Chapter 3

Developing the TIMSS 2003 Background Questionnaires

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3.1 Overview

For a fuller appreciation of what the TIMSS achievement results mean and how they may be used to improve student learning in mathematics and science, it is important to understand the contexts in which students learn. Therefore, TIMSS collects extensive information about the contexts for learning mathematics and science by administering a range of background questionnaires. Four types of background questionnaires were used in TIMSS 2003 to gather information at various levels of the educational system: (i) curriculum questionnaires addressed issues of system-wide curriculum design and support and curricular emphasis in mathematics and science; (ii) a school questionnaire asked school principals/headmasters of the students tested to provide information about curricular and instructional arrangements, school resources, and school climate; (iii) teacher questionnaires asked mathematics and science teachers of the students tested about their preparation to teach, their teaching activities and approaches, their attitudes toward teaching the subject matter, and the curriculum that is implemented in the classroom; and (iv) a questionnaire for the students tested sought information about their home backgrounds, their attitudes toward learning mathematics and science, and their experiences in learning these subjects.

The questionnaires were based on the contextual framework included in the *TIMSS Assessment Frameworks and Specifications 2003* (Mullis, Martin, Smith, Garden, Gregory, Gonzalez, Chrostowski, & O'Connor, 2003). The contextual framework specifies the major characteristics of the educational

and social contexts to be studied and identifies the areas to be addressed in the background questionnaires. Questionnaires were developed at both the fourth and eighth grades.

Because TIMSS is a trend study designed to measure change in student achievement in mathematics and science over time, it was important to retain many of the questions included in the background questionnaires in prior cycles of TIMSS for use in TIMSS 2003. Here the focus was on retaining those questions that were found to be most valuable in analysis and reporting in prior cycles of TIMSS. However, at the same time, it was also important to refine some questions and add new ones to address emerging research areas of interest. In particular, TIMSS 2003 added new questions on teacher preparation and professional development, and on the use of information technology for teaching and learning. In order to allow for such expansion in the questionnaires while also keeping response burden manageable, it was necessary to delete questions from earlier cycles of the study, and the focus here was on questions that were not included in reporting TIMSS results. In general, great effort was made to streamline the questionnaires in order to keep response burden to a minimum.

The conceptual framework underlying TIMSS uses the curriculum, broadly defined, as the major organizing concept to explain international variation in student achievement. The TIMSS curriculum model has three aspects: the intended curriculum, the implemented curriculum, and the attained curriculum. These represent, respectively, the mathematics and science that society intends for students to learn and how the education system should be organized to facilitate this learning; what is actually taught in classrooms, who teaches it, and how it is taught; and finally, what students have learned, and what they think about these subjects. Based on this model, TIMSS collects, through the background questionnaires, information about the factors likely to influence students' learning of mathematics and science at the national (or regional), school, classroom, and student level.

This chapter describes the contextual framework underlying the questionnaires, the process used to develop the questionnaires, and their content.

3.2 Contextual Framework for the Background Questionnaires

Just as the mathematics and science frameworks describe the content and cognitive domains to be assessed in those subjects, the contextual framework identifies the major characteristics of the educational and social contexts to be examined with a view toward improving student learning in mathematics and science.

3.2.1 Development of the Contextual Framework

In conjunction with the updating of the original TIMSS assessment frameworks in mathematics and science (see Chapter 2), a new contextual framework was developed by the TIMSS & PIRLS International Study Center (ISC) in collaboration with the TIMSS 2003 Expert Panel.[1] The contextual framework, like the mathematics and science assessment frameworks, went through an extensive and widely consultative development process spanning approximately one year. This work was supported by a grant from the U.S. National Science Foundation, in response to the proposal "A New TIMSS for a New Century." The three overarching goals of this proposal were to update the TIMSS frameworks to ensure that the latest developments in mathematics and science would be addressed by the TIMSS 2003 assessment, develop detailed specifications of the mathematics and science that should be covered in the TIMSS 2003 assessments, and articulate key policy issues that should be addressed in the TIMSS 2003 background questionnaires, i.e., teacher preparation and professional development, and the use of information technology in the classroom.

The development work on the frameworks began in September 2000 when the ISC distributed a survey to the National Research Coordinators (NRCs) seeking their suggestions for areas where the mathematics and science frameworks needed strengthening and revision and potential areas for inclusion in the contextual framework. In regard to the contextual framework and background questionnaires, some of the issues NRCs identified for exploration were:

- the relationship between student achievement and well-defined national curriculum and examinations;
- teacher preparation and professional development;
- student mobility and transience;
- school climate;
- simplifying the language used in the fourth-grade questionnaires;
- pruning the questionnaires by deleting items that have proven to be unreliable or not useful in analysis and reporting; and
- improving the layout of the questionnaires and organizing questionnaire items into logical blocks.

Development work on the contextual framework continued with the first meeting of the Expert Panel in November 2000 in Boston. The primary tasks of the Expert Panel regarding the contextual framework were to identify the main policy issues and new research questions to address in the background questionnaires, and to discuss data sources and methods of data

1 See Appendix A for a list of members of the Expert Panel.

collection. The first Expert Panel meeting included a discussion of the policy issues addressed in TIMSS 1999, an overview of the TIMSS 1999 background questionnaires, an articulation of the key policy issues to be addressed in TIMSS 2003, and a discussion of potential data sources and methods to collect contextual information for TIMSS 2003. Panel members agreed that there was a need to focus on a limited number of policy issues. The panel recognized the need to ensure that the questionnaires used in TIMSS 2003 maintain continuity with previous TIMSS surveys in order to measure trend, yet at the same time recognized the tension between the dual needs of addressing new policy areas while also streamlining the questionnaires in order to minimize response burden.

Following the first meeting of the Expert Panel, staff at the International Study Center prepared a model of the contextual framework for discussion at the First TIMSS 2003 National Research Coordinators' Meeting, held in February 2001 in Hamburg, Germany. NRCs emphasized that in developing the TIMSS 2003 questionnaires, the questions used in past TIMSS reports should be retained, and questions not used should be deleted. Also, the total time devoted to each questionnaire should not exceed that in TIMSS 1999. NRCs were asked to submit suggestions for the contextual framework, including areas of study and specific questions to include in the background questionnaires.

From March through April 2001, following the first NRC meeting, ISC staff further developed the assessment frameworks based on the input from NRCs. The revised frameworks were reviewed by the Expert Panel at its second meeting, held in May 2001 in Amsterdam, the Netherlands. The Expert Panel suggested the following topics for further exploration:

- **Teacher training:** The link between teacher training and later teaching effectiveness could be investigated. This could include the type of teacher training institution attended by teachers, the curriculum offered, the length of training and the amount of teaching practice, the use of technology in teacher training, and teacher competency standards.
- **Professional development:** Topics suitable for exploration include who provides the professional development, the nature of the professional development, the incentives for engaging in professional development, and the attractiveness of teaching as a profession.
- **Technology:** A central question to investigate would be level of access to the Internet by students and teachers, and how the Internet is used to facilitate teaching and learning. Additional topics that could be addressed include the ability of students to judge the quality of information they obtain via the Internet, and potential problems associated with Internet use.

Based on the input from the Expert Panel, ISC staff further revised the assessment frameworks for final review and approval by NRCs at the Second TIMSS 2003 National Research Coordinators' Meeting, held in June 2001 in Montreal, Canada. National Research Coordinators provided additional input on the frameworks, and upon incorporating some new suggestions from NRCs, the International Study Center published the first edition of the *TIMSS Assessment Frameworks and Specifications 2003* in September 2001.[2] In addition to the mathematics, science, and contextual frameworks, this document also includes a chapter on the planned assessment design.

3.2.2 Content of the Contextual Framework

The TIMSS contextual framework describes the contextual areas to be studied, and provides direction for development of the curriculum, school, teacher and student background questionnaires. The contextual framework encompasses five broad areas that interact with each other to impact student achievement:

- the curriculum;
- the schools;
- teachers and their preparation;
- classroom activities and characteristics;
- the students.

In particular, the framework focuses on the curricular goals of the education system and how the system is organized to attain and sustain those goals; the educational resources provided and how the school is organized to foster teaching and learning; the teaching force and how it is educated and supported; the topics that are taught and the learning activities that go on in the classroom; and the students' home background and learning support and the attitudes they bring to school.

The following sections briefly summarize the main areas included in the contextual framework.

3.2.2.1 The Curriculum

The TIMSS contextual framework sees curriculum development as a process involving consideration of the society which the education system serves, the needs and aspirations of the students, the nature and function of learning, and the formulation of statements on what learning is important. Building on past IEA experience, the TIMSS contextual framework addresses five broad aspects of the intended curriculum in mathematics and science: formulating

2 The second edition of the frameworks was published in February 2003, and features example mathematics and science achievement items used in the field test but not the main data collection, as well as a revised assessment design chapter.

the curriculum; defining the scope and content of the curriculum; organizing the curriculum, monitoring and evaluating the implemented curriculum; and providing curricular materials and support.

3.2.2.2 The Schools

In the TIMSS contextual model, the school is the institution through which the goals of the curriculum are implemented. TIMSS focuses on a set of indicators of school quality that research has shown to characterize schools that function as well-managed integrated systems supportive of teaching and learning. These include: organization of the school; school goals; roles of the school principal; resources to support mathematics and science learning; parental involvement; and a disciplined school environment.

3.2.2.3 Teachers and Their Preparation

Teachers are the primary agents of curriculum implementation in the TIMSS contextual model. Regardless of how closely prescribed the curriculum, or how explicit the textbook, the actions of the teacher in the classroom can greatly affect student learning. What teachers know and are able to do is of critical importance. In this area, TIMSS focuses on a set of indicators related to having highly qualified teachers in the classroom. These include: academic preparation and certification; teacher recruitment; teacher assignment; teacher induction; teaching experience; teaching styles; and professional development.

3.2.2.4 Classroom Activities and Characteristics

Although the school provides the general context for learning, it is in the classroom setting and through the guidance of the teacher that most teaching and learning take place. Aspects of the implemented curriculum that are most readily studied in the classroom include the curriculum topics that are actually taught, the pedagogical approaches used, the materials and equipment available, and the conditions under which learning takes place, including the size and composition of the class and the amount of classroom time devoted to mathematics and science education. Here the TIMSS contextual framework addresses several areas: curriculum topics taught; instructional time; homework; assessment; classroom climate; use of information technology; calculator use; emphasis on scientific investigation; and class size.

3.2.2.5 The Students

Students come to school from different backgrounds and with different experiences that affect their attitudes toward learning mathematics and science

and their academic performance in these subjects. In this area TIMSS focuses on: students' home background and resources for learning; their prior experiences; and their attitudes toward learning.

3.3 The TIMSS 2003 Background Questionnaires

The TIMSS 2003 contextual framework served as the foundation in developing the TIMSS 2003 background questionnaires. As mentioned above, four types of background questionnaires were used to collect information regarding the contexts in which students learn mathematics and science.

- The **curriculum questionnaire** addressed issues of the intended national curriculum in mathematics and science. Four versions of this questionnaire were administered: fourth-grade mathematics, fourth-grade science, eighth-grade mathematics, and eight-grade science.
- The **school questionnaire** asked school principals or headmasters to provide information about the school contexts for the teaching and learning of mathematics and science. There were separate versions for fourth grade and eighth grade.
- The **teacher questionnaire** collected information about the teachers' preparation and professional development, their pedagogical activities, and the implemented curriculum. At fourth grade there was one questionnaire that addressed both mathematics and science, and at eighth grade there were separate versions for mathematics teachers and science teachers.
- The **student questionnaire** sought information about the students' home backgrounds and their experiences in learning mathematics and science. There were separate versions for fourth grade and eighth grade, and at eighth grade there were different versions for countries where eighth-grade science is taught as a single integrated subject and countries where it is taught as separate subjects (i.e., biology, chemistry, physics, earth science).

3.3.1 Development of the Background Questionnaires

Like the contextual framework, the TIMSS 2003 background questionnaires were developed through an iterative and widely collaborative process that spanned slightly more than one year. This process involved the TIMSS & PIRLS International Study Center, National Research Coordinators, the Questionnaire Item Review Committee (QIRC), and the IEA Data Processing Center. The process included a series of reviews of draft instruments, a field test of the questionnaires, a review of the field-test data, and a revision of the field-test instruments for use in the main data collection.

The development work began at the second NRC meeting in June 2001, when NRCs reviewed the TIMSS 1999 questionnaires in conjunction with the TIMSS 2003 contextual framework to advise what should be included in the 2003 assessment. Where questionnaire items had been used in the TIMSS 1999 international reports, NRCs decided that in general these items should be retained, preferably in the same form in order to measure trend. Items not reported in TIMSS 1999 were to be modified or deleted. NRCs also suggested to add or expand questions regarding the type of homework that students do, whether students get support for homework outside of school, the types of threats to safety that students experience, how teachers are licensed and evaluated, and the types of professional development that teachers undergo.

Working from the contextual framework and the TIMSS 1999 questionnaire review conducted by NRCs, staff at the International Study Center produced drafts of all the background questionnaires during the period of June through September 2001. The drafts were sent to members of the Questionnaire Item Review Committee for their review.[3] The first meeting of the Questionnaire Item Review Committee was held in October 2001 in Washington, D.C., at which the draft questionnaires were reviewed in detail. QIRC members suggested many improvements, as well as ways to reduce response burden by eliminating some questions thought to be less useful for reporting purposes. Following this meeting, the suggested revisions were implemented, and the revised drafts were submitted to further internal review at the ISC. The draft questionnaires were then provided to NRCs for their review at the Third TIMSS 2003 National Research Coordinators' Meeting, held in December 2001 in Madrid, Spain. NRCs suggested a number of improvements to the questionnaires that were to be field tested, and these revisions were implemented by the ISC during January 2002, in preparation for the field test. The field-test instruments were then provided to NRCs for translation, production, and administration.[4]

The TIMSS 2003 field test was conducted during April through June 2002. One of the primary purposes of the field test was to check across participating countries whether the questionnaires were appropriate for the measurement purposes for which they were designed. Although the questionnaires were adapted from previous versions, because there were a number of additions and refinements in the 2003 version it was necessary to field test them.[5] In all, 20 out of 26 countries participated in the field test at the fourth grade, and 41 of 48 countries participated at the eighth grade.

3 See Appendix A for a list of members of the Questionnaire Item Review Committee.

4 Please see Chapter 4 for more information about the translation and verification process.

5 The curriculum questionnaires were not administered in the field test.

After administering the field test, countries prepared their data files and sent them to the IEA Data Processing Center for checking and cleaning. After the field-test data were verified and transformed into the international format, they were sent to the International Study Center for analysis, and for review by the QIRC and NRCs. To facilitate review of the questionnaire data, the ISC prepared three data almanacs each for fourth and eighth grades, one for the school questionnaire, one for the teacher questionnaire, and one for the student questionnaire. For every country that participated, each almanac displayed student-weighted distributions of responses to each item in the questionnaires. For categorical variables, the weighted percentage of respondents choosing each option was shown together with the corresponding average student achievement in mathematics and science. For questions with numeric responses, the mean, mode, and selected percentiles were given. The almanacs were the basic data summaries that were used by ISC staff, the QIRC, and NRCs in assessing the quality of the field-test instruments and in making suggestions for the instruments to be used in the main data collection.

The initial review of the field-test results was conducted by the International Study Center in early July 2002. The questionnaire items were reviewed in terms of how well they worked both across countries and within individual countries. Based on this review, ISC staff made some improvements to the school, teacher, and student questionnaires, upon consultation with the QIRC. Also at this time, drafts of the curriculum questionnaires (which were not field tested) were completed.

At its second meeting, in July 2002 in Amsterdam, QIRC members reviewed the field-test results for the school, teacher, and student questionnaires, examining the statistics for each item and determining if there were any anomalies. Items that did not work well were deleted. The committee also discussed potential improvements suggested by the ISC, suggested modifications to some items, and arrived at a set of recommended changes to be brought before NRCs at their next meeting. The QIRC also proposed some refinements to the draft curriculum questionnaires.

During the latter half of July 2002, staff at the International Study Center prepared draft instruments for the main survey and documented the recommended changes from the field-test version for review by NRCs at the Fifth TIMSS 2003 National Research Coordinators' Meeting, held in late July and early August 2002 in Tunis, Tunisia. The draft instruments were well received and widely discussed by NRCs, who recommended a number of additional improvements. A substantial organizational change was made to the fourth grade teacher questionnaire, to facilitate data collection in coun-

tries where mathematics and science at fourth grade were taught by different teachers. Immediately after the NRC meeting, ISC staff finalized the instruments, and these were provided to NRCs during the latter part of August, for translation, production, and administration in the main TIMSS 2003 data collection, which was held during September through November 2002 in southern hemisphere countries and during February through July 2003 in northern hemisphere countries.

3.3.2 Content of the Background Questionnaires

The curriculum, school, teacher, and student questionnaires used in TIMSS 2003 were developed from the TIMSS 1999 questionnaires. While most of the questions were thematically similar in both assessments, some questions from 1999 were eliminated, some were modified with the intention of refining them, and some new questions were introduced in 2003, either as replacements for eliminated items or to provide additional information in areas deemed important to the study. In general, every effort was made to streamline the questionnaires in order to limit response burden. Based upon the guidelines specified in the contextual framework, new emphasis was placed upon the areas of teacher preparation and professional development, and the access to and use of technology for teaching and learning.

The organization of the questionnaires was improved so that the questions were more clearly organized into logical blocks, each with a heading. The design and layout also was improved to make the questionnaires easier to complete, especially where filter questions were used. Parallel questions were used in different questionnaires to measure the same constructs from different sources, and wherever possible the wording of such questions was identical. Questions that addressed the focus areas of teacher preparation and professional development, and use of technology for teaching and learning, were included in the four different questionnaire types.

The content of the TIMSS 2003 background questionnaires used to collect information about the contexts for learning mathematics and science is described below.

3.3.2.1 Curriculum Questionnaire

The fourth- and eighth-grade curriculum questionnaires for mathematics and science were addressed to National Research Coordinators, who were asked to supply information about their nation's mathematics and science curricula in the target grades, drawing on the expertise of curriculum specialists in their countries. The curriculum questionnaires were designed to collect basic information about the organization of and support for the intended mathematics

and science curriculum in each country, and whether the mathematics and science topics included in the TIMSS 2003 assessment were included in the country's intended curriculum through the target grade. The four versions of the curriculum questionnaire were the same in structure and very similar in content, with the mathematics and science versions tailored to the subject matter and grade level wherever necessary. One notable difference was that the eighth-grade science curriculum questionnaire included a question asking whether eighth-grade science was taught as a single integrated subject or as separate science subjects.

Some of the central questions addressed in the curriculum questionnaire included:

- Is there a national curriculum in mathematics/science at the target grade?
- Does the country administer public examinations in mathematics/science that have consequences for individual students?
- What methods are used to support and monitor implementation of the national mathematics/science curriculum?
- How does the national curriculum address the issue of students with different levels of ability?
- What aspects of the teaching and learning of mathematics/science are emphasized in the national curriculum?
- What are the requirements for becoming a mathematics/science teacher, and is there a process to license or certify teachers?
- Are the topics included in the TIMSS 2003 assessment included in the national curriculum, and if so, for what proportion of students, and at what grades are the topics intended to be taught?

The complete contents of the TIMSS 2003 mathematics and science curriculum questionnaires at fourth and eighth grades are described in Exhibit 3.1.

3.3.2.2 School Questionnaire

The fourth- and eighth-grade school questionnaires were to be completed by the school principal or headmaster of each school sampled for the study. They were designed to collect information concerning some of the major factors thought to influence student achievement in mathematics and science. The fourth- and eighth-grade versions of the school questionnaire are nearly identical, although two of the questions are tailored to the appropriate grade. The school questionnaire was designed to be completed in about 30 minutes.

Exhibit 3. 1 **Content of the TIMSS 2003 Mathematics and Science Curriculum Questionnaires at the Eighth and Fourth Grades**

Item Number				Item Content	Description
Mathematics Grade 8	Mathematics Grade 4	Science Grade 8	Science Grade 4		
1	1	1	1	National curriculum	Whether the country has a national mathematics/science curriculum at the target grade, the year introduced, and whether under revision
-	-	2	-	Separate sciences	Whether science is taught as separate subjects by eighth grade, and the specific subjects and grades taught
2	2	3	2	Public examinations	Whether the country administers public examinations in mathematics/science that have consequences for individual students, the authority that administers such examinations, and the grades at which they are given
3	3	4	3	Methods used to help implement the national curriculum	Whether the country uses various methods to help monitor implementation of the national mathematics/science curriculum at the target grade
4	4	5	4	Specification of instructional time	Whether the national curriculum specifies the percentage of instructional time intended to be devoted to mathematics/science at various grades, and the percentage of time designated
5	5	6	5	Differentiation of the curriculum	How the national mathematics/science curriculum at the target grade addresses the issue of students with different levels of ability
6	6	7	6	Emphasis on approaches and processes	How much emphasis the national mathematics/science curriculum at the target grade places on various approaches and processes
7	7	-	-	Policy on calculator use	Whether the national mathematics curriculum contains statements/policies on the use of calculators at the target grade, and a brief description of such policies
-	-	8	7	Policy on emphasis given scientific inquiry	Whether the national science curriculum contains statements/policies about the emphasis that should be placed on scientific inquiry at the target grade, and a brief description of such policies
8	8	9	8	Policy on computer use	Whether the national mathematics/science curriculum contains statements/policies on the use of computers at the target grade, and a brief description of such policies

Exhibit 3. 1 **Content of the TIMSS 2003 Mathematics and Science Curriculum Questionnaires at the Eighth and Fourth Grades** *(...Continued)*

Item Number				Item Content	Description
Mathematics Grade 8	Mathematics Grade 4	Science Grade 8	Science Grade 4		
9	9	10	9	Preparation of teachers in how to teach the intended curriculum	Whether mathematics/science teachers at the target grade receive specific preparation in how to teach the intended curriculm as part of their pre-service or in-service education, and a brief description of such preparation
10	10	11	10	Teaching requirements	Whether mathematics/science teachers at the target grade must fulfill various requirements in order to teach
11	11	12	11	Licensure process	Whether there is a process to license or certify mathematics/science teachers at the target grade, and what entity licenses the teachers
12	12	13	12	The teaching of the TIMSS topics	Whether the TIMSS mathematics/science topics are included in the national curriculum through the target grade, the proportion of students intended to be taught the topics, and the grade(s) at which the topics are intended to be taught

Some of the main questions addressed in the school questionnaire were:

- What is the school climate like?
- What are the school's expectations of parents?
- How does the school organize mathematics/science instruction for students with different levels of ability?
- How difficult was it to fill mathematics/science teaching vacancies, and were any incentives used to recruit or retain teachers?
- What types of professional development activities did mathematics/science teachers engage in?
- How safe is the school environment?
- Is the school's capacity to provide instruction affected by a shortage of various resources?
- What is the availability of computers for educational purposes in the school, and how many have access to the Internet?

The complete contents of the TIMSS 2003 school questionnaires at fourth and eighth grades are described in Exhibit 3.2.

Exhibit 3. 2 **Content of the TIMSS 2003 School Questionnaires at the Eighth and Fourth Grades**

Item Number		Item Content	Description
Grade 8	Grade 4		
1	1	Grade levels	Grade range of the school
2	2	Enrollment	Total school enrollment in all grades and in the target grade
3	3	Community size	Size of the community in which the school is located
4	4	Absenteeism	Percentage of students absent from school on a typical school day
5	5	Stability/ mobility of student body	Percentage of students enrolled at the beginning of the school year who were still enrolled at the time of testing, and percentage of students who enrolled after the beginning of the school year
6	6	Students' background	Percentage of students who come from economically disadvantaged or affluent homes, and percentage of students whose native language is the language of the test
7	7	School climate	Principal's perception of teachers' job satisfaction and expectations for student achievement; of parental support and involvement; and of students' regard for school property and desire to do well in school
8	8	Principal's experience	Number of years as a principal of this school
9	9	Principal's time allocation	Percentage of time principal spends on various activities across the school year
10	10	Parental involvement	Whether the school expects parents to participate in various activities
11	11	Instructional time	Number of days per year and days per week the school is open for instruction, and number of hours of instructional time in a typical day
12	12	Differentation of mathematics curriculum	How the school organizes mathematics instruction for students with different levels of ability
13	13	Tracking in mathematics	Whether the students are grouped by ability in their mathematics classes
14	14	Enrichment/ remedial mathematics	Whether the school offers enrichment and remedial courses in mathematics

Exhibit 3. 2 **Content of the TIMSS 2003 School Questionnaires at the Eighth and Fourth Grades** *(...Continued)*

Item Number		Item Content	Description
Grade 8	Grade 4		
15	15	Differentiation of science curriculum	How the school organizes science instruction for students with different levels of ability
16	16	Tracking in science	Whether the students are grouped by ability in their science classes
17	17	Enrichment/ remedial science	Whether the school offers enrichment and remedial courses in science
18	18	Teacher vacancies	Difficulty in filling teacher vacancies in mathematics, science, and computer science/information technology (4th grade version does not ask about specific subjects)
19	19	Incentives for teachers	Whether the school uses incentives to recruit or retain teachers in mathematics, science, and/or other subjects (4th grade version does not ask about specific subjects)
20	20	Professional development	Frequency with which teachers participated in various types of professional development activities during the school year
21	21	Teacher evaluation	Whether the school uses various procedures in evaluating mathematics and science teachers
22	22	Student behavior	Frequency and severity of various problematic student behaviors occurring in the school
23	23	Instructional resources	Degree to which the school's capacity to provide instruction is affected by shortages or inadequacy of various resources
24	24	Computers	Number of computers available for educational purposes, and proportion of computers with access to the Internet
25	25	Technology support	Whether there is anyone available to help teachers use information and communication technology for teaching and learning, and description of that person

3.3.2.3 Teacher Questionnaire

The teacher questionnaires were designed to gather information about the classroom contexts for the teaching and learning of mathematics and science, and about the implemented curriculum in these subjects. For each participating school at the fourth grade, there was one teacher questionnaire addressed to the classroom teacher of the sampled class. At eighth grade, for each sampled school a single mathematics class was sampled for the TIMSS 2003 assessment.[6] The mathematics teacher of that class was asked to complete a mathematics teacher questionnaire, and the science teacher(s) of the students

6 In some circumstances it was necessary to sample two classes to yield the desired sample size. Please see Chapter 5 for more information on sample design.

in that class was asked to complete a science teacher questionnaire, which paralleled that for the mathematics teacher. Although the general background questions were essentially the same for all versions, questions pertaining to instructional practices, content coverage, and teachers' views about teaching the subject matter were tailored toward mathematics or science. Many questions, such as those related to classroom characteristics and activities, and homework and assessment, were answered with respect to the specific classes of the sampled TIMSS students. Because the fourth- and eighth-grade versions of the teacher questionnaire were designed to be similar in length, and because the fourth-grade version included questions about both mathematics and science, some questions had to be eliminated or shortened in the fourth-grade version.

Some of the primary questions addressed in the teacher questionnaire were:

- What is teachers' educational background, and do they have a teaching license or certificate?
- How many years of pre-service teacher training did teachers have, and how many years have they been teaching?
- How ready do teachers feel they are to teach various topics at the target grade?
- What types of professional development have teachers participated in?
- What is the teaching load of teachers, and how do they spend their time both during and outside the formal school day (eighth grade only)?
- What are teachers' attitudes toward teaching the subject matter, and their perceptions regarding school climate and school safety?
- What instructional activities are provided to the students in the TIMSS class, and how do the students spend their time during their mathematics and science lessons?
- Do various student- and resource-related factors limit how teachers instruct the students in the TIMSS class (eighth grade only)?
- What percentages of time are devoted to the various mathematics and science content areas in teaching the TIMSS class?
- When have the students in the TIMSS class been taught the topics included in the TIMSS 2003 assessment?
- Do students have calculators available to them, and how do they use them (mathematics only)
- Do students have computers available to them, and how do they use them?
- How much homework is assigned to students?

- How often are students given a test or examination, and what types of questions are included (eighth grade only)?

The TIMSS 2003 teacher questionnaires were designed to take about 45 minutes to complete. The complete contents of the TIMSS 2003 teacher questionnaires are described in Exhibit 3.3 for the eighth grade and in Exhibit 3.4 for the fourth grade.

3.3.2.4 Student Questionnaire

Each student in the sampled fourth- and eighth-grade TIMSS classes completed a student questionnaire, which sought information about the student's home background and resources for learning, their attitudes about mathematics and science, and their experiences in learning these subjects. The fourth- and eighth-grade versions of the student questionnaire were thematically and organizationally similar to each other. Some questions were identical in the two versions, while for other questions the language was simplified in the fourth-grade version or the specific content of the question was altered to be appropriate to the fourth grade. The fourth-grade questionnaire was shorter in length than the eighth-grade version.

As in TIMSS 1999, two versions of the eighth-grade questionnaire were used, a *general science version* intended for countries where eighth-grade science is taught as a single integrated subject, and a *separate science subjects version* intended for countries where eighth-grade science is taught as separate subject (e.g., biology, earth science, chemistry, physics); countries administered the version that was consistent with the way in which science instruction was organized at the eighth grade. In the general science version, science-related questions pertaining to students' attitudes and classroom activities were based on single questions asking about "science," to which students were to respond in terms of the "general or integrated science" course they were taking. In the separate science subjects version, the same questions were asked about each science subject area, and students were to respond with respect to each science course they were taking. This structure accommodated the diverse systems that participated in TIMSS. Although the two versions differed with respect to the science questions, the general background and mathematics-related questions were identical across the two forms.

The student questionnaire was designed to gather information on some of the major factors thought to influence student achievement in mathematics and science. Some of the central questions addressed in the student questionnaire included:

- What are students' general demographic backgrounds – age, gender, native language, country of origin, household size?
- What are the resources for learning in the students' homes?

- What is the educational attainment of the students' parents, and what are the students' own educational aspirations?
- What is students' affinity for learning mathematics and science, and how do they perceive success in and the utility of learning mathematics and science?
- What types of learning activities do students engage in in their mathematics and science lessons?
- Do students use a computer, where, and for what learning activities?
- What are students' perceptions about school climate and school safety?
- How do students spend their time outside of school?
- How much homework do students do?

The TIMSS 2003 student questionnaires were designed to take about 30 minutes to complete. The complete contents of the TIMSS 2003 student questionnaires are described in Exhibit 3.5 for the eighth grade and in Exhibit 3.6 for the fourth grade.

Exhibit 3. 3 **Content of the TIMSS 2003 Mathematics and Science Teacher Questionnaires at the Eighth Grade**

Item Number		Item Content	Description
Mathematics Teacher Questionnaire	Science Teacher Questionnaire		
1	1	Age	Teacher's age
2	2	Gender	Teacher's gender
3	3	Teaching experience	Number of years as a teacher
4	4	Formal education	Highest level of formal education completed by the teacher
5	5	Teacher training	Number of years of pre-service teacher training completed by the teacher
6	6	Major area of study	Teacher's major area of study during post-secondary education
7	7	Teaching requirements	Requirements the teacher had to satisfy in order to become a teacher
8	8	Teaching license	Whether the teacher has a teaching license or certificate, and the type of license
9	9	Preparation to teach	How ready the teacher feels to teach the topics included in the TIMSS mathematics/science test
10	10	Teaching load	Number of periods for which the teacher is formally scheduled per week for various activities, and number of minutes in a period
11	11	Extra working time	Number of hours teacher spends on teaching-related activities outside the formal school day
12	12	Teacher interactions	Frequency of various types of interactions the teacher has with colleagues
13	13	Professional development	Whether the teacher participated in various types of professional development activities
14	14	Attitudes toward subject	Teacher's beliefs about the nature of mathematics/science and how the subject should be taught.
15	15	School setting	Teacher's perceptions about the adequacy of the school facility and about school safety
16	16	School climate	Teacher's perception of teachers' job satisfaction and expectations for student achievement; of parental support and involvement; and of students' regard for school property and desire to do well in school
17	17	Class size	Number of students in the sampled class
18	18	Time spend teaching subject	Minutes per week the teacher teaches mathematics/science to the sampled class
19	19	Textbook	Whether a textbook(s) is used as a primary or supplementary resource
20	20	Student learning activities	Percentage of time students spend doing various learning activities in a typical week
21	21	Content-related activities	Frequency with which the teacher asks students to do various content-related activities in mathematics/science

Exhibit 3. 3 **Content of the TIMSS 2003 Mathematics and Science Teacher Questionnaires at the Eighth Grade** *(...Continued)*

Item Number			
Mathematics Teacher Questionnaire	**Science Teacher Questionnaire**	**Item Content**	**Description**
22	22	Factors limiting teaching	Extent to which the teacher perceives various student and resource factors to limit teaching
23	23	Emphasis on content areas	Percentage of time spent on mathematics/science content areas over the course of the year
24	24	Topic coverage	When the students were taught the TIMSS mathematics/science topics, by content area
25	-	Calculator use policy	Whether the students are permitted to use calculators during mathematics lessons
26	-	Calculator availability	Proportion of students that have access to calculators during mathematics lessons
27	-	Graphing calculator availability	Proportion of students that have access to graphing calculators during mathematics lessons
28	-	Calculator use	Frequency with which the students use calculators for various learning activities
29	-	Calculators in test/exams	How often the students are allowed to use calculators during tests or examinations
30	25	Computer availability	Whether the students have access to computers during mathematics/science lessons and whether computers have access to Internet
31	26	Computer use	Frequency with which the students use computers for various learning activities
32	27	Homework	Whether the teacher assigns mathematics/science homework
33	28	Frequency of homework	How often the teacher assigns mathematics/science homework
34	29	Amount of homework	Number of minutes it would take an average student to complete a mathematics/science homework assignment
35	30	Type of homework	Frequency with which the teacher assigns various types of homework
36	31	Use of homework	How often the teacher uses mathematics/science homework for various purposes
37	32	Assessment	Frequency with which the teacher gives a mathematics/science test or examination
38	33	Question format	Item formats the teacher typically uses in mathematics/science tests or examinations
39	34	Type of questions	Types of questions the teacher uses in mathematics/science tests or examinations

Exhibit 3. 4 **Content of the TIMSS 2003 Teacher Questionnaire at the Fourth Grade**

Item Number	Item Content	Description
1	Age	Teacher's age
2	Gender	Teacher's gender
3	Teaching experience	Number of years as a teacher
4	Formal education	Highest level of formal education completed by the teacher
5	Teacher training	Number of years of pre-service teacher training completed by the teacher
6	Major area of study	Teacher's major area of study during post-secondary education
7	Teaching requirements	Requirements the teacher had to satisfy in order to become a teacher
8	Teaching license	Whether the teacher has a teaching license or certificate, and the type of license
9	School climate	Teacher's perception of teachers' job satisfaction and expectations for student achievement; of parental support and involvement; and of students' regard for school property and desire to do well in school
10	School setting	Teacher's perceptions about the adequacy of the school facility and about school safety
11	Teacher interactions	Frequency of various types of interactions the teacher has with colleagues
12	Preparation to teach mathematics	How ready the teacher feels to teach the topics included in the TIMSS mathematics test
13	Professional development in mathematics	Whether the teacher participated in various types of professional development activities for mathematics teaching
14	Mathematics class size	Number of students in the sampled class for mathematics, and number of those in the fourth grade
15	Time spend teaching mathematics	Minutes per week the teacher teaches mathematics to the sampled class
16	Mathematics textbook	Whether a textbook(s) is used as a primary or supplementary resource in teaching mathematics
17	Student learning activities in mathematics	Percentage of time students spend doing various learning activities in a typical week of mathematics lessons
18	Calculator use policy	Whether the students are permitted to use calculators during mathematics lessons
19	Calculator availability	Proportion of students that have access to calculators during mathematics lessons
20	Calculator use	Frequency with which the students use calculators for various learning activities
21	Calculators in test/exams	How often the students are allowed to use calculators during tests or examinations
22	Computer availability for mathematics	Whether the students have access to computers during mathematics lessons and whether computers have access to the Internet
23	Computer use in mathematics	Frequency with which the students use computers for various learning activities in mathematics

Exhibit 3. 4 **Content of the TIMSS 2003 Teacher Questionnaire at the Fourth Grade**
(...Continued)

Item Number	Item Content	Description
24	Mathematics content-related activities	Frequency with which the teacher asks students to do various content-related activities in mathematics
25	Emphasis on mathematics content areas	Percentage of time spent on mathematics content areas over the course of the year
26	Mathematics topic coverage	When the students were taught the TIMSS mathematics topics, by content area
27	Mathematics homework	Whether the teacher assigns mathematics homework
28	Frequency of mathematics homework	How often the teacher assigns mathematics homework
29	Amount of mathematics homework	Number of minutes it would take an average student to complete a mathematics homework assignment
30	Preparation to teach science	How ready the teacher feels to teach the topics included in the TIMSS science test
31	Professional development in science	Whether the teacher participated in various types of professional development activities for science teaching
32	Science class size	Number of students in the sampled class for science, and number of those in the fourth grade
33	Time spend teaching science	Minutes per week the teacher teaches science to the sampled class
34	Science textbook	Whether a textbook(s) is used as a primary or supplementary resource in teaching science
38	Student learning activities in science	Percentage of time students spend doing various learning activities in a typical week of science lessons
35	Computer availability for science	Whether the students have access to computers during science lessons and whether computers have access to the Internet
36	Computer use in science	Frequency with which the students use computers for various learning activities in science
37	Science content-related activities	Frequency with which the teacher asks students to do various content-related activities in science
39	Preparation to teach science	How ready the teacher feels to teach the topics included in the TIMSS science test
40	Science homework	Whether the teacher assigns science homework
41	Frequency of science homework	How often the teacher assigns science homework
42	Amount of science homework	Number of minutes it would take an average student to complete a science homework assignment

Exhibit 3. 5 **Content of the TIMSS 2003 Student Questionnaire at the Eighth Grade**

Item Number			
General science version	Separate science subjects version	Item Content	Description
1	1	Age	Month and year of student's birth
2	2	Gender	Student's gender
3	3	Language	Student's frequency of use of the language of the test at home
4	4	Books in the home	Number of books in the student's home
5	5	Home possessions	Educational resources and general possessions in the student's home
6	6	Parents' education	Highest level of education completed by mother and father
7	7	Educational expectations	Level of education the student expects to complete
8	8	Liking mathematics	How much the student likes and feels competent at mathematics
9	9	Valuing mathematics	Importance and value the student attributes to mathematics
10	10	Learning activities in mathematics	Frequency with which student does various learning activities in mathematics lessons
11	-	Liking science	How much the student likes and feels competent at science
12	-	Valuing science	Importance and value the student attributes to science
13	-	Learning activities in science	Frequency with which student does various learning activities in science lessons
-	11	Study biology	Whether the student is studying biology this year
-	12	Liking biology	How much the student likes and feels competent at biology
-	13	Valuing biology	Importance and value the student attributes to biology
-	14	Learning activities in biology	Frequency with which student does various learning activities in biology lessons
-	15	Study earth science	Whether the student is studying earth science this year
-	16	Liking earth science	How much the student likes and feels competent at earth science
-	17	Valuing earth science	Importance and value the student attributes to earth science
-	18	Learning activities in earth science	Frequency with which student does various learning activities in earth science lessons

Exhibit 3. 5 **Content of the TIMSS 2003 Student Questionnaire at the Eighth Grade**
(...Continued)

Item Number		Item Content	Description
General science version	Separate science subjects version		
-	19	Study chemistry	Whether the student is studying chemistry this year
-	20	Liking chemistry	How much the student likes and feels competent at chemistry
-	21	Valuing chemistry	Importance and value the student attributes to chemistry
-	22	Learning activities in chemistry	Frequency with which student does various learning activities in chemistry lessons
-	23	Study physics	Whether the student is studying physics this year
-	24	Liking physics	How much the student likes and feels competent at physics
-	25	Valuing physics	Importance and value the student attributes to physics
-	26	Learning activities in physics	Frequency with which student does various learning activities in physics lessons
14	27	Computers	Whether student uses a computer, where uses it, and frequency with which student uses a computer for various educational activities
15	28	School climate	Student's affinity for school, and perception of other students' motivation in school and teachers' expectations and care of students
16	29	Safety in school	Whether the student experienced being the object of problematic behaviors by other students
17	30	Out-of-school activities	Frequency with which student does various non-academic activities and homework outside of school
18	31	Extra lessons/ tutoring	Frequency of extra lessons or tutoring in mathematics and science
19	32	Mathematics homework	Frequency and amount of mathematics homework
20	32	Science homework	Frequency and amount of science homework
21	33	Persons living in home	Number of people living at home
22	34	Parents born in country	Whether mother and father were born in country
23	35	Student born in country	Whether student was born in country, and if not age at which student emigrated

Exhibit 3. 6 **Content of the TIMSS 2003 Student Questionnaire at the Fourth Grade**

Item Number	Item Content	Description
1	Age	Month and year of student's birth
2	Gender	Student's gender
3	Language	Student's frequency of use of the language of the test at home
4	Books in the home	Number of books in the student's home
5	Home possessions	Educational resources and general possessions in the student's home
6	Liking mathematics	How much the student likes and feels competent at mathematics
7	Learning activities in mathematics	Frequency with which student does various learning activities in mathematics lessons
8	Liking science	How much the student likes and feels competent at science
9	Learning activities in science	Frequency with which student does various learning activities in science lessons
10	Computers	Whether student uses a computer, where uses it, and frequency with which student uses a computer for various educational activities
11	School climate	Student's affinity for school, and perception of other students' motivation in school and teachers' expectations and care of students
12	Safety in school	Whether the student experienced being the object of problematic behaviors by other students
13	Out-of-school activities	Frequency with which student does various non-academic activities and homework outside of school
14	Extra lessons	Frequency of extra lessons or tutoring in mathematics and science
15	Mathematics homework	Frequency and amount of mathematics homework
16	Science homework	Frequency and amount of science homework
17	Persons living in home	Number of people living at home
18	Parents born in country	Whether mother and father were born in country
19	Student born in country	Whether student was born in country, and if not age at which student emigrated

References

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