools and very small schools (fewer than nine students in Grade 8)
- Explicit stratification by school size
- No implicit stratification

Table B.5: Allocation of School Sample in Denmark

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	61	0	3	35	11	0	12
Large Schools	68	0	12	33	6	1	16
Medium-size Schools	74	0	4	40	2	1	27
Small Schools	82	0	7	48	10	0	17
Very Small Schools	115	0	10	62	14	0	29
Total	**400**	**0**	**36**	**218**	**43**	**2**	**101**

B.6 Estonia

- School-level exclusions consisted of Waldorf schools, schools with specialized curriculum, schools for undisciplined students, and special education schools
- Explicit stratification by school size
- No implicit stratification

Table B.6: Allocation of School Sample in Estonia

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	29	0	0	14	0	0	15
Large Schools	37	0	0	22	0	0	15
Medium-size Schools	51	0	1	26	0	0	24
Small Schools	82	1	0	41	0	0	40
Very Small Schools	232	1	1	123	0	0	107
Total	**431**	**2**	**2**	**226**	**0**	**0**	**201**

B.7 Finland

- School-level exclusions consisted of schools on Åland and special education schools
- Explicit stratification by region, urbanization, and school size
- No implicit stratification
- Census of Swedish-speaking schools

Table B.7: Allocation of School Sample in Finland

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
South, Rural, (Very) Large Schools	10	0	1	6	1	0	2
South, Rural, Medium-size Schools	13	0	0	9	4	0	0
South, Urban, Very Large Schools	23	0	1	13	0	0	9
South, Urban, Large Schools	25	0	1	16	2	0	6
South, Urban, Medium-size Schools	26	0	1	12	4	0	9
South, Urban, Small Schools	30	0	1	16	4	0	9
South, Urban, Very Small Schools	40	0	5	23	3	0	9
West, Rural, (Very) Large Schools	8	0	1	6	0	0	1
West, Rural, Medium-size Schools	9	0	0	7	1	0	1
West, Rural, (Very) Small Schools	12	0	3	6	1	0	2
West, Urban, Very Large Schools	10	0	1	9	0	0	0
West, Urban, Large Schools	11	0	1	8	1	0	1
West, Urban, Medium-size Schools	12	0	2	10	0	0	0
West, Urban, Small Schools	13	0	3	9	1	0	0
West, Urban, Very Small Schools	18	0	1	12	1	0	4
East, Rural, (Very) Large Schools	7	0	1	4	0	0	2
East, Rural, Medium-size Schools	9	0	0	8	0	0	1
East, Rural, (Very) Small Schools	12	0	1	10	1	0	0
East, Urban, (Very) Large Schools	8	0	0	5	1	0	2
East, Urban, Medium-size Schools	8	0	0	7	1	0	0
East, Urban, (Very) Small Schools	11	0	0	10	1	0	0
North, Rural, (Very) Large Schools	7	0	1	5	1	0	0
North, Rural, Medium-size Schools	7	0	1	6	0	0	0
North, Rural, (Very) Small Schools	11	0	0	9	1	0	1

Table B.7: Allocation of School Sample in Finland (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
North, Urban, Very Large Schools	7	0	0	5	0	0	2
North, Urban, Large Schools	8	0	0	5	0	0	3
North, Urban, Small Schools	9	0	0	7	0	0	2
North, Urban, Very Small Schools	12	0	0	9	1	0	2
Swedish-speaking	44	0	2	29	0	0	13
Total	**420**	**0**	**28**	**281**	**30**	**0**	**81**

B.8 France

- School-level exclusions consisted of schools in the overseas territories
- Explicit stratification by school type and school size
- No implicit stratification

Table B.8: Allocation of School Sample in France

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Priority, Very Large Schools	10	0	1	6	1	0	2
Priority, Large Schools	11	0	2	7	0	0	2
Priority, Medium-size Schools	12	0	4	3	3	0	2
Priority, Small Schools	14	0	2	7	0	2	3
Priority, Very Small Schools	17	0	4	8	2	0	3
Non-priority, Very Large Schools	38	0	4	19	4	4	7
Non-priority, Large Schools	41	0	4	22	3	0	12
Non-priority, Medium-size Schools	45	0	5	26	2	0	12
Non-priority, Small Schools	49	0	8	32	3	2	4
Non-priority, Very Small Schools	68	0	9	38	6	2	13
Private, Very Large Schools	13	0	0	8	1	0	4
Private, Large Schools	15	0	3	6	0	0	6
Private, Medium-size Schools	16	0	1	7	2	1	5
Private, Small Schools	19	0	0	7	2	2	8
Private, Very Small Schools	32	0	4	10	2	0	16
Total	**400**	**0**	**51**	**206**	**31**	**13**	**99**

B.9 Hong Kong SAR

- School-level exclusions consisted of schools that do not follow the local school curriculum (such as international schools) and special education schools
- Explicit stratification by language of instruction, school type, and school size
- No implicit stratification

Table B.9: Allocation of School Sample in Hong Kong SAR

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
English, Boys	14	0	0	11	2	0	1
English, Girls	26	0	0	18	0	0	8
English, Mixed	59	0	3	38	3	0	15
Chinese, Boys	22	0	1	12	1	0	8
Chinese, Girls	10	0	0	8	1	0	1
Chinese, Mixed, Very Large Schools	46	0	2	36	1	0	7
Chinese, Mixed, Large Schools	49	0	0	34	1	0	14
Chinese, Mixed, Medium-size Schools	51	0	4	34	3	0	10
Chinese, Mixed, Small Schools	54	0	0	35	1	0	18
Chinese, Mixed, Very Small Schools	69	0	3	43	1	0	22
Total	**400**	**0**	**13**	**269**	**14**	**0**	**104**

B.10 Israel

- Independent orthodox schools were not covered by the national-defined target population
- School-level exclusions consisted of special education schools
- Explicit stratification by school type, sector, and school size
- Implicit stratification by district and SES, for a total of 227 strata

Table B.10: Allocation of School Sample in Israel

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Public, Jewish, Very Large Schools	30	0	0	29	0	0	1
Public, Jewish, Large Schools	33	0	0	33	0	0	0
Public, Jewish, Medium-size Schools	36	0	0	36	0	0	0
Public, Jewish, Small Schools	39	1	1	36	1	0	0
Public, Jewish, Very Small Schools	65	0	0	59	3	1	2
Public, Other Sectors, Very Large Schools	16	1	0	15	0	0	0
Public, Other Sectors, Large Schools	17	3	1	13	0	0	0
Public, Other Sectors, Medium-size Schools	18	2	1	15	0	0	0
Public, Other Sectors, Small Schools	22	5	3	14	0	0	0
Public, Other Sectors, Very Small Schools	35	6	0	26	2	0	1
Public, Religious, Very Large Schools	12	0	0	11	0	0	1
Public, Religious, Large Schools	14	0	0	12	0	0	2
Public, Religious, Medium-size Schools	16	0	4	12	0	0	0
Public, Religious, Small Schools	19	1	1	17	0	0	0
Public, Religious, Very Small Schools	28	0	2	23	1	0	2
Total	**400**	**19**	**13**	**351**	**7**	**1**	**9**

B.11 Italy

- No school-level exclusions
- Explicit stratification by school size
- Implicit stratification by region, for a total of 96 strata
- In Italy, science and mathematics are taught simultaneously as one subject. Half of the teachers were asked to fill in the questionnaire with regards to teaching mathematics; half of the teachers were asked to do this task with regards to teaching science

Table B.11: Allocation of School Sample in Italy

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	56	0	2	43	10	1	0
Large Schools	62	0	1	50	7	1	3
Medium-size Schools	70	0	7	52	8	1	2
Small Schools	83	0	3	62	14	0	4
Very Small Schools	129	0	8	98	17	4	2
Total	**400**	**0**	**21**	**305**	**56**	**7**	**11**

B.12 Japan

- School-level exclusions consisted of schools for educable functionally or mentally disabled students and very small schools (fewer than nine students in Grade 8)
- Explicit stratification by school size
- Implicit stratification by school type and town size (for public), for a total of 15 implicit strata

Table B.12: Allocation of School Sample in Japan

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Small Schools	132	0	0	130	0	0	2
Medium-size Schools	144	0	0	142	0	0	2
Large Schools	124	0	0	122	0	0	2
Total	**400**	**0**	**0**	**394**	**0**	**0**	**6**

B.13 Lithuania

- School-level exclusions consisted of youth schools, special needs schools, and very small schools (fewer than seven students in Grade 8)
- Explicit stratification by school size
- No implicit stratification

Table B.13: Allocation of School Sample in Lithuania

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	53	0	4	37	0	0	12
Large Schools	56	0	9	45	0	0	2
Medium-size Schools	61	0	4	48	0	0	9
Small Schools	75	0	9	49	0	0	17
Very Small Schools	155	0	7	107	4	0	37
Total	**400**	**0**	**33**	**286**	**4**	**0**	**77**

B.14 Moscow, Russian Federation

- School-level exclusions consisted of special education schools
- Explicit stratification by school category and school size
- Implicit stratification by school type (for non-advanced), for a total of 15 implicit strata
- To increase precision, those schools from the Russian Federation sample selected for the Moscow region were added to the Moscow sample for data analysis (refer to Table B.17, explicit strata: Moscow, Adv. Schools, Large Schools; Moscow, Adv. Schools, Small Schools; Moscow, Non-adv. Schools, Large Schools; Moscow, Non-adv. Schools, Small Schools)

Table B.14: Allocation of School Sample in Moscow, Russian Federation

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Adv. Schools, Very Large Schools	9	0	0	9	0	0	0
Adv. Schools, Large Schools	10	0	0	10	0	0	0
Adv. Schools, Medium-size Schools	11	0	0	11	0	0	0
Adv. Schools, Small Schools	12	0	0	12	0	0	0
Adv. Schools, Very Small Schools	15	0	0	15	0	0	0
Non-adv. Schools, Very Large Schools	53	0	0	53	0	0	0
Non-adv. Schools, Large Schools	59	0	0	59	0	0	0
Non-adv. Schools, Medium-size Schools	65	0	0	65	0	0	0
Non-adv. Schools, Small Schools	72	0	0	72	0	0	0
Non-adv. Schools, Very Small Schools	94	0	0	94	0	0	0
Total	**400**	**0**	**0**	**400**	**0**	**0**	**0**

B.15 Norway

- School-level exclusions consisted of Sami schools and very small schools (fewer than 16 students in Grade 8)
- Explicit stratification by language and school size
- No implicit stratification

Table B.15: Allocation of School Sample in Norway

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Bokmål, Very Large Schools	46	0	1	33	1	0	11
Bokmål, Large Schools	49	0	5	30	3	0	11
Bokmål, Medium-size Schools	54	2	6	28	3	0	15
Bokmål, Small Schools	61	0	15	28	5	0	13
Bokmål, Very Small Schools	113	1	12	52	12	2	34
Nynorsk, Very Large Schools	10	0	2	7	0	0	1
Nynorsk, Large Schools	11	0	2	7	1	0	1
Nynorsk, Medium-size Schools	13	0	2	6	1	0	4
Nynorsk, Small Schools	16	0	1	9	2	0	4
Nynorsk, Very Small Schools	27	0	2	11	3	0	11
Total	**400**	**3**	**48**	**211**	**31**	**2**	**105**

B.16 Ontario, Canada

- School-level exclusions consisted of private schools, native schools, special education schools, and very small schools (fewer than six students in Grade 8)
- Explicit stratification by language and school size
- Implicit stratification by school type, for a total of 14 implicit strata

Table B.16: Allocation of School Sample in Ontario, Canada

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
English, Very Large Schools	48	0	1	38	0	0	9
English, Large Schools	58	0	5	44	0	0	9
English, Medium-size Schools	71	0	2	63	0	0	6
English, Small Schools	83	0	5	69	0	0	9
English, Very Small Schools	120	0	10	99	0	0	11
French, (Very) Large Schools	7	0	0	6	0	0	1
French, (Very) Small Schools	13	0	0	8	0	0	5
Total	**400**	**0**	**23**	**327**	**0**	**0**	**50**

B.17 Russian Federation

- School-level exclusions consisted of special education schools
- A PPS sample of 45 regions was selected from a frame of 86 regions. Sixteen regions were large enough to be sampled with certainty
- Explicit stratification by expected ICT usage (in large regions) and school size (in large strata)
- Implicit stratification by location, for a total of 295 implicit strata
- To increase precision, the schools from the Moscow sample were added to the Russian Federation sample for data analysis

Table B.17: Allocation of School Sample in the Russian Federation

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Adygea	2	0	0	2	0	0	0
Bashkortostan, Adv. Schools, Large	2	0	0	2	0	0	0
Bashkortostan, Adv. Schools, Small	4	0	0	4	0	0	0
Bashkortostan, Non-adv. Schools, Large	5	0	0	5	0	0	0
Bashkortostan, Non-adv. Schools, Small	10	0	0	10	0	0	0
Buratia	5	0	0	5	0	0	0
Dagestan, Adv. Schools	2	0	0	2	0	0	0
Dagestan, Non-adv. Schools, Large	5	0	0	4	0	0	1
Dagestan, Non-adv. Schools, Small	10	0	0	6	0	0	0
Karelia, Adv. Schools	2	0	0	2	0	0	0
Karelia, Non-adv. Schools	3	0	0	3	0	0	0
Komi, Adv. Schools	2	0	0	2	0	0	0
Komi, Non-adv. Schools	3	0	0	3	0	0	0
Marii Al	3	0	0	3	0	0	0
Tatarstan, Adv. Schools, Large	4	0	0	4	0	0	0
Tatarstan, Adv. Schools, Small	6	0	0	6	0	0	0
Tatarstan, Non-adv. Schools, Large	4	0	0	4	0	0	0
Tatarstan, Non-adv. Schools, Small	7	0	0	7	0	0	0
Udmurtia, Adv. Schools	2	0	0	2	0	0	0
Udmurtia, Non-adv. Schools	5	0	0	5	0	0	0
Altay kr., Adv. Schools	3	0	0	3	0	0	0
Altay kr., Non-adv. Schools, Large	3	0	0	3	0	0	0
Altay kr., Non-adv. Schools, Small	6	0	0	6	0	0	0
Krasnodar kr., Adv. Schools	3	0	0	3	0	0	0

Table B.17: Allocation of School Sample in Russian Federation (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Krasnodar kr., Non-adv. Schools, Large	5	0	0	5	0	0	0
Krasnodar kr., Non-adv. Schools, Small	9	0	0	9	0	0	0
Krasnoyarsk obl., Adv. Schools	5	0	0	5	0	0	0
Krasnoyarsk obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
Krasnoyarsk obl., Non-adv. Schools, Small	7	0	0	7	0	0	0
Primorsk kr., Adv. Schools	2	0	0	2	0	0	0
Primorsk kr., Non-adv. Schools, Large	2	0	0	2	0	0	0
Primorsk kr., Non-adv. Schools, Small	5	0	0	5	0	0	0
Stavropol kr., Adv. Schools	5	0	0	5	0	0	0
Stavropol kr., Non-adv. Schools, Large	3	0	0	3	0	0	0
Stavropol kr., Non-adv. Schools, Small	6	0	0	6	0	0	0
Khabarovsk kr., Adv. Schools	2	0	0	2	0	0	0
Khabarovsk kr., Non-adv. Schools	4	0	0	4	0	0	0
Arhangelsk obl.	4	0	0	4	0	0	0
Astrakhan obl.	4	0	0	4	0	0	0
Belgorod obl., Adv. Schools	2	0	0	2	0	0	0
Belgorod obl., Non-adv. Schools	4	0	0	4	0	0	0
Bransk obl.	5	0	0	5	0	0	0
Vladimir obl.	5	0	0	5	0	0	0
Volgograd obl., Adv. Schools	5	0	0	5	0	0	0
Volgograd obl., Non-adv. Schools, Large	3	0	0	3	0	0	0
Volgograd obl., Non-adv. Schools, Small	7	0	0	7	0	0	0
Voronezh obl., Adv. Schools	3	0	0	3	0	0	0
Voronezh obl., Non-adv. Schools, Large	3	0	0	3	0	0	0
Voronezh obl., Non-adv. Schools, Small	6	0	0	6	0	0	0
Irkutsk obl., Adv. Schools	5	0	0	5	0	0	0
Irkutsk obl., Non-adv. Schools, Large	2	0	0	2	0	0	0
Irkutsk obl., Non-adv. Schools, Small	5	0	0	5	0	0	0

Table B.17: Allocation of School Sample in Russian Federation (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Kaluga obl.	4	0	0	4	0	0	0
Kemerovo obl., Adv. Schools	2	0	0	2	0	0	0
Kemerovo obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
Kemerovo obl., Non-adv. Schools, Small	6	0	0	6	0	0	0
Kirov obl., Adv. Schools	3	0	0	3	0	0	0
Kirov obl., Non-adv. Schools	3	0	0	3	0	0	0
Kurgan obl.	4	0	0	4	0	0	0
Moscow obl., Adv. Schools, Large	5	0	0	5	0	0	0
Moscow obl., Adv. Schools, Small	7	0	0	7	0	0	0
Moscow obl., Non-adv. Schools, Large	5	0	0	5	0	0	0
Moscow obl., Non-adv. Schools, Small	8	0	0	8	0	0	0
N. Novgorod obl., Adv. Schools	4	0	0	4	0	0	0
N. Novgorod obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
N. Novgorod obl., Non-adv. Schools, Small	8	0	0	8	0	0	0
Novosibirsk obl., Adv. Schools	4	0	0	4	0	0	0
Novosibirsk obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
Novosibirsk obl., Non-adv. Schools, Small	7	0	0	7	0	0	0
Orenburg obl., Adv. Schools	2	0	0	2	0	0	0
Orenburg obl., Non-adv. Schools, Large	3	0	0	3	0	0	0
Orenburg obl., Non-adv. Schools, Small	5	0	0	5	0	0	0
Pensa obl.	5	0	0	5	0	0	0
Perm obl., Adv. Schools	3	0	0	3	0	0	0
Perm obl., Non-adv. Schools, Large	3	0	0	3	0	0	0
Perm obl., Non-adv. Schools, Small	7	0	0	7	0	0	0
Rostov obl., Adv. Schools	2	0	0	2	0	0	0
Rostov obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
Rostov obl., Non-adv. Schools, Small	8	0	0	8	0	0	0
Razan obl.	4	0	0	4	0	0	0

Table B.17: Allocation of School Sample in Russian Federation (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Samara obl., Adv. Schools, Large	3	0	0	3	0	0	0
Samara obl., Adv. Schools, Small	3	0	0	3	0	0	0
Samara obl., Non-adv. Schools, Large	4	0	0	4	0	0	0
Samara obl., Non-adv. Schools, Small	7	0	0	7	0	0	0
Saratov obl., Adv. Schools	2	0	0	2	0	0	0
Saratov obl., Non-adv. Schools, Large	3	0	0	3	0	0	0
Saratov obl., Non-adv. Schools, Small	6	0	0	6	0	0	0
Sakhalin obl., Sverdlovsk obl., Adv.	2	0	0	2	0	0	0
Schools, Large	4	0	0	4	0	0	0
Sverdlovsk obl., Adv. Schools, Small	5	0	0	5	0	0	0
Sverdlovsk obl., Non-adv. Schools, Large	6	0	0	6	0	0	0
Sverdlovsk obl., Non-adv. Schools, Small	11	0	0	11	0	0	0
Tambov obl.	5	0	0	5	0	0	0
Tomsk obl.	4	0	0	4	0	0	0
Chelyabinsk obl., Large	4	0	0	4	0	0	0
Chelyabinsk obl., Small	8	0	0	8	0	0	0
Sankt-Petersburg, Adv. Schools, Large	6	0	0	6	0	0	0
Sankt-Petersburg, Adv. Schools, Small	7	0	0	7	0	0	0
Sankt-Petersburg, Non-adv. Schools, Large	4	0	0	4	0	0	0
Sankt-Petersburg, Non-adv. Schools, Small	6	0	0	6	0	0	0
Hanty-Mansii-ok, Adv. Schools	2	0	0	2	0	0	0
Hanty-Mansii-ok, Non-adv. Schools, Large	3	0	0	2	0	0	1
Hanty-Mansii-ok, Non-adv. Schools, Small	4	0	0	4	0	0	0
Moscow, Adv. Schools, Large Schools	4	0	0	4	0	0	0

Table B.17: Allocation of School Sample in Russian Federation (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Moscow, Adv. Schools, Small Schools	6	0	0	13	0	0	0
Moscow, Non-adv. Schools, Large Schools	13	0	0	6	0	0	0
Moscow, Non-adv. Schools, Small Schools	17	0	0	17	0	0	0
Total	**500**	**0**	**0**	**494**	**0**	**0**	**6**

B.18 Singapore

- No school-level exclusions
- Census of schools

Table B.18: Allocation of School Sample in Singapore

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Singapore	164	0	0	164	0	0	0
Total	**164**	**0**	**0**	**164**	**0**	**0**	**0**

B.19 Slovak Republic

- No school-level exclusions
- Explicit stratification by school type and school size
- Implicit stratification by region, for a total of 64 implicit strata

Table B.19: Allocation of School Sample in the Slovak Republic

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Basic, Very Large Schools	52	1	0	47	4	0	0
Basic, Large Schools	58	2	0	51	4	0	1
Basic, Medium-size Schools	64	1	0	61	2	0	0
Basic, Small Schools	76	0	0	66	7	0	3
Basic, Very Small Schools	117	4	0	101	10	0	2
Gymnasium, Large Schools	9	0	0	8	1	0	0
Gymnasium, Medium-size Schools	11	0	0	9	1	1	0
Gymnasium, Small Schools	13	0	0	10	3	0	0
Total	**400**	**8**	**0**	**353**	**32**	**1**	**6**

B.20 Slovenia

- School-level exclusions consisted of an Italian school and a Waldorf school
- Explicit stratification by school size
- No implicit stratification

Table B.20: Allocation of School Sample in Slovenia

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Very Large Schools	38	0	1	36	0	0	1
Large Schools	55	0	0	51	0	0	4
Medium-size Schools	69	0	2	56	0	0	11
Small Schools	91	1	1	78	0	0	11
Very Small Schools	168	0	1	160	0	0	7
Total	**421**	**1**	**5**	**381**	**0**	**0**	**34**

B.21 South Africa

- No school-level exclusions
- Explicit stratification by expected ICT usage, region (for unknown), and school size
- Implicit stratification by province, for a total of 159 implicit strata

Table B.21: Allocation of School Sample in South Africa

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
High ICT Usage Expected, Very Large Schools	11	0	0	0	0	0	1
High ICT Usage Expected, Large Schools	13	0	0	12	1	0	0
High ICT Usage Expected, Medium-size Schools	14	0	0	14	0	0	0
High ICT Usage Expected, Small Schools	15	0	1	11	0	0	3
High ICT Usage Expected, Very Small Schools	24	0	0	22	0	0	2
Low ICT Usage Expected, Very Large Schools	24	0	0	23	0	0	1
Low ICT Usage Expected, Large Schools	26	0	0	24	1	0	1
Low ICT Usage Expected, Medium-size Schools	29	0	0	25	0	0	4
Low ICT Usage Expected, Small Schools	33	0	0	31	0	0	2
Low ICT Usage Expected, Very Small Schools	48	1	0	43	1	0	3
ICT Usage Unknown, Gauteng, Western Cape, Very Large Schools	8	0	0	7	0	0	1
ICT Usage Unknown, Gauteng, Western Cape, Large Schools	9	1	0	7	0	0	1
ICT Usage Unknown, Gauteng, Western Cape, Medium-size Schools	10	0	1	6	0	0	3
ICT Usage Unknown, Gauteng, Western Cape, Small Schools	10	0	1	7	1	0	1
ICT Usage Unknown, Gauteng, Western Cape, Very Small Schools	15	1	0	13	0	0	1
ICT Usage Unknown, Other Provinces, Very Large Schools	18	1	0	14	0	0	3
ICT Usage Unknown, Other Provinces, Large Schools	20	0	0	19	0	0	1

Table B.21: Allocation of School Sample in South Africa (contd.)

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-Participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
ICT Usage Unknown, Other Provinces, Medium-size Schools	23	0	0	21	0	0	2
ICT Usage Unknown, Other Provinces, Small Schools	28	0	0	24	1	0	3
ICT Usage Unknown, Other Provinces, Very Small Schools	43	1	1	38	1	0	2
No Computers Available, Very Large Schools	11	0	0	11	0	0	0
No Computers Available, Large Schools	13	0	0	12	0	0	1
No Computers Available, Medium-size Schools	14	0	0	13	0	0	1
No Computers Available, Small Schools	17	0	0	16	0	0	1
No Computers Available, Very Small Schools	24	0	1	22	0	0	1
Total	**500**	**5**	**5**	**445**	**6**	**0**	**39**

B.22 Thailand

- School-level exclusions consisted of demonstration schools of universities, Border Patrol Police Bureau schools, Local Administration Department schools, schools in provinces with terrorist activity, and very small schools (fewer than nine students in Grade 8)
- Explicit stratification by school type, urbanization, and school size
- Implicit stratification by groups of Educational Service Areas, for a total of 210 implicit strata

Table B.22: Allocation of School Sample in Thailand

Explicit Stratum	Total Sampled Schools	Ineligible Schools	Requirements Not Met	Participating Schools			Non-Participating Schools
				Sampled	*First Replacement*	*Second Replacement*	
Public, Urban, Very Large Schools	12	0	0	11	1	0	0
Public, Urban, Large Schools	13	0	1	11	1	0	0
Public, Urban, Medium-size Schools	13	0	0	10	3	0	0
Public, Urban, Small Schools	17	0	0	16	1	0	0
Public, Urban, Very Small Schools	45	0	0	32	9	0	4
Public, Rural, Very Large Schools	34	0	0	30	2	0	2
Public, Rural, Large Schools	38	0	2	35	1	0	0
Public, Rural, Medium-size Schools	46	0	0	35	7	1	3
Public, Rural, Small Schools	65	0	1	55	8	0	1
Public, Rural, Very Small Schools	117	0	0	89	13	2	13
Private, Urban, Large Schools	5	0	0	5	0	0	0
Private, Urban, Medium-size Schools	7	0	0	6	0	0	1
Private, Urban, Small Schools	13	0	0	12	0	0	1
Private, Rural, Very Large Schools	9	0	0	7	2	0	0
Private, Rural, Large Schools	11	0	0	11	0	0	0
Private, Rural, Medium-size Schools	13	0	0	10	3	0	0
Private, Rural, Small Schools	15	0	0	10	4	0	1
Private, Rural, Very Small Schools	27	0	0	15	5	2	5
Total	**500**	**0**	**4**	**400**	**60**	**5**	**31**

Appendix C: Sampling Stratification Variables

This appendix describes the sampling stratification used in national samples (see also Appendix B) and the resulting variables in the international database.

C.1 IDSTRATE (Explicit Stratification)

The values for the explicit stratification were assigned after completion of the national sampling plans and are included in the international database as variable IDSTRATE.

Stratification codes are comparable only within but not across education systems. Specifically, school size was used as the final level of explicit stratification wherever possible (see Chapter 6). Also, the specific school-size grouping and binning was different for each participating system and is therefore not comparable across systems. For instance, although the stratification code for "very large schools" in Alberta and Denmark was numerically identical, the definition of "very large schools" was different for these two systems.

Table C.1: Explicit Strata and Corresponding Variables Codes

IDCNTRY	Education System	Comment
9134	Alberta, Canada	1 = Very Large Schools 2 = Large Schools 3 = Medium-size Schools 4 = Small Schools 5 = Very Small Schools
724	Catalonia, Spain	1 = Public, Very Large Schools 2 = Public, Large Schools 3 = Public, Medium-size Schools 4 = Public, Small Schools 5 = Public, Very Small Schools 6 = Private, Very Large Schools 7 = Private, Large Schools 8 = Private, Medium-size Schools 9 = Private, Small Schools 10 = Private, Very Small Schools
152	Chile	1 = Public, Rural 2 = Public, Urban, Very Large Schools 3 = Public, Urban, Large Schools 4 = Public, Urban, Medium-size Schools 5 = Public, Urban, Small Schools 6 = Public, Urban, Very Small Schools 7 = Semi-Public, Rural 8 = Semi-Public, Urban, Very Large Schools 9 = Semi-Public, Urban, Large Schools 10 = Semi-Public, Urban, Medium-size Schools 11 = Semi-Public, Urban, Small Schools 12 = Semi-Public, Urban, Very Small Schools 13 = Private, Rural 14 = Private, Urban, Very Large Schools 15 = Private, Urban, Large Schools 16 = Private, Urban, Small Schools 17 = Private, Urban, Very Small Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
158	Chinese Taipei	1 = North, Very Large Schools 2 = North, Large Schools 3 = North, Medium-size Schools 4 = North, Small Schools 5 = North, Very Small Schools 6 = Central, Very Large Schools 7 = Central, Large Schools 8 = Central, Medium-size Schools 9 = Central, Small Schools 10 = Central, Very Small Schools 11 = South, Very Large Schools 12 = South, Large Schools 13 = South, Medium-size Schools 14 = South, Small Schools 15 = South, Very Small Schools 16 = East, Large Schools 17 = East, Medium-size Schools 18 = East, Small Schools 19 = Islands
208	Denmark	1 = Very Large Schools 2 = Large Schools 3 = Medium-size Schools 4 = Small Schools 5 = Very Small Schools
233	Estonia	1 = Very Large Schools 2 = Large Schools 3 = Medium-size Schools 4 = Small Schools 5 = Very Small Schools
246	Finland	1 = Southern Finland, Rural, (Very) Large Schools 2 = Southern Finland, Rural, Medium-size Schools 3 = Southern Finland, Urban, Very Large Schools 4 = Southern Finland, Urban, Large Schools 5 = Southern Finland, Urban, Medium-size Schools 6 = Southern Finland, Urban, Small Schools 7 = Southern Finland, Urban, Very Small Schools 8 = Western Finland, Rural, (Very) Large Schools 9 = Western Finland, Rural, Medium-size Schools 10 = Western Finland, Rural, (Very) Small Schools 11 = Western Finland, Urban, Very Large Schools 12 = Western Finland, Urban, Large Schools 13 = Western Finland, Urban, Medium-size Schools 14 = Western Finland, Urban, Small Schools 15 = Western Finland, Urban, Very Small Schools 16 = Eastern Finland, Rural, (Very) Large Schools 17 = Eastern Finland, Rural, Medium-size Schools 18 = Eastern Finland, Rural, (Very) Small Schools 19 = Eastern Finland, Urban, (Very) Large Schools 20 = Eastern Finland, Urban, Medium-size Schools 21 = Eastern Finland, Urban, (Very) Small Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		22 = Northern Finland, Rural, (Very) Large Schools
		23 = Northern Finland, Rural, Medium-size Schools
		24 = Northern Finland, Rural, (Very) Small Schools
		25 = Northern Finland, Urban, Very Large Schools
		26 = Northern Finland, Urban, Large Schools
		27 = Northern Finland, Urban, Small Schools
		28 = Northern Finland, Urban, Very Small Schools
		29 = Swedish Speaking
250	France	1 = Priority, Very Large Schools
		2 = Priority, Large Schools
		3 = Priority, Medium-size Schools
		4 = Priority, Small Schools
		5 = Priority, Very Small Schools
		6 = Non-Priority, Very Large Schools
		7 = Non-Priority, Large Schools
		8 = Non-Priority, Medium-size Schools
		9 = Non-Priority, Small Schools
		10 = Non-Priority, Very Small Schools
		11 = Private, Very Large Schools
		12 = Private, Large Schools
		13 = Private, Medium-size Schools
		14 = Private, Small Schools
		15 = Private, Very Small Schools
344	Hong Kong SAR	1 = English, Boys
		2 = English, Girls
		3 = English, Mixed
		4 = Chinese, Boys
		5 = Chinese, Girls
		6 = Chinese, Mixed, Very Large Schools
		7 = Chinese, Mixed, Large Schools
		8 = Chinese, Mixed, Medium-size Schools
		9 = Chinese, Mixed, Small Schools
		10 = Chinese, Mixed, Very Small Schools
376	Israel	1 = Public, Jewish, Very Large Schools
		2 = Public, Jewish, Large Schools
		3 = Public, Jewish, Medium-size Schools
		4 = Public, Jewish, Small Schools
		5 = Public, Jewish, Very Small Schools
		6 = Public, Other Sectors, Very Large Schools
		7 = Public, Other Sectors, Large Schools
		8 = Public, Other Sectors, Medium-size Schools
		9 = Public, Other Sectors, Small Schools
		10 = Public, Other Sectors, Very Small Schools
		11 = Public, Religious, Very Large Schools
		12 = Public, Religious, Large Schools
		13 = Public, Religious, Medium-size Schools
		14 = Public, Religious, Small Schools
		15 = Public, Religious, Very Small Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
380	Italy	1 = Very Large Schools 2 = Large Schools 3 = Medium-size Schools 4 = Small Schools 5 = Very Small Schools
392	Japan	1 = Small Schools 2 = Medium-size Schools 3 = Large Schools
440	Lithuania	1 = Very Large Schools 2 = Large Schools 3 = Medium-size Schools 4 = Small Schools 5 = Very Small Schools
6431	Moscow, Russian Federation	1 = Adv. Schools, Very Large Schools 2 = Adv. Schools, Large Schools 3 = Adv. Schools, Medium-size Schools 4 = Adv. Schools, Small Schools 5 = Adv. Schools, Very Small Schools 6 = Non-adv. Schools, Very Large Schools 7 = Non-adv. Schools, Large Schools 8 = Non-adv. Schools, Medium-size Schools 9 = Non-adv. Schools, Small Schools 10 = Non-adv. Schools, Very Small Schools
578	Norway	1 = Bokmål, Very Large Schools 2 = Bokmål, Large Schools 3 = Bokmål, Medium-size Schools 4 = Bokmål, Small Schools 5 = Bokmål, Very Small Schools 6 = Nynorsk, Very Large Schools 7 = Nynorsk, Large Schools 8 = Nynorsk, Medium-size Schools 9 = Nynorsk, Small Schools 10 = Nynorsk, Very Small Schools
9132	Ontario, Canada	1 = English, Very Large Schools 2 = English, Large Schools 3 = English, Medium-size Schools 4 = English, Small Schools 5 = English, Very Small Schools 6 = French, (Very) Large Schools 7 = French, (Very) Small Schools
643	Russian Federation	1 = Adygea 2 = Bashkortostan, Adv. Schools, Large Schools 3 = Bashkortostan, Adv. Schools, Small Schools 4 = Bashkortostan, Non-adv. Schools, Large Schools 5 = Bashkortostan, Non-adv. Schools, Small Schools 6 = Buratia 7 = Dagestan, Adv. Schools 8 = Dagestan, Non-adv. Schools, Large Schools 9 = Dagestan, Non-adv. Schools, Small Schools 10 = Karelia, Adv. Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		11 = Karelia, Non-adv. Schools 12 = Komi, Adv. Schools 13 = Komi, Non-adv. Schools 14 = Marii Al 15 = Tatarstan, Adv. Schools, Large Schools 16 = Tatarstan, Adv. Schools, Small Schools 17 = Tatarstan, Non-adv. Schools, Large Schools 18 = Tatarstan, Non-adv. Schools, Small Schools 19 = Udmurtia, Adv. Schools 20 =Udmurtia, Non-adv. Schools 21 = Altay kr., Adv. Schools 22 = Altay kr., Non-adv. Schools, Large Schools 23 = Altay kr., Non-adv. Schools, Small Schools 24 = Krasnodar kr., Adv. Schools 25 = Krasnodar kr., Non-adv. Schools, Large Schools 26 = Krasnodar kr., Non-adv. Schools, Small Schools 27 = Krasnoyarsk obl., Adv. Schools 28 = Krasnoyarsk obl., Non-adv. Schools, Large Schools 29 = Krasnoyarsk obl., Non-adv. Schools, Small Schools 30 = Primorsk kr., Adv. Schools 31 = Primorsk kr., Non-adv. Schools, Large Schools 32 = Primorsk kr., Non-adv. Schools, Small Schools 33 = Stavropol kr., Adv. Schools 34 = Stavropol kr., Non-adv. Schools, Large Schools 35 = Stavropol kr., Non-adv. Schools, Small Schools 36 = Khabarovsk kr., Adv. Schools 37 = Khabarovsk kr., Non-adv. Schools 38 = Arhangelsk obl. 39 = Astrakhan obl. 40 = Belgorod obl., Adv. Schools 41 = Belgorod obl., Non-adv. Schools 42 = Bransk obl. 43 = Vladimir obl. 44 = Volgograd obl., Adv. Schools 45 = Volgograd obl., Non-adv. Schools, Large Schools 46 = Volgograd obl., Non-adv. Schools, Small Schools 47 = Voronezh obl., Adv. Schools 48 = Voronezh obl., Non-adv. Schools, Large Schools 49 = Voronezh obl., Non-adv. Schools, Small Schools 50 = Irkutsk obl., Adv. Schools 51 = Irkutsk obl., Non-adv. Schools, Large Schools 52 = Irkutsk obl., Non-adv. Schools, Small Schools 53 = Kaluga obl. 54 = Kemerovo obl., Adv. Schools 55 = Kemerovo obl., Non-adv. Schools, Large Schools 56 = Kemerovo obl., Non-adv. Schools, Small Schools 57 = Kirov obl., Adv. Schools 58 = Kirov obl., Non-adv. Schools 59 = Kurgan obl. 60 = Moscow obl., Adv. Schools, Large Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		61 = Moscow obl., Adv. Schools, Small Schools 62 = Moscow obl., Non-adv. Schools, Large Schools 63 = Moscow obl., Non-adv. Schools, Small Schools 64 = N. Novgorod obl., Adv. Schools 65 = N. Novgorod obl., Non-adv. Schools, Large Schools 66 = N. Novgorod obl., Non-adv. Schools, Small Schools 67 = Novosibirsk obl., Adv. Schools 68 = Novosibirsk obl., Non-adv. Schools, Large Schools 69 = Novosibirsk obl., Non-adv. Schools, Small Schools 70 = Orenburg obl., Adv. Schools 71 = Orenburg obl., Non-adv. Schools, Large Schools 72 = Orenburg obl., Non-adv. Schools, Small Schools 73 = Pensa obl. 74 = Perm obl., Adv. Schools 75 = Perm obl., Non-adv. Schools, Large Schools 76 = Perm obl., Non-adv. Schools, Small Schools 77 = Rostov obl., Adv. Schools 78 = Rostov obl., Non-adv. Schools, Large Schools 79 = Rostov obl., Non-adv. Schools, Small Schools 80 = Razan obl. 81 = Samara obl., Adv. Schools, Large Schools 82 = Samara obl., Adv. Schools, Small Schools 83 = Samara obl., Non-adv. Schools, Large Schools 84 = Samara obl., Non-adv. Schools, Small Schools 85 = Saratov obl., Adv. Schools 86 = Saratov obl., Non-adv. Schools, Large Schools 87 = Saratov obl., Non-adv. Schools, Small Schools 88 = Sakhalin obl. 89 = Sverdlovsk obl., Adv. Schools, Large Schools 90 = Sverdlovsk obl., Adv. Schools, Small Schools 91 = Sverdlovsk obl., Non-adv. Schools, Large Schools 92 = Sverdlovsk obl., Non-adv. Schools, Small Schools 93 = Tambov obl. 94 = Tomsk obl. 95 = Chelyabinsk obl., Large Schools 96 = Chelyabinsk obl., Small Schools 101 = Sankt-Petersburg, Adv. Schools, Large Schools 102 = Sankt-Petersburg, Adv. Schools, Small Schools 103 = Sankt-Petersburg, Non-adv. Schools, Large Schools 104 = Sankt-Petersburg, Non-adv. Schools, Small Schools 105 = Hanty-Mansii-ok, Adv. Schools 106 = Hanty-Mansii-ok, Non-adv. Schools, Large Schools 107 = Hanty-Mansii-ok, Non-adv. Schools, Small Schools 108 = Moscow, Adv. Schools, Very Large Schools 109 = Moscow, Adv. Schools, Large Schools 110 = Moscow, Adv. Schools, Medium-size Schools 111 = Moscow, Adv. Schools, Small Schools 112 = Moscow, Adv. Schools, Very Small Schools 113 = Moscow, Non-adv. Schools, Very Large Schools 114 = Moscow, Non-adv. Schools, Large Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		115 = Moscow, Non-adv. Schools, Medium-size Schools
		116 = Moscow, Non-adv. Schools, Small Schools
		117 = Moscow, Non-adv. Schools, Very Small Schools
702	Singapore	1 = None
703	Slovak Republic	1 = Basic, Very Large Schools
		2 = Basic, Large Schools
		3 = Basic, Medium-size Schools
		4 = Basic, Small Schools
		5 = Basic, Very Small Schools
		6 = Gymnasium, Large Schools
		7 = Gymnasium, Medium-size Schools
		8 = Gymnasium, Small Schools
705	Slovenia	1 = Very Large Schools
		2 = Large Schools
		3 = Medium-size Schools
		4 = Small Schools
		5 = Very Small Schools
710	South Africa	1 = High ICT Usage Expected, Very Large Schools
		2 = High ICT Usage Expected, Large Schools
		3 = High ICT Usage Expected, Medium-size Schools
		4 = High ICT Usage Expected, Small Schools
		5 = High ICT Usage Expected, Very Small Schools
		6 = Low ICT Usage Expected, Very Large Schools
		7 = Low ICT Usage Expected, Large Schools
		8 = Low ICT Usage Expected, Medium-size Schools
		9 = Low ICT Usage Expected, Small Schools
		10 = Low ICT Usage Expected, Very Small Schools
		11 = ICT Usage Unknown, Gauteng, Western Cape, Very Large Schools
		12 = ICT Usage Unknown, Gauteng, Western Cape, Large Schools
		13 = ICT Usage Unknown, Gauteng, Western Cape, Medium-size Schools
		14 = ICT Usage Unknown, Gauteng, Western Cape, Small Schools
		15 = ICT Usage Unknown, Gauteng, Western Cape, Very Small Schools
		16 = ICT Usage Unknown, Other Provinces, Very Large Schools
		17 = ICT Usage Unknown, Other Provinces, Large Schools
		18 = ICT Usage Unknown, Other Provinces, Medium-size Schools
		19 = ICT Usage Unknown, Other Provinces, Small Schools
		20 = ICT Usage Unknown, Other Provinces, Very Small Schools
		21 = No Computers Available, Very Large Schools
		22 = No Computers Available, Large Schools
		23 = No Computers Available, Medium-size Schools
		24 = No Computers Available, Small Schools
		25 = No Computers Available, Very Small Schools

Table C.1: Explicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
764	Thailand	1 = Public, Urban, Very Large Schools 2 = Public, Urban, Large Schools 3 = Public, Urban, Medium-size Schools 4 = Public, Urban, Small Schools 5 = Public, Urban, Very Small Schools 6 = Public, Rural, Very Large Schools 7 = Public, Rural, Large Schools 8 = Public, Rural, Medium-size Schools 9 = Public, Rural, Small Schools 10 = Public, Rural, Very Small Schools 11 = Private, Urban, Large Schools 12 = Private, Urban, Medium-size Schools 13 = Private, Urban, Small Schools 14 = Private, Rural, Very Large Schools 15 = Private, Rural, Large Schools 16 = Private, Rural, Medium-size Schools 17 = Private, Rural, Small Schools 18 = Private, Rural, Very Small Schools

C.2 IDSTRATU (Implicit Stratification)

In addition to explicit stratification and sample size allocation, implicit stratification was used to order schools on the sampling frame prior to selection (see Chapter 6 for details). The SITES 2006 international database features two additional variables—IDSTRATI and IDSTRATU—that carry the system-specific information about these stratification values. The variables are not labeled in the public data files; readers and database users are therefore referred to Table C.2 below.

IDSTRATI carries information about the implicit stratification based on the sampling forms and plans and as assigned during the selection. Values for IDSTRATI are conditional on the IDSTRATE values and can only be interpreted in connection with that variable. IDSTRATU, however, carries unique information about the implicit stratification and takes the same number for each level of IDSTRATE. Secondary analysts are therefore encouraged to use the IDSTRATU information in the international database for the purpose of analysis and for grouping schools and teachers sharing implicit stratification.

Table C.2: Implicit Strata and Corresponding Variables Codes

IDCNTRY	Education System	Comment
9134	Alberta, Canada	Not available (removed per NRC request)
724	Catalonia, Spain	1 = Area Code BCI: Barcelona-I (Ciutat), Large Town
		2 = Area Code BCO: Barcelona-II (Comarques), Large Town 3 = Area Code BCO: Barcelona-II (Comarques), Medium-size Town 4 = Area Code BCO: Barcelona-II (Comarques), Small Town 5 = Area Code BLA: Baix Llobregat-Anoia, Medium-size Town 6 = Area Code BLA: Baix Llobregat-Anoia, Small Town 7 = Area Code MAR: Maresme, Large Town

Table C.2: Implicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		8 = Area Code MAR: Maresme, Medium-size Town
		9 = Area Code MAR: Maresme, Small Town
		10 = Area Code VAO: Vallès Occidental, Large Town
		11 = Area Code VAO: Vallès Occidental, Medium-size Town
		12 = Area Code VAO: Vallès Occidental, Small Town
		13 = Area Code GIR: Girona, Medium-size Town
		14 = Area Code GIR: Girona, Small Town
		15 = Area Code LLE: Lleida, Large Town
		16 = Area Code LLE: Lleida, Medium-size Town
		17 = Area Code LLE: Lleida, Small Town
		18 = Area Code TAR: Tarragona, Large Town
		19 = Area Code TAR: Tarragona, Medium-size Town
		20 = Area Code TAR: Tarragona, Small Town
		21 = Area Code TEB: Terres de l'Ebre, Medium-size Town
		22 = Area Code TEB: Terres de l'Ebre, Small Town
152	Chile	1 = None
158	Chinese Taipei	1 = None
208	Denmark	1 = None
233	Estonia	1 = None
246	Finland	1 = None
250	France	1 = None
344	Hong Kong SAR	1 = None
376	Israel	1 = Agricultural, Low SES
		2 = Agricultural, Below-average SES
		3 = Agricultural, Above-average SES
		4 = Agricultural, High SES
		5 = Center, Low SES
		6 = Center, Below-average SES
		7 = Center, Above-average SES
		8 = Center, High SES
		9 = Haifa, Low SES
		10 = Haifa, Below-average SES
		11 = Haifa, Above-average SES
		12 = Haifa, High SES
		13 = Jerusalem, Low SES
		14 = Jerusalem, Below-average SES
		15 = Jerusalem, Above-average SES
		16 = Jerusalem, High SES
		17 = North, Low SES
		18 = North, Below-average SES
		19 = North, Above-average SES
		20 = North, High SES
		21 = South, Low SES
		22 = South, Below-average SES
		23 = South, Above-average SES
		24 = South, High SES
		25 = Tel-Aviv, Low SES
		26 = Tel-Aviv, Below-average SES
		27 = Tel-Aviv, Above-average SES
		28 = Tel-Aviv, High SES

Table C.2: Implicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
		29 = Other, Low SES
		30 = Other, Below-average SES
		31 = Other, Above-average SES
		32 = Other, High SES
380	Italy	1 = Abruzzo
		2 = Basilicata
		3 = Calabria
		4 = Campania
		5 = Emilia Romagna
		6 = Friuli
		7 = Lazio
		8 = Liguria
		9 = Lombardia
		10 = Marche
		11 = Molise
		12 = Piemonte
		13 = Puglia
		14 = ardegna
		15 = Sicilia
		16 = Toscana
		17 = Trentino-Alto-Adige
		18 = Umbria
		19 = Valle d'Aosta
		20 = Veneto
392	Japan	1 = Private
		2 = Public, Very Large Cities
		3 = Public, Large Cities
		4 = Public, Small Cities
		5 = Public, Non-city Areas
440	Lithuania	1 = None
6431	Moscow, Russian Federation	1 = Full Secondary School
		2 = Other School Type
578	Norway	1 = None
9132	Ontario, Canada	1 = Public
		2 = Separate
643	Russian Federation	1 = Rural
		2 = Small Town
		3 = Large Town
702	Singapore	1 = None
703	Slovak Republic	1 = Bratislava Region
		2 = Trnava Region
		3 = Trenčín Region
		4 = Nitra Region
		5 = Žilina Region
		6 = Banská Bystrica Region
		7 = Prešov Region
		8 = Košice Region
705	Slovenia	1 = None

Table C.2: Implicit Strata and Corresponding Variables Codes (contd.)

IDCNTRY	Education System	Comment
710	South Africa	1 = Eastern Cape
		2 = Free State
		3 = Gauteng
		4 = KwaZulu Natal
		5 = Limpopo
		6 = Mpumalanga
		7 = Northern Cape
		8 = North West
		9 = Western Cape
764	Thailand	1 = ESA Group 01
		2 = ESA Group 02
		3 = ESA Group 03
		4 = ESA Group 04
		5 = ESA Group 05
		6 = ESA Group 06
		7 = ESA Group 07
		8 = ESA Group 08
		9 = ESA Group 09
		10 = ESA Group 10
		11 = ESA Group 11
		12 = ESA Group 12
		13 = ESA Group 13

Appendix D: Cultural and National Adaptations to the Questionnaires

This appendix describes adaptations to the international versions of the questionnaire items made by the national research coordinators (NRCs) during the translation process. It provides users with guidance regarding the availability of internationally comparable data for use in secondary analyses.

The adaptations to questionnaires are presented in two sections: (1) common cultural adaptations and variables; and (2) other adaptations specific to individual systems.

D.1 Common Cultural Adaptations and Variables

Cultural adaptations relate to those text passages in the international English version of the instruments that had to be adapted (this was mandatory) to the specific national settings and terminology. Mandatory cultural adaptations were indicated using pointed brackets in the international English version, for instance, <target grade>. The information included in the tables below details those instances when the version of the question administered in an education system differed from the version of the question as it appeared in the international version of the questionnaires.

D.1.1 Grade Range

References to a particular <grade range> were made in Questions 1 and 5 of the technical questionnaire. In SITES-M 1, the grade range was generally defined as ranging from target grade minus 1 until target grade plus 1. This range was used for questions that were too general to ask at the target grade level but for which the research consortium expected (sometimes evidence-based) that the answers might differ between, for instance, the upper- and lower-secondary levels in a school. Special cases consisted of countries where a school-level boundary occurred somewhere within this grade range.

In general, NRCs were advised to use the same translation as in SITES Module 1 for Population 2, that is, students of age 14 in the eighth month of the school year, and to contact the consortium when in doubt.

Table D.1: Grade Range Adaptation

IDCNTRY	Education System	Adapted Passage (back-translated into English)
9134	Alberta, Canada	Grades 6–9
724	Catalonia, Spain	Grades 7–8 (First cycle of compulsory secondary education)
152	Chile	Grades 5–8
158	Chinese Taipei	Grades 7–9
208	Denmark	Grades 7–9
233	Estonia	Grades 7-9
246	Finland	Grades 7–9
250	France	Grades 3–5
344	Hong Kong SAR	Grades 7–9
376	Israel	Grades 7–9 (Grades 6–8 for eight-year schools)
380	Italy	Grades 6–8

3 See Pelgrum, W. J., & Anderson R. E. (Eds.). (2001). *ICT and the emerging paradigm for life-long learning. Amsterdam:* International Association for the Evaluation of Educational Achievement (pp. 12–13) for details regarding the SITES Module 1 population definitions.

Table D.1: Grade Range Adaptation (contd.)

IDCNTRY	Education System	Adapted Passage (back-translated into English)
392	Japan	Grades 7–9
440	Lithuania	Grades 7–9
6431	Moscow, Russian Federation	Grades 5–9
578	Norway	Grades 8–10
9132	Ontario, Canada	Grades 6–8
643	Russian Federation	Grades 5–9
702	Singapore	Grades 7–9
703	Slovak Republic	Grades 7–9
705	Slovenia	Grades 7–9
710	South Africa	Grades 8–10
764	Thailand	Grades 7–9

D.1.2 Target Grade

The passage <target grade> was used in the following places:

- Principal questionnaire: introduction; Questions 2, 3, 4, 5, 6, 8, 10, 11, 12 (and instruction before), 14, 15, 17, and 18
- Technical questionnaire: introduction; questions 3, 4, and 9

NRCs were asked to consistently replace <target grade> with the grade level that was defined in the national sampling plan (see Chapter 6 and Appendix B).

Table D.2: Target Range Adaptation

IDCNTRY	Education System	Adapted Passage (back-translated into English)
9134	Alberta, Canada	Grade 8
724	Catalonia, Spain	Grade 8 (second year of compulsory secondary education)
152	Chile	Grade 8
158	Chinese Taipei	Grade 8
208	Denmark	Grade 8
233	Estonia	Grade 8
246	Finland	Grade 8
250	France	Grade 4
344	Hong Kong SAR	Grade 8
376	Israel	Grade 8
380	Italy	Grade 8
392	Japan	Grade 8
440	Lithuania	Grade 8
6431	Moscow, Russian Federation	Grade 8
578	Norway	Grade 8
9132	Ontario, Canada	Grade 8
643	Russian Federation	Grade 8
702	Singapore	Grade 8
703	Slovak Republic	Grade 8
705	Slovenia	Grade 8
710	South Africa	Grade 8
764	Thailand	Grade 8

D.1.3 Language of Instruction

Question 23 of the principal questionnaire asked for the approximate percentage of students in the school who were native speakers of the <national language=language of instruction>. Depending on the language version of the questionnaires, the following adaptations were used.

Table D.3: Language of Instruction Adaptation

IDCNTRY	Education System	Adapted Passage (back-translated into English)
9134	Alberta, Canada	English
724	Catalonia, Spain	Catalan
152	Chile	Spanish
158	Chinese Taipei	Chinese
208	Denmark	Danish
233	Estonia	Estonian
246	Finland	Swedish, Finnish
250	France	French
344	Hong Kong SAR	Chinese
376	Israel	Hebrew for Hebrew-speakers and Arab for Arab-speakers
380	Italy	Italian
392	Japan	Japanese
440	Lithuania	Lithuanian
6431	Moscow, Russian Federation	Russian
578	Norway	Norwegian
9132	Ontario, Canada	English, French
643	Russian Federation	Russian
702	Singapore	English
703	Slovak Republic	Slovak
705	Slovenia	Slovene
710	South Africa	English
764	Thailand	Thai

D.1.4 Language of Questionnaire (ITLANG)

This variable was not part of the questionnaire data itself but was tracked by the national center. The majority of participating systems used only one language version of the questionnaire. The values for the other systems given in Table D.3 indicate the language version of the teacher questionnaire that was administered. The corresponding values are included in the mathematics and science teacher data files as variable ITLANG.

Table D.4: Language of Administered Questionnaire Adaptations

IDCNTRY	Education System	Description
9134	Alberta, Canada	1 = English
724	Catalonia, Spain	1 = Catalan
152	Chile	1 = Spanish
158	Chinese Taipei	1 = Traditional Chinese
208	Denmark	1 = Danish
233	Estonia	1 = Estonian 2 = Russian
246	Finland	1 = Finnish 2 = Swedish
250	France	1 = French
344	Hong Kong SAR	1 = Traditional Chinese
376	Israel	1 = Hebrew
380	Italy	1 = Italian
392	Japan	1 = Japanese
440	Lithuania	1 = Lithuanian
6431	Moscow, Russian Federation	1 = Russian
578	Norway	1 = Norwegian (Bokmål)
9132	Ontario, Canada	1 = English 2 = French
643	Russian Federation	1 = Russian
702	Singapore	1 = English
703	Slovak Republic	1 = Slovak
705	Slovenia	1 = Slovene
710	South Africa	1 = English
764	Thailand	1 = Thai

D.2 Education-system-specific Adaptations and Variables

In line with the rules and guidelines for national adaptations as outlined in Chapter 5, Table D.4 lists the type of structural adaptation made in the questionnaires and the recoding action that was carried out at the IEA Data Processing and Research Center.

In the documentation, adaptations have one of two different codes:

- *Code D:* National data for a system are included in the international database.
  This code is used for questions where the specific national version was considered appropriate for comparison.
- *Code X:* National data for a system are not included in the international database.
  This code is used to refer to all questions that were not administered, not applicable, or deleted for any of several reasons (e.g., not internationally comparable, removed because of NRC request, or removed due to other data problems).

The column "item" uses the acronym TG to refer to the teacher questionnaire, CT to refer to the technical questionnaire, and CP to refer to the principal questionnaire.

Table D.5: Specific Education System Adaptations

IDCNTRY	Education System	Item	Adaptation	Recoding	Code
9134	Alberta, Canada	TG-33A1	Category "post-secondary education (e.g., teachers college)" (2) was removed from the questionnaire because it was not applicable to the Alberta context. National categories were recoded to fit the international ones.	NAT --> INT 1 --> 1 2 --> 3 3 --> 4	D
152	Chile	TG-03A1	Because there is no curriculum tracking in Chile, the variable was consistently coded to "no tracking" (3).	Code to 3	D
152	Chile	TG-12A1	The category "at any time" (4) was removed from the questionnaire because all school hours are scheduled.	n/a	D
152	Chile	TG-13A1	The category "at any time" (4) was removed from the questionnaire because all school hours are scheduled.	n/a	D
208	Denmark	TG-03A1	Because there is no curriculum tracking in Denmark, the variable was consistently coded to "no tracking" (3).	Code to 3	D
208	Denmark	TG-33A1	International category 3 "Bachelor's degree" was split into two national options as follows: 1 = Secondary or high school 2 = Post-secondary education (e.g., teachers' college) 3 = Bachelor's from an institution that is not a university 4 = Bachelor's from a university 5 = Master's degree or above National categories were recoded to fit the international ones.	NAT --> INT 1 --> 1 2 --> 2 3 --> 3 4 --> 3 5 --> 4	D
233	Estonia	TG-03A1	Because there is no curriculum tracking in Estonia, the question was not administered and the variable was consistently coded to "no tracking." Question 3 was used to collect national information about "humanitarian tracking" (1), "mathematics–science tracking" (2), "no tracking" (3).	Code to 3	D
246	Finland	CT-13C1	Item "head of department" (C) was removed from the questionnaire, as it was not applicable to the Finnish context.	n/a	X
344	Hong Kong SAR	CT-03E1	Three additional items—G, H, and I—were added to the questionnaire for national purposes.	n/a	X

Table D.5: Specific Education System Adaptations (contd.)

IDCNTRY	Education System	Item	Adaptation	Recoding	Code
344	Hong Kong SAR	TG-03A1	The category "no tracking" (3) was removed from the questionnaire, as it was not applicable in the national context.	n/a	D
380	Italy	CP-21A1	International category "more than 500,000 people" (6) was split into national categories as follows: 1 = 3,000 people or fewer 2 = 3,001 to 15,000 people 3 = 15,001 to 50,000 people 4 = 50,001 to 100,000 people 5 = 100,001 to 500,000 people 6 = 500,001 to 1,000,000 people 7 = More than 1,000,000 people National categories were recoded to fit the international ones.	NAT --> INT 1 --> 1 2 --> 2 3 --> 3 4 --> 4 5 --> 5 6 --> 6 7 --> 6	D
380	Italy	CT-03F1	Item "ICT as separate subject" (F) was not applicable for Grades 6–8 in Italy and was therefore removed.	n/a n/a	X
380	Italy	CT-13C1	Item "head of department" (C) was removed from the questionnaire because it is not applicable to the Italian context.	n/a	X
380	Italy	TG-33A1	Categories "secondary or high school" (1) and "post-secondary education (e.g., teacher's college)" (2) were removed because they a not applicable to the system in Italy. The remaining categories were recoded to fit the international ones.	NAT --> INT 1 --> 3 2 --> 4	D
380	Italy	TG-35A1	The original no/yes question was expanded to cover four types of licenses/certificates in Italy as follows: 1 = Teacher training by a compulsory public qualifier competitive examination 2 = Postgraduate school for secondary school teachers' qualification (SSIS - DPR 470/96) 3 = Special courses for the obtainment of teacher training (D.M. n. 21, 2005) 4 = No teacher training National categories were recoded to fit the international ones.	NAT --> INT 1 --> 2 2 --> 2 3 --> 2 4 --> 1	D
392	Japan	CP-05A1-L1 CP-07A1-K1 CP-24A1-F1 CP-26A1-H1 CP-32A1-J1 CP-33A1 CP-34A1-B1	The international sequence of response was changed from "no/yes" to "yes/no."	NAT--> INT 1 --> 2 2 --> 1	D
392	Japan	CT-09A1-E1 CT-10A1-D1 CT-11A1-J1 CT-13A1-F1 CT-14A1-F1 CT-18A1 CT-19A1-B1	The international sequence of response categories was changed from "no/yes" to to "yes/no."	NAT--> INT 1 --> 2 2 --> 1	D

IDCNTRY	Education System	Item	Adaptation	Recoding	Code
392	Japan	TG-09A2-M2 TG-14A2-L2 TG-15A1-H1 TG-15A2-H2 TG-16A2-L2 TG-18A1 TG-23A1-L1 TG-29A1 TG-30A1-B1 TG-35A1	The international sequence of response categories was changed from "no/yes" to "yes/no."	NAT--> INT 1 --> 2 2 --> 1	D
578	Norway	TG-03A1	Because there is no curriculum tracking in Norway, the variable was consistently coded to "no tracking" (3).	Code to 3	D
702	Singapore	CP-21A1	Because Singapore is a city state, the variable was consistently coded to "more than 500,000 people" (6).	Code to 6	D
702	Singapore	TG-03A1	Because secondary schools in Singapore currently offer only academic tracks, the variable was consistently coded to "academic" (1).	Code to 1	D
702	Singapore	TG-37A1	Removed international option Part VIII.	Code to "not administered"	X
702	Singapore	TG-38AT	Removed international option Part VIII.	Code to "not administered"	X
702	Singapore	TG-39A1-K1	Removed international option Part VIII.	Code to "not administered"	X
702	Singapore	TG-40A1-P1	Removed international option Part VIII.	Code to "not administered"	X
702	Singapore	TG-41A1-M1	Removed international option Part VIII.	Code to "not administered"	X
703	Slovak Republic	CP-31A1	Due to a conversion error, the first two categories were incorrectly displayed in the online version of the questionnaire. Data for this variable were therefore not internationally comparable and were removed.	Code to "not administered"	X
705	Slovenia	TG-03A1	Because there is no curriculum tracking in Slovenia, the variable was consistently coded to "no tracking" (3).	Code to 3	D
710	South Africa	TG-33A1	International category "Master's degree or above" (4) was split into two national options as follows: 1 = Secondary or high school 2 = Post-secondary education (e.g., teachers' college) 3 = Bachelor's degree 4 = Honors' degree 5 = Master's degree or above National categories were recoded to fit the international ones.	NAT --> INT 1 --> 1 2 --> 2 3 --> 3 4 --> 4 5 --> 4	D
764	Thailand	CP-20A1-B1	The maximum grade level in Thailand is Grade 12, so the last category "13" (14) was removed.	n/a	D

Appendix E: Examples of Teacher Listing and Tracking Forms

This appendix includes the teacher listing forms and the teacher tracking forms used for mathematics and for science. The information and IDs that they contain are for a fictional school—9999.

To illustrate the listing and sampling and administration procedures described in Chapters 6 and 7, especially with respect to the identification of teachers teaching both mathematics and science and their corresponding cross-link between the mathematics and science listing forms in column (3), the example provided in Section 6.7 has been reused here.

E.1 SITES 2006 (MS): Teacher Listing Form (Mathematics)

SITES Participant: Sample Country

School Name: Sample School

School ID: 9999

ICT Usage %: [ ] 0 [x] 1-50 [ ] 51-75 [ ] 76-100

(1) Mathematics ID	(2) Teacher Name	(3) Science ID	(4) Year Of Birth	(5) Sex	(6) Exclusion Status	(7) Courses/Classes
99990101	Teacher A	99990201	1950	1		8a Math, 8b Math
99990102	Teacher B	99990202	1960	2		8c Math
99990103	Teacher C	99990203	1961	2		8d Math
99990104	Teacher D	99990204	1972	1		8e Math
99990105	Teacher E		1953	2		8f Math
99990106	Teacher F		1982	1		8g Math
99990107	Teacher G		1976	1		8h Math
99990108	Teacher H		1979	2		8i Math, 8j Math
99990109						
99990110						
99990111						
99990112						
99990113						
99990114						
99990115						
99990116						

Use additional sheets if necessary

Sex (Column 5): 1 = female /2 = male / 9 = missing

Exclusion Status (Column 6): 1 = teaches disabled students only / 2 = nationally defined reason [NRC: Delete if no reason specified] / 9 = missing

Courses /Classes (Column 7): Name of all the mathematics courses/classes which are taught by the teacher for the target grade. Please separate each name with a comma.

E.2 SITES 2006 (MS): Teacher Listing Form (Science)

SITES Participant: Sample Country

School Name: Sample School

School ID: 9999

ICT Usage %: [ ] 0 [x] 1-50 [ ] 51-75 [ ] 76-100

(1) Science ID	(2) Teacher Name	(3) Mathematics ID	(4) Year of Birth	(5) Sex	(6) Exclusion Status	(7) Courses/Classes
99990201	Teacher A	99990101	1950	1		8b Physics, 8e Physics, 8a Biology, 8e Biology
99990202	Teacher B	99990102	1960	2		8b Biology, 8c Biology, 8d Biology
99990203	Teacher C	99990103	1961	2		8c Physics, 8d Physics
99990204	Teacher D	99990104	1972	1		8a Physics, 8a Chemistry, 8e Chemistry
99990205	Teacher I		1960	2		8b Chemistry, 8c Chemistry, 8d Chemistry
99990206	Teacher J		1985	2		8e Physics, 8f Physics
99990207	Teacher K		1989	2		8g Physics, 8f Chemistry, 8g Chemistry
99990208	Teacher L		1968	1		8e Biology, 8h Chemistry, 8i Chemistry
99990209						
99990210						
99990211						
99990212						
99990213						
99990214						
99990215						
99990216						

Use additional sheets if necessary

Sex (Column 5): 1 = female / 2 = male / 9 = missing

Exclusion Status (Column 6): 1 = teaches disabled students only / 2 = nationally defined reason [NRC: Delete if no reason specified] / 9 = missing

Courses / Classes (Column 7): Name of all the science courses / classes which are taught by the teacher for the target grade. Please separate each name with a comma

E.3 SITES 2006 (MS): Teacher Tracking Form (Mathematics)

School Name	SITES Participant
Sample School	Sample Country

[a] School ID	[b] Group ID	[a] School ID	[b] Group ID
9999	01	9999	01

(1)	(2)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Teacher Name	Teacher ID	Teacher ID	Check Sum	Exclusion Status	Year of Birth	Sex	Online	Participation Status
Teacher A	99990101	99990101	1234	9	1950	1	X	
Teacher C	99990103	99990103	1234	9	1961	2	X	
Teacher E	99990105	99990105	1234	9	1953	2	X	
Teacher G	99990107	99990107	1234	9	1976	1	X	

Exclusion Status (Column 4): 1 = teaches disabled students only / 2 = nationally defined reason [NRC: Delete if no reason specified] / 9=missing
Sex (Column 6): 1 = female / 2 = male / 9 = missing
Participation Status (Column 8): NA = left school permanently / R = returned / N = not returned / O = online

E.4 SITES 2006 (MS): Teacher Tracking Form (Science)

School Name	**SITES Participant**
Sample School	Sample Country

[a] School ID	[b] Group ID	[a] School ID	[b] Group ID
9999	02	9999	02

(1)	(2)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Teacher Name	Teacher ID	Teacher ID	Check Sum	Exclusion Status	Year of Birth	Sex	Online	Participation Status
Teacher B	99990202	99990202	1234	9	1960	2	X	
Teacher D	99990204	99990204	1234	9	1972	1	X	
Teacher J	99990206	99990206	1234	9	1985	2	X	
Teacher L	99990208	99990208	1234	9	1968	1	X	

Exclusion Status (Column 4): 1=teaches disabled students only / 2 = nationally defined reason [NRC: Delete if no reason specified] / 9 = missing
Sex (Column 6): 1 = female / 2 = male / 9 = missing
Participation Status (Column 8): NA = left school permanently