



16.3 Reporting the TIMSS 1999 Benchmarking Data

The TIMSS 1999 Benchmarking results were reported in separate mathematics and science volumes (Mullis et al., 2001; Martin et al., 2001). These reports each contain four chapters devoted to the questionnaire data, dealing with students' backgrounds and attitudes, the nature and coverage of the curriculum, teachers and instruction, and school contexts for learning. Each report included a number of summary indices based on some of the background data. These were presented to highlight issues related to good educational practice.

The TIMSS 1999 Benchmarking Reports present the question-

reported having 25 or fewer books in the home, not all three educational aids, and some secondary or less education as the highest level for either parent. Students with all other response combinations were assigned to the middle category.

The 17 indices computed for the TIMSS 1999 Benchmarking Reports are listed in Exhibit 16.1, which gives the name of the index; the label used to identify it in the TIMSS 1999 Benchmarking Reports and database; the mathematics or science exhibit in the TIMSS 1999 Benchmarking Report where the index data were reported; and the method used to compute the index.

Exhibit 16.1 Summary Indices from Background Data in the TIMSS 1999 Benchmarking Report

Name of Index	Label	Exhibit ^a	Analysis Method
Index of Home Educational Resources	HER	4.1 (M) 4.1 (S)	Index based on students' responses to three questions about home educational resources: number of books in the home; educational aids in the home (computer, study desk/table for own use, dictionary); parents' education. High level indicates more than 100 books in the home; all three educational aids; and either parent's highest level of education is finished university. Low level indicates 25 or fewer books in the home; not all three educational aids; and both parents' highest level of education is some secondary or less or is not known. Medium level includes all other possible combinations of responses. Response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries.
Index of Out-of-School Study Time	OST	4.6 (M) 4.6 (S)	Index based on students' responses to three questions about out-of-school study time: time spent after school studying mathematics or doing mathematics homework; time spent after school studying science or doing science homework; time spent after school studying or doing homework in school subjects other than mathematics and science. Number of hours based on: no time = 0, less than 1 hour = 0.5, 1-2 hours = 1.5, 3-5 hours = 4, more than 5 hours = 7. High level indicates more than three hours studying all subjects combined. Medium level indicates more than one hour to three hours studying all subjects combined. Low level indicates one hour or less studying all subjects combined.
Index of Students' Self-Concept in Mathematics	SCM	4.8 (M)	Index based on students' responses to five statements about their mathematics ability: 1) I would like mathematics much more if it were not so difficult; 2) although I do my best, mathematics is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just not talented in mathematics; 4) sometimes, when I do not understand a new topic in mathematics initially, I know that I will never really understand it; 5) mathematics is not one of my strengths. High level indicates student disagrees or strongly disagrees with all five statements. Low level indicates student agrees or strongly agrees with all five statements. Medium level includes all other possible combinations of responses.
Index of Students' Self-Concept in the Sciences [*]	SCS-G SCS-E SCS-B SCS-P SCS-C	4.8 (S)	Index based on students' responses to four statements about their science ability: 1) I would like science much more if it were not so difficult; 2) although I do my best, science is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just not talented in science; 4) science is not one of my strengths. In countries where science is taught as separate subjects, students were asked about each subject area separately. High level indicates student disagrees or strongly disagrees with all four statements. Low level indicates student agrees or strongly agrees with all four statements. Medium level includes all other possible combinations of responses.

Index of Positive Attitudes Towards Mathematics	PATM	4.10 (M)	Index based on students' responses to five statements about mathematics: 1) I like mathematics; 2) I enjoy learning mathematics; 3) mathematics is boring (reversed scale); 4) mathematics is important to everyone's life; 5) I would like a job that involved using mathematics. Average is computed across the five items based on a 4-point scale: 1 = strongly negative; 2 = negative; 3 = positive; 4 = strongly positive. High level indicates average is greater than 3. Medium level indicates average is greater than 2 and less than or equal to 3. Low level indicates average is less than or equal to 2.
Index of Positive Attitudes Towards the Sciences	PATS-G PATS-E PATS-B PATS-P PATS-C	4.10 (S)	Index based on students' responses to five statements about science: 1) I like science; 2) I enjoy learning science; 3) science is boring (reversed scale); 4) science is important to everyone's life; 5) I would like a job that involved using science. Average is computed across the five items based on a 4-point scale: 1 = strongly negative; 2 = negative; 3 = positive; 4 = strongly positive. In countries where science is taught as separate subjects, students were asked about each subject area separately. High level indicates average is greater than 3. Medium level indicates average is greater than 2 and less than or equal to 3. Low level indicates average is less than or equal to 2.
Index of Confidence in Preparation to Teach Mathematics	CPTM	6.3 (M)	Index based on teachers' responses to 12 questions about how prepared they feel to teach different mathematics topics based on a 3-point scale: 1 = not well prepared; 2 = somewhat prepared; 3 = very well prepared. Average is computed across the 12 items for topics for which the teacher did not respond "do not teach". High level indicates average is greater than or equal to 2.75. Medium level indicates average is greater than or equal to 2.25 and less than 2.75. Low level indicates average is less than 2.25.
Index of Confidence in Preparation to Teach Science	CPTS	6.3 (S)	Index based on teachers' responses to 10 questions about how prepared they feel

<p>Index of Emphasis on Conducting Experiments in Science Classes*</p>	<p>ECES-G ECES-E ECES-B ECES-P ECES-C</p>	<p>6.13 (S)</p>	<p>Index based on teachers' reports on the percentage of time they spend demonstrating experiments; teachers' reports on the percentage of time students spend conducting experiments; students' reports on how often the teacher gives a demonstration of an experiment in science lessons; students' reports on how often they conduct an experiment or practical investigation in class. In countries where science is taught as separate subjects, students were asked about each subject area separately, and only teachers who teach a particular subject are included in the index shown for that subject. High level indicates teacher reported that at least 25% of class time is spent on the teacher demonstrating experiments or students conducting experiments, and the student reported that the teacher gives a demonstration of an experiment or the student conducts an experiment or practical investigation in class almost always or pretty often. Low level indicates the teacher reported that less than 10% of class time is spent on the teacher demonstrating experiments or students conducting experiments, and student reported that the teacher gives a demonstration of an experiment and the student conducts an experiment or practical investigation in class once in a while or never. Medium level includes all other possible combinations of responses.</p>
	<p>ECMC</p>	<p>6.13 (M)</p>	<p>Index based on students' reports of the frequency of using calculators in mathematics lessons and teachers' reports of students' use of calculators in mathematics class for five activities: checking answers; tests and exams; routine computation; solving complex problems; and exploring number concepts. High level indicates the student reported using calculators in mathematics lessons almost always or pretty often, and the teacher reported students use calculators at least once or twice a week for any of the tasks. Low level indicates the student reported using calculators once in a while or never, and the teacher reported students use calculators never or hardly ever for all of the tasks. Medium level includes all other possible combinations of responses.</p>

Analyses began with the preparation of prototype exhibits. This required a careful review of the questionnaires, detailed documentation of the variables and response categories, development of general analysis plans (including the cutoffs for high, medium, and low levels of indices), and the specification of any country-specific modified analyses required to account for national adaptations. These plans were documented in analysis notes for each proposed exhibit.

The analysis plans, report outlines, and prototype exhibits were drafted by the International Study Center and reviewed by the coordinators from the Benchmarking jurisdictions in September 2000. Consensus was reached on the reporting priorities: which indices and variables should be reported, how much information should be included, and which trend tables to present. Coordinators reviewed the final data exhibits and draft text in January 2001. The Mathematics and Science Benchmarking reports were published in April 2001 (Martin et al., 2001; Mullis et al., 2001).

16.5 Reporting Student Background Data

Reporting the data from the Student Questionnaire was fairly straightforward. Most of the tables in the TIMSS 1999 Benchmarking reports present weighted percentages of students in each country for each response category, together with the mean achievement (mathematics or science) of those students. International averages are also displayed for each category. In general, jackknife standard errors accompany the statistics reported.³ In addition to the exhibits showing percentages of students overall, the reports include some information separately by gender. For gender-based exhibits, the percentages of boys and girls in each category were displayed, along with the statistical significance of the gender difference.

Reporting student attitudes, self-perceptions, and activities related to science was complicated by the fact that in some countries, science is taught as a general, integrated subject, while in others the fields of science—earth science, physics, chemistry, and biology—are taught as separate subjects. Countries could choose the appropriate version of the Student Questionnaire: the general science version or the separate-subjects version. The

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3. See chapter 11 for a description of the jackknife methodology.

exhibits showing results for questions that differed in the two versions have separate sections for countries that administered each one. The United States and the Benchmarking participants used the general science version.

In the exhibits based on questions about the separate sciences, data were presented in five panels corresponding to the types of science subjects included in the international version of the Student Questionnaires: general/integrated science and the four separate science subjects. Countries appear in the appropriate panels. Countries where earth science or chemistry was not applicable for the eighth grade were excluded from these panels. Also, in some countries combined courses were taught, such as physical science (physics/chemistry) or natural science (biology/earth science). In

Table 16.2 Countries that Administered the Two Versions of the Student Questionnaire

Country	General Version	Separate Science Version			
	General / Integrated Science	Earth Science	Biology	Physics	Chemistry
Australia	●				
Belgium (Flemish)		●	●	●	
Bulgaria		●	●	●	●
Canada	●				
Chile	●				
^a Chinese Taipei	●				
Cyprus	●				
Czech Republic		●	●	●	●
England	●				
Finland		●	●	●	●
Hong Kong, SAR	●				
Hungary		●	●	●	●
^b Indonesia	●				
Iran, Islamic Republic	●				
Israel	●				
Italy	●				
Japan	●				
Jordan	●				
Korea, Republic of	●				
Latvia			●	●	●
Lithuania			●	●	●
Macedonia, Republic of		●	●	●	●
Malaysia	●				
Moldova		●			

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response category exhibit to show the relationship with achievement. For indices computed from teacher data, percentages of students and average achievement are displayed at the high, medium, and low level of the index.

The data obtained from the science teachers were displayed in two ways. The general science data were presented together for all science teachers in each country or jurisdiction. Data specific to the science subject, such as preparation to teach the sciences, instructional time in the sciences, and emphasis on experiments, were presented both for the general science teachers and for the separate-subject teachers. The tracking information provided by schools that identified teachers by the type of course taught to the sampled students — mathematics, physics, biology, chemistry, earth science, or integrated science — was used to organize the panels for exhibits showing data for the separate sciences.

In general, the countries displayed in the separate-science panels correspond to those in Exhibit 16.2.⁴ Exceptions

reporting purposes. When a student was taught a subject by more than one teacher, the student's sampling weight used in reporting results for the subject was distributed among those teachers. The student's contribution to student population estimates thus remained constant regardless of the number of teachers. This was consistent with the policy of reporting attributes of teachers and their classrooms in terms of the percentages of students taught by teachers with these attributes. Exceptions were where student-level variables were based on composite responses of all of the students' teachers in a given subject. Analyses of this type involved computing the sum or determining the highest value reported across all of a student's teachers. The composite values obtained were then used to

curriculum was introduced and its current status; methods used to support and monitor curriculum implementation; use of public examinations and system-wide assessments; percentage of instructional time specified for mathematics and science; differentiation of instruction for students with different abilities or interests; emphasis placed on different approaches and processes; and subjects offered at the eighth grade (science only). For TIMSS countries without a national curriculum (i.e., Australia, Canada, and the United States), composite information that reflected the curriculum across the states or provinces was provided in answer to most questions.

A major function of the Curriculum Questionnaires was to collect information about which topics in mathematics and science were intended to have been taught by the end of the eighth grade. Responses were summarized to give the percentages of the topics in each content area that were intended to be taught to all or almost all of the eighth-grade students in each country or Benchmarking jurisdiction. Detailed information on the percentage of students intended to be taught each mathematics or science topic was reported in the accompanying reference section. Most of these topics were addressed by items on the TIMSS achievement tests. (In the Teacher Questionnaires, these topics were also presented to the mathematics and science teachers, who were asked to what extent they had been covered in class during the year or in previous years.) The curriculum chapters in the Benchmarking reports present both teachers' reports of the topics actually taught (i.e., the implemented curriculum) and reports from Benchmarking Coordinators of topics intended to be taught (i.e., the intended curriculum), providing complementary perspectives on the coverage of the mathematics and science curriculum in each country.

16.9 Reporting Response Rates for Background Questionnaire Data

While it is desirable that all questions included in a data collection instrument be answered by all intended respondents, a certain percentage of non-response is inevitable. Not only do some questions remain unanswered; sometimes entire questionnaires are not completed or not returned. In TIMSS 1999 Benchmarking, since teachers, students, or principals sometimes did not complete the questionnaire assigned to them or some questions within it, certain variables had less than a 100% response rate.

The handling of non-responses varied depending on how the data were to be reported. For background variables that were reported directly, the non-response rates indicate the percentage of students for whom no response was available for a given question. In general, derived variables based on more than one background question were coded as missing if data for any of the required background variables were missing. For index variables, however, cases were coded as missing only if there was no response for more than one-third of the questions used to compute the index; index values would be computed if there were valid data for at least two-thirds of the required variables.

The tables in the TIMSS 1999 Benchmarking reports contain special notations on response rates for the background variables. Although in general the response rates for the student and school background variables were high, some variables and some countries or jurisdictions exhibited less than acceptable rates. The non-response rates were somewhat higher for the teacher background data, particularly in cases where teachers were required to complete more than one questionnaire. Since the student is the unit of analysis, the non-response rates given in the Benchmarking reports always reflect the percentage of students for whom the required responses from students, teachers, or schools were not available. The following special notations were used to convey information about response rates in tables in the TIMSS 1999 Benchmarking reports.⁶

- For a country or jurisdiction where student, teacher or school responses were available for 70% to 84% of the students, “r” appears next to the data.
- Where student, teacher, or school responses were available for 50% to 69% of the students, “s” appears next to the data for that country or jurisdiction.
- When student, teacher or school responses were available for less than 50% of the students, “x” replaces the data.
- When the percentage of students in a particular category fell below 2%, achievement data were not reported in that category. The data were replaced by a tilde (~).

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6. Since the information from the Curriculum Questionnaires was obtained at the national or jurisdiction level, no non-response flags were necessary in exhibits based on these data.

- When data were unavailable for all respondents in a country or jurisdiction, dashes (--) were used in place of data in all of the affected columns.⁷

16.10 Summary

This chapter presented how TIMSS reported and analyzed the background data collected for the Benchmarking Study from students, teachers, schools, and Benchmarking jurisdiction coordinators. It documented how summary indices were created, as well as the consensus approach used in developing the TIMSS 1999 Benchmarking reports.

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