CHAPTER 2

Updating the TIMSS Instruments for Describing Contexts of Student Learning

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Introduction

Since the first TIMSS assessment in 1995, each TIMSS assessment cycle has collected information from participating countries about the national, home, school, and classroom contexts in which students learn mathematics and science. These data enable the exploration of educational factors related to mathematics and science achievement across and within countries. This resource is valuable to countries, researchers conducting secondary analyses, and policymakers. In each TIMSS cycle:

- The Home,[1] School, Teacher, and Student Context Questionnaires are administered together with the mathematics and science assessment. The School, Teacher, and Student Questionnaires are administered with the fourth- and eighth-grade assessments, and the Home Questionnaire is administered with the fourth-grade assessment only.
- Portions of the TIMSS International Results report are devoted to reporting the data collected via the Home, School, Teacher, and Student Questionnaires.
- The TIMSS Encyclopedia publication summarizes countries' responses to the TIMSS Curriculum Questionnaire and contains a chapter from each country describing its mathematics and science curricula and general education policies.

While many contextual variables collected in these instruments remain the same from one TIMSS assessment cycle to the next, the instruments are updated for each assessment to address important areas of current research. As TIMSS transitions to a fully digital assessment, questionnaires are also presented online, not only for the student context questionnaire, but increasingly also for the other instruments. After providing a general description of the contextual instruments administered as part of each TIMSS assessment, this chapter describes the overall approach to the updating process, including revising the TIMSS Context Questionnaire Framework and Context Questionnaires and producing a TIMSS Encyclopedia publication to describe the education systems and national contexts for teaching and learning

1 The Home Questionnaire was first introduced in TIMSS 2011.

mathematics and science in the participating countries. It provides an overview of each step within the development process and highlights the roles and responsibilities of organizations and individuals involved. The end of the chapter focuses on aspects of development specific to TIMSS 2023, including specific updates to the questionnaires.

Description of the TIMSS Context Questionnaires

This section describes the TIMSS Context Questionnaires, including the intended respondents, content covered, and mode of administration. The questionnaires collect a lot of information in the form of groups of items or scales (typically 6–9 items) that measure particular constructs related to mathematics and science achievement.

Home Questionnaire (Early Learning Survey)

The Home Questionnaire is administered to fourth-grade students' parents or guardians. Topics covered include resources for fostering literacy and numeracy skills, parents' highest level of education, employment situations, opinions about their child's school, their child's attendance in preprimary education programs, the emphasis on literacy and numeracy activities in the home before their child attended school (such as reading books, singing songs, writing words and numbers, and counting), and the level of their child's literacy and numeracy skills when beginning school. Countries ask students' parents or guardians to complete the questionnaire online or send the questionnaire to the students' homes in paper-and-pencil format to be completed and returned to the national center.

School Questionnaire

The School Questionnaire is administered to the principals of the schools sampled in the fourth and eighth grades. Topics include the availability of instructional resources, the socioeconomic background of the students attending the school, the school's emphasis on academic success, the need for discipline, and the principals' education. Countries administer the questionnaire either online or via paper and pencil.

Teacher Questionnaire

The Teacher Questionnaire is administered to mathematics and science teachers of the participating students. At the fourth grade, countries administer a single version of the questionnaire, given that the same teachers generally teach the students mathematics and science. At the eighth grade, there are separate questionnaire versions for the students' mathematics teachers and science teachers. Topics include teachers' education, professional development, and career satisfaction, as well as students' readiness for instruction, frequency of various instructional activities, assessment practices, and availability of digital devices for instruction. Countries administer the Teacher Questionnaire either online or via paper and pencil.

Student Questionnaire

The Student Questionnaire is administered online to all students at the fourth and eighth grades after they complete the mathematics and science assessment. The questionnaire gathers information about students' educational experiences at home and school related to mathematics and science. Two versions of the questionnaire are available for eighth-grade students. Countries choose to administer either an integrated science version of the eighth-grade student questionnaire, where all science-related items are phrased to target integrated science instruction, or a separate science subjects version, where science items are repeated for biology, chemistry, physics, and earth science. In countries using the separate science subjects version, students respond to the subject-specific items only for the science subjects in which they were enrolled at the time of the TIMSS assessment.

Curriculum Questionnaire and Encyclopedia

The Curriculum Questionnaire is administered online to the National Research Coordinators (NRCs) of participating countries. This questionnaire collects information about national curriculum policies and practices related to the countries' educational systems and mathematics and science curricula.

The NRCs of participating countries are also asked to contribute a chapter to the TIMSS Encyclopedia, which is edited and compiled into a resource by staff at the TIMSS & PIRLS International Study Center. Collectively, these chapters offer a concise yet rich portrait of educational policies, curricula, and instructional practices.

Development Process for Updating TIMSS Contextual Instruments

The TIMSS & PIRLS International Study Center at Boston College follows a collaborative and iterative process to update the TIMSS contextual framework and questionnaires for each assessment cycle. First, updates are made to the descriptions of the contexts for student learning developed in the previous TIMSS cycle for the TIMSS Context Questionnaire Framework, which outlines the variables and constructs covered by the TIMSS context questionnaire instruments. Then, the questionnaires are updated to address changes to the framework. Several rounds of review are conducted by the TIMSS Questionnaire Item Review Committee (QIRC) and the National Research Coordinators (NRCs) in cooperation with TIMSS & PIRLS International Study Center staff.

The field test is essential for assessing the quality of the home, school, teacher, and student questionnaire instruments and measurement scales before data collection. Particularly for newly developed items, this step in the updating process also allows countries to ensure the items are appropriately translated and adapted to their national contexts so that their data are internationally comparable. During the field test, data is collected on these revised instruments in all participating countries to examine the statistical properties of the questionnaire items and evaluate the relationship of a selection of these items with mathematics and science achievement.

After the field test, the TIMSS & PIRLS International Study Center analysis unit produces data almanacs containing item statistics for each questionnaire item, including the percentage of students responding to each response option, with the corresponding average student achievement in mathematics or science. The staff also prepare context questionnaire scale summaries to evaluate the suitability of the items for scaling. The scales are evaluated for unidimensionality, reliability, and their relationship with achievement (see more information about context scaling in Chapter 15). The TIMSS & PIRLS International Study Center reviews the field test results and updates the questionnaires as necessary for the final round of reviews by the QIRC and NRCs before the main data collection.

Like the context questionnaires, the TIMSS Curriculum Questionnaire is periodically revised to streamline content, enhance clarity, and reduce the response burden for National Research Coordinators. New items are introduced to capture emerging educational trends, such as social-emotional learning, environmentalism, and school sustainability efforts.

The format and content of the TIMSS Encyclopedia, which provides insights into mathematics and science education across participating countries, undergo periodic updates to ensure its relevance and accuracy. The TIMSS Encyclopedia remains a valuable resource for understanding educational systems worldwide by continually revising and aligning the content.

Role of Organizations and Individuals in the Updating Process

Staff at the TIMSS & PIRLS International Study Center are responsible for overseeing the development of the contextual instruments throughout all steps of the process and for working closely with development partners, including TIMSS NRCs and the QIRC. National Research Coordinators (NRCs) play a key role in reviewing the TIMSS context questionnaires, providing feedback, and proposing new topics at NRC meetings throughout the development process, including at TIMSS NRC meetings before the field test and before the main data collection.

The TIMSS Questionnaire Item Review Committee (QIRC) contributes in various ways to developing the context questionnaires. The group comprises survey experts, often NRCs, with experience and expertise in education policy analysis and survey development. Members of the QIRC suggest updates to the contextual framework and assist in reviewing the framework and revising the context questionnaires. This includes conducting an asynchronous review and attending two multi-day synchronous/in-person review and development meetings, one before the field test and one before data collection.

TIMSS 2023 Process for Updating Contextual Instruments

TIMSS 2023 is the eighth TIMSS administration, and much of the contextual data collected with the assessment has become relatively stable across cycles. Updating the TIMSS Context Questionnaires for 2023 followed a similar process to previous TIMSS assessments.

In addition to improvements being made to the questionnaires administered in TIMSS 2019, the primary unique aspect of TIMSS 2023 included a special emphasis on measuring environmental attitudes and behaviors. The TIMSS 2023 Environmental Attitudes and Behaviors Framework was developed as a supplement to the TIMSS 2023 Context Questionnaire Framework to describe the constructs of environmental attitudes and behaviors to be collected in the TIMSS 2023 Context Questionnaires. For this work, the TIMSS & PIRLS International Study Center convened a special committee of experts to review and finalize the constructs.

TIMSS 2023 NRCs and members of the QIRC worked closely with the TIMSS & PIRLS International Study Center to update the TIMSS contextual instruments for 2023. The process began in March 2021 with the 1st TIMSS 2023 QIRC meeting, where TIMSS & PIRLS International Study Center staff and QIRC members discussed priorities for updating the TIMSS 2023 context questionnaires for 2023. Following the meeting, the study center drafted updates to the TIMSS 2019 Context Questionnaire Framework and Context Questionnaires for TIMSS 2023 for review by NRCs and QIRC. In June and July of 2021, NRCs reviewed the draft TIMSS 2023 Context Questionnaire Framework and sent feedback to the study center to incorporate into the draft.

The 2nd TIMSS 2023 QIRC meeting was held virtually in August 2021 to review the draft field test versions of the home, school, teacher, and student context questionnaires. Based on the meeting, the draft field test context questionnaires were revised by the study center for review by NRCs at the 3rd TIMSS 2023 NRC meeting. With NRCs' feedback, the TIMSS & PIRLS International Study Center finalized the TIMSS 2023 Field Test Home, School, Teacher, and Student Questionnaires and provided them to participating countries for translation in November 2021 in preparation for the field test. Based on the field test results, the TIMSS & PIRLS International Study Center drafted refinements to the field test versions of the context questionnaires for the main data collection.

In parallel with countries conducting the TIMSS 2023 Field Test, the TIMSS & PIRLS International Study Center began working to identify additional topics of interest related to environmentalism and sustainability, and a special expert committee convened to finalize the constructs and draft items to add to the proposed TIMSS 2023 Context Questionnaires after the field test. The committee's work is documented in the TIMSS 2023 Environmental Attitudes and Behaviors Framework.

Following the environmental expert group meeting, study center staff finalized the draft additions to the questionnaires for review by QIRC and NRCs together with the other revisions based on the field test results. In August 2022, the 3rd QIRC meeting was held virtually to review the proposed TIMSS 2023 Context Questionnaires together with the field test results. NRCs

conducted a final review of the proposed TIMSS 2023 Home, School, Teacher, and Student Questionnaires at the 5th TIMSS 2023 NRC meeting in September 2022.

Updates to the TIMSS 2019 Curriculum Questionnaire and Encyclopedia chapter outline were drafted at the 3rd QIRC meeting, and NRCs reviewed the proposed material at the 6th TIMSS 2023 NRC meeting in March 2023.

Organizations and Individuals Involved in Updating the TIMSS 2023 Questionnaires

Members of the TIMSS 2023 QIRC are listed in Exhibit 2.1. For TIMSS 2023, a special committee of experts was also convened to develop the TIMSS 2023 Environmental Attitudes and Behaviors Framework and accompanying items across the four questionnaires. Members of this committee are listed in Exhibit 2.2.

Exhibit 2.1: TIMSS 2023 Questionnaire Item Review Committee (QIRC)

Sue Thomson Australian Council for Educational Research Australia	**Kyongah Sang** Korean Institute for Curriculum and Evaluation Korea, Republic of
Heike Wendt Institute for Educational Research and Pedagogical Education Austria	**Trude Nilsen** University of Oslo Norway
Josef Basl Czech School Inspectorate Czech Republic	**Anabela Serrão** IAVE Portugal
Kit-tai Hau The Chinese University of Hong Kong Hong Kong SAR	**Barbara Japelj** Educational Research Institute Slovenia
Laura Palmerio INVALSI Italy	

Exhibit 2.2: TIMSS 2023 Environmental Attitudes and Behaviors Initiative Committee

Franz Bogner University of Bayreuth Germany	**Taciano Milfont** The University of Waikato New Zealand
Ute Harms IPN Leibniz Institute for Science and Mathematics Education Germany	**Trude Nilsen** University of Oslo Norway
Bruce Johnson University of Arizona United States	

Updates to the TIMSS 2023 Context Questionnaires and Encyclopedia Chapters

Many scales and items in the TIMSS 2023 Home, School, Teacher, and Student Questionnaires were brought forward (sometimes with modifications) from TIMSS 2019. However, some new topics were added to the questionnaires to address important areas of current research, such as the use of digital devices in mathematics and science instruction or environmental sustainability. The TIMSS 2023 Curriculum Questionnaire and outline for countries' Encyclopedia chapters were also updated and reorganized to reflect newer areas of interest and facilitate more intuitive reporting.

TIMSS 2023 is a digital assessment, and the use of digital devices for instruction has expanded since the onset of the COVID-19 pandemic in 2020. Given this context, TIMSS 2023 renewed efforts to collect data about technology use for instruction and assessment by updating items from TIMSS 2019. The School Questionnaire asked principals about the availability of modern technology resources, such as digital devices for student use and high-speed internet connection. Teachers were asked additional questions about using digital devices to support students during mathematics and science instruction and any barriers they face in incorporating digital devices into their instruction. The Student Questionnaire included an improved version of the *Digital Self-Efficacy* scale that was administered to countries that transitioned to digital assessment in TIMSS 2019, as well as several items asking how much time students spend using digital devices for school-related tasks.

The Teacher Questionnaire has historically included a series of items inquiring about students' exposure to the mathematics and science topics included in the TIMSS assessment. These items were revised for TIMSS 2023 to reduce ambiguity for respondents and reflect the updated TIMSS 2023 Mathematics and Science Assessment Frameworks.

In response to the increasing urgency of environmental problems, all TIMSS 2023 questionnaire respondents (students, parents, teachers, and principals) completed items related to environmentalism and sustainability. Students reported their attitudes towards the natural environment and the frequency of their enactment of environmentally responsible behaviors. Parents responded to items about how they engage their children in environmental issues. In the educational realm, principals reported on schoolwide initiatives to promote environmentalism and sustainability and teachers indicated particular instructional activities that they employ to teach about these topics.

TIMSS 2019 included a scale measuring teachers' emphasis on science inquiry that included items asking about the frequency of particular hands-on science activities. This scale was reconceptualized for TIMSS 2023. Teachers were asked to indicate their emphasis on particular inquiry activities, such as encouraging students to ask questions about scientific phenomena or having students create representations to explain those phenomena.

Perhaps the most important and universal factor impacting students' learning contexts since 2020 has been the global COVID-19 pandemic. Items were added to the Home and School

Questionnaires to gather information on school closures during various academic years, as well as parents' perceptions of the pandemic's impact on their child's learning. An item about enduring education policy changes emerging from the pandemic was added to the Curriculum Questionnaire.

TIMSS 2023 also retired and reorganized content within the Curriculum Questionnaire and countries' Encyclopedia chapters. Several topics, such as coverage of topics in early childhood education curricula, were deleted from the Curriculum Questionnaire to reduce response burden for National Research Coordinators. Remaining items in the early childhood education section of the Curriculum Questionnaire were reorganized in order to increase comparability and clarity across different countries' contexts. New items were also added to the Curriculum Questionnaire to gather information about any national efforts to promote social-emotional learning, as well as environmentalism and sustainability within schools.