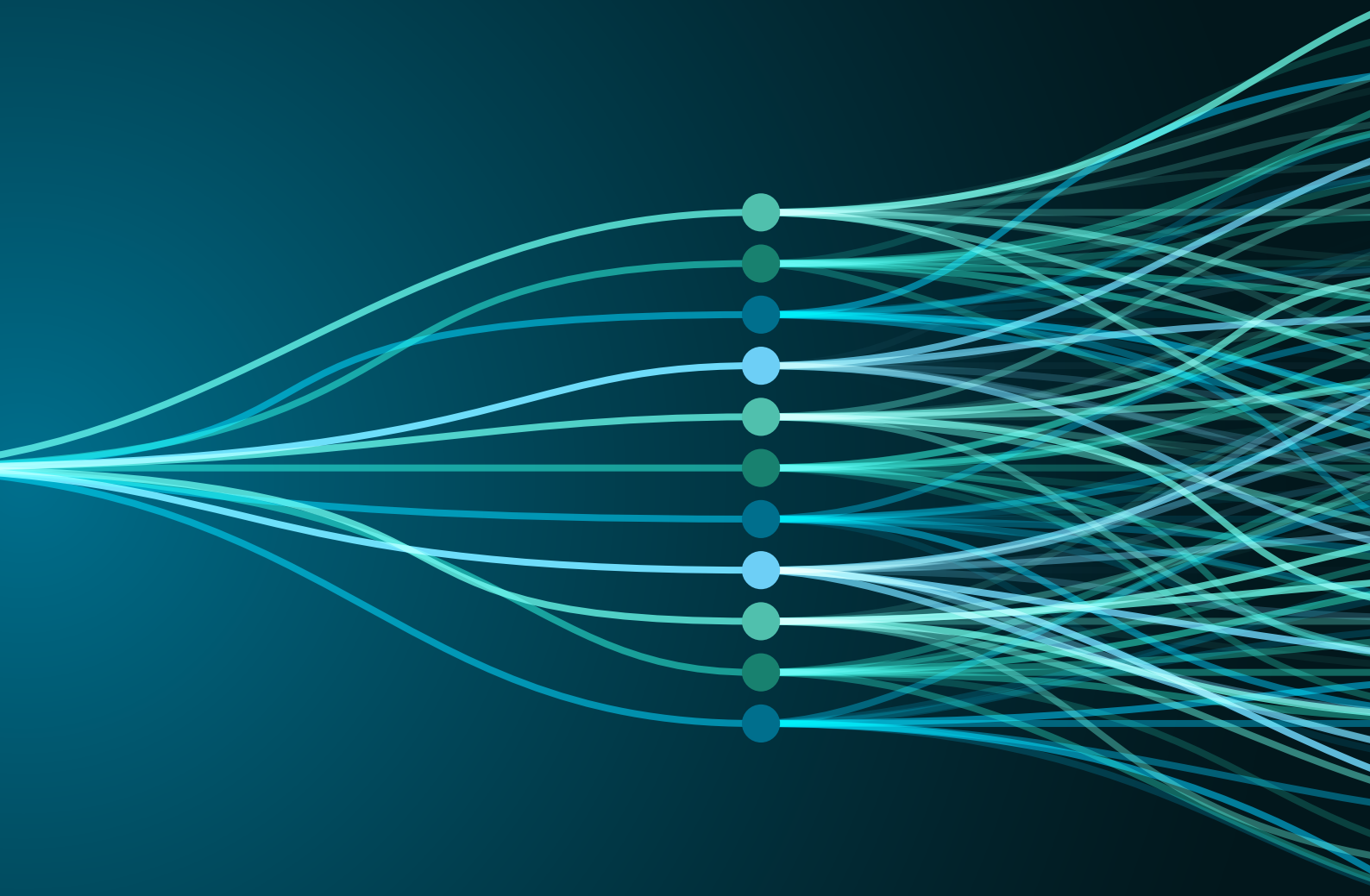
IEA TIMSS LONGITUDINAL

TIMSS 2023 LONGITUDINAL

User Guide for the International Database



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Suggested citation:

Fishbein, B., Taneva, M., & Kowolik, K. (2026). *TIMSS 2023 Longitudinal User Guide for the International Database*. Boston College, TIMSS & PIRLS International Study Center. https://timss2023.org/longitudinal/data

Publishers:
TIMSS & PIRLS International Study Center, Lynch School of Education and Human Development, Boston College, and International Association for the Evaluation of Educational Achievement (IEA)

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Contents

Introduction

Overview

This User Guide is a companion to the TIMSS 2023 Longitudinal International Database, presenting example analyses using the data and describing the content and format of the data files and supplemental materials within the database. This User Guide should be used in conjunction with the *TIMSS 2023 Longitudinal Technical Report* (Fishbein et al., 2025), a special addendum to the *TIMSS 2023 Technical Report* (von Davier et al., 2024), documenting the methods and procedures involved in the development, implementation, and reporting of TIMSS 2023 Longitudinal. Select results from the study are reported in *TIMSS 2023 Longitudinal International Results in Mathematics and Science* (von Davier et al., 2025).

The TIMSS 2023 Longitudinal Study is an extension of TIMSS 2023, conducted to explore how growth in achievement varies within and across education systems, among different subgroups of students, and in relation to students' attitudes, engagement, and school experiences. The results from the two data collections report on students' mathematics and science achievement and related contextual factors at two time points over the course of one school year. The first data collection took place in 2023 for fourth- and eighth-grade students, and the second data collection was in 2024 when most of these students were toward the end of their fifth- and ninth-grade school years, respectively. The data collections in 2023 and 2024 used the same mathematics and science achievement instruments; however, booklets were assigned to students under a carefully designed procedure so that students would not be administered the same items twice.

TIMSS 2023 Longitudinal collected a rich array of information about students' attitudes and experiences as well as about the home, school, and classroom contexts in which they learn mathematics and science, including factors of interest that may relate to learning gains. Students and their parents, teachers, and school principals completed context questionnaires in 2023 and 2024, with some overlapping items between years to allow for examining change in select contextual constructs. Data collected from National Research Coordinators (NRCs), responsible for overseeing the study implementation in each participating country, highlights the national contexts of participating countries, with a focus on education policies and mathematics and science curricula, as well as curricular and policy changes between the grade levels assessed. Together, these contextual data provide internationally comparable evidence about the educational factors related to students' growth in mathematics and science achievement over one year of schooling. In

addition, process data collected through computer-based assessment allows for analyzing students' test navigation behaviors in relation to growth and other contextual factors.

The TIMSS 2023 Longitudinal International Database makes the data collected and analyzed available to researchers, analysts, and other users to support and promote secondary analysis. Nine countries participated in TIMSS 2023 Longitudinal for Grades 4 and 5, and three countries for Grades 8 and 9. The national data contained in the International Database has been authorized to be made publicly available by the participating countries.

About the TIMSS 2023 Longitudinal User Guide

This User Guide describes the content and format of the data and supplemental material in the TIMSS 2023 Longitudinal International Database and presents example analyses with the data. Following this introduction, the User Guide includes the following chapters:

- **Chapter 1** introduces the IEA International Database (IDB) Analyzer Software (IEA, 2025) and presents examples of analyses with the TIMSS 2023 Longitudinal data using this software in conjunction with R/RStudio (R Development Core Team, 2025; Posit Software, 2025).
- **Chapter 2** serves as a reference for information about the structure and contents of the International Database, including detailed descriptions of the various data files, conventions for naming data files and variables, and descriptions of all the supporting documentation provided with the International Database.
- **Chapter 3** describes special R, SPSS, and SAS programs available with the database to needed to make full use of the International Database, including programs to score the achievement items according to the assigned item response codes.

TIMSS 2023 Longitudinal involved complex procedures for drawing student samples, tracking students over time, measuring students' achievement and growth, analyzing the data, and reporting the results. To work effectively with the data, it is important to understand the characteristics of the study. This User Guide should be used in conjunction with the corresponding technical documentation described fully in *TIMSS 2023 Longitudinal Technical Report* and the *TIMSS 2023 Technical Report*. While the User Guide describes the organization and contents of the database, the chapters of the technical reports provide the rationale for the techniques used and for the measures created in the process of data collection and compilation. Throughout this User Guide, references are provided for specific technical report chapters and other documentation and materials where relevant.

About the TIMSS 2023 Longitudinal International Database

The public-use TIMSS 2023 Longitudinal International Database, including the User Guide and supplemental material, is available on the Boston College, TIMSS & PIRLS International Study Center's website and through IEA's Data Repository. The International Database contains the TIMSS 2023 Longitudinal student achievement data files, process data files, student, home, school, and teacher context data files, curriculum data files, national item selections for the Test-Curriculum Matching Analysis (TCMA), and supplemental materials. Exhibit 1 describes the general structure of the International Database, with a brief description of the support materials available for download. Detailed descriptions of the contents are provided in Chapter 2.

Exhibit 1: Summary of Contents of the TIMSS 2023 Longitudinal International Database

User Guide	TIMSS 2023 Longitudinal User Guide for the International Database
Data Files	
Data (R, SPSS, SAS)	Student, process, home, school, and teacher data files
Curriculum Data	Curriculum Questionnaire data Excel files
TCMA Data	Test-Curriculum Matching Analysis data Excel files
Supplemental Material	
Codebooks	List describing all variables in the R, SPSS, and SAS data files
Data Almanacs	Country-level summary statistics for all achievement items and context variables
Achievement Item Information	List with information about achievement items
Context Questionnaire Variables	International versions of the context questionnaires and variable mapping details
National Adaptations Database	Documentation of national adaptations to the context questionnaires
Derived Context Variables	Variables derived from the student, home, teacher, and school context data
Special Programs	R, SPSS, and SAS programs to score achievement items

TIMSS 2023 Longitudinal Restricted-Use Data

Some data collected as part of TIMSS 2023 Longitudinal is available only for restricted use to maintain the security of individual study participants and secure assessment content. Users who require access to restricted-use data to conduct their analyses can submit a request through the IEA Study Data Repository to obtain permission and access to the files.

Restricted-Use Variables

The public-use data files available in the TIMSS 2023 Longitudinal International Database exclude some variables to minimize the risk of disclosing information that could potentially help identify study participants. Restricted-use versions of these files are available by special request, which include the variables listed in Chapter 2 of this User Guide.

Regardless of which database is used, users can replicate all published TIMSS 2023 Longitudinal results with the public-use files.

Event Log Data Files

Additionally, users can request access to TIMSS 2023 Longitudinal Event Log Data Files through the IEA Study Data Repository. These files contain timestamped records from the digital assessment platform about students' navigation behaviors, item response history, and other screen-level interactions with achievement test content. The files can be merged with the public-use International Database files to analyze students' test-taking behaviors and their potential associations with growth and other contextual factors. Documentation accompanying the data files provides detailed information about the types of events recorded in the data to facilitate their use.

Acknowledgments

The TIMSS 2023 Longitudinal Study was a collaborative effort involving numerous individuals and organizations worldwide, including the TIMSS & PIRLS International Study Center, IEA Amsterdam, IEA Hamburg, RTI International, RM Results, and the National Research Coordinators and their teams in the participating countries. A list of organizations and individuals involved in conducting the study is provided in Appendix D of the *TIMSS 2023 Longitudinal International Results* report. In addition, TIMSS 2023 Longitudinal acknowledges the participating students, parents, teachers, and school principals who contributed their time and effort to the study.

CHAPTER 1

Analyzing TIMSS 2023 Longitudinal Data with the IEA IDB Analyzer

Overview

This chapter describes the use of the IEA's IDB Analyzer software (IEA, 2025) for analyzing the TIMSS 2023 Longitudinal data, with a focus on replicating a selection of results in *TIMSS 2023 Longitudinal International Results in Mathematics and Science*. Used in conjunction with R (R Development Core Team, 2025), IBM SPSS Statistics (IBM Corporation, 2025), or SAS (SAS Institute, 2025), the IEA IDB Analyzer provides a user-friendly interface to easily merge and analyze the various data file types of the TIMSS 2023 Longitudinal International Database. The software seamlessly accounts for the sampling information and the multiple imputed achievement scores to produce accurate statistical results.

The TIMSS 2023 Longitudinal International Database includes measures of achievement in overall mathematics and science in both 2023 and 2024, as well as the difference between them (change) to facilitate analysis of average growth between years. Six example analyses described in this chapter illustrate some of the capabilities of the IEA IDB Analyzer (Version 5.0.50), including the computation of percentages of students in specified subgroups, mean student achievement and achievement growth in specified subgroups, and percentages of students reaching the TIMSS International Benchmarks of achievement. The examples use student, home, school, and teacher context data files to replicate some of the TIMSS 2023 Longitudinal results highlighting growth in student achievement and associations with contextual measures. The examples presented here are an extension of those featured in the *TIMSS 2023 User Guide for the International Database*. Users may refer to the *TIMSS 2023 User Guide* for additional examples, including an example using regression analysis.

Users should be able to perform statistical analyses with the IEA IDB Analyzer with a basic knowledge of the TIMSS 2023 Longitudinal International Database. Chapter 2 gives a detailed description of the data files contained in the International Database, including their structure and contents, conventions for naming data files and variables, and descriptions of all the supporting material provided with the International Database.

About the IEA IDB Analyzer

Developed by IEA Hamburg, the IEA IDB Analyzer is a graphical user interface that reads the contents of IEA study data files and generates syntax for R, SPSS, or SAS to combine data files and conduct analysis with these data. The IEA IDB Analyzer enables users to combine data files from IEA's large-scale assessments and conduct analyses without writing programming code. The generated R, SPSS, or SAS syntax accounts for information from the sampling design in the computation of statistics and their standard errors. In addition, it makes appropriate use of plausible values for calculating estimates of achievement scores and their standard errors, combining both sampling variance and imputation variance. Chapter 13 of *TIMSS 2023 Technical Report (Methods and Procedures)* provides details about estimating standard errors in the TIMSS results.

The IEA IDB Analyzer consists of two main modules—the Merge Module and the Analysis Module. The Merge Module is used to create analysis datasets by combining data files of different types (e.g., student and teacher context data files) and from different countries and selecting subsets of variables for analysis. The Analysis Module provides procedures for computing various statistics and their standard errors. A third module converts SPSS files to R format for merging or analyzing in R.

R and RStudio can be downloaded and installed at no cost from r-project.org and posit.co, respectively (R Development Core Team, 2025; Posit Software, 2025). The latest version of R should be used with the IEA IDB Analyzer. When running a script produced by the IDB Analyzer, RStudio will print in the console a list of necessary packages, and check if the user has installed the R packages that are needed to run the analysis. If a required package is not installed, or if it needs updating, a pop-up window will ask to install or update the package.

Installing and Launching the IEA IDB Analyzer

The latest version of the IEA IDB Analyzer is available for download from the IEA Data and Tools website. When the IEA IDB Analyzer application is launched, the main window will appear. Users are first directed to choose SPSS, SAS, or R as their statistical software of choice. The examples in this chapter use R and RStudio. However, the IDB Analyzer interface is the same for all software options.

After selecting the statistical software, users choose to **Convert Files from SPSS to R**, **Access the Merge Module**, **Access the Analysis Module**, **View the Help Manual**, **Access the Sample Files**, or simply **Exit** the application.

The IEA IDB Analyzer has an extensive manual, accessible through the Help button, which users are encouraged to consult for full details on all the functionalities and features of the IEA IDB Analyzer.

Merging TIMSS 2023 Longitudinal Data Files with the IEA IDB Analyzer

The IEA IDB Analyzer uses the data files available from the TIMSS & PIRLS International Study Center's TIMSS 2023 Longitudinal International Database webpage and the IEA Data Repository. The TIMSS 2023 Longitudinal data files are disseminated separately by file type (i.e., data source) and by country. In addition to allowing users to combine datasets from more than one country for cross-country analyses, the Merge Module allows for the combination of data from different sources (e.g., student, home, school, and teacher) into one R, SPSS, or SAS dataset for subsequent analysis.

Before doing any statistical analysis with the TIMSS 2023 Longitudinal International Database, users should download and copy all the data files into a single folder either on their computer or on a server. All files should be within a single folder. For the examples in this chapter, all data files are copied within the folder C:\TIMSS-L2023\DATA\R.

The following steps will create a data file with data from multiple countries and/or multiple file types:

1. Start the IEA IDB Analyzer and click the **Merge Module** button.
2. Under the **Select Data Files and Participants** tab and in the **Select Directory** field, browse to the folder where all data files are located. For example, in Exhibit 1.1, all R data files are located in the folder C:\TIMSS-L2023\DATA\R. The program will automatically recognize and complete the **Select Study**, **Select Cycle**, and **Select Population** fields and list all countries available in this folder as possible to merge. If the folder contains data from more than one IEA study (e.g., TIMSS, PIRLS), cycle (e.g., TIMSS 2023, TIMSS 2023 Longitudinal), or population (e.g., Grades 4 & 5, Grades 8 & 9), users should select the desired combination. TIMSS 2023 Longitudinal, Grades 4 & 5 are selected in Exhibit 1.1.
3. Click a country of interest from the **Available Participants** list and click the **right arrow** (▸) button to move it to the **Selected Participants** panel. Individual countries can be moved directly to the **Selected Participants** panel by double-clicking on the row. To select multiple countries, hold the **Ctrl** key on the keyboard when clicking countries. Click the **tab-right arrow** (▸|) button to move all countries to the **Selected Participants** panel. In Exhibit 1.1, Georgia and Italy are selected.
4. Click the **Next >** button to proceed to the next step. The software will open the **Select File Types and Variables** tab of the Merge Module, as shown in Exhibit 1.2, to select the file types and the variables to be included in the merged data file.

Exhibit 1.1: IEA IDB Analyzer Merge Module—Select Data Files and Participants

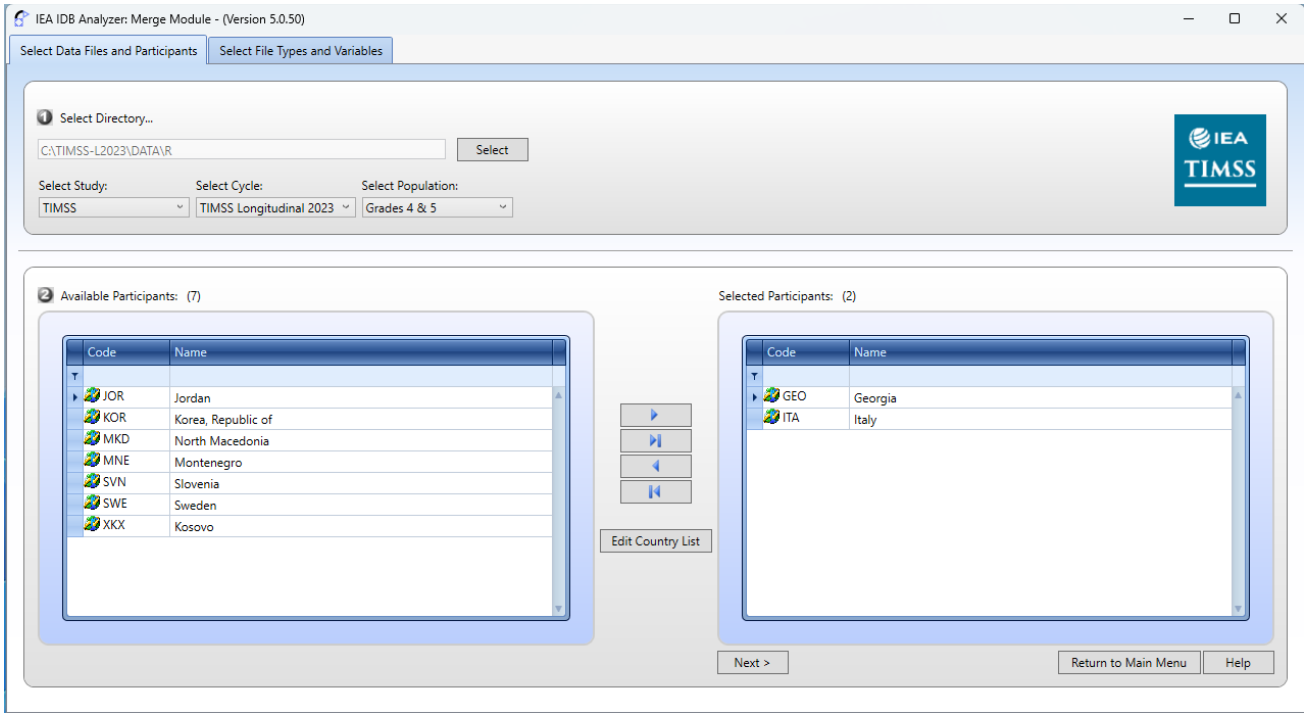
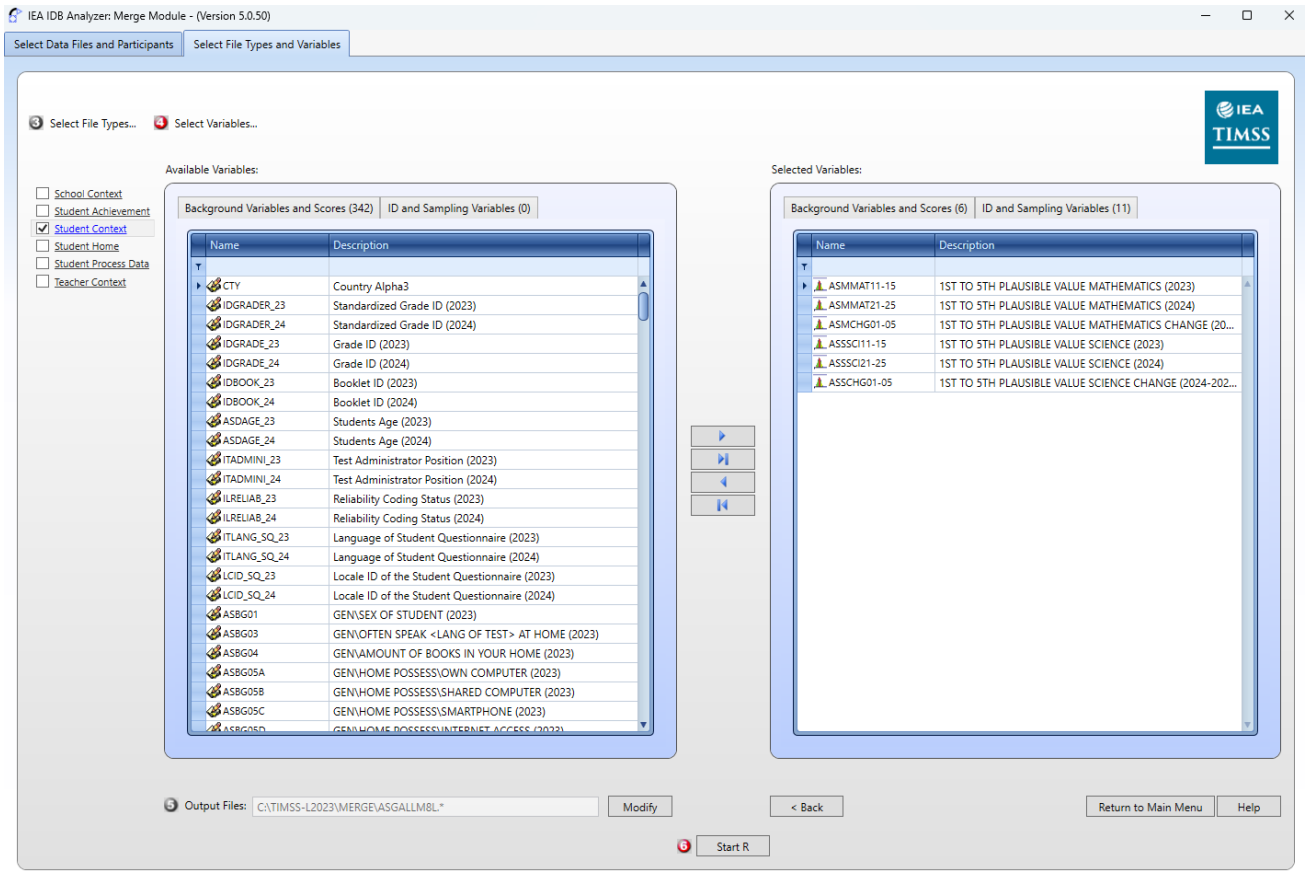


Exhibit 1.2: IEA IDB Analyzer Merge Module—Select File Types and Variables



5. Select the files for merging by checking the appropriate boxes to the left of the window. For example, in Exhibit 1.2, the box next to **Student Context** is checked, indicating the student context data files are selected.
6. Select the variables of interest from the **Available Variables** list in the left panel. As described in Chapter 2 of this User Guide, the Codebook files and the Context Questionnaire Variable downloads provide the variable names for storing the data from all questions in the TIMSS 2023 Longitudinal Context Questionnaires. The labels shown in the description column indicate the year in which the data was collected (2023 or 2024). Variables are selected by clicking on them, then moving them to the **Selected Variables** list by clicking the **right arrow** (▸) button. Clicking the **tab-right arrow** (▸|) button selects and moves all variables to the **Selected Variables** list. Note that there are two tabs under the **Selected Variables** list: **Background Variables and Scores** and **ID and Sampling Variables**. All achievement measures and all identification, tracking, and sampling variables are selected by default.
7. Specify the desired name for the merged data file and the folder where it will be stored in the **Output Files** field by clicking the **Define** (or **Modify**) button. The IEA IDB Analyzer will create an R script (*.R), SPSS syntax file (*.SPS), or SAS syntax file (*.SAS) of the same name and in the same folder, with the code necessary to perform the merge. In the example shown in Exhibit 1.2, the R script file ASGALLM8L.R and the merged data file ASGALLM8L.Rdata both will be created and stored in the folder C:\TIMSS-L2023\MERGE. The merged data file will contain all the variables listed in the **Selected Variables** panel on the right.
8. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution. The IEA IDB Analyzer will display a warning if it is about to overwrite an existing file in the specified folder. The R script can be executed by clicking the **Source** button or pressing **Ctrl+Alt+R** on the keyboard. In SPSS, open the **Run** menu and select the **All** menu option. In SAS, click the **Run** (🏃) button (or select **Submit** in the **Run** menu).

Once R, SPSS, or SAS has completed its execution, it is important to check the software output window or log file for possible warnings. If warnings appear, they should be examined carefully, as they might indicate that the merge process was not performed properly and that the resulting merged data file might not be as expected.[1]

Merging Student and Home Context Data Files

The parents of the students participating in TIMSS 2023 Longitudinal at the fourth and fifth grades were administered a home questionnaire in each data collection year. Their responses to the questions administered in each year are included in the home context

[1] For more information on how to use the IEA IDB Analyzer, and for troubleshooting, users should consult the Help manual.

data files (named beginning with "ASH"). Although home context variables are located in their own files, they are in essence attributes of the students and must be analyzed in the same manner as student context variables. This will require users to merge the home context data files with the student context data files through the Merge Module of the IEA IDB Analyzer. This is an important step to ensure the proper weights and achievement variables are included for analysis.

To merge home data for analysis, select both the **Student Context** and **Student Home** file types in the **Select File Types and Variables** tab. Then, variables of interest need to be selected separately for both file types, as described step-by-step below in the section on Merging Student and Teacher Context Data Files.

Merging Student and School Context Data Files

Because TIMSS includes representative samples of schools, it is possible to compute appropriate statistics with schools as units of analysis. However, the school samples were designed to optimize the student samples and the student-level results. For this reason, it is preferable to analyze school context variables as attributes of the students by merging the school information with the student records. For each school in the longitudinal sample, the school context data files contain variables with data collected in 2023 and 2024.

To merge the student and school context data files, select both the **Student Context** and **School Context** file types in the **Select File Types and Variables** tab of the IEA IDB Analyzer Merge Module. This is an important step to ensure the student weights and achievement variables are included for analysis. The variables of interest to be included in the merged data file are selected separately by file type, as described step-by-step below in the next section.

Merging Student and Teacher Context Data Files

In 2023 and 2024, the mathematics and science teachers of students sampled for TIMSS 2023 Longitudinal completed a context questionnaire for each class taught to the selected students in that school year, answering questions about their education and training, attitudes, and instructional practices for that class. The teachers in the sample do not constitute representative samples of teachers in the participating countries. Rather, they are the teachers of nationally representative samples of students. Therefore, analyses with teacher data should always be made with students as the units of analysis and reported in terms of students who are taught by teachers with a particular attribute.

Because responses to the teacher questionnaires pertain only to the class for the particular school year, teacher questionnaire data should not be combined across years, even when provided by the same teacher. Analyses can be conducted to examine the characteristics or instructional practices of students' teachers for the 2023 school year

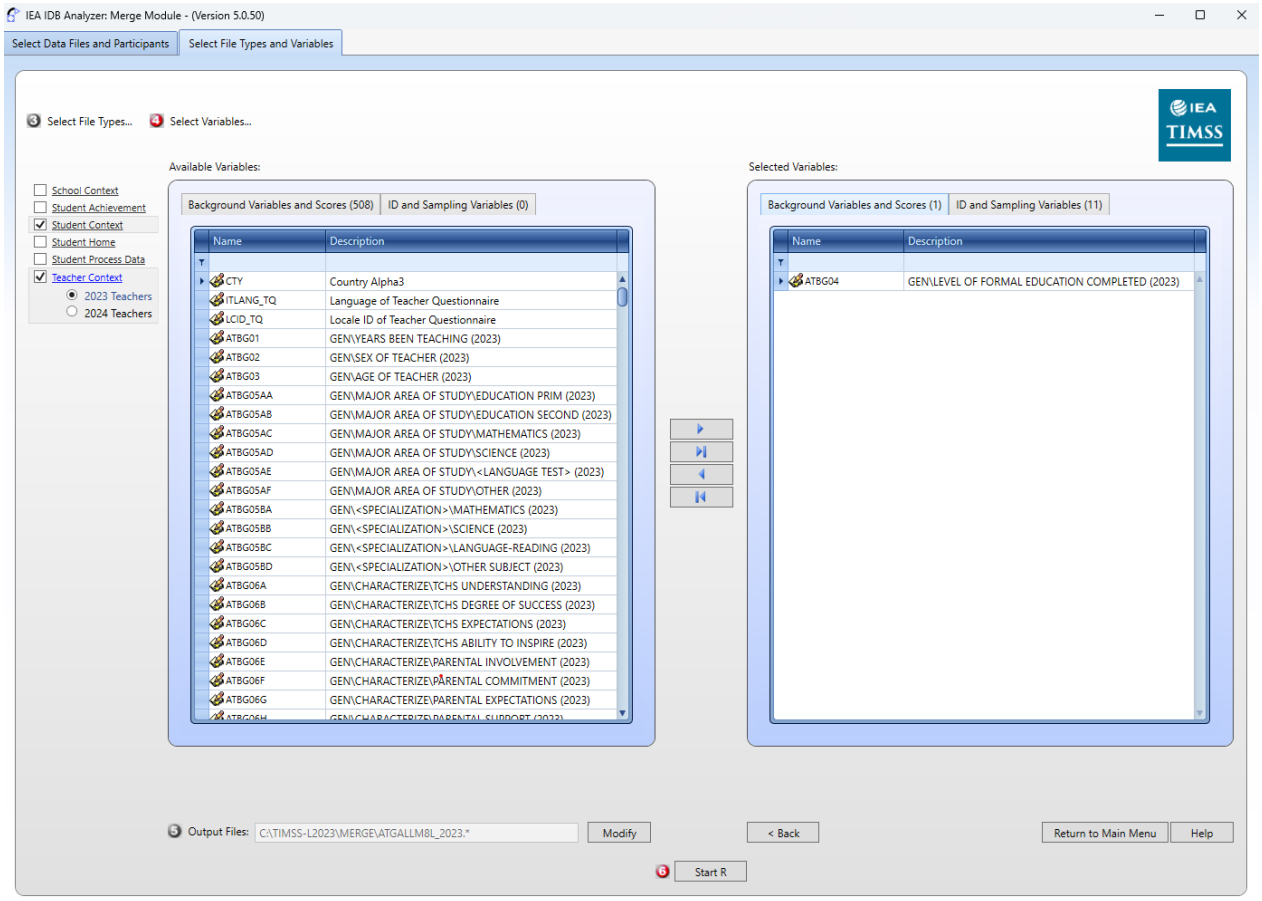
(Grades 4 or 8) or for the 2024 school year (Grades 5 or 9). Therefore, merging student and teacher data requires an additional step to specify the year of interest for the teacher data.

TIMSS 2023 Longitudinal teacher context data are analyzed by linking the student records to their teachers by using the student-teacher linkage data files. The IEA IDB Analyzer does this automatically. To merge teacher data for analysis, after selecting participants for the data file, users can select the **Teacher Context** file type in the **Select File Types and Variables** tab of the IEA IDB Analyzer Merge Module. To analyze student and teacher context data simultaneously, however, both the **Student Context** and **Teacher Context** file types must be selected in the **Select File Types and Variables** tab (see Exhibit 1.3).[2] The variables of interest need to be selected separately for both file types, as follows:

1. Click the checkbox next to the **Student Context** file type so that it appears checked and highlighted. The **Background Variables and Scores** listed in the left-hand **Available Variables** panel will list all variables from the student context data files. This is an important step to ensure the proper weights and achievement variables are included for analyses.
2. By default, all student achievement plausible values, identification, and tracking variables are added to the data file. Select any additional student variables of interest from the left panel and click the **right arrow** (▸) button to move these variables to the **Selected Variables** panel on the right. Click the **tab-right arrow** (▸|) button to select all available variables.
3. Click the checkbox next to the **Teacher Context** file type, then select the year of interest for analysis, either "2023 Teachers" or "2024 Teachers." In Exhibit 1.3, "2023 Teachers is selected."
4. Select the variables of interest from the **Background Variables and Scores** panel on the left in the same manner as in Steps 1 and 2. In Exhibit 1.3, the 2023 variable ATBG04 reporting level of formal education is selected.
5. Specify the desired name for the merged data file and the folder where it will be stored in the **Output Files** field by clicking the **Define/Modify** button. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution.

[2] When working with Grade 8 and 9 teacher data, users can choose either mathematics teachers or science teachers, but not both. For each subject, users must also choose 2023 teachers or 2024 teachers.

Exhibit 1.3: IEA IDB Analyzer Merge Module—Select File Types and Variables for Merging Student and Teacher Context Data



Steps 1 and 2 above are required only if student data (achievement or context) and teacher context data are analyzed simultaneously. Because of the way in which weights are allocated to teachers, a file with teacher data should only be used when analyzing teacher variables.

Merged Data Files for the User Guide Examples

To conduct the analysis examples presented in this chapter, a number of merged data files were created. The examples presented in this User Guide use TIMSS 2023 Longitudinal Grades 4–5 data.

The following merged data files were created:

ASGALLM8L	Merged student context data files
ASHALLM8L	Merged home and student context data files
ACGALLM8L	Merged school and student context data files
ATGALLM8L_2023	Merged 2023 teacher and student context data files
ATGALLM8L_2024	Merged 2024 teacher and student context data files

Although separate files were created for the example analyses with student, home, and school context data, users may also combine data across these respondents for analysis if desired, as the same student-level weights are used to make student-level inferences. However, as described above, teacher data should only be merged for analyzing teacher variables.

Conducting Analyses with the IEA IDB Analyzer

This chapter presents example analyses that produce exhibits in the *TIMSS 2023 Longitudinal International Results in Mathematics and Science* report using the Analysis Module of the IEA IDB Analyzer with the merged data files.

Statistical Procedures in the IEA IDB Analyzer

Many types of analyses can be conducted using the data files from the TIMSS 2023 Longitudinal International Database with the Analysis Module of the IEA IDB Analyzer. The following statistical procedures can be used to produce exhibits in the *TIMSS 2023 Longitudinal International Results in Mathematics and Science* report, including percentages and means, percentages only, benchmarks, percentiles, and linear regression analyses. See the IEA IDB Analyzer Help manual for a full list of statistical procedures.

Percentages and Means

Compute percentages, means, and standard deviations for selected analysis variables by subgroups defined by grouping variable(s). This procedure is used in Examples 1, 2, 4, and 5 of this chapter.

Percentages Only

Compute percentages by subgroups defined by grouping variable(s). This procedure is used in Example 6 of this chapter.

Benchmarks

Compute percentages of students reaching a set of user-specified achievement benchmarks, in particular the TIMSS International Benchmarks, by subgroups defined by grouping variable(s). This procedure is used in Example 3 of this chapter.

Percentiles

Compute the scale score points that separate a given proportion of the distribution of a continuous analysis variable by subgroups defined by the grouping variable(s).

Linear Regression

Compute linear regression coefficients for selected independent variables to predict a continuous dependent variable by subgroups defined by grouping variable(s). An example analysis using linear regression to examine significance of achievement differences between groups can be found in the *TIMSS 2023 User Guide for the International*

Database. When conducting regression analyses to predict student growth with TIMSS 2023 Longitudinal data, it is recommended that users define 2024 achievement as the dependent variable and control for 2023 achievement as a predictor alongside context variables of interest.

Definitions of Analysis Variables in the IEA IDB Analyzer

The various variables required to conduct an analysis are input into specific variable fields according to their purpose. The variables listed below are relevant to the examples in this chapter. All available features of the IEA IDB Analyzer are described extensively in its Help manual.

Grouping Variables

This is a list of variables to define subgroups of interest. The list must consist of at least one grouping variable. By default, the IEA IDB Analyzer includes the variable IDCNTRY used to distinguish the participating countries. Additional variables can be selected from the available list. If the **Exclude Missing From Analysis** option is checked, only cases that have non-missing values in the grouping variables will be used in the analysis. If it is not checked, missing values become reporting categories.

Analysis Variables

This is a list of variables for which means, percentages, correlations, or percentiles are to be computed. Usually, more than one analysis variable can be selected. To compute statistics based on achievement scores, after choosing the **Statistic Type**, it is necessary to select the **Use PVs** option in the **Plausible Value Option** drop-down menu and select the achievement scores of interest in the **Plausible Values** field.

Plausible Values (PVs)

This section is used to identify the set of plausible values to be used when achievement or growth measures are the analysis variable for computing statistics. After choosing the **Statistic Type**, select the **Use PVs** option in the **Plausible Value Option** drop-down menu before specifying the achievement measure of interest in the **Plausible Values** field.

Achievement Benchmarks

These are the values that will be used as cut points on an achievement scale, selected in the **Plausible Values** section, for computing the percentages of students meeting the specified benchmarks. Multiple cut points can be specified, each separated by a blank space. A drop-down menu is available to select the four TIMSS International Benchmarks.

Percentiles

These are the percentiles that will be calculated from the distribution of a continuous analysis variable. Achievement PVs can be selected as analysis variables. Select the **Use PVs** option in the **Plausible Value Option** drop-down menu and select the achievement

scale of interest in the **Plausible Values** field. Multiple percentiles can be specified, each separated by a blank space.

Weight Variable

This is the sampling weight variable that will be used in the analysis. The IEA IDB Analyzer automatically selects the appropriate weight variable for analysis based on the file types included in the merged data file. Generally, this will be TOTWGT, but SENWGT and HOUWGT also are available for student-level analyses with student, home, or school context data. For analyzing teacher data, MATWGT_23 or MATWGT_24 should be used to analyze mathematics teacher data and SCIWGT_23 or SCIWGT_24 should be used to analyze science teacher data. The Sampling and Weighting Variables section in Chapter 2 of this User Guide provides more information on the sampling weights.

Conducting Analyses with TIMSS Student Achievement and Context Data

The examples in this section use the merged TIMSS 2023 Longitudinal Grades 4–5 student context data file ASGALLM8L described earlier in the section on Merging Data Files with the IEA IDB Analyzer. Example 1 computes country-level average growth in achievement as well as achievement for Grade 4 (2023) and Grade 5 (2024), respectively. Example 2 computes national average growth separately for girls and boys, as well as differences in achievement between girls and boys for each grade level (time point). Lastly, Example 3 computes the percentages of students reaching each of the TIMSS International Benchmarks of Mathematics Achievement for each grade level.

Example 1—Analysis of Average Growth in Achievement and Achievement by Grade Level

This first example replicates the analysis of the overall distribution of growth in mathematics achievement and mathematics achievement by grade level, presented in Exhibit 1.1.1a and Exhibit 1.1.1b of *TIMSS 2023 Longitudinal International Results in Mathematics and Science.* These are repeated below in Exhibit 1.4a and Exhibit 1.4b.

Because the results in Exhibits 1.4a and 1.4b are based on plausible values, users should make sure they are included as selected variables when creating the file using the Merge Module and also indicate that the analysis will make use of them with the **Use PVs** option. The **Percentages and Means** statistic type with the **Use PVs** option selected will compute average growth or achievement based on plausible values and their respective standard errors, as well as 95% confidence intervals and standard deviations. The percentiles depicted graphically in Exhibit 1.4b can be produced using the Percentiles statistic type (steps not described here).

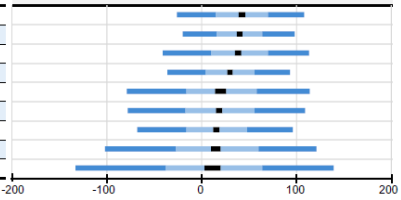
Exhibit 1.4a: International Results Exhibit of Example 1—Analysis of Average Growth in Achievement

Mathematics • Grades 4–5

Exhibit 1.1.1a: Average Growth in Mathematics Achievement and Change Distributions

Country	Grade 4 Average Achievement	Grade 5 Average Achievement	Average Growth
Slovenia	513 (1.8)	555 (1.9)	42 (1.7)
Korea, Rep. of	595 (2.5)	635 (2.5)	40 (1.6)
[2] Italy	512 (2.7)	550 (2.7)	38 (1.9)
[2] Sweden	531 (2.7)	560 (2.8)	30 (1.6)
[1] Georgia	497 (3.2)	517 (3.2)	20 (3.1)
[2] Montenegro	476 (1.8)	494 (1.6)	18 (1.7)
[2] Kosovo	451 (3.1)	467 (3.4)	16 (1.8)
North Macedonia	473 (3.2)	488 (3.5)	15 (2.5)
Jordan	428 (5.3)	440 (4.7)	12 (4.5)

Distribution of Change in Achievement



( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
See Appendix A.2 for population coverage notes 1 and 2.

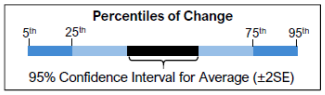


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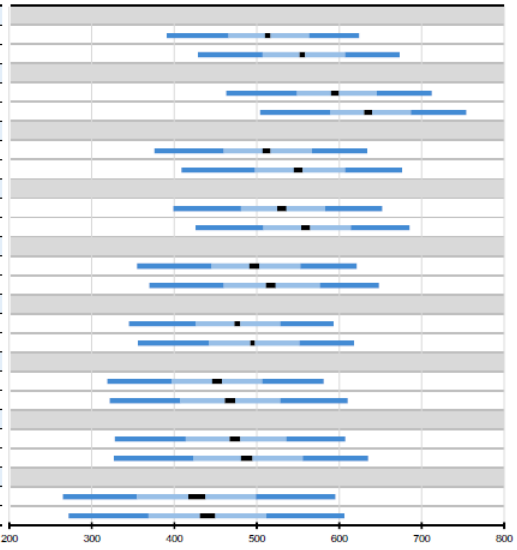
Exhibit 1.4b: International Results Exhibit of Example 1—Analysis of Average Achievement by Grade Level

Mathematics • Grades 4–5

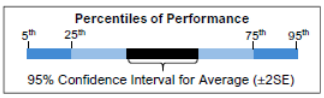
Exhibit 1.1.1b: Average Mathematics Achievement and Scale Score Distributions

Country	Average Scale Score	95% Confidence Interval for Average Achievement	Standard Deviation
Slovenia			
Grade 4	513 (1.8)	510 - 517	72 (1.1)
Grade 5	555 (1.9)	552 - 559	74 (1.0)
Korea, Rep. of			
Grade 4	595 (2.5)	590 - 600	76 (2.2)
Grade 5	635 (2.5)	630 - 640	77 (2.0)
[2] **Italy**			
Grade 4	512 (2.7)	507 - 517	78 (1.6)
Grade 5	550 (2.7)	545 - 556	81 (1.6)
[2] **Sweden**			
Grade 4	531 (2.7)	525 - 536	76 (1.4)
Grade 5	560 (2.8)	555 - 566	78 (1.7)
[1] **Georgia**			
Grade 4	497 (3.2)	491 - 503	81 (1.5)
Grade 5	517 (3.2)	511 - 524	85 (1.4)
[2] **Montenegro**			
Grade 4	476 (1.8)	472 - 479	75 (1.2)
Grade 5	494 (1.6)	491 - 497	80 (1.2)
[2] **Kosovo**			
Grade 4	451 (3.1)	445 - 457	79 (1.9)
Grade 5	467 (3.4)	461 - 474	87 (1.7)
North Macedonia			
Grade 4	473 (3.2)	467 - 480	86 (1.6)
Grade 5	488 (3.5)	481 - 495	94 (1.7)
Jordan			
Grade 4	428 (5.3)	417 - 438	101 (2.8)
Grade 5	440 (4.7)	430 - 449	102 (2.5)

Mathematics Achievement Distribution



( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
See Appendix A.2 for population coverage notes 1 and 2.



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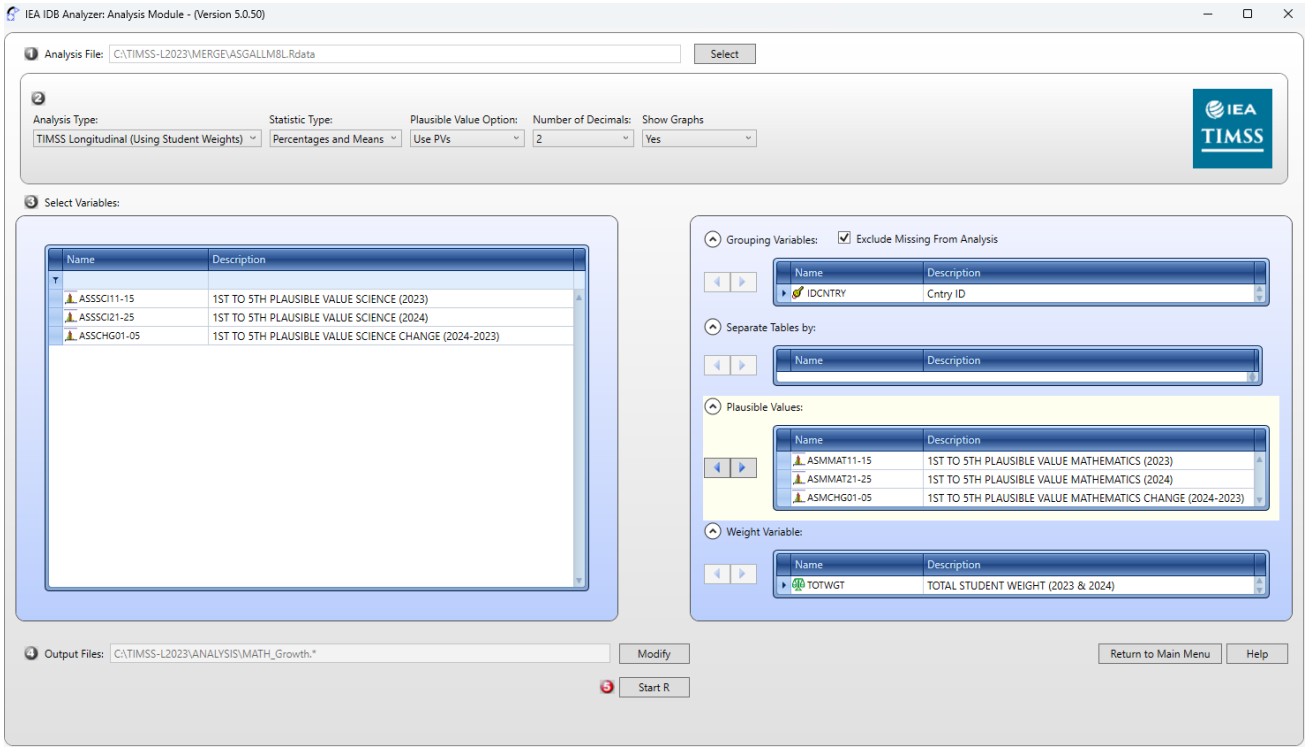
After creating the merged data file ASGALLM8L, the **Analysis Module** of the IEA IDB Analyzer is used to conduct the analysis for both exhibits in the following steps. The completed Analysis Module for this example is shown in Exhibit 1.5.

Exhibit 1.5: IEA IDB Analyzer Analysis Module Setup for Example 1—Analysis of Average Growth in Achievement and Achievement by Grade Level



1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ASGALLM8L as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS Longitudinal (Using Student Weights)** as the **Analysis Type**.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. The default value in the **Number of Decimals** drop-down menu is **2**. Changing this value affects only the number of visible decimal places in the output files.
7. The default value selected in the **Show Graphs** menu is **Yes**. For this analysis, selecting **Yes** will produce two graphs in the output file: one graph showing average achievement by country (bar graph in R and SPSS; line graph in SAS), and one bar graph for the weighted percentage of the total students in each country.
8. The IDB Analyzer automatically selects the variable IDCNTRY for the **Grouping Variables**. No additional grouping variables are needed for this analysis. The IEA IDB Analyzer automatically checks the **Exclude Missing From Analysis**, which

excludes cases with missing values on the grouping variables from the analysis. This box should be checked for this analysis.

9. The **Separate Tables by** field should be empty for this analysis. This field is used to separately analyze several grouping variables or several continuous dependent (non-achievement) variables. See the IEA IDB Analyzer Help manual for more information.
10. Specify the outcome measures to be used for the analysis by first clicking the **Plausible Values** field to activate it. Then, select the desired measures from the list of available variables in the left panel and move it to the right **Plausible Values** field by clicking the **right arrow** (▸) button. Because this analysis reports Grade 4 Average Achievement, Grade 5 Average Achievement, and Average Growth, three sets of measures are selected: ASMMAT11–15 (2023 achievement), ASMMAT21–25 (2024 achievement), and ASMCHG01–05 (growth).
11. The **Weight Variable** is selected automatically by the software; TOTWGT is selected by default because this example analysis uses student data.
12. Specify the desired name for the output files and the folder they will be stored in by clicking the **Define** (or **Modify**) button in the **Output Files** field. The IEA IDB Analyzer also will create an R script (*.R), SPSS syntax file (*.SPS), or SAS syntax file (*.SAS) of the same name and in the same folder, with the code necessary to perform the analysis. In Exhibit 1.5, the syntax file MATH_Growth.R and the output files with the same name will be created and stored in the C:\TIMSS-L2023\ANALYSIS folder.
13. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution. The IEA IDB Analyzer will display a warning if it is about to overwrite an existing file in the specified folder. The R script can be executed by clicking the **Source** button or pressing **Ctrl+Alt+R** on the keyboard. In SPSS, open the **Run** menu and select the **All** menu option. In SAS, click the **Run** (🏃) button (or select **Submit** in the **Run** menu).

The IDB Analyzer produces and saves a set of results output in multiple file formats for each outcome measure, within the same folder specified in Step 12. The output files are named using the same name specified for the syntax file in Step 12. The reports are named with a suffix indicating the outcome variable—"_ASMMAT1" for 2023 achievement, "_ASMMAT2" for 2024 achievement, and "_ASMCHG0" for growth. The IEA IDB Analyzer produces an additional results file in Rdata and xlsx formats, named with the suffix "_sig," that indicates the significance of differences in the outcome variable (achievement or growth) by the grouping variable (IDCNTRY). For this example, the "_sig" output indicates the significance of the differences between each possible combination of two countries. For a full list and description of the output files created by the IDB Analyzer, refer to the Help Manual.

Exhibit 1.6 displays the results in the R output for ASMCHG0 for Average Growth, as reported in Exhibit 1.4a. The results are presented in the "Report" section of the HTML output produced by R.

Exhibit 1.6: R Output for Example 1—Analysis of Average Growth in Achievement

Report

Analysis for ASMCHG0 by IDCNTRY

Cntry ID	N of Cases	Sum of TOTWGT	Sum of TOTWGT (s.e.)	Percent	Percent (s.e.)	ASMCHG0 (Mean)	ASMCHG0 (s.e.)	Confidence Interval (95)	Std.Dev.	Std.Dev. (s.e.)	Percent Missing	Number of Variance Strata
Georgia	4491	46933	646.95	3.69	0.06	20.13	3.10	14 to 26	59.38	1.95	0.00	79
Italy	4610	476832	9241.51	37.45	0.60	38.39	1.85	35 to 42	48.68	2.15	0.00	76
Jordan	6172	170331	5825.10	13.38	0.43	11.90	4.46	3 to 21	82.84	3.05	0.00	115
Korea, Republic of	4507	398373	11591.04	31.28	0.69	40.14	1.64	37 to 43	36.24	0.77	0.00	78
Kosovo	4747	22969	623.21	1.80	0.05	16.23	1.83	13 to 20	50.61	1.02	0.00	86
Montenegro	4559	6875	78.45	0.54	0.01	18.09	1.68	15 to 21	56.89	1.07	0.00	125
Slovenia	5015	17542	338.85	1.38	0.03	42.09	1.74	39 to 45	40.78	1.09	0.00	75
Sweden	5358	115474	3292.66	9.07	0.27	29.52	1.57	26 to 33	39.86	0.94	0.00	81
North Macedonia	4866	18050	240.33	1.42	0.03	14.85	2.48	10 to 20	67.02	1.46	0.00	87
Table Average	NA	NA	NA	11.11	0.12	25.71	0.81	24 to 27	53.59	0.55	NA	NA

Each country's results are presented on a single line, with countries ordered sequentially according to their numeric ISO code (see Exhibit 2.2). Results for "Table Average" are based on all countries included in the data file. The countries are identified in the first column (Cntry ID) and the second column reports the number of valid cases (N of Cases). The third column reports the sum of weights of the sampled students (Sum of TOTWGT), indicating the estimated total fourth/fifth grade population. The fourth column is the standard error of the sum of weights (Sum of TOTWGT (s.e.)). The next two columns report the weighted percentage of students by the grouping variable (Percent), which for this analysis is the percentage of all students in each country out of the total, and its standard error (Percent (s.e.)). The next two columns report the estimated average for the outcome variable, in this case change in mathematics achievement (ASMCHG0 (Mean)) and its standard error (ASMCHG0 (s.e.)) ("mnpv" and "mnpv_se" in Excel). These are the values reported in the "Average Growth" column of Exhibit 1.4a. To report average achievement by grade level, as shown in both Exhibit 1.4a and Exhibit 1.4b, users should refer to the numbers in the outputs for ASMMAT1 (2023 achievement for Grade 4) and ASMMAT2 (2024 achievement for Grade 5).

Exhibit 1.4b also reports a 95% confidence interval and standard deviation for the country's average achievement at each grade. In the results output, the "Confidence Interval (95)" column reports the 95% confidence interval for the mean. The confidence

interval provides a score range around the estimated mean that illustrates the uncertainty in this estimate, which is based on a sample of students in a selection or subset of classrooms within a sample of schools in each country. Intervals constructed in this way around the estimated average have a 95% chance to include the true average of the country's achievement.

The standard deviation of the achievement scores (Std.Dev.) and its standard error (Std.Dev. (s.e.)) are reported in the next two columns. The last two columns report the percentage of cases with missing data on the outcome variable (Percent Missing) and the number of jackknife zones used for computing standard errors (Number of Variance Strata), respectively (see Chapter 13 of *TIMSS 2023 Technical Report* for information about jackknifing).

As shown in the first line of Exhibit 1.6, Georgia had valid data for 4,491 students, and these students represented a population of 46,933 eligible students indicated by the sum of weights. The average change in mathematics achievement between Grade 4 (2023) and Grade 5 (2024) in Georgia was 20.13 scale score points (standard error of 3.10). The 95% confidence interval for Georgia's average growth ranged from 14 to 26 points, and the standard deviation was 59.38 (standard error of 1.95).

Example 2—Analysis of Average Growth and Achievement for Girls and Boys

The second example investigates growth between years for girls and boys, respectively, as well as differences in mathematics achievement between girls and boys by grade level for 2023 (Grade 4) and 2024 (Grade 5). These results, presented in Exhibit 1.1.2a and Exhibit 1.1.2b of *TIMSS 2023 Longitudinal International Results in Mathematics and Science*, are repeated below in Exhibits 1.7a and Exhibits 1.7b.

The results of this analysis are based on characteristics of students. In general, before conducting analyses using TIMSS contextual variables, users should refer to the relevant codebook for the data file to identify the appropriate variables and understand the coding scheme. The codebook for student context data files indicates that the tracking variable ITSEX contains categorical information on the gender of students (and is typically preferred for analysis instead of the student-reported questionnaire variable).

The **Analysis Module** of the IEA IDB Analyzer is used to conduct this analysis. The **Percentages and Means** statistic type and the **Use PVs** plausible value option will allow us to compute the percentages of students in each gender group and their average achievement based on plausible values and their respective standard errors.

Exhibit 1.7a: International Results Exhibit of Example 2—Analysis of Average Growth for Girls and Boys

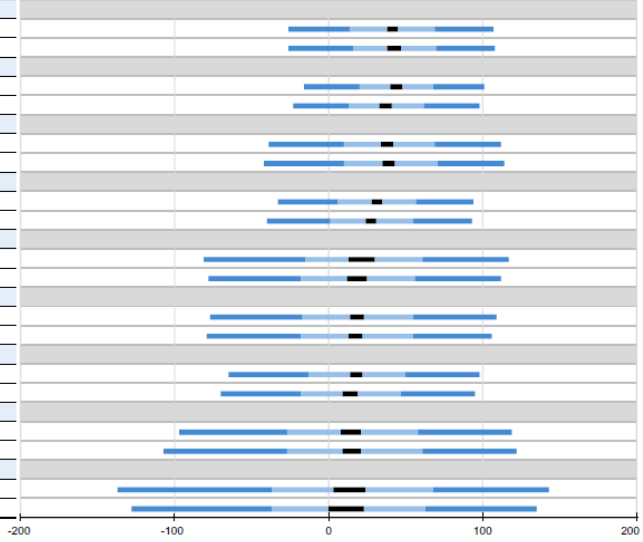
Mathematics • Grades 4–5

IEA TIMSS LONGITUDINAL 2023 – 2024

Exhibit 1.1.2a: Average Growth in Mathematics Achievement for Girls and Boys

Country	Percent of Students	Average Growth
Slovenia		
Girls	49 (0.7)	42 (1.7)
Boys	51 (0.7)	43 (2.2)
Korea, Rep. of		
Girls	50 (0.5)	43 (2.0)
Boys	50 (0.5)	38 (2.0)
[2] **Italy**		
Girls	48 (0.7)	38 (2.0)
Boys	52 (0.7)	38 (2.2)
[2] **Sweden**		
Girls	51 (0.8)	32 (1.8)
Boys	49 (0.8)	27 (1.8)
[1] **Georgia**		
Girls	50 (0.8)	21 (4.2)
Boys	50 (0.8)	19 (3.3)
[2] **Montenegro**		
Girls	48 (0.6)	19 (2.2)
Boys	52 (0.6)	17 (2.2)
[2] **Kosovo**		
Girls	48 (0.9)	18 (2.1)
Boys	52 (0.9)	15 (2.5)
North Macedonia		
Girls	50 (0.8)	15 (3.3)
Boys	50 (0.8)	15 (3.0)
Jordan		
Girls	52 (2.6)	13 (5.3)
Boys	48 (2.6)	11 (5.8)

Distribution of Change in Achievement



Students' gender information was obtained from school tracking data.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
See Appendix A.2 for population coverage notes 1 and 2.

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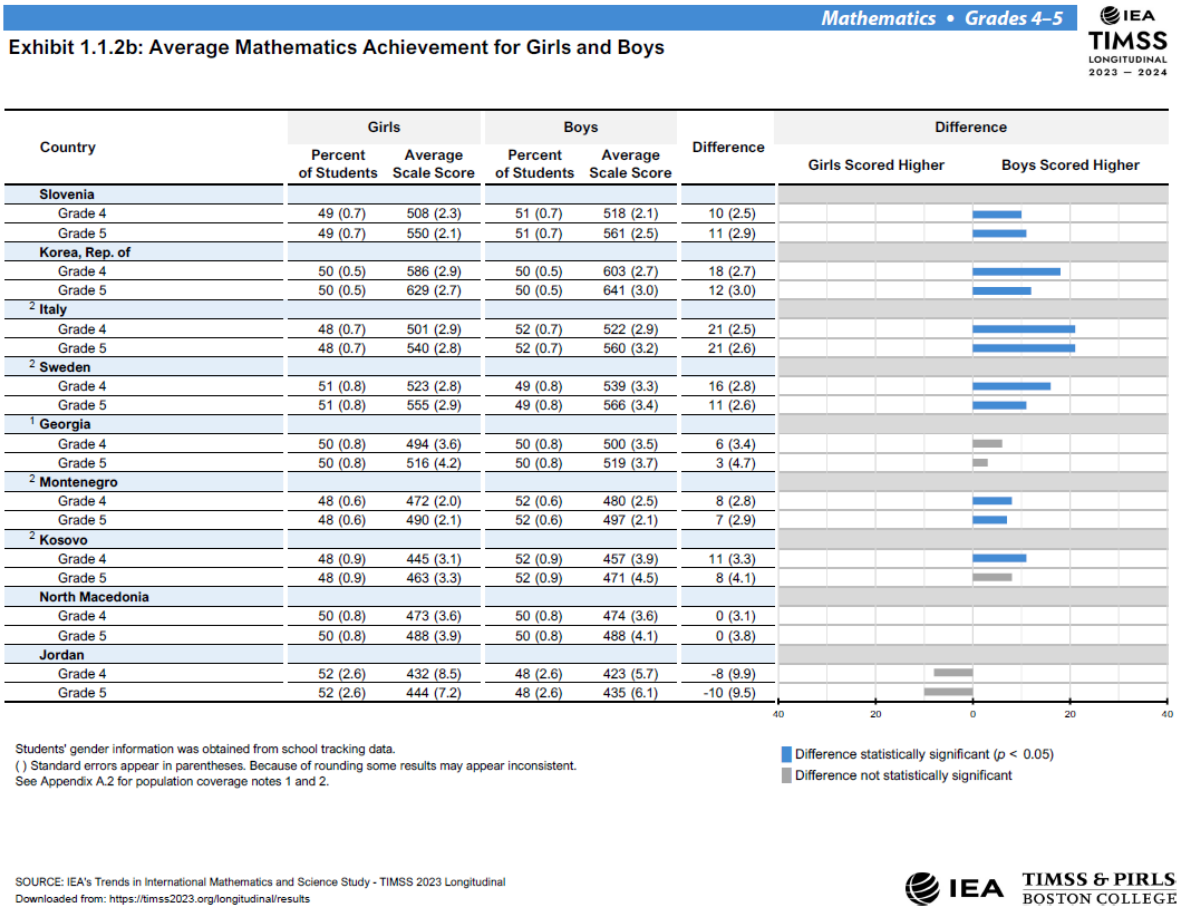
Exhibit 1.7b: International Results Exhibit of Example 2—Analysis of Average Achievement for Girls and Boys by Grade Level



Mathematics • Grades 4–5

Exhibit 1.1.2b: Average Mathematics Achievement for Girls and Boys

IEA TIMSS LONGITUDINAL 2023 – 2024

Country	Girls		Boys		Difference	Difference
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher / Boys Scored Higher
Slovenia						
Grade 4	49 (0.7)	508 (2.3)	51 (0.7)	518 (2.1)	10 (2.5)	
Grade 5	49 (0.7)	550 (2.1)	51 (0.7)	561 (2.5)	11 (2.9)	
Korea, Rep. of						
Grade 4	50 (0.5)	586 (2.9)	50 (0.5)	603 (2.7)	18 (2.7)	
Grade 5	50 (0.5)	629 (2.7)	50 (0.5)	641 (3.0)	12 (3.0)	
[2] **Italy**						
Grade 4	48 (0.7)	501 (2.9)	52 (0.7)	522 (2.9)	21 (2.5)	
Grade 5	48 (0.7)	540 (2.8)	52 (0.7)	560 (3.2)	21 (2.6)	
[2] **Sweden**						
Grade 4	51 (0.8)	523 (2.8)	49 (0.8)	539 (3.3)	16 (2.8)	
Grade 5	51 (0.8)	555 (2.9)	49 (0.8)	566 (3.4)	11 (2.6)	
[1] **Georgia**						
Grade 4	50 (0.8)	494 (3.6)	50 (0.8)	500 (3.5)	6 (3.4)	
Grade 5	50 (0.8)	516 (4.2)	50 (0.8)	519 (3.7)	3 (4.7)	
[2] **Montenegro**						
Grade 4	48 (0.6)	472 (2.0)	52 (0.6)	480 (2.5)	8 (2.8)	
Grade 5	48 (0.6)	490 (2.1)	52 (0.6)	497 (2.1)	7 (2.9)	
[2] **Kosovo**						
Grade 4	48 (0.9)	445 (3.1)	52 (0.9)	457 (3.9)	11 (3.3)	
Grade 5	48 (0.9)	463 (3.3)	52 (0.9)	471 (4.5)	8 (4.1)	
North Macedonia						
Grade 4	50 (0.8)	473 (3.6)	50 (0.8)	474 (3.6)	0 (3.1)	
Grade 5	50 (0.8)	488 (3.9)	50 (0.8)	488 (4.1)	0 (3.8)	
Jordan						
Grade 4	52 (2.6)	432 (8.5)	48 (2.6)	423 (5.7)	-8 (9.9)	
Grade 5	52 (2.6)	444 (7.2)	48 (2.6)	435 (6.1)	-10 (9.5)	

Students' gender information was obtained from school tracking data.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
See Appendix A.2 for population coverage notes 1 and 2.

Difference statistically significant ($p < 0.05$)
Difference not statistically significant

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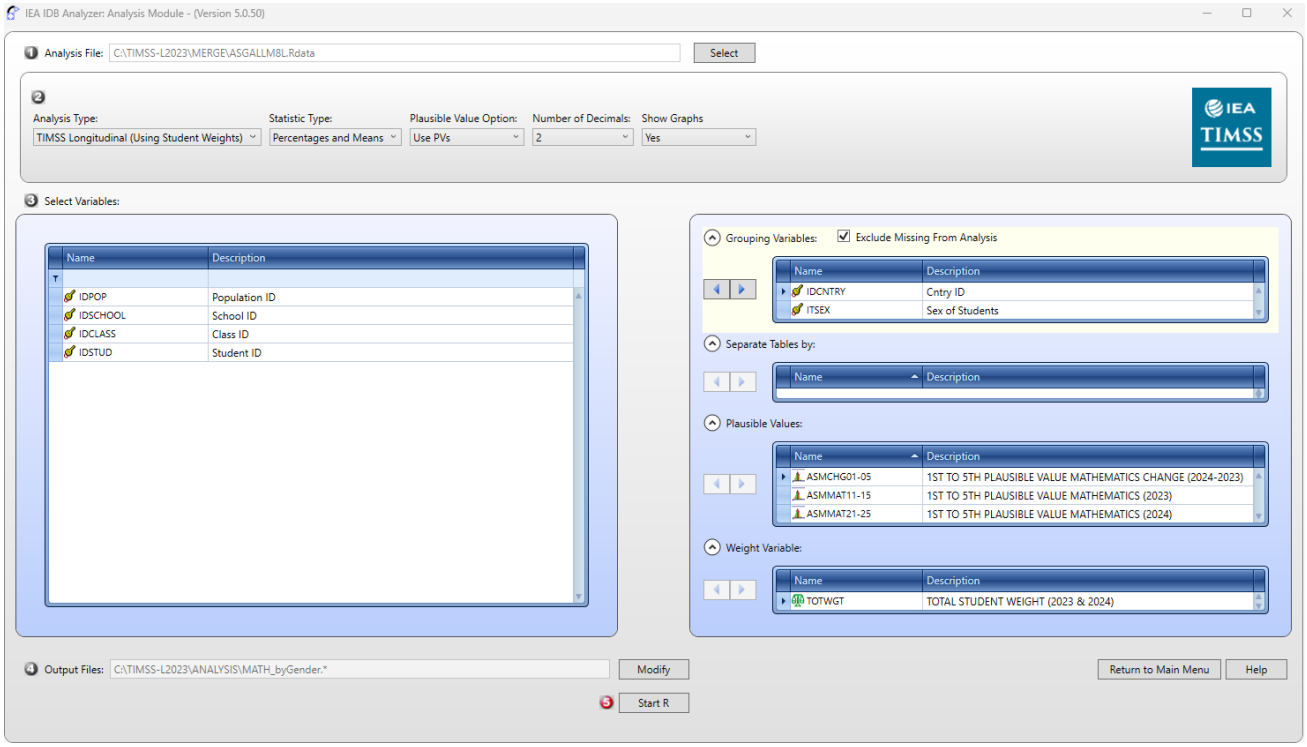
Exhibit 1.8 presents the completed Analysis Module for this example, based on the following steps.

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ASGALLM8L as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS Longitudinal (Using Student Weights)** as the **Analysis Type**. TOTWGT is used by default because the analysis uses student data.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. The default value in the **Number of Decimals** drop-down menu is **2**. Changing this value affects only the number of visible decimal places in the output files.

Exhibit 1.8: IEA IDB Analyzer Analysis Module Setup for Example 2—Analysis of Average Growth and Achievement for Girls and Boys



7. The default value selected in the **Show Graphs** menu is **Yes**. For this analysis, selecting **Yes** will produce three graphs in the output file: a line graph of the average achievement for each gender by country, a clustered bar graph of average achievement for each gender by country, and a stacked bar graph of average percent of students for each gender by country. R also produces graphs separately for each country.
8. Specify the variable ITSEX as a second grouping variable by first clicking the **Grouping Variables** field to activate it. Then, select ITSEX from the list of variables in the left panel, and move it to the **Grouping Variables** field.
9. Specify the **Plausible Values** as outcome measures for analysis. Because this analysis reports average growth for girls and boys (Exhibit 1.7a) and average achievement for girls and boys at each grade level (Exhibit 1.7b), three sets of measures are selected: ASMCHG01–05 (growth), ASMMAT11–15 (2023 achievement) and ASMMAT21–25 (2024 achievement).
10. Specify the desired name for the output files and the folder where they will be stored in the **Output Files** field by clicking the **Define/Modify** button. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution.

The IDB Analyzer produces and saves three sets of results output, one for each outcome measure, plus an additional Excel output with statistics for all three outcomes.

The outputs use the same format and naming conventions in Example 1, but also specifying the second grouping variable in the name (e.g., "_by_ITSEX"). The IEA IDB Analyzer produces two additional results files in Rdata and xlsx formats. The output file named with the suffix "_sig" reports the significance of the differences between analysis groups—in this case girls and boys—for each country. The output file named with the suffix "_sig2" reports the significance of differences between countries within each of the girl and boy groups.

The results of Example 2 for average growth by gender as shown in the R output file for ASMCHG0 are presented in Exhibit 1.9 for Georgia, Italy, and Jordan.

Exhibit 1.9: R Output for Example 2—Analysis of Average Growth for Girls and Boys

Report

Analysis for ASMCHG0 by IDCNTRY ITSEX

Cntry ID	Sex of Students	N of Cases	Sum of TOTWGT	Sum of TOTWGT (s.e.)	Percent	Percent (s.e.)	ASMCHG0 (Mean)	ASMCHG0 (s.e.)	Confidence Interval (95)	Std.Dev.	Std.Dev. (s.e.)	Percent Missing	Number of Variance Strata
Georgia	Girl	2272	23573	461.21	50.23	0.80	21.25	4.22	13 to 30	60.58	2.90	0.00	78
Georgia	Boy	2219	23360	524.26	49.77	0.80	19.01	3.30	13 to 25	58.08	1.79	0.00	79
Italy	Girl	2254	229919	5784.41	48.22	0.73	38.44	2.02	34 to 42	47.59	2.12	0.00	76
Italy	Boy	2356	246913	5801.98	51.78	0.73	38.35	2.17	34 to 43	49.67	2.44	0.00	76
Jordan	Girl	3194	88311	5994.75	51.85	2.63	12.55	5.30	2 to 23	84.45	3.88	0.00	76
Jordan	Boy	2978	82019	4664.30	48.15	2.63	11.20	5.81	0 to 23	81.04	3.72	0.00	80

Countries are ordered sequentially according to their numeric ISO code. Each country's results are displayed on two lines, one for each value of the grouping variable (ITSEX). The country is identified in the first column (Cntry ID) and the second column (Sex of Students) indicates the category of the grouping variable ITSEX being reported according to the value labels (1: Girl, 2: Boy). The third column reports the number of valid cases (N of Cases), the fourth column reports the sum of weights of the sampled students (Sum of TOTWGT), indicating the estimated total students in the population represented by the sample, and the fifth column is the standard error of the sum of weights (Sum of TOTWGT (s.e.)).

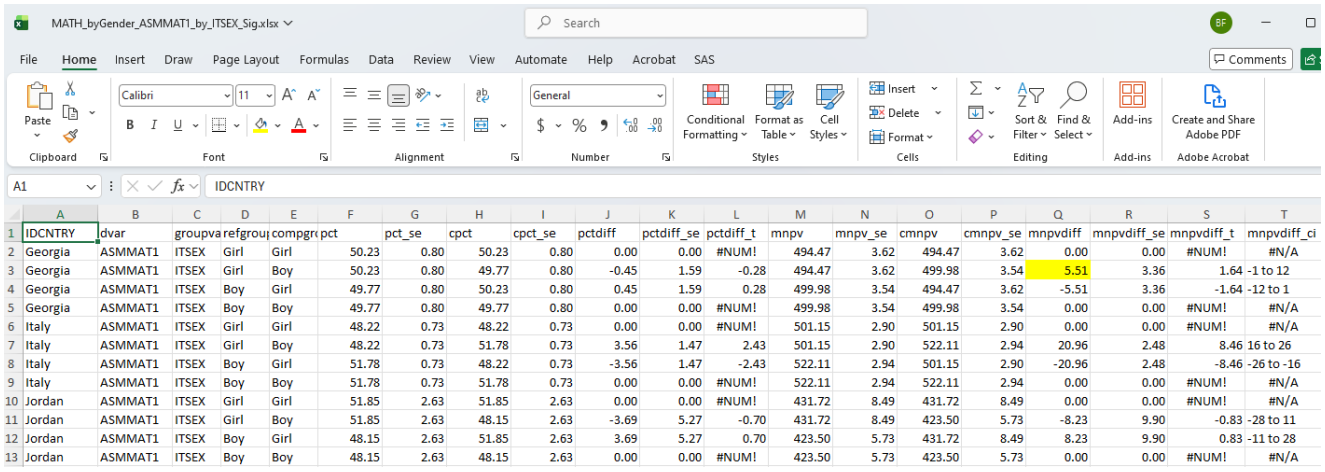
The next two columns report the weighted percentage of students in the particular category of the second grouping variable (Percent), which for this analysis is the percent of students in each category of ITSEX within IDCNTRY, and its standard error (Percent (s.e.)). The next two columns report the estimated average for the outcome variable for the group, in this case average growth in mathematics achievement (ASMCHG0 (Mean)) and its standard error (ASMCHG0 (s.e.)). The "Confidence Interval (95)" column reports the 95% confidence interval for the mean for the group. The standard deviation of the change scores (Std.Dev.) and its standard error (Std.Dev. (s.e.)) are reported in the next two

columns. The last two columns report the percentage of cases with missing data on the outcome variable (Percent Missing) and the number of jackknife zones used for computing standard errors (Number of Variance Strata), respectively.

The results for Georgia are interpreted here as an example. From the two lines of results for Georgia in Exhibit 1.9, the national sample had approximately equal distribution of girls and boys: 50.23% of students were girls and 49.77% were boys (with standard errors of 0.80). The average growth in mathematics achievement between years was similar for girls and boys: 21.25 scale score points for girls (standard error of 4.22) and 19.01 points for boys (standard error of 3.30).

For the results in Exhibit 1.7b, the outputs for differences in achievement between girls and boys for Grade 4 in 2023 (ASMMAT1) and Grade 5 in 2024 (ASMMAT2), follow the same format. The statistical significance of the gender differences for each year, reported in the "Difference" column of Exhibit 1.7b, can be determined by examining the output files named with the suffix "_sig." This example refers to the Excel version of the file with results for Grade 4 2023 results (MATH_byGender_ASMMAT1_by_ITSEX_sig), shown in Exhibit 1.10 with differences in achievement between girls and boys highlighted for Georgia.

Exhibit 1.10: Excel "Sig" Output for Example 2—Analysis of Average Achievement for Girls and Boys



MATH_byGender_ASMMAT1_by_ITSEX_Sig.xlsx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	IDCNTRY	dvar	groupva	refgrou	compgr	pct	pct_se	cpct	cpct_se	pctdiff	pctdiff_se	pctdiff_t	mnpv	mnpv_se	cmnpv	cmnpv_se	mnpvdiff	mnpvdiff_se	mnpvdiff_t	mnpvdiff_ci
2	Georgia	ASMMAT1	ITSEX	Girl	Girl	50.23	0.80	50.23	0.80	0.00	0.00	#NUM!	494.47	3.62	494.47	3.62	0.00	0.00	#NUM!	#N/A
3	Georgia	ASMMAT1	ITSEX	Girl	Boy	50.23	0.80	49.77	0.80	-0.45	1.59	-0.28	494.47	3.62	499.98	3.54	5.51	3.36	1.64	-1 to 12
4	Georgia	ASMMAT1	ITSEX	Boy	Girl	49.77	0.80	50.23	0.80	0.45	1.59	0.28	499.98	3.54	494.47	3.62	-5.51	3.36	-1.64	-12 to 1
5	Georgia	ASMMAT1	ITSEX	Boy	Boy	49.77	0.80	49.77	0.80	0.00	0.00	#NUM!	499.98	3.54	499.98	3.54	0.00	0.00	#NUM!	#N/A
6	Italy	ASMMAT1	ITSEX	Girl	Girl	48.22	0.73	48.22	0.73	0.00	0.00	#NUM!	501.15	2.90	501.15	2.90	0.00	0.00	#NUM!	#N/A
7	Italy	ASMMAT1	ITSEX	Girl	Boy	48.22	0.73	51.78	0.73	3.56	1.47	2.43	501.15	2.90	522.11	2.94	20.96	2.48	8.46	16 to 26
8	Italy	ASMMAT1	ITSEX	Boy	Girl	51.78	0.73	48.22	0.73	-3.56	1.47	-2.43	522.11	2.94	501.15	2.90	-20.96	2.48	-8.46	-26 to -16
9	Italy	ASMMAT1	ITSEX	Boy	Boy	51.78	0.73	51.78	0.73	0.00	0.00	#NUM!	522.11	2.94	522.11	2.94	0.00	0.00	#NUM!	#N/A
10	Jordan	ASMMAT1	ITSEX	Girl	Girl	51.85	2.63	51.85	2.63	0.00	0.00	#NUM!	431.72	8.49	431.72	8.49	0.00	0.00	#NUM!	#N/A
11	Jordan	ASMMAT1	ITSEX	Girl	Boy	51.85	2.63	48.15	2.63	-3.69	5.27	-0.70	431.72	8.49	423.50	5.73	-8.23	9.90	-0.83	-28 to 11
12	Jordan	ASMMAT1	ITSEX	Boy	Girl	48.15	2.63	51.85	2.63	3.69	5.27	0.70	423.50	5.73	431.72	8.49	8.23	9.90	0.83	-11 to 28
13	Jordan	ASMMAT1	ITSEX	Boy	Boy	48.15	2.63	48.15	2.63	0.00	0.00	#NUM!	423.50	5.73	423.50	5.73	0.00	0.00	#NUM!	#N/A

TIMSS 2023 Longitudinal International Results in Mathematics and Science labels differences between girls and boys as statistically significant based on two-tailed null hypothesis significance tests. For each country, the "sig" output reports the average achievement difference between the reference group (column D) and the comparison group (column E) in column Q, labeled "mnpvdiff." Dividing this value by its standard error ("mnpvdiff_se" in column R) gives a *t*-statistic ("mnpvdiff_t" in column S) for evaluating whether the estimated difference is significantly different from zero. For a *t*-test with infinite degrees of freedom and an error level (α) of 0.05, values greater than +1.96 (the upper

critical value) or less than –1.96 (the lower critical value) indicate that the difference between the reference group (girls) average and the comparison group (boys) average is significantly different from zero. Values between –1.96 and +1.96 (the lower and upper critical values for α = 0.05) indicate the achievement difference between the two groups is not statistically significantly different from zero. However, due to smaller degrees of freedom encountered when using estimated variances, the critical value may be larger than +1.96 or smaller than –1.96, (Johnson & Rust, 1993; Satterthwaite, 1941, 1946; Student, 1908; von Davier, 2025; Welch, 1947), so that a test with these as critical values may flag differences at an error rate larger than 5%.

The *t*-value for the achievement difference between fourth-grade girls and boys in Georgia in 2023 is 1.64, which is between the lower and upper critical *t*-values for an error level of 0.05. The (null) hypothesis was not rejected, indicating the achievement difference is not statistically significant.

It can be observed in Exhibit 1.7b that differences of about 10 points or more tend to be flagged as statistically significant with an alpha level of 0.05. In contrast, smaller differences tend not to be flagged as significantly different from 0, unless their standard error (given in parentheses) is unusually small. Statistical significance does not necessarily imply that a difference is practically meaningful and achievement differences between girls and boys should always be considered in broader educational contexts within countries.

Example 3—Analysis of TIMSS International Benchmarks by Grade Level

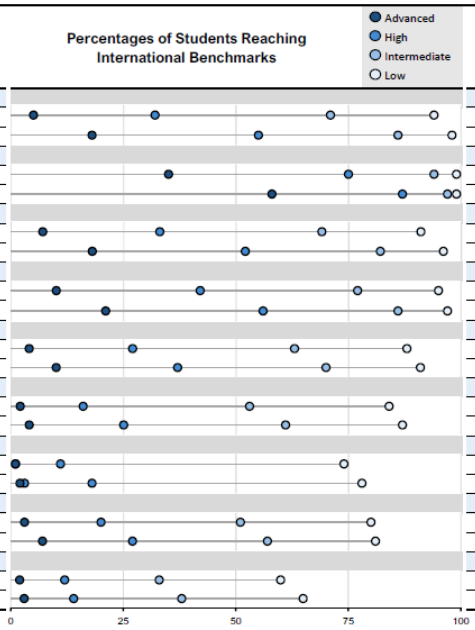
This section describes how to use the IEA IDB Analyzer to perform analyses of student achievement in relation to the TIMSS International Benchmarks. This example computes the percentages of students reaching each of the four TIMSS International Benchmarks of mathematics achievement (Advanced, High, Intermediate, and Low) at the two time points (grade levels), using the merged ASGALLM8L example data file. These example results, presented in Exhibit 1.1.3 of the *TIMSS 2023 Longitudinal International Results* report, are shown below in Exhibit 1.11. The exhibit reports the percentage of students reaching the benchmarks at Grade 4 in 2023 and at Grade 5 in 2024.

Exhibit 1.11: International Results Exhibit of Example 3—Analysis of TIMSS International Benchmarks by Grade Level

Mathematics • Grades 4–5

Exhibit 1.1.3: Percentages of Students Reaching the International Benchmarks of Mathematics Achievement

Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
Slovenia				
Grade 4	5 (0.5)	32 (1.0)	71 (1.1)	94 (0.5)
Grade 5	18 (0.9)	55 (1.2)	86 (0.7)	98 ~
Korea, Rep. of				
Grade 4	35 (1.3)	75 (1.3)	94 (0.7)	99 ~
Grade 5	58 (1.3)	87 (1.0)	97 (0.5)	99 ~
[2] **Italy**				
Grade 4	7 (0.6)	33 (1.4)	69 (1.6)	91 (0.8)
Grade 5	18 (1.1)	52 (1.5)	82 (1.1)	96 (0.6)
[2] **Sweden**				
Grade 4	10 (0.7)	42 (1.4)	77 (1.3)	95 (0.7)
Grade 5	21 (1.1)	56 (1.5)	86 (1.1)	97 (0.6)
[1] **Georgia**				
Grade 4	4 (0.6)	27 (1.4)	63 (1.6)	88 (1.1)
Grade 5	10 (1.0)	37 (1.6)	70 (1.4)	91 (0.8)
[2] **Montenegro**				
Grade 4	2 ~	16 (1.0)	53 (1.1)	84 (0.8)
Grade 5	4 (0.4)	25 (0.8)	61 (1.1)	87 (0.7)
[2] **Kosovo**				
Grade 4	1 ~	11 (1.0)	39 (1.7)	74 (1.7)
Grade 5	3 (0.4)	18 (1.2)	47 (1.7)	78 (1.5)
North Macedonia				
Grade 4	3 (0.5)	20 (1.2)	51 (1.6)	80 (1.4)
Grade 5	7 (0.6)	27 (1.4)	57 (1.8)	81 (1.3)
Jordan				
Grade 4	2 ~	12 (1.6)	33 (2.2)	60 (2.1)
Grade 5	3 (0.8)	14 (1.5)	38 (1.9)	65 (1.8)



( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates result not reported because estimation is not reliable.
See Appendix A.2 for population coverage notes 1 and 2.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

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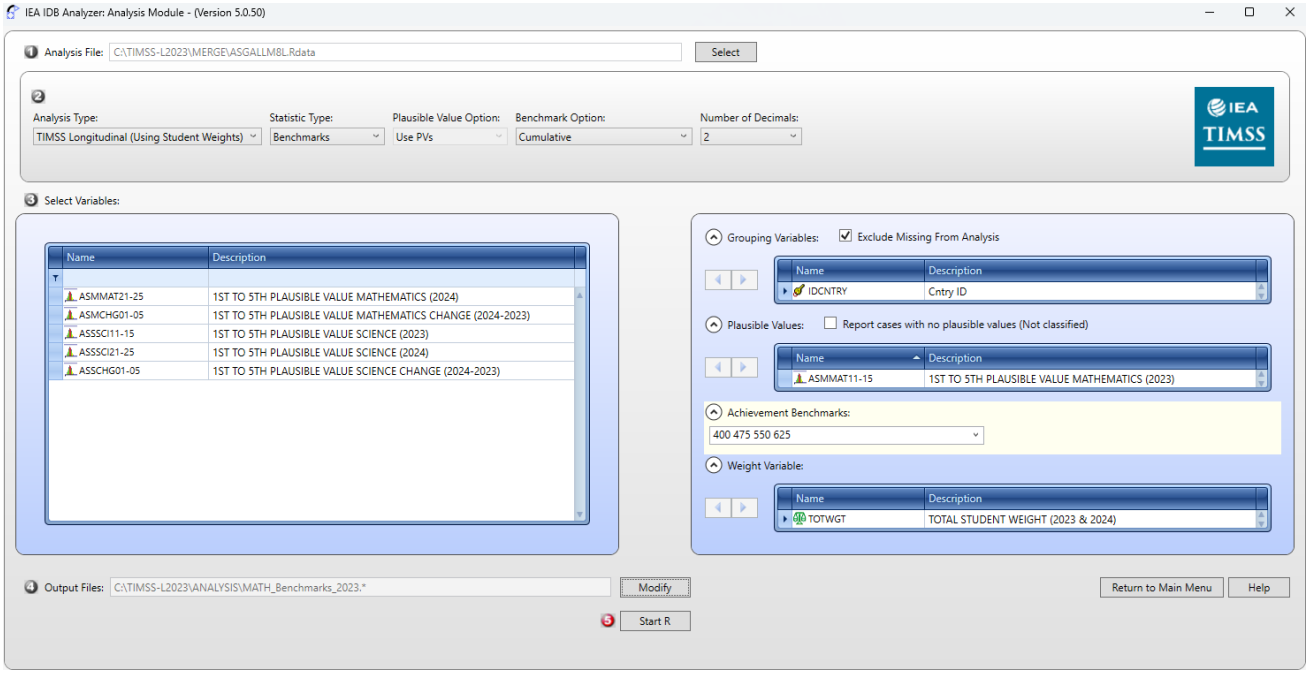
This example is conducted in the **Analysis Module** of the IEA IDB Analyzer and must be conducted separately for each grade level (time point). The following steps describe the analysis for Grade 4 achievement based on the plausible values for mathematics achievement in 2023. The completed Analysis Module is shown in Exhibit 1.12.

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASGALLM8L as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS Longitudinal (Using Student Weights)** as the **Analysis Type**. TOTWGT is used by default because the analysis uses student data.
4. Select **Benchmarks** as the **Statistic Type**.
5. Select the **Cumulative** option under the **Benchmark Option** drop-down menu to get cumulated percentages of students reaching the TIMSS International Benchmarks.

Exhibit 1.12: IEA IDB Analyzer Analysis Module Setup for Example 3—Analysis of TIMSS International Benchmarks



6. For Grade 4 results, specify the 2023 mathematics achievement measures (ASMMAT11–15) to be used for the analysis by first clicking the **Plausible Values** field to activate it. Then, select from the list of available variables in the left panel, and move it to the right **Plausible Values** field by clicking the **right arrow** (▸) button.
7. In the **Achievement Benchmarks** field, specify the average achievement score for each of the TIMSS International Benchmarks in ascending order: 400, 475, 550, and 625 (Low, Intermediate, High, and Advanced, respectively). These values can be entered manually with each separated by a blank space, or they can be selected by clicking on the drop-down menu available for this field.
8. Specify the desired name for the output files and the folder where they will be stored in the **Output Files** field by clicking the **Define/Modify** button. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution.

Exhibit 1.13 presents the results of Example 3 as shown in the R html output, under the "Report" section. Results are shown for Georgia, Italy, and Jordan.

Exhibit 1.13: R Output for Example 3—Analysis of TIMSS International Benchmarks

Report

Percentage by Performance Group of ASMMAT1

Cntry ID	cutvar	N of Cases	Sum of TOTWGT	Sum of TOTWGT (s.e.)	Percent	Percent (s.e.)
Georgia	1. At or Above 400	3980	41101	756.70	87.57	1.08
Georgia	2. At or Above 475	2884	29620	821.23	63.11	1.59
Georgia	3. At or Above 550	1183	12479	638.02	26.59	1.36
Georgia	4. At or Above 625	183	2068	290.18	4.41	0.62
Italy	1. At or Above 400	4222	435492	9395.72	91.33	0.79
Italy	2. At or Above 475	3200	331009	9341.22	69.42	1.56
Italy	3. At or Above 550	1512	156040	6953.37	32.72	1.39
Italy	4. At or Above 625	307	31593	2713.43	6.63	0.56
Jordan	1. At or Above 400	3402	101616	5076.21	59.66	2.08
Jordan	2. At or Above 475	1761	55391	4360.69	32.52	2.23
Jordan	3. At or Above 550	629	20521	2872.13	12.05	1.61
Jordan	4. At or Above 625	102	3907	1289.82	2.29	0.75

Countries are ordered according to their numeric ISO code, and each country's results are displayed on four lines, one for each TIMSS International Benchmark. The countries are identified in the first column (Cntry ID) and the second column (cutvar) indicates the benchmark level being reported (this is labeled "Performance Group" in SPSS). The third column reports the number of valid cases (N of Cases), the fourth column reports the sum of weights of the sampled students (Sum of TOTWGT) corresponding to the number of students in the population represented by the sample, and the fifth column is the standard error of the sum of weights (Sum of TOTWGT (s.e.)). The last two columns report the cumulative percentage of students reaching each benchmark (Percent) and its standard error (Percent (s.e.)), as reported in Exhibit 1.11.

As shown in the four lines of results for Italy, 91.33% of the students in Italy performed at or above the Low International Benchmark of 400 in 2023 at Grade 4, with a standard error of 1.56; 69.42% of students reached the Intermediate International Benchmark at Grade 4, with a standard error of 1.56; 32.72% of students reached the High International Benchmark, with a standard error of 1.39; and 6.63% of students reached the Advanced International Benchmark, with a standard error of 0.56.

To replicate these results for Grade 5, the above steps should be repeated using the 2024 mathematics achievement measures as plausible values (ASMMAT21–25).

Conducting Analyses with TIMSS Home Context Data

This section presents an analysis conducted using the IEA IDB Analyzer with home context data from the TIMSS 2023 Longitudinal International Database. Home context data were collected from the parents of participating students at Grades 4–5 through home questionnaires administered in 2023 and 2024. The example computes results for a context questionnaire scale based on parents' responses to the questions. Section 8 of *TIMSS 2023 Longitudinal Technical Report* provides information about context questionnaire scales created from the response data.

Analyzing home context data from the TIMSS 2023 Longitudinal International Database requires that the home context data files (named beginning with "ASH") be merged with either student achievement files ("ASA") or student context files ("ASG") to retrieve the achievement scores and required sample design variables. Example 4 uses home context data merged with student context data described earlier in the section on Merging Data Files with the IEA IDB Analyzer (ASHALLM8L).

Example 4—Analysis of a Context Questionnaire Scale with Home Context Data

Example 4 computes the percentages of students—with their average growth and achievement by grade level (year)—for each of the categories of a context questionnaire scale, along with the average context scale score by grade level. This example describes analyses to replicate Exhibit 3.2a and Exhibit 3.2b of *TIMSS 2023 Longitudinal International Results in Mathematics and Science*, repeated below in Exhibit 1.14a and Exhibit 1.14b. These exhibits report results for the TIMSS *Home Socioeconomic Status* scale, created based on parents' reports. Exhibit 1.15a reports the percentage of students in each scale category in Grade 4 (2023) along with their average growth in mathematics achievement between the two grade levels. Exhibit 1.14b reports the percentages of students in each scale category in Grade 4 (2023) and in Grade 5 (2024), with their corresponding average achievement for each year. It also reports the average scale score for each year.

Exhibit 1.14a: International Results Exhibit of Example 4—Analysis of a Context Questionnaire Scale and Average Growth with Home Context Data

Mathematics • Grades 4–5

IEA TIMSS LONGITUDINAL 2023 – 2024

Exhibit 3.2a: Home Socioeconomic Status and Growth in Achievement

Parents' Reports in 2023

Country		Higher Socioeconomic Status		Middle Socioeconomic Status		Lower Socioeconomic Status	
		Percent of Students	Average Growth	Percent of Students	Average Growth	Percent of Students	Average Growth
Georgia		36 (1.2)	23 (3.1)	52 (1.1)	20 (3.9)	12 (0.8)	15 (6.7)
Italy		26 (1.4)	43 (2.3)	51 (1.2)	39 (2.2)	23 (1.1)	35 (2.8)
Jordan		6 (0.6)	11 (8.0)	49 (1.3)	16 (5.6)	45 (1.5)	8 (5.1)
Korea, Rep. of		64 (1.5)	39 (1.7)	32 (1.3)	42 (2.1)	3 (0.4)	41 (6.4)
Kosovo	s	16 (1.2)	19 (4.0)	51 (1.3)	17 (2.6)	33 (1.7)	16 (3.0)
Montenegro	r	31 (1.1)	24 (2.3)	53 (0.9)	19 (2.4)	16 (0.7)	2 (3.3)
North Macedonia		18 (1.2)	23 (4.2)	47 (1.2)	21 (2.6)	36 (1.5)	6 (4.8)
Slovenia	r	45 (1.1)	43 (1.8)	47 (1.1)	41 (1.8)	8 (0.5)	34 (4.4)
Sweden	r	56 (1.8)	31 (2.1)	39 (1.4)	29 (2.0)	6 (0.6)	23 (4.2)

This TIMSS context questionnaire scale was established in 2019 based on the combined response distribution of countries that participated in TIMSS 2019. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
An "r" indicates data are available for at least 70% but less than 85% of the students.
An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

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Exhibit 1.14b: International Results Exhibit of Example 4—Analysis of a Context Questionnaire Scale and Average Achievement with Home Context Data

Mathematics • Grades 4–5

IEA TIMSS LONGITUDINAL 2023 – 2024

Exhibit 3.2b: Home Socioeconomic Status and Average Achievement

Parents' Reports in 2023 and 2024

Country		Higher Socioeconomic Status		Middle Socioeconomic Status		Lower Socioeconomic Status		Average Scale Score
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia								
Grade 4		36 (1.2)	523 (3.4)	52 (1.1)	490 (3.4)	12 (0.8)	459 (9.4)	10.5 (0.04)
Grade 5	r	36 (1.4)	549 (3.3)	51 (1.5)	511 (3.7)	13 (1.4)	474 (9.7)	10.5 (0.05)
Italy								
Grade 4		26 (1.4)	544 (3.0)	51 (1.2)	513 (3.2)	23 (1.1)	486 (4.1)	10.0 (0.06)
Grade 5		26 (1.4)	586 (4.0)	52 (1.0)	552 (3.1)	22 (1.2)	516 (3.9)	10.1 (0.06)
Jordan								
Grade 4		6 (0.6)	487 (8.9)	49 (1.3)	445 (5.3)	45 (1.5)	407 (7.2)	8.9 (0.05)
Grade 5	r	6 (0.6)	501 (9.1)	54 (1.4)	456 (5.0)	41 (1.7)	410 (6.1)	9.0 (0.05)
Korea, Rep. of								
Grade 4		64 (1.5)	613 (2.5)	32 (1.3)	568 (3.2)	3 (0.4)	519 (11.0)	11.6 (0.05)
Grade 5		58 (1.5)	654 (2.6)	38 (1.3)	615 (3.1)	5 (0.6)	561 (10.1)	11.4 (0.05)
Kosovo								
Grade 4	s	16 (1.2)	509 (6.2)	51 (1.3)	465 (3.7)	33 (1.7)	425 (6.2)	9.5 (0.06)
Grade 5	y	- -	- -	- -	- -	- -	- -	- -
Montenegro								
Grade 4	r	31 (1.1)	506 (3.1)	53 (0.9)	474 (2.2)	16 (0.7)	444 (3.3)	10.2 (0.04)
Grade 5	s	30 (1.1)	534 (3.1)	54 (1.2)	494 (2.2)	16 (0.8)	447 (3.9)	10.2 (0.04)
North Macedonia								
Grade 4		18 (1.2)	522 (4.6)	47 (1.2)	482 (3.4)	36 (1.5)	443 (4.8)	9.4 (0.08)
Grade 5	r	18 (1.3)	550 (4.6)	48 (1.4)	500 (3.6)	33 (1.7)	451 (4.9)	9.4 (0.07)
Slovenia								
Grade 4	r	45 (1.1)	540 (2.3)	47 (1.1)	502 (2.3)	8 (0.5)	477 (4.6)	10.8 (0.03)
Grade 5	r	44 (1.2)	584 (2.6)	47 (1.1)	546 (2.2)	9 (0.6)	509 (4.9)	10.8 (0.04)
Sweden								
Grade 4	r	56 (1.8)	559 (2.4)	39 (1.4)	513 (3.1)	6 (0.6)	484 (4.4)	11.3 (0.07)
Grade 5	y	- -	- -	- -	- -	- -	- -	- -

This TIMSS context questionnaire scale was established in 2019 based on the combined response distribution of countries that participated in TIMSS 2019. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
An "r" indicates data are available for at least 70% but less than 85% of the students.
An "s" indicates data are available for at least 50% but less than 70% of the students.
A "y" indicates data are available for less than 40% of the students.
A dash (-) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

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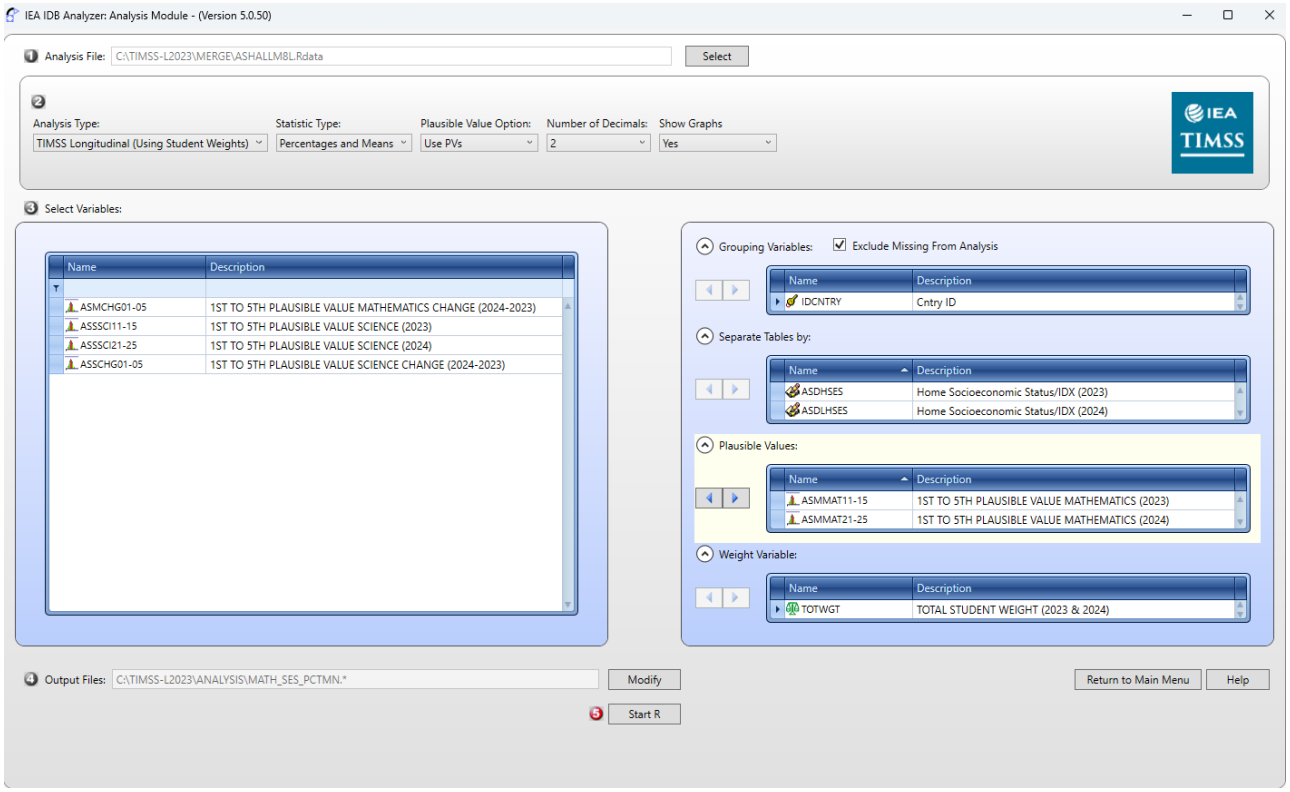
To compute the results in Exhibit 1.14a, reporting percentages of students in each category based on parents' reports in 2023 along with average growth in mathematics achievement, the **Analysis Module** of the IEA IDB Analyzer should be used with the ASHALLM8L data file. The steps are parallel to Example 2, specifying the **Analysis Type** as **TIMSS Longitudinal (Using Student Weights)**, and using **Percentages and Means** as the **Statistic Type**. For this example, the variable ASDHSES (scale index variable for 2023) should be defined as a second **Grouping Variable**, and ASMCHG01–05 should be used as **Plausible Values** for the outcome measure as growth in mathematics achievement. This produces the results output files consistent with those described in Example 2, with ASDHSES as the second grouping variable instead of ITSEX. Each country's results are displayed on three lines, one for each value of the scale index variable.

To replicate Exhibit 1.14b, the percentage of students and average achievement in both years can be calculated in a single set up using **Percentages and Means** as above, but using both 2023 and 2024 scale index variables (ASDHSES and ASDLHSES) in the **Separate Tables By** field, and both 2023 and 2024 achievement measures (ASMMAT11–15 and ASMMAT21–25) as **Plausible Values**. The completed **Analysis Module** for this step is shown in Exhibit 1.15.

Exhibit 1.15: IEA IDB Analyzer Analysis Module Setup for Example 4—Analysis of a Context Questionnaire Scale with Home Context Data (Percentages and Means)

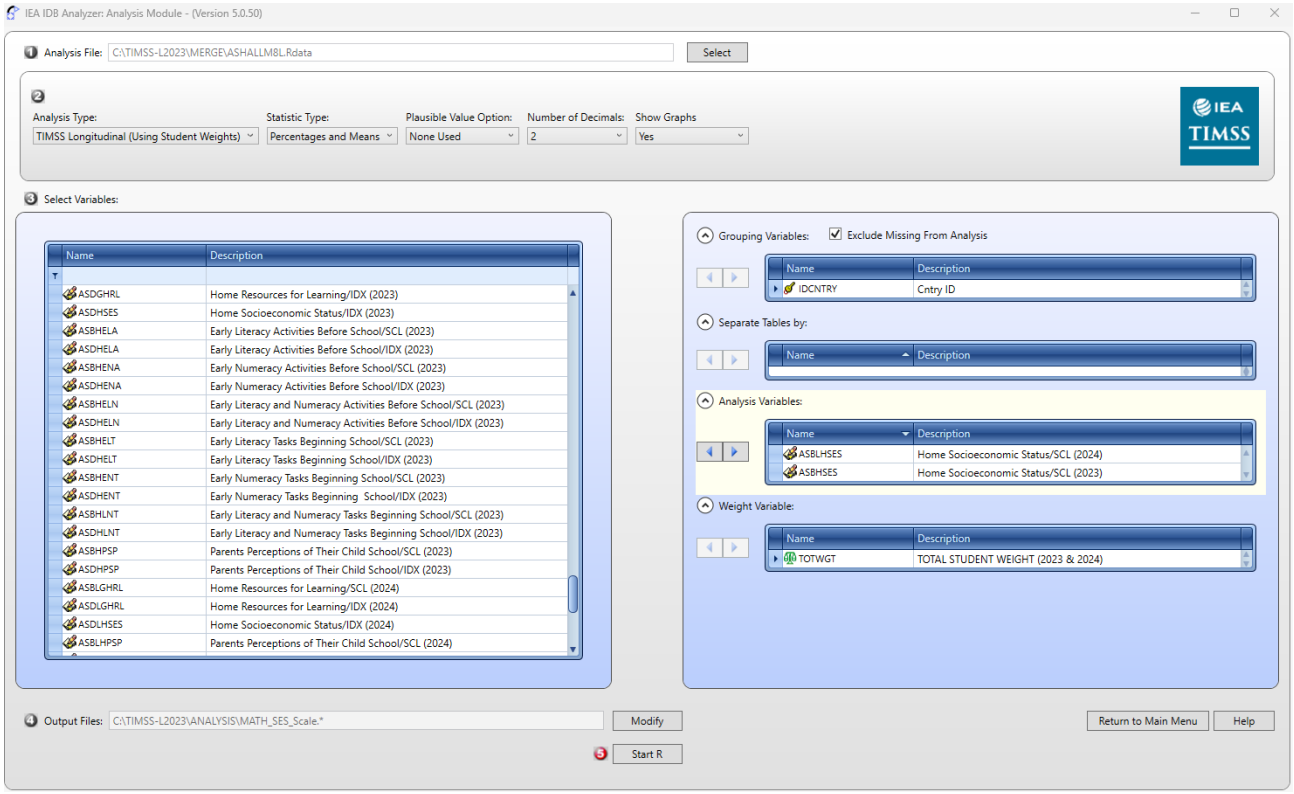


The program will present results for each combination of these variables, and the corresponding combinations are selected for analysis. The outputs named with the suffix "_ASDHSES_ASMMAT1" report results for Grade 4 (2023), and those named with "_ASDLHSES_ASMMAT2" report results for Grade 5 (2024).

A separate analysis step is required to replicate the "Average Scale Score" column of Exhibit 1.14b for both time points, following the steps listed below. The completed **Analysis Module** for this step is shown in Exhibit 1.16.

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASHALLM8L as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS Longitudinal (Using Student Weights)** as the **Analysis Type**.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **None Used** as the **Plausible Value Option**, because achievement outcomes are not used for this part of the analysis.
6. The default value selected in the **Show Graphs** menu is **Yes**. For this analysis, selecting **Yes** will produce two bar graphs in the output file: one for average scale score by country, and one for average percent of the total students in each country.

Exhibit 1.16: IEA IDB Analyzer Analysis Module Setup for Example 4—Analysis of a Context Questionnaire Scale with Home Context Data (Average Scale Score)



7. The IDB Analyzer automatically selects the variable IDCNTRY for the **Grouping Variables**. No additional grouping variables are needed for this analysis. The IEA IDB Analyzer automatically checks the **Exclude Missing From Analysis**, which excludes cases with missing values on the grouping variables from the analysis. This box should be checked for this analysis.
8. The **Separate Tables by** field should be empty for this analysis. This field is used to separately analyze several grouping variables or several continuous dependent (non-achievement) variables. See the IEA IDB Analyzer Help manual for more information.
9. Specify both the 2023 and 2024 variables to be used for the analysis by first clicking the **Analysis Variables** field to activate it. Then, move both ASBHSES and ASBLHSES from the list of available variables in the left panel to the right **Analysis Variables** field by clicking the **right arrow** (▸) button.
10. The **Weight Variable** is selected automatically by the software; TOTWGT is selected by default because this example analysis uses student context data combined with home context data.
11. Specify the desired name for the output files and the folder where they will be stored in the **Output Files** field by clicking the **Define/Modify** button. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution.

This step of the analysis produces the same results output files as described in Example 1, with one for each outcome measure (ASBHSES and ASBHLSES), plus an additional Excel output with statistics for both outcomes. Exhibit 1.17 shows the results in the R output file for Grade 5 average scale score (ASBLHSES), based on parents' reports in 2024.

Sweden is interpreted as an example. On average, students in Sweden scored 11.55 based on their parents' responses in 2024 to the items on the *Home Socioeconomic Status* context questionnaire scale, with a standard error of 0.07.

When analyzing context data, it is important to check the "Percent Missing" column in the output, which shows that 62.84% of students in Sweden do not have data for the scale. In Exhibit 1.14b, Sweden's line of results is not reported because they had a high level of missing data on the ASBLHSES variable. The "y" annotation indicates that data was available for less than 40% of students, so their data are not reported due to concerns about reliability.

Exhibit 1.17: R Output for Example 4—Analysis of a Context Questionnaire Scale with Home Context Data (Average Scale Score)

Report

Analysis for ASBLHSES by IDCNTRY

Cntry ID	N of Cases	Sum of TOTWGT	Sum of TOTWGT (s.e.)	Percent	Percent (s.e.)	ASBLHSES (Mean)	ASBLHSES (s.e.)	Std.Dev.	Std.Dev. (s.e.)	Percent Missing	Number of Variance Strata
Georgia	3350	35640	1094.57	3.50	0.12	10.49	0.05	1.55	0.04	24.06	79
Italy	4111	427033	10467.28	41.92	0.77	10.06	0.06	1.65	0.03	10.44	76
Jordan	4885	132331	5659.41	12.99	0.54	9.01	0.05	1.42	0.03	22.31	115
Korea, Republic of	3746	341138	11813.11	33.49	0.87	11.36	0.05	1.56	0.02	14.37	77
Kosovo	1539	7315	429.61	0.72	0.04	9.46	0.08	1.64	0.04	68.15	84
Montenegro	3121	4583	98.05	0.45	0.01	10.23	0.04	1.56	0.03	33.33	124
Slovenia	3588	12597	420.61	1.24	0.05	10.78	0.04	1.49	0.02	28.19	75
Sweden	1925	42911	1924.44	4.21	0.20	11.55	0.07	1.56	0.03	62.84	81
North Macedonia	4095	15199	329.87	1.49	0.04	9.42	0.07	1.87	0.04	15.79	87
Table Average	NA	NA	NA	11.11	0.15	10.26	0.02	1.59	0.01	NA	NA

Conducting Analyses with TIMSS School Context Data

School context data in the TIMSS 2023 Longitudinal International Database are typically analyzed to make student-level inferences. The *TIMSS 2023 Longitudinal International Results in Mathematics and Science* report presents results about students who attend schools with a certain characteristic, rather than about schools of a certain characteristic. Analyzing school context data with student achievement requires that the school context data files be merged with the student context data files to retrieve the achievement scores and required sample design variables.

This section describes an analysis conducted using the IEA IDB Analyzer with context variables derived from school context data collected from principals of schools attended by participating students during the fourth- and fifth-grade school years, in 2023 and 2024, respectively. Example 5 uses school context data merged with student context data to compute the percentages and average growth and achievement of students who attended schools composed of students with different levels of socioeconomic background.

Before conducting analyses using school context variables, users should refer to the relevant codebook for the data file to identify the appropriate variables related to the school's composition of students by socioeconomic background and understand the coding scheme. The codebook for the school context data file indicates that the derived context variable ACDGSBC contains information on the socioeconomic composition of

schools in three categories according to principals' reports in 2023, and the variable ACDLGSBC contains the same information according to principals' reports in 2024.

On the TIMSS 2023 Longitudinal International Database webpage, the Derived Context Variables supplemental download describes how each derived context variable was created from the questionnaire response variables. As described in the download, two source variables were used to derive ACDGSBC based on 2023 data: ACBG03A for the percentage of students economically disadvantaged and ACBG03B for the percentage of students economically affluent. Schools are characterized as "more affluent," "more disadvantaged," or "neither more affluent nor more disadvantaged." To derive ACDLGSBC based on 2024 data, ACBLG02A and ACBLG02B were used.

Example 5—Analysis of a Derived Context Variable with School Questionnaire Data

The results of this analysis are presented in Exhibit 4.2a and Exhibits 4.2b of *TIMSS 2023 Longitudinal International Results in Mathematics and Science,* repeated below in Exhibits 1.18a and 1.18b.

In this example, the **Percentages and Means** statistic type is used along with the **Use PVs** option to estimate the percentages of students with their average growth in mathematics achievement and average achievement by categories of students' socioeconomic background as reported by school principals.

Exhibit 1.18a: International Results Exhibit of Example 5—Analysis of Average Growth in Achievement by School Socioeconomic Composition

Mathematics • Grades 4–5

IEA TIMSS LONGITUDINAL 2023 – 2024

Exhibit 4.2a: School Composition by Socioeconomic Background of the Student Body and Growth in Achievement

Principals' Reports in 2023

Country	More Affluent		Neither More Affluent Nor More Disadvantaged		More Disadvantaged	
	Percent of Students	Average Growth	Percent of Students	Average Growth	Percent of Students	Average Growth
Georgia	42 (4.1)	20 (4.9)	30 (3.5)	18 (5.8)	28 (3.7)	19 (7.0)
Italy	38 (3.9)	36 (3.1)	43 (4.1)	41 (2.5)	19 (3.2)	39 (4.1)
Jordan	18 (3.2)	31 (10.8)	28 (4.2)	9 (9.3)	55 (3.7)	5 (5.3)
Korea, Rep. of	27 (4.0)	34 (3.2)	66 (3.9)	43 (1.8)	7 (2.1)	40 (4.8)
Kosovo r	61 (4.4)	14 (2.7)	28 (4.0)	20 (4.1)	12 (2.9)	30 (6.3)
Montenegro	28 (0.5)	24 (3.0)	51 (0.6)	19 (2.5)	22 (0.6)	12 (3.7)
North Macedonia	60 (3.4)	18 (3.2)	28 (3.3)	16 (5.2)	12 (2.6)	-3 (8.8)
Slovenia	24 (4.1)	45 (3.4)	54 (4.9)	44 (2.0)	22 (3.5)	38 (3.4)
Sweden	62 (3.9)	29 (2.2)	27 (3.6)	30 (2.4)	11 (2.9)	25 (5.1)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

IEA TIMSS & PIRLS BOSTON COLLEGE

Exhibit 1.18b: International Results Exhibit of Example 5—Analysis of Average Achievement by School Socioeconomic Composition

Mathematics • Grades 4–5

IEA TIMSS LONGITUDINAL 2023 – 2024

Exhibit 4.2b: School Composition by Socioeconomic Background of the Student Body and Average Achievement

Principals' Reports in 2023 and 2024

Country	More Affluent		Neither More Affluent Nor More Disadvantaged		More Disadvantaged	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Georgia						
Grade 4	42 (4.1)	500 (5.6)	30 (3.5)	499 (5.9)	28 (3.7)	496 (5.9)
Grade 5	41 (4.3)	527 (5.3)	33 (4.3)	516 (5.7)	26 (3.8)	502 (7.8)
Italy						
Grade 4	38 (3.9)	523 (3.8)	43 (4.1)	515 (5.1)	19 (3.2)	485 (7.0)
Grade 5	38 (4.3)	556 (5.4)	45 (4.7)	557 (4.9)	17 (3.4)	523 (6.7)
Jordan						
Grade 4	18 (3.2)	447 (9.1)	28 (4.2)	442 (11.2)	55 (3.7)	419 (8.1)
Grade 5	18 (3.4)	458 (11.1)	30 (4.5)	443 (10.8)	52 (4.3)	428 (8.1)
Korea, Rep. of						
Grade 4	27 (4.0)	619 (5.3)	66 (3.9)	589 (2.6)	7 (2.1)	554 (18.3)
Grade 5 r	32 (4.5)	655 (4.4)	60 (4.7)	626 (3.8)	8 (2.5)	625 (4.9)
Kosovo						
Grade 4 r	61 (4.4)	457 (4.9)	28 (4.0)	452 (7.4)	12 (2.9)	436 (11.7)
Grade 5 y	- -	- -	- -	- -	- -	- -
Montenegro						
Grade 4	28 (0.5)	478 (3.2)	51 (0.6)	479 (2.3)	22 (0.6)	473 (4.2)
Grade 5	- -	- -	- -	- -	- -	- -
North Macedonia						
Grade 4	60 (3.4)	490 (4.2)	28 (3.3)	459 (6.8)	12 (2.6)	447 (13.3)
Grade 5 r	58 (4.0)	500 (4.3)	29 (3.9)	478 (8.0)	13 (2.7)	441 (11.8)
Slovenia						
Grade 4	24 (4.1)	514 (4.5)	54 (4.9)	515 (2.2)	22 (3.5)	506 (4.1)
Grade 5	23 (3.8)	561 (4.9)	58 (4.6)	555 (2.5)	19 (3.2)	546 (4.6)
Sweden						
Grade 4	62 (3.9)	543 (2.9)	27 (3.6)	518 (4.4)	11 (2.9)	486 (9.4)
Grade 5	61 (3.8)	574 (2.9)	27 (3.8)	549 (4.1)	12 (2.9)	517 (11.8)

Montenegro's data for 2024 are not reported due to concerns about comparability.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available.
An "r" indicates data are available for at least 70% but less than 85% of the students.
A "y" indicates data are available for less than 40% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

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To compute the results in Exhibit 1.18a, showing percentages of students in each derived variable category based on principals' reports in 2023 along with average growth in mathematics achievement, the **Analysis Module** of the IEA IDB Analyzer should be used with the ACGALLM8L data file. The steps are parallel to Example 2, specifying the **Analysis Type** as **TIMSS Longitudinal (Using Student Weights)**, and using **Percentages and Means** as the **Statistic Type**. For this example, the variable ACDGSBC should be defined as a second **Grouping Variable** for school socioeconomic background in 2023, and ASMCHG01–05 should be used as **Plausible Values** for the outcome measure as growth in mathematics achievement. TOTWGT is used as the **Weight Variable**. The completed Analysis Module is shown in Exhibit 1.19.

This produces the results output files consistent with those described in Example 2, with ACDGSBC as the second grouping variable instead of ITSEX. Each country's results are displayed on three lines, one for each value of the derived variable. However, there are fewer lines if any category does not have any observations. Exhibit 1.20 shows the results in the R output file for Georgia and Italy.

Exhibit 1.19: IEA IDB Analyzer Analysis Module Setup for Example 5—Analysis of Average Growth in Achievement by School Socioeconomic Composition

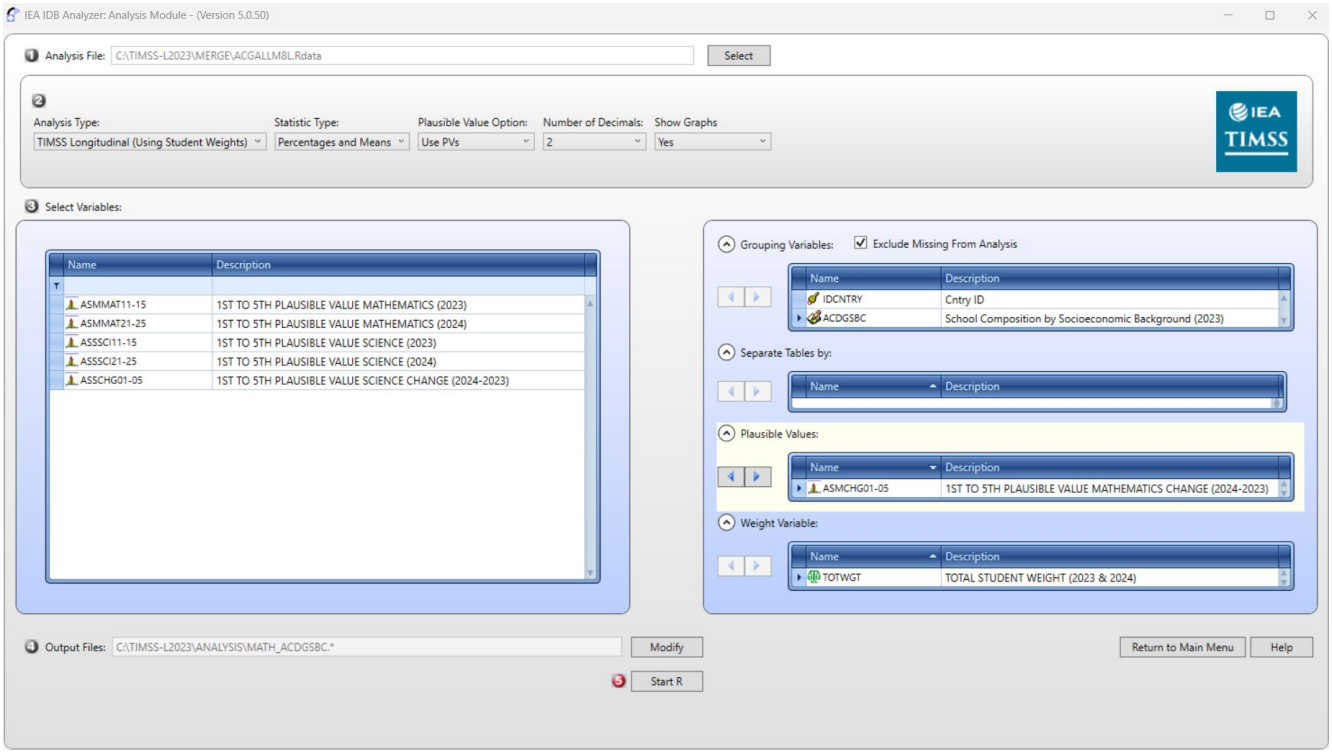

Exhibit 1.20: R Output for Example 5—Analysis of Average Growth in Achievement by School Socioeconomic Composition

Report

Analysis for ASMCHG0 by IDCNTRY ACDGSBC

Cntry ID	School Composition by Socioeconomic Background (2023)	N of Cases	Sum of TOTWGT	Sum of TOTWGT (s.e.)	Percent	Percent (s.e.)	ASMCHG0 (Mean)	ASMCHG0 (s.e.)	Confidence Interval (95)	Std.Dev.	Std.Dev. (s.e.)	Percent Missing	Number of Variance Strata
Georgia	More Affluent	1786	18908	1864.09	41.63	4.07	20.02	4.86	10 to 30	56.80	2.14	0.00	49
Georgia	Neither More Affluent nor More Disadvantaged	1495	13575	1608.43	29.89	3.51	18.19	5.80	7 to 30	58.23	3.84	0.00	37
Georgia	More Disadvantaged	1074	12939	1700.68	28.49	3.68	18.80	6.97	5 to 32	64.35	4.86	0.00	36
Italy	More Affluent	1677	175522	18086.70	37.56	3.90	36.09	3.10	30 to 42	53.20	5.00	0.00	46
Italy	Neither More Affluent nor More Disadvantaged	2015	202502	20293.16	43.34	4.10	40.59	2.53	36 to 46	45.76	1.41	0.00	50
Italy	More Disadvantaged	824	89232	15156.87	19.10	3.21	38.53	4.07	31 to 47	45.68	2.61	0.00	24

The results for Georgia are interpreted as an example. As shown in Exhibit 1.20, 41.63% of students in Georgia attended schools classified as "more affluent" by their principals in 2023 (standard error of 4.07). On average, these students grew 20.02 mathematics scale score points between Grades 4 and 5 (standard error of 4.86). These students had similar growth to the 29.89% of students who attended schools classified as "neither more affluent nor more disadvantaged" and the 28.49% who attended "more disadvantaged" schools, with average growth of 18.19 and 18.80, respectively.

The "Percent Missing" column is reported only based on the outcome variable, not the grouping variable. Users of the data can check for the proportion of missing data on the context variables in the Data Almanacs, described in Chapter 2 of this User Guide.

To replicate Exhibit 1.18b, the same steps are used to compute columns for the percentages of students and average achievement separate by grade level as in Example 4. Use both ACDGSBC (2023) and ACDLGSBC (2024) variables in the **Separate Tables by** field, and both ASMMAT11–15 (2023) and ASMMAT21–25 (2024) as **Plausible Values**. Then, select the appropriate combinations of variables from the outputs.

Conducting Analyses with TIMSS Teacher Context Data

Analyses with TIMSS teacher context data seek to make inferences about students whose teachers have a given characteristic, attitude, or instructional practice. Because the teachers in TIMSS do not constitute representative samples of teachers, inferences should not be made about teachers themselves, but rather about students taught by teachers with certain characteristics.

This section presents an analysis conducted using the IEA IDB Analyzer with teacher context data from the TIMSS 2023 Longitudinal International Database. When conducting analyses to associate teacher data with growth in achievement, users need to consider which school year they hypothesize that teacher characteristics, attitudes, or practices relate to student growth.

As an example of an analysis using teacher context data, Example 6 investigates the formal education of students' teachers during the fourth- and fifth-grade school years. Because this example analyzes teacher context data, teacher context data should be merged with student data through the student-teacher linkage file to retrieve the required sample design variables (see earlier section on Merging Data Files with the IEA IDB Analyzer). Separate analysis files are used for students' teachers in 2023 and students' teachers in 2024.

Example 6—Analysis of Teachers' Formal Education

This example involves using the **Percentages Only** statistic type to estimate the percentages of students by categories of teachers' level of formal education during the

Grade 4 (2023) and Grade 5 (2024) school years. Examining changes in policy related to teacher credentials between grade levels, the results of this analysis are presented in Exhibit 5.1.2 of *TIMSS 2023 Longitudinal International Results in Mathematics and Science,* repeated below in Exhibit 1.21.

Exhibit 1.21: International Results Exhibit of Example 6—Analysis of Teachers' Formal Education

Mathematics • Grades 4–5

Exhibit 5.1.2: Teachers' Formal Education*

Teachers' Reports in 2023 and 2024

Country		Percent of Students by Teacher Education			
		Completed Postgraduate University Degree**	Completed Bachelor's Degree or Equivalent but Not a Postgraduate Degree	Completed Post-Secondary Education but Not a Bachelor's Degree	No Further than Upper-Secondary Education
Georgia					
Grade 4		74 (3.2)	22 (3.1)	2 ~	1 ~
Grade 5		84 (2.9)	15 (3.0)	1 ~	0 ~
Italy					
Grade 4		37 (3.1)	7 (1.4)	4 (1.5)	52 (3.2)
Grade 5		39 (3.3)	7 (1.7)	3 (0.7)	51 (3.0)
Jordan					
Grade 4		11 (2.5)	80 (3.5)	3 (1.6)	5 (2.0)
Grade 5		9 (2.2)	83 (2.9)	2 ~	6 (1.8)
Korea, Rep. of					
Grade 4		33 (3.9)	67 (3.9)	0 ~	0 ~
Grade 5		28 (2.3)	72 (2.3)	0 ~	0 ~
Kosovo					
Grade 4		11 (1.9)	83 (2.5)	4 (1.8)	1 ~
Grade 5	x	11 (3.2)	84 (4.1)	1 ~	4 (2.3)
Montenegro					
Grade 4		76 (2.8)	6 (1.6)	18 (2.4)	0 ~
Grade 5		75 (2.6)	6 (1.8)	18 (2.1)	0 ~
North Macedonia					
Grade 4	r	7 (1.7)	71 (3.2)	20 (3.0)	1 ~
Grade 5		7 (1.4)	75 (3.0)	19 (2.6)	0 ~
Slovenia					
Grade 4		74 (2.7)	9 (1.8)	17 (2.1)	0 ~
Grade 5	r	83 (2.5)	4 (1.5)	12 (2.0)	0 ~
Sweden					
Grade 4		15 (2.8)	79 (3.5)	6 (1.8)	1 ~
Grade 5	r	18 (3.0)	76 (3.4)	6 (1.8)	1 ~

* Based on countries' categorizations according to UNESCO's International Standard Classification of Education (Operational Manual for ISCED 2011)
** For example, doctorate, master's, or other postgraduate degree
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A tilde (~) indicates insufficient data to report result.
An "r" indicates data are available for at least 70% but less than 85% of the students.
An "x" indicates data are available for at least 40% but less than 50% of the students—interpret with caution.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2023 Longitudinal
Downloaded from: https://timss2023.org/longitudinal/results

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The codebook for the teacher context data file indicates that the variable ATBG04 contains information on fourth-grade teachers' level of formal education, and ATBLG04 contains the same information for fifth-grade teachers, in seven categories:

1. Did not complete <Upper secondary education—ISCED Level 3>
2. <Upper secondary education—ISCED Level 3>
3. <Post-secondary, non-tertiary education—ISCED Level 4>
4. <Short-cycle tertiary education—ISCED Level 5>
5. <Bachelor's or equivalent level—ISCED Level 6>
6. <Master's or equivalent level—ISCED Level 7>
7. <Doctor or equivalent level—ISCED Level 8>

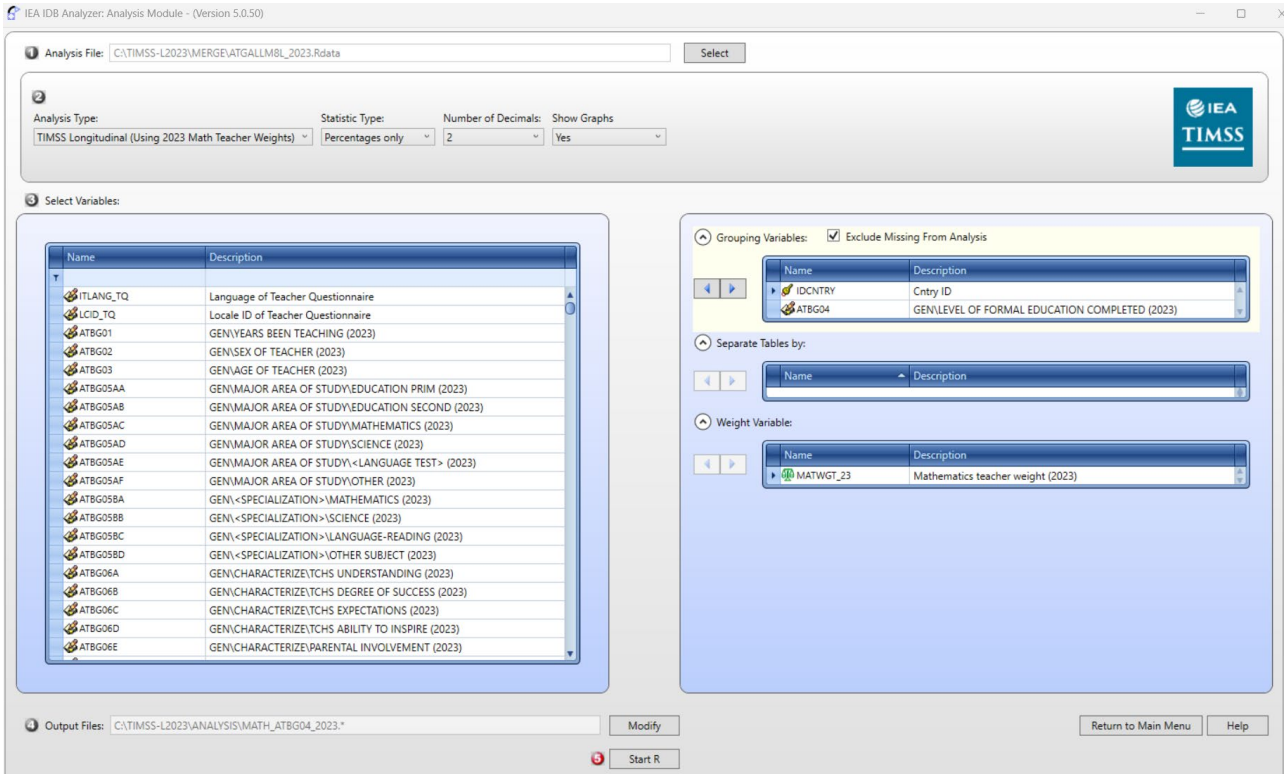
The exhibit reports the original variable in four categories by collapsing original response categories 1 and 2 and categories 6 and 7. The item was specifically designed to be adapted to each unique education system, indicated by the category labels being contained within carets in the codebooks, e.g., "<Bachelor's or equivalent level—ISCED Level 6>." Despite the various education system structures and translations across countries, the variable is made internationally comparable by adhering to the International Standard Classification of Education (ISCED; UNESCO, 2012), which provides an internationally accepted classification scheme for describing levels of schooling across countries. Users can refer to the National Adaptations Database supplemental materials that provide English back translations for the answer categories for each country.

This example uses the merged ATGALLM8L_2023 and ATGALLM8L_2024 example data files. The analysis is conducted in the **Analysis Module** of the IEA IDB Analyzer, separate for each data collection year.

The **Analysis Module** to produce results for students' fourth-grade teachers in 2023 is shown completed in Exhibit 1.22, using the following steps.

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ATGALLM8L_2023 as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS Longitudinal (Using 2023 Math Teacher Weights)** as the **Analysis Type**.
4. Select **Percentages Only** as the **Statistic Type**.
5. Specify the variable ATBG04 as a second grouping variable for teachers' reports in 2023 by first clicking the **Grouping Variables** field to activate it. Then, select ATBG04 from the list of variables in the left panel, and move it to the **Grouping Variables** field by clicking the **right arrow** (▸) button. The IEA IDB Analyzer automatically checks the **Exclude Missing From Analysis**, which excludes cases with missing values on the grouping variables from the analysis. This box should be checked for this analysis.
6. The **Weight Variable** is selected automatically by the software; MATWGT_23 is selected by default because of the **Analysis Type** selected in Step 3.
7. Specify the desired name for the output files and the folder where they will be stored in the **Output Files** field by clicking the **Define/Modify** button. Click the **Start R** button (or Start SPSS/SAS) to create the R script (or SPSS/SAS syntax file) and open it for execution.

Exhibit 1.22: IEA IDB Analyzer Analysis Module Setup for Example 6—Analysis of Teachers' Formal Education



This analysis produces the results output files in the same manner as described for Example 2, with countries identified in the first column and the second column describing the categories of the analysis variable ATBG04. However, because this uses the **Percentages Only** type, no means, confidence intervals, or percent missing are displayed. Exhibit 1.23 shows the results as shown in the R output file with two example countries: Korea and Kosovo. As an example, reading the first line of results for Korea shows that 66.68% of students had teachers in Grade 4 (2023) with Bachelor's degrees or equivalent (standard error of 3.90).

Each country's results are displayed on up to seven lines, one for each value of the ATBG04 variable. There are fewer lines if any category does not have any observations. For example, in Exhibit 1.23, Korea has only three lines of results, because no teacher responded in the lowest categories. A country with no valid data on this variable would not appear in the results output.

For categories with very few students, standard errors associated with percentages may appear unusually high or low because variance estimates cannot be estimated reliably for small numbers of students. In *TIMSS 2023 Longitudinal International Results in Mathematics and Science*, standard errors are not reported for groups of students representing less than 2.5% of a given country (as seen in Exhibit 1.21).

Exhibit 1.23: R Output for Example 6—Analysis of Teachers' Formal Education

Report

Percentages by IDCNTRY ATBG04

Cntry ID	GENOF FORMAL EDUCATION COMPLETED (2023)	N of Cases	Sum of MATWGT_23	Sum of MATWGT_23 (s.e.)	Percent	Percent (s.e.)	Number of Variance Strata
Korea, Republic of	<Bachelor's or equivalent level—ISCED Level 6>	2748	246675	15994.57	66.68	3.90	69
Korea, Republic of	<Master's or equivalent level—ISCED Level 7>	1373	118804	16124.03	32.12	3.95	48
Korea, Republic of	<Doctor or equivalent level—ISCED Level 8>	48	4449	3186.70	1.20	0.86	2
Kosovo	<Upper secondary education—ISCED Level 3> (If you have not completed <postsecondary or tertiary education>, you will b	57	278	179.93	1.37	0.88	3
Kosovo	<Post-secondary, non-tertiary education—ISCED Level 4>	44	361	300.89	1.78	1.47	2
Kosovo	<Short-cycle tertiary education—ISCED Level 5>	98	433	210.29	2.13	1.04	5
Kosovo	<Bachelor's or equivalent level—ISCED Level 6>	3541	16968	918.73	83.41	2.51	81
Kosovo	<Master's or equivalent level—ISCED Level 7>	490	2106	332.67	10.35	1.67	16
Kosovo	<Doctor or equivalent level—ISCED Level 8>	10	196	196.03	0.96	0.96	1

The same steps are used to compute columns for the percentages of students in each category according to their Grade 5 teachers (2024), but using the ATGALLM8L_2024 data file. **TIMSS Longitudinal (Using 2024 Math Teacher Weights)** should be selected as the **Analysis Type**, which uses the MATWGT_24 weight variable by default. ATBLG04 should be defined as the **Grouping Variable**, for percentages of students based on teachers' results in 2024.

CHAPTER 2

Contents and Structure of the TIMSS 2023 Longitudinal International Database

Overview

This chapter describes the contents of the public-use TIMSS 2023 Longitudinal International Database. The various data files and related materials included in the database are described, in accordance with the structure summarized in Exhibit 2.1. Descriptions of data files include the conventions for naming the various file types and variables as well as codes for missing values.

Exhibit 2.1: Contents of the TIMSS 2023 Longitudinal International Database

User Guide	TIMSS 2023 Longitudinal User Guide for the International Database
Data Files	
R Data	Student, process, home, school, and teacher R data files
SPSS Data	Student, process, home, school, and teacher SPSS data files
SAS Data	Student, process, home, school, and teacher SAS data files
Curriculum Data	Curriculum Questionnaire data Excel files
TCMA Data	Test-Curriculum Matching Analysis data Excel files
Supplemental Material	
Codebooks	List describing all variables in the R, SPSS, and SAS data files
Data Almanacs	Country-level summary statistics for all achievement items and context variables
Achievement Item Information	List with information about achievement items
Context Questionnaire Variables	International versions of the context questionnaires and variable mapping details
National Adaptations Database	Documentation of national adaptations to the context questionnaires
Derived Context Variables	Variables derived from the student, home, teacher, and school context data
Special Programs	R, SPSS, and SAS programs to score achievement items

The TIMSS 2023 Longitudinal International Database contains data collected in 2023 and 2024 for student assessment results in mathematics and science, process data, and extensive contextual information collected from participating students as well as their parents, their teachers, and their school principals. Additional data collected from National

Research Coordinators highlight the national contexts of participating countries, focusing on education policies and mathematics and science curricula, including transitions between grade levels.

Exhibit 2.2 lists the TIMSS 2023 Longitudinal participating countries with data in the International Database, along with their alpha and numeric codes used to identify data files and records within the data files. The dot indicates the country participated in those grades.

Exhibit 2.2: Countries in the TIMSS 2023 Longitudinal International Database

Country	Identification Codes		Grades 4 & 5	Grades 8 & 9
	Alpha	Numeric		
Georgia	GEO	268	●	
Italy	ITA	380	●	
Jordan	JOR	400	●	●
Korea, Rep. of	KOR	410	●	●
Kosovo	XKX	411	●	
Montenegro	MNE	499	●	
North Macedonia	MKD	807	●	
Slovenia	SVN	705	●	
Sweden	SWE	752	●	●

TIMSS 2023 Longitudinal Restricted-Use Variables

Exhibit 2.3 lists the variables removed from the public-use data files. Users requiring access to these variables should contact IEA through its Data Repository. Note that the variable reporting students' age is available in the public-use database.

Exhibit 2.3: TIMSS 2023 Longitudinal Restricted-Use Variables

Variable	Description
ITBIRTHY / ITBIRTHM	Students' year and month of birth from the tracking forms
ITDATE_23 / ITDATE_24	Students' testing dates from the tracking forms
ITMODE_x_23 / ITMODE_x_24	Mode of administration for the assessments and context questionnaires
ITDEV_23 / ITDEV_24	Type of device used by students for the assessments
ASBG02A / ASBG02B / ASBLG02A / ASBLG02B BSBG02A / BSBG02B / BSBLG02A / BSBLG02B	Students' year and month of birth from the student questionnaires
ACBG01 / BCBG01	Total school enrollment from the school questionnaire
ACBG02 / ACBLG01 BCBG02 / BCBLG01	School enrollment in the target grade from the school questionnaire

TIMSS 2023 Longitudinal Data Files

The TIMSS 2023 Longitudinal International Database includes data collected from all instruments administered to the students and their parents, school principals, and teachers at both time points, 2023 and 2024. This includes the coded responses to the achievement items, assessment process data for screen-level time and visits, and the responses to the student, home, school, and teacher context questionnaires. These data files also include the achievement scores estimated for participating students, as well as context variables derived from the questionnaire responses. National Research Coordinators' responses to the Curriculum Questionnaires and Test-Curriculum Matching Analysis (TCMA) also are part of the International Database, described in this chapter.

The next few sections describe the format and contents of the public-use TIMSS 2023 Longitudinal data files. Except for the curriculum data files and TCMA data files, the data files are available in R (*.Rdata), SPSS (*.SAV), and SAS (*.SAS7BDAT) formats.

The file names given to the various data file types are shown in Exhibit 2.4. These are named with the suffix "M8L" corresponding to the longitudinal extension of the eighth cycle of TIMSS. Data files for the Grades 4–5 data are named beginning with "A" and the files for Grades 8–9 data are named beginning with "B." The second and third characters indicate the data file type, and the fourth through sixth characters indicate the country according to ISO 3166 alpha code (see Exhibit 2.2). For example, ASGKORM8L.Rdata is an R file that contains Korea's TIMSS 2023 Longitudinal Grades 4–5 student context questionnaire data.

For each file type, a separate data file is provided for each participating country. All data files and the variables they contain are described in the following sections, beginning with the student achievement data files.

Exhibit 2.4: TIMSS 2023 Longitudinal Data File Names

Assessment	File Name	Description
Grades 4 & 5	ACG●●●M8L	School context data files
	ASA●●●M8L	Student achievement data files
	ASP●●●M8L	Student process data files
	ASR●●●M8L	Within-country scoring reliability data files
	ASG●●●M8L	Student context data files
	ASH●●●M8L	Home context data files
	AST●●●M8L	Student-teacher linkage files
	ATG●●●M8L	Teacher context data files
Grades 8 & 9	BCG●●●M8L	School context data files
	BSA●●●M8L	Student achievement data files
	BSP●●●M8L	Student process data files
	BSR●●●M8L	Within-country scoring reliability data files
	BSG●●●M8L	Student context data files
	BST●●●M8L	Student-teacher linkage files
	BTM●●●M8L	Mathematics teacher context data files
	BTS●●●M8L	Science teacher context data files

●●● = Three-character country abbreviation based on the ISO alpha coding scheme (see Exhibit 2.2)

Student Achievement Data Files (ASA/BSA)

The TIMSS 2023 Longitudinal student achievement data files contain the coded responses to the individual achievement items in the assessments administered in 2023 and 2024. The student achievement data files also include achievement variables (plausible values) for the mathematics and science scales for 2023 and 2024, along with the difference between the two time points, as well as sampling and weighting variables for analysis.

Even though the same assessment items were administered at both time points (see Section 1 of the *TIMSS 2023 Longitudinal Technical Report*), the TIMSS 2023 Longitudinal student achievement data files include separate variables to store item data collected in 2023 and item data collected in 2024.

In all the booklets administered as part of TIMSS 2023 Longitudinal, some of the items were multiple-choice format and some were constructed-response format. The student achievement data files contain the actual responses to the multiple-choice questions (e.g., where 1 corresponds to the first response option, 2 to the second option, and so on), and the score codes assigned to the constructed-response items based on the TIMSS 2023 scoring guides.

Achievement Item Variable Naming Convention

The variable names for the item responses collected in 2023 begin "M" for mathematics items and "S" for science items, following an eight- or nine- character naming convention as described below. The data collected in 2024 use the same convention, but with a second character "L" added so that the variables begin with "ML" or "SL."

For 2023 item variables:

- The first character is either "M" for mathematics items, or "S" for science items.
- The second character indicates the assessment mode or type. The letter "E" is used for stand-alone digital items, and "Q" is used for items that are part of TIMSS Problem-Solving and Inquiry (PSI) tasks (see Chapter 1 in *TIMSS 2023 Technical Report*).
- The third character indicates the assessment cycle when the item was first presented in TIMSS.
- The fourth character is either "1" for fourth- and fifth-grade items or "2" for eighth- and ninth-grade items.
- The fifth through seventh characters represent a unique three-digit number used to identify the items.
    - TIMSS PSI items have a letter identifier for the fifth character corresponding to the particular PSI task, followed by two numeric digits. In Grades 4–5 mathematics, the letter "A" is used for the *Little Penguins* PSI, "B" for the *Amazon River*, "R" for a set of *Robots* items, and "Z" for *Amazing Bamboo*. In science, the letter "R" is used for *Earth's Motions* and "S" for *Sugar Experiment*. In Grades 8–9 mathematics, "D" is used for *Dinosaur Speed*, "C" for the *Singing Competition*, and "N" for *Tennis Balls*. In science, "T" is used for *Earth's Motions*, "L" for *Elephants*, and "S" for *Sunken Ship*.
- The eighth character indicates the item part and appears only when required. It is generally a letter from "A" to "H," depending on how many parts there are to a particular item.
- An additional ninth or tenth character is present when an item part itself consists of further parts.

As an example of an item variable name storing 2023 data, MQ71A04A is the first part (part A) of a fourth-grade mathematics PSI TIMSS item introduced in TIMSS 2019 and whose sequential number in the task is 4. The corresponding item variable for 2024 data is MLQ71A04A. The data variable labels specify the data collection year.

Achievement Item Response Codes

A series of conventions were adopted to code the item responses included in the student achievement data files. The value assigned to each item response depends on the item format.

For multiple-choice items, numerical values 1, 2, 3, 4, etc., are used to correspond to the response options A, B, C, D, etc., respectively. For these items, the correct response key is included in the item information files and as part of the variable label in the achievement codebook files (described in a later section).

Each constructed-response item has its own scoring guide that uses a one- or two-digit coding scheme. Items developed in TIMSS 2019 and earlier cycles use the two-digit coding scheme, and items developed in TIMSS 2023 and later use the one-digit scheme.

The two-digit coding scheme uses two-digit codes to characterize the response. The first digit of the code refers to the number of score points given to the response. For correct or partially correct responses, the first digit is 1 for one-point responses or 2 for two-point responses. For an incorrect response, the first digit is 7. The second digit of the score provides diagnostic information for correct and incorrect responses, such as indicating a specific method used to solve the problem or to track a common student misconception or error. An incorrect response not fitting a pre-defined incorrect code is given a 79 for "other incorrect." If no diagnostic categories are defined, all incorrect responses receive code 79. A special two-digit code, 99, is used for responses left completely blank.

In the one-digit coding, the 0 is used for incorrect responses. For correct or partially correct responses, 1 is used for one-point responses and 2 is used for two-point responses. For some items, code 7 (0-point response) can be assigned to an incorrect response with a notable misconception or to an incorrect response with some elements of a correct answer which is nonetheless wrong. Code 9 is used for responses left completely blank.

Chapter 3 describes R, SPSS, and SAS programs available in the TIMSS 2023 Longitudinal International Database that convert all item response codes into correctness scores (score points) for analysis.

Derived Achievement Item Variables

For some items, students were asked to provide more than one answer or a multiple-part answer, each one being scored separately. The pattern of responses across these item parts determined the score on the item as a whole. These multi-part items can be worth 1 or 2 score points, according to their scoring guide. A list of all derived item variables in the TIMSS 2023 assessments and the rules for awarding item response codes is provided in Appendix 10G of *TIMSS 2023 Technical Report.* The same derived item variables are

included for 2024, following the naming convention described above with an "L" added as the second character.

The schemes for naming and assigning response codes for derived items follow the same conventions for constructed-response items described in the previous sections on Achievement Item Variable Naming Convention and Achievement Item Response Codes. The total score for the item is contained in a derived variable, identified by the word "DERIVED" in the item label.

For example, derived item variables SE71009 (2023 data) and SLE71009 (2024 data) contain the combined score for its six parts labeled SE71009A through SE71009F and SLE71009A through SLE71009F. The derived item response was assigned 2 score points (complete comprehension) if all six parts were answered correctly, 1 score point (partial comprehension) if four or five parts were answered correctly, and 0 points otherwise.

Codes for Missing Values on Achievement Items

A subset of values is reserved for specific item response codes related to different categories of missing data. The codebooks specify the exact scheme used for each variable.

Not Administered Response Codes (R: NA; SPSS: SYSMIS; SAS: .A)
Not Administered codes are used to distinguish cases from data that were missing due to student nonresponse. The Not Administered code was used in the following cases:

- Assessment item was not assigned to the student
- Student was absent from the session or part of the session when the item was administered
- Item malfunctioned, mistranslated, or deleted due to poor psychometric functioning (see Appendix C of the *TIMSS 2023 Longitudinal Technical Report*)

Omitted or Invalid Response Codes (R: 9, 99; SPSS: 9, 99; SAS: .)
Omitted or invalid response codes were used for items that a student was administered and had a chance to respond, but did not.

Not Reached Response Codes (R: 6, 96; SPSS: 6, 96; SAS: .R)
An assessment item was considered *Not Reached* when the item itself and the one immediately preceding it were not answered, and no other items were answered in the remainder of that part of the booklet. These codes are implemented separately for each part.

Handling Missing Values in R
When using R data files (*.Rdata) without the IDB Analyzer, it is crucial to understand how missing data is represented and handled. In R, there is only one true native missing code: *NA*. However, the R data files were originally created from SPSS files, where multiple user-

defined missing codes can be represented as specific numeric values. For example, in the SPSS files, missing codes for “omitted” responses are often represented as 9, 99, etc., while “not reached” codes in the achievement files are represented as 6, 96, and so on.

To determine which numeric values have been defined as missing values, users can check the R data file by executing the following command line:

attr(<your R data file>$<variable of interest>, “na_values”)

Alternatively, you can consult the "Missing Scheme Detailed (SPSS)" column in the codebook. This resource provides the necessary details for correctly identifying and handling missing data. This should also be taken into account when adding variables to R data files. Any numeric missing codes should be recoded to R’s native *NA*.

TIMSS Achievement Variables

The TIMSS 2023 Longitudinal International Database includes five plausible values for each achievement measure. Results for the TIMSS achievement scales were produced for overall mathematics and science in both 2023 and 2024, as well as the difference between them (change) to facilitate analysis of average growth between years. The TIMSS 2023 Longitudinal achievement plausible values are listed in Exhibit 2.5.

Exhibit 2.5: TIMSS 2023 Longitudinal Plausible Values of Achievement

Assessment		Plausible Values of Achievement	
Grades 4 & 5	Mathematics	2023	ASMMAT11 – ASMMAT15
		2024	ASMMAT21 – ASMMAT25
		Change	ASMCHG01 – ASMCHG05
	Science	2023	ASSSCI11 – ASSSCI15
		2024	ASSSCI21 – ASSSCI25
		Change	ASSCHG01 – ASSCHG05
Grades 8 & 9	Mathematics	2023	BSMMAT11 – BSMMAT15
		2024	BSMMAT21 – BSMMAT25
		Change	BSMCHG01 – BSMCHG05
	Science	2023	BSSSCI11 – BSSSCI15
		2024	BSSSCI21 – BSSSCI25
		Change	BSSCHG01 – BSSCHG05

A detailed description of the TIMSS 2023 Longitudinal scaling approach and how these achievement measures were created is available in Section 6 *TIMSS 2023 Longitudinal Technical Report*.

The plausible values for any given scale are the best available measures of student achievement in the TIMSS 2023 Longitudinal International Database and should be used as the outcome measure in any study of student achievement or growth. It is important to note that these plausible values are not suitable measures of individual student achievement or growth. Plausible values can be analyzed readily using the IEA IDB Analyzer.

The plausible value variable names in Exhibit 2.5 are based on an eight-character alphanumeric code, which adheres to the following rules:

- The first character is either “A” for fourth- and fifth-grade variables, or “B” for eighth- and ninth-grade variables.
- The second character is always “S” to indicate it is a student achievement scale variable.
- The third character is either “M” for a mathematics score, or “S” for a science variable.
- The fourth through sixth characters are a three-character code describing the achievement scale, “MAT” for mathematics by year, “SCI” for science by year, or “CHG” for the difference between years.
- The seventh character is a “1” for plausible values of 2023 achievement, “2” for plausible values of 2024 achievement, or “0” for the difference between years.
- The eighth character indicates the plausible value: 1, 2, 3, 4, or 5.

For example, ASMMAT11 is the first plausible value on the mathematics scale for achievement at Grade 4 in 2023.

TIMSS International Benchmarks of Achievement

To help users of the TIMSS data understand what performance on the overall mathematics and science achievement scales signifies in terms of the mathematics and science students know and can do, TIMSS identified four points on the overall mathematics and science scales to serve as International Benchmarks (see Chapter 14 of *TIMSS 2023 Technical Report*). As shown in Exhibit 2.6, the TIMSS International Benchmark scores are 625, 550, 475, and 400, which correspond to the Advanced, High, Intermediate, and Low International Benchmark, respectively.

Exhibit 2.6: TIMSS International Benchmarks of Mathematics and Science Achievement

Scale Score	International Benchmark
625	Advanced International Benchmark
550	High International Benchmark
475	Intermediate International Benchmark
400	Low International Benchmark

The TIMSS 2023 Longitudinal International Database contains a set of variables indicating which International Benchmark the students have reached in each data collection year for each of the five plausible values in mathematics and science. The International Benchmark variables follow the achievement score variable naming convention where the fourth through sixth positions have the letters "IBM." Thus, for the Grades 4–5 data, **ASMIBM11–15** are the five benchmark variables for mathematics in 2023, **ASMIBM21–25** are the variables for mathematics in 2024, **ASSIBM11–15** are the five benchmark variables for science in 2023, and **ASSIBM21–25** are the variables for science in 2024. The same variable names are used for Grades 8–9, but using "B" as the first character instead of "A."

The codes defined for the benchmark variables are described in Exhibit 2.7.

Exhibit 2.7: TIMSS International Benchmark Variable Codes

Code	Description
1	Performed below the Low International Benchmark
2	Performed at or above the Low International Benchmark, but below the Intermediate Benchmark
3	Performed at or above the Intermediate International Benchmark, but below the High Benchmark
4	Performed at or above the High International Benchmark, but below the Advanced Benchmark
5	Performed at or above the Advanced International Benchmark

Nonresponse Indicator Variables

The student achievement data files include several variables indicating whether students had omitted or not-reached item responses for different subgroups of items based on item type and TIMSS mathematics or science subdomain. These nonresponse indicator variables were utilized in calibration and when generating plausible values of student achievement. The nonresponse indicator variables equal 1 if the student answered all items in the subset, or 0 if the student had at least one missing item response in the subset. The nonresponse indicator variable names are based on an eight- or nine-character scheme, with the last three digits indicating the TIMSS content subdomain for the group of items according to the *TIMSS 2023 Assessment Frameworks*.

The same variable names are used to store indicators based on item response data for 2023 and 2024, respectively, but for data collected in 2024, the letter "L" is added following the first subject character. For more information about how these variables were used in achievement scaling, see Chapter 12 of *TIMSS 2023 Technical Report* and Section 6 of *TIMSS 2023 Longitudinal Technical Report*.

Student Process Data Files (ASP/BSP)

The TIMSS 2023 Longitudinal student process data files contain variables associated with students' screen navigation in the digital assessments. The data files include separate variables to store process data collected in 2023 and data collected in 2024. Event log data files from which the variables were derived are available for restricted use through the IEA Study Data Repository.

The process data files include three types of process variables associated with the individual screens in the assessments:

- Total time on screen (seconds)
- Time on first screen visit (seconds)
- Number of screen visits (frequency)

Codebooks published with the database list all derived variables included in the data files and describe codes for missing values in the process data. The process variables for each screen are named according to the item variable naming convention (described in the previous Achievement Item Variable Naming Convention section for the student achievement data files), followed by the suffix "_S" for total time, "_R" for time on first visit, and "_F" for the number of visits.

Typically, a screen displays a single item and thus will have the same ID as the item shown. However, there are occasional screens that display more than one item sharing a common stem but requiring separate responses. In these instances, the variable names consist of the first seven common characters of the corresponding item names for 2023, or the first eight common characters for 2024. For example, ME72106A, ME72106B, and ME72106C are three items with separate responses but share the same stem and are shown on the same screen. The process data variable names associated with that screen for 2023 data are ME72106_S for total time spent on screen, ME72106_R for time spent on first screen visit, and ME72106_F for the frequency of screen visits. For data collected in 2024, the variable names are MLE72106_S, MLE72106_R, and MLE72106_F. PSI screens may not contain any items and use a different naming convention. The Achievement Item Information downloads (see later section) list the screen ID associated with each item ID. The screen ID is always the basis of the process variable name.

The student process data variables were derived from the raw student response data files generated through the TIMSS 2023 digital assessments administered in 2023 and

2024. The raw event log data files contain timestamped records of students' interactions with the digital assessment. For the generation of derived process variables, specific events corresponding to the screen navigation were used. The data in the student process data files were cleaned for inconsistencies, outliers, and any known technical issues in the production of the raw data files.

In addition to the derived process variables, the student process data files include identification and tracking data for each student (see later sections on Identification Variables and Tracking Variables), and additional tracking and indicator variables about student participation and cleaning of the process variables. Variables ITPARTPT1_23, ITPARTPT1_24, ITPARTPT2_23, and ITPARTPT2_24 indicate whether the student has valid item responses (non-missing) in the respective part of the assessment for each assessment year. Process data is not available for a part if no valid item responses are available. Variables FLAGPT1_23, FLAGPT1_24, FLAGPT2_23, and FLAGPT2_24 indicate whether the student had process data removed in a specific part of the assessment for each year. More information about the codes used in these variables can be found in the codebooks corresponding to the data files.

Within-Country Scoring Reliability Data Files (ASR/BSR)

The TIMSS within-country scoring reliability data files contain data that can be used to investigate the reliability of the item scoring for human-scored constructed-response items. The scoring reliability data files contain one record for each student whose responses to constructed-response items, in whole or in part, were double scored during the within-country scoring reliability exercise (see Chapter 7 and Chapter 10 in *TIMSS 2023 Technical Report*—the same procedures were used in both 2023 and 2024). For each constructed-response item requiring human scoring, the following three variables are included in the scoring reliability data files:

- **Original Score:** the score assigned by the first scorer and also present in the student achievement files
- **Second Score:** the score assigned by the second scorer and present only in the scoring reliability files
- **Score Agreement:** a dichotomous variable indicating agreement between the two scorers

In the student achievement data files (ASA/BSA), the variables ILRELIAB_23 and ILRELIAB_24 indicate whether the students' responses were included for scoring reliability (1) or not included (0), for the 2023 and 2024 data collection, respectively.

It should be noted that the Second Score data were used only to evaluate within-country scoring reliability and were not used in computing the achievement scores

included in the International Database and presented in *TIMSS 2023 Longitudinal International Results in Mathematics and Science*.

Scoring Reliability Variable Naming Convention

The variable names for the Original Score, Second Score, and Score Agreement variables are based on the same naming convention as the achievement item variables discussed earlier. The Second Score and Score Agreement variables have one more character added to the Original Score variable as follows:

- The **Original Score** variable follows the item variable naming convention described earlier. For 2023 data variables, the second character has letter "E" for a digital item or the letter "Q" for a digital PSI item. For 2024 data variables, the letter "L" precedes this.
- The **Second Score** variable has the letter "R" added to the Original Score variable after the second character for 2023 data variables (e.g., MER81033), or after the third character for 2024 data variables (e.g., MLER81033).
- The **Score Agreement** variable has the letter "I" added to the Original Score variable after the second character for 2023 data variables (e.g., MEI81033), or after the third character for 2024 data variables (e.g., MLEI81033).

Scoring Reliability Codes

The values contained in both the Original Score and Second Score variables are the scores assigned using the TIMSS scoring guides. The Score Agreement variable may have one of three values, depending on the degree of agreement between the score codes assigned by the two scorers, as described in Exhibit 2.8. The earlier section on Achievement Item Response Codes describes how codes in the scoring guides translate to score points (levels).

Exhibit 2.8: TIMSS 2023 Longitudinal Score Agreement Variable Codes

Code	Description
0	Identical codes and score levels
1	Identical score levels, but different diagnostic codes
2	Different score levels

Context Data Files

This section describes the TIMSS 2023 Longitudinal context data files and the conventions for naming the various files and variables and coding the data. There are six types of context data files: the first four context data files correspond to the four types of context questionnaires administered as part of TIMSS 2023 Longitudinal (student, home, school, and teacher); the fifth data file serves to link the student and teacher context data; and the

sixth data file corresponds to the Curriculum Questionnaires administered to the National Research Coordinators of each participating country. Curriculum data are provided separately from the other data files in the International Database. Comprising mostly descriptive, narrative information about the national education systems, these data are provided in Excel format.

The four context data files for student, home, school, and teacher questionnaires contain the responses to the questions asked in their respective context questionnaires, plus additional derived context variables (see Derived Context Variable supplemental material), as well as variables for the context questionnaire scales (see Section 8 of *TIMSS 2023 Longitudinal Technical Report*).

The home questionnaires were only administered to students' parents at Grades 4–5. For Grades 8–9, separate files are provided for mathematics teachers and science teachers.

In each data file, separate variables are included to report context data collected in 2023 and 2024, and variables reporting data for 2024 include an "L" as the fourth character of the variable name. Student and home data contain one record for each participating student. School data contains one record for each participating school, even if a different principal from the same school responded to the questionnaire in 2024 compared to 2023.

While student, home, and school data contain single records for each respondent to report data collected in both years, the TIMSS 2023 Longitudinal International Database includes 2023 and 2024 teacher data as separate records, intended for separate analysis, even if they are the same individual across years. For each time point, the mathematics and science teachers who taught the sampled students during that school year completed a context questionnaire pertaining to the class for that year. Because responses to the teacher questionnaires pertain only to the class for the particular school year, teacher questionnaire data should not be combined across years, even when provided by the same teacher. Analyses can be conducted to examine the characteristics or instructional practices of students' teachers for the 2023 school year (Grades 4 or 8) or for the 2024 school year (Grades 5 or 9). Therefore, users will need to choose the year of interest for analyzing teacher data. Student-teacher linkage files link student and teacher context data for analysis, and students may have had more than one teacher in a given year.

Student Context Data Files (ASG/BSG)

The student context data files contain responses to the context questionnaire administered to students at each time point with questions related to their home context, school experiences, and attitudes toward mathematics and science. They also contain students' mathematics and science achievement variables (plausible values) and variables derived from questionnaire responses.

Two versions of the student questionnaire were administered for Grades 8–9. One version is for students in educational systems where science is taught as an integrated subject (General/Integrated Science version). The other version is for students in educational systems where the sciences—biology, physics, chemistry, and earth science—are taught as separate subjects (Separate Science version).

For students who were administered the General/Integrated Science version, questions that were given only in the Separate Science version were coded as "Not Administered." For students who were assigned the Separate Science version, questions that were asked only in the General/Integrated Science version were coded as "Not Administered." Korea administered General/Integrated questionnaires in both years and Sweden administered Separate Science questionnaires in both years. Jordan administered General/Integrated questionnaires in 2023, but Separate Science questionnaires in 2024.

There was a single version of the Grades 4–5 student questionnaire for each data collection year, tailored for general science.

The student context data files also contain a number of identification, tracking, sampling, and weighting variables. These variables are described later in the section on Structure and Design Variables.

Home Context Data Files (ASH)

For countries that participated at Grades 4–5, TIMSS 2023 Longitudinal included a home questionnaire for each of the data collections to be completed by the students' parents or guardians. The questionnaires asked questions about preparations for primary schooling, including attendance in preschool and numeracy and literacy activities in the home before the child began school, such as reading books, singing songs, writing letters or words, or adding and subtracting. Parents also answered questions about home resources, their highest level of education, and their employment status. The home questionnaire data needs to be merged with the student questionnaire data file for analysis, as the student data file contains the sampling weights and achievement variables. These files can be merged using IDCNTRY and IDSTUD as matching variables.

School Context Data Files (ACG/BCG)

The school context data files contain principals' responses to the questions in the school questionnaires administered in 2023 and 2024. Although school-level analyses where the schools are the units of analysis can be performed, it is preferable to analyze school-level variables as attributes of students. To perform student-level analyses with school data, the school context data files must be merged with the student context data files using the country and school identification variables.

Teacher Context Data Files (ATG/BTM/BTS)

The mathematics and science teachers of the participating students were administered a questionnaire with questions pertaining to their teaching context and attitudes and their teaching practices for each of the classes they taught to the sampled students. For each of the data collection years, the teacher context data files contain one record for each of the classes taught either by a mathematics or a science teacher.

If a teacher taught more than one class to the sampled students, they were expected to complete multiple questionnaires for each class taught. The teacher files contain one record per class taught by a teacher to the selected students. By definition, classes in 2023 are different from those in 2024, even if taught by the same teacher to the same students, and therefore the teacher questionnaire has one entry for each of these classes.

There were two types of teacher questionnaires administered for Grades 8–9: one for the mathematics teachers, and one for the science teachers. As described in Exhibit 2.4, the responses of teachers to the mathematics questionnaires are found in the BTM files and the responses of teachers to the science questionnaires are found in the BTS files. For Grades 4–5, there was a single teacher questionnaire for each year requesting information on both mathematics and science, and all teachers' responses are found in the ATG files.

In all teacher context data files, each teacher record has a unique identification number (IDTEACH) and a link number (IDLINK) combination that is specific to the class taught by the teacher. The IDTEALIN variable is a concatenation of IDTEACH and IDLINK. Students linked to teachers identified by the same IDTEACH but different IDLINK are taught by the same teacher but in different classes. The ITYEAR variable indicates the year in which the teacher data was collected. The teacher context data files can be linked to the student data files, with sampling variables and achievement scores, using the student-teacher linkage data files, described next.

When conducting analysis, it is important to note that the teachers in the teacher context data files do not constitute a representative sample of teachers in a country, but rather are the teachers who taught a representative sample of students. The teacher data, therefore, should be thought of as attributes of the students to which they are linked through the student-teacher linkage data files.

Student-Teacher Linkage Data Files (AST/BST)

The student-teacher linkage data files contain one entry per student-teacher linkage combination for each assessment year. For instance, if a student has three teachers in 2023 and three teachers in 2024, the file has six entries corresponding to that student. The sole purpose of the student-teacher linkage data files is to link students with their teacher-level data to perform appropriate student-level analyses. The student-teacher linkage data

files also include sampling and weighting information and achievement scores to facilitate the analyses of teacher data.

Curriculum Data

The TIMSS 2023 Longitudinal Curriculum Data contains the responses provided by the National Research Coordinators of the participating countries to the Curriculum Questionnaires administered in 2023 and 2024. The data are available to download in Excel files for each grade from the TIMSS 2023 Longitudinal International Database webpage. Separate sheets contain responses separate for 2023 and 2024, for general (not subject-specific) questions, mathematics questions, and science questions, respectively.

Context Variable Naming Convention

The context variable naming convention for the variables in the student, home, school, and teacher context data files uses a string with seven to nine characters. The following rules are applied in naming the context variables:

- The first character is always "A" for fourth- and fifth-grade data, or "B" for eighth- and ninth-grade data.
- The second character indicates the source of the data. The letter "C" identifies data from the school questionnaire, the letter "T" for teacher questionnaire, and the letter "S" for student and home data.
- The third character is used to indicate the source of the data. The letter "B" is used for all context variables reporting responses to the context questionnaires. The letter "D" is used for variables derived from responses in the context questionnaires. In addition, the letter "B" is used for the Rasch scores to context questionnaire scales derived from questionnaire data, and the letter "D" is used for the categorical (index) variables constructed from these context questionnaire scale Rasch scores (see Section 8 of *TIMSS 2023 Longitudinal Technical Report*).
- A fourth character "L" is added for data collected in 2024. This character is not used for data collected in 2023.
- The fourth character (2023 data) or fifth character (2024 data) is used to indicate the subject or topic to which a context question refers. The following letters are used:

  G—General questions (not subject-specific)

  H—Home questionnaire questions

  M—Questions related to mathematics

  S—Questions related to science

  B—Questions related to biology

C—Questions related to chemistry

E—Questions related to earth science

P—Questions related to physics

- The fifth through eighth characters (2023 data) or sixth through ninth characters (2024 data) of all context variables represent the sequential numbering of the questions as presented in their respective questionnaires.

The curriculum data files follow their own variable naming convention whereby the first three characters of a variable name are as follows:

GEN—General questions (not subject-specific)

MA4—Questions related to fourth-grade mathematics (2023 data only)

MA5—Questions related to fifth-grade mathematics (2024 data only)

SC4—Questions related to fourth-grade science (2023 data only)

SC5—Questions related to fifth-grade science (2024 data only)

MA8—Questions related to eighth-grade mathematics (2023 data only)

MA9—Questions related to ninth-grade mathematics (2024 data only)

SC8—Questions related to eighth-grade science (2023 data only)

SC9—Questions related to ninth-grade science (2024 data only)

The remaining characters in the curriculum data variable naming convention refer to the question location, as summarized in Exhibit 2.9.

Context Question Location Convention

The context variable naming convention explicitly indicates the ordering of questions in the context questionnaires. Each question was also assigned a unique location code. This unique code includes the sequence number of the question within the questionnaire—the same sequence number found in the question's variable name—appended to a three-character string corresponding to the questionnaire source as shown in Exhibit 2.9. For example, if the question location for the 2023 instrument is given as SQG-08A, it refers to part A of general question 8 in the student context questionnaire given in 2023. The data for this question is stored in the student context data files (ASG) under variable name ASBG08A. This convention is followed in the codebooks, the data almanacs, and in the description of the variables included in the Context Questionnaire Variables download, all available on the TIMSS 2023 Longitudinal International Database webpage.

Exhibit 2.9: TIMSS 2023 Longitudinal Context Variable and Question Location Naming Convention by Data Collection Year

Questionnaire	Question Location Name		Context Variable Name		Question Types
	2023	2024	2023	2024	
Student Questionnaire	SQG-●●●	SQG-●●●	ASBG●●● BSBG●●●	ASBLG●●● BSBLG●●●	Grade 4/5 general Grade 8/9 general
	SQMS-●●●	SQMS-●●●	ASBM●●● ASBS●●●	ASBLM●●● ASBLS●●●	Grade 4/5 mathematics Grade 4/5 science
	SQM-●●●	SQM-●●●	BSBM●●●	BSBLM●●●	Grade 8/9 mathematics
	SQIS-●●●	SQIS-●●●	BSBS●●●	BSBLS●●●	Grade 8/9 integrated science
	SQSS-●●● (Grade 8 Separate science version)	SQSS-●●● (Grade 9 Separate science version)	BSBS●●● BSBB●●● BSBC●●● BSBE●●● BSBP●●●	BSBLS●●● BSBLB●●● BSBLC●●● BSBLE●●● BSBLP●●●	Grade 8/9 general science Grade 8/9 biology Grade 8/9 chemistry Grade 8/9 earth science Grade 8/9 physics
Home Questionnaire	HQ-●●●	HQ-●●●	ASBH●●●	ASBLH●●●	Grade 4/5 all
School Questionnaire	ScQ-●●●	ScQ-●●●	ACBG●●● BCBG●●●	ACBLG●●● BCBLG●●●	Grade 4/5 all Grade 8/9 all
Teacher Questionnaire	TQG-●●●	TQG-●●●	ATBG●●● BTBG●●●	ATBLG●●● BTBLG●●●	Grade 4/5 general Grade 8/9 general
	TQM-●●●	TQM-●●●	ATBM●●● BTBM●●●	ATBLM●●● BTBLM●●●	Grade 4/5 mathematics Grade 8/9 mathematics
	TQS-●●●	TQS-●●●	ATBS●●● BTBS●●●	ATBLS●●● BTBLS●●●	Grade 4/5 science Grade 8/9 science
Curriculum Questionnaire	CQG-●●●	CQG-●●●	GEN●●●	GEN●●●	General
	CQM4-●●●	CQM5-●●●	MA4●●●	MA5●●●	Grade 4/5 mathematics
	CQS4-●●●	CQS5-●●●	SC4●●●	SC5●●●	Grade 4/5 science
	CQM8-●●●	CQM9-●●●	MA8●●●	MA9●●●	Grade 8/9 mathematics
	CQS8-●●●	CQS9-●●●	SC8●●●	SC9●●●	Grade 8/9 science

●●● = Sequential numbering of the question location in the questionnaire for data collection year

Context Variable Response Codes

The values assigned to each of the context variables depend on the item format and the number of options available. For categorical questions, sequential numerical values are used to correspond to the response options available. The numbers correspond to the sequence of appearance of the response options. For example, the first response option is represented with a 1, the second response option with a 2, etc. Open-ended questions such as “How many students are in this class?” are coded with the actual number given as a response.

Codes for Missing Values on Context Items

A subset of values was reserved for specific item response codes related to different categories of missing data, described below.

Not Administered Response Codes (R: NA; SPSS: SYSMIS; SAS: .A)
Special codes were given to items that were *Not Administered* to distinguish these cases from data that were missing due to nonresponse. The Not Administered code was used in the following cases:

- The entire questionnaire was not completed or not returned by the respondent
- Question was removed from a country's national questionnaire
- Question malfunctioned, misprinted, mistranslated, or not internationally comparable

The National Adaptations of the Context Questionnaires downloads available from the TIMSS 2023 Longitudinal International Database webpage reports all instances of questions removed or questions modified such that the data were not internationally comparable.

Omitted or Invalid Response Codes (R: 9, 99, 999, ...; SPSS: 9, 99, 999, ...; SAS: .)
Omitted or invalid response codes were used for questions that were presented and should have been answered but were not. The length of the Omitted response code given to a variable in the R and SPSS data files depends on the number of characters needed to represent the variable. In all cases, the space necessary to represent the variable is filled with 9s. No distinction is made between items left blank and items with invalid responses.

Not Applicable Response Codes (R: 6, 96, 996, ...; SPSS: 6, 96, 996, ...; SAS: .B)
Not Applicable response codes were used for the context questionnaire items for which responses were dependent upon a filter question. For example, in the eighth- and ninth-grade Student Questionnaires—Separate Science Version, if a student answers "No" to being asked if they studied biology in school this year, all questions corresponding to biology were coded as "Not Applicable."

Context Questionnaire Scales and Derived Variables

In the context questionnaires administered as part of TIMSS 2023 Longitudinal, there are instances where several questions are asked about various aspects of a single construct. In these cases, responses to the individual items were combined to create a score which provided a more comprehensive interpretation of the construct of interest than the individual variables could on their own. These context questionnaire scales also were categorized, usually into three groups, to create an index. The context questionnaire scales and their indices are included in the TIMSS 2023 Longitudinal International Database context data files and described in Section 8 of *TIMSS 2023 Longitudinal Technical Report*.

Additional variables were derived from responses to multiple questions to provide additional information for analysis and reporting. Parents' education is an example where responses from both parents were combined into a single variable to report a single educational level. A description of the derived variables included in the TIMSS 2023 Longitudinal International Database is provided in the Derived Context Variables download on the TIMSS 2023 Longitudinal International Database webpage.

Sampling and Weighting Variables

Several sampling and weighting variables are included in the TIMSS 2023 Longitudinal data files; they are listed and described in Exhibit 2.10. Exhibit 2.11 indicates the location of the various sampling and weighting variables among the different types of data files in the TIMSS 2023 Longitudinal International Database. It is important to note that the teacher context data files, home context data files, and scoring reliability data files do not contain any sampling and weighting variables.

The variable TOTWGT is the overall student sampling weight that should be used for most student-level analyses (except when teacher data are involved—see below). The variable TOTWGT, within each country, sums up to the estimated population of students in the country.

The variable SENWGT is a linear transformation of the student TOTWGT that adds to 500 within each participating country. This weight is used during TIMSS operational calibration procedures to control the proportional contribution of each country to the estimates. By using the SENWGT, each country contributes the same to the analysis, regardless of sample or population size, assuming no missing data on the analysis variables.

HOUWGT is another transformed version of TOTWGT that adds to each country's actual sample size. This weight can be used with some legacy analysis programs that use actual sample size, instead of the sum of the weights, for variance estimation. While such programs are rare, users can check for this by running the same analysis using TOTWGT and using HOUWGT and comparing the results. Except for estimates of population size (e.g., number of students), all other estimates should not vary.

The weight variables TOTWGT, SENWGT, and HOUWGT are designed for use in student-level analyses from all student-level and school-level files, including the home context data files. The weight variable SCHWGT is designed for use in school-level analyses where the schools are the units of analysis. The weight variable STOTWGTU is a school-level weight which is the sum of TOTWGT for all students within a school.

Exhibit 2.10: TIMSS 2023 Longitudinal Sampling and Weighting Variables

Variable	Description
TOTWGT	Total student weight—sums to the national student population
SENWGT	Student senate weight—sums to 500 in each country
HOUWGT	Student house weight—sums to the national student sample size
SCHWGT	Total school weight—the product of WGTFAC1 and WGTADJ1
STOTWGTU	Sum of TOTWGT at the school level
TCHWGT_23	Overall teacher weight (2023)
TCHWGT_24	Overall teacher weight (2024)
MATWGT_23	Mathematics teacher weight (2023)
MATWGT_24	Mathematics teacher weight (2024)
SCIWGT_23	Science teacher weight (2023)
SCIWGT_24	Science teacher weight (2024)
JKZONE	The sampling zone, or stratum, to which the student's school is assigned
JKREP	The sampling replicate, or primary sampling unit, to which the student's school is assigned
JKCZONE	The sampling zone, or stratum, to which the school is assigned
JKCREP	The sampling replicate, or primary sampling unit, to which the school is assigned
WGTFAC1	School weighting factor
WGTADJ1	School weighting adjustment
WGTFAC2	Class weighting factor
WGTADJ2	Class weighting adjustment
WGTFAC3	Student weighting factor
WGTADJ3	Student weighting adjustment

The weight variables TCHWGT_23, TCHWGT_24, MATWGT_23, MATWGT_24, SCIWGT_23, and SCIWGT_24 are specifically designed for using teacher context data in student-level analyses and are based on TOTWGT. TCHWGT_23 and TCHWGT_24 are used for analyses using all teachers of students in 2023 and 2024, respectively. MATWGT_23, MATWGT_24, SCIWGT_23, and SCIWGT_24 are used for analyses of 2023 and 2024 mathematics teachers and 2023 and 2024 science teachers, respectively. These teacher weights, used in practice as student-level weights, are located in the student-teacher linkage files (AST and BST), not in the actual teacher context data files (ATG, BTM, and BTS). Analyses with teacher data will be weighted properly by merging the teacher files with the student-teacher linkage files.

Exhibit 2.11: Locations of Sampling and Weighting Variables in TIMSS 2023 Longitudinal Data Files

Variable	Data File				
	ASA/BSA	ASP/BSP	ASG/BSG	AST/BST	ACG/BCG
TOTWGT	●	●	●		
SENWGT	●	●	●		
HOUWGT	●	●	●		
SCHWGT					●
STOTWGTU					●
TCHWGT_23				●	
TCHWGT_24				●	
MATWGT_23				●	
MATWGT_24				●	
SCIWGT_23				●	
SCIWGT_24				●	
JKZONE	●	●	●	●	
JKREP	●	●	●	●	
JKCZONE					●
JKCREP					●
WGTFAC1	●	●	●		●
WGTADJ1	●	●	●		●
WGTFAC2	●	●	●		
WGTADJ2	●	●	●		
WGTFAC3	●	●	●		
WGTADJ3	●	●	●		

Exhibit 2.4 describes the file name conventions.

All weighting variables beginning with the letters “WGT” provide insight into the multi-stage sampling and weighting methodology applied to the data. These weights are described in detail in Chapter 3 of *TIMSS 2023 Technical Report*.

The sampling variables beginning with the letters “JK” are used to compute standard errors based on the jackknife repeated replication methodology (see Chapter 13 of *TIMSS 2023 Technical Report* and Section 7 of *TIMSS 2023 Longitudinal Technical Report*).

Structure and Design Variables

Besides the variables used to store responses to the context questionnaires and achievement booklets, the data files also contain variables meant to store information that identify and describe the respondents and design information required to properly analyze the data.

Identification Variables

In all data files, several identification variables are included that provide information to identify countries, students, teachers, or schools. These variables also are used to link, or merge, cases between the different data file types. The identification variables have the prefix "ID" and are described below.

IDCNTRY

IDCNTRY is a six-digit country identification code based on the ISO classification as shown in Exhibit 2.2. This variable should always be used as the first linking variable whenever files are linked within and across countries.

IDSCHOOL

IDSCHOOL is a four-digit identification code that uniquely identifies the participating schools within each country. The school codes are generated randomly for TIMSS and do not represent actual school identifiers used in the participating countries. They are not unique across countries. Schools across countries can be uniquely identified only with the IDCNTRY and IDSCHOOL combination of linking variables.

IDCLASS

IDCLASS is a six-digit identification code that uniquely identifies the sampled classrooms within a country. The variable IDCLASS has a hierarchical structure and is formed by concatenating the IDSCHOOL variable and a two-digit sequential number identifying the sampled classrooms within a school. Classrooms can be identified uniquely in the database by the combination of IDCNTRY and IDCLASS as linking variables.

IDSTUD

IDSTUD is an eight-digit identification code that uniquely identifies each sampled student in a country. The variable IDSTUD also has a hierarchical structure and is formed by concatenating the IDCLASS variable and a two-digit sequential number identifying all students within each classroom. Students can be identified uniquely in the database by the combination of IDCNTRY and IDSTUD as linking variables.

IDTEACH

IDTEACH is a six-digit identification code that uniquely identifies a teacher within a school. It has a hierarchical structure and is formed by the concatenation of IDSCHOOL and a two-digit sequential number within each school.

IDLINK

IDLINK uniquely identifies the class for which a teacher answered a questionnaire. The combination of linking variables IDCNTRY, IDTEACH, and IDLINK uniquely identifies all teacher-class combinations in the database.

IDTEALIN
IDTEALIN is a concatenation of IDTEACH and IDLINK. It can be used with IDCNTRY, instead of IDTEACH and IDLINK, to uniquely identify all teacher-class combinations in the database.

IDGRADE_23 / IDGRADE_24
IDGRADE_23 identifies the target grade of the participating students for the 2023 data collection and IDGRADE_24 for the 2024 data collection. In the teacher and student-teacher linkage files, this variable is called IDGRADE, and the year of assessment is stored in a separate variable ITYEAR.

IDBOOK_23 / IDBOOK_24
IDBOOK_23 and IDBOOK_24 identify the specific assessment booklet that was administered to each student in 2023 and 2024, respectively. In the student-teacher linkage files, this variable is called IDBOOK, and the year of assessment is stored in a separate variable ITYEAR.

Exhibit 2.12 shows in which data files the various identification variables are located. Cells are shaded to indicate the combinations of variables used to uniquely identify the records contained in the different data file types.

Exhibit 2.12: Location of Identification Variables in TIMSS 2023 Longitudinal Data Files

Variable	Data File						
	ASA/BSA	ASP/BSP	ASG/BSG	AST/BST	ATG/BTM/BTS	ACG/BCG	ASH
IDCNTRY	●	●	●	●	●	●	●
IDSCHOOL	●	●	●	●	●	●	●
IDCLASS	●	●	●	●			●
IDSTUD	●	●	●	●			●
IDTEACH				●	●		
IDLINK				●	●		
IDTEALIN				●	●		
IDGRADE_23	●	●	●			●	●
IDGRADE_24	●	●	●			●	●
IDGRADE				●	●		
IDBOOK_23	●	●	●	●			
IDBOOK_24	●	●	●	●			
IDBOOK				●			

Shading indicates combinations of variables that allow for uniquely identifying records across data files.
Exhibit 2.4 describes the file name conventions.

In the student context, home context, student process, and achievement data files, the variables IDCNTRY and IDSTUD provide a unique identification number to identify all students in the database. Since teachers may teach more than one class, the combination of the IDCNTRY, IDTEACH, and IDLINK (or IDTEALIN) variables in the teacher context data files is needed to uniquely identify all teachers and the classes they teach. Teacher context variables are linked to the appropriate students using the student-teacher linkage data files. The variable IDSCHOOL, contained in all files, is a unique identification number for each school within a country. Combined with IDCNTRY, it can be used to link school context data to corresponding students or teachers.

Tracking Variables

Tracking variables are used to store information about students, teachers, and schools provided by the survey tracking forms, containing lists of students, teachers, and schools used for sampling and administrative purposes. Tracking variables also include information about the test administration. Many of these variables have the prefix "IT." All tracking variables are included in the student context data files (ASG/BSG), except ITCOURSE which is specific to teacher records. ITLANG and ITMODE variables are also included in the home, school, and teacher context files.

ITSEX

ITSEX indicates the gender of each student as stated in the Student Tracking Forms.

ITBIRTHM and ITBIRTHY

ITBIRTHM and ITBIRTHY indicate the month and year of birth of each student as stated in the Student Tracking Forms. Both variables are available only in the restricted-use data.

ITDATE_23 / ITDATE_24

ITDATE_23 and ITDATE_24 indicate the testing date for each student in 2023 and 2024, respectively. These variables are available only in the restricted-use data.

ASDAGE_23 / ASDAGE_24 / BSDAGE_23 / BSDAGE_24

ASDAGE_23/BSDAGE_23 and ASDAGE_24/BSDAGE_24 indicate the age of each student at the time of testing in 2023 and 2024, respectively. It is derived from ITBIRTHM, ITBIRTHY, and ITDATE_23 or ITDATE_24. Age is reported in years with decimal precision.

ITLANG_x_23 / ITLANG_x_24

ITLANG_x_23 and ITLANG_x_24 indicate the language of the TIMSS assessment and context questionnaires in 2023 and 2024, respectively, where "x" can take the values "SA," "HQ," "SQ," "CQ," and "TQ" to denote the various survey instruments. The valid codes are specified in the codebook files.

ITMODE_x_23 / ITMODE_x_24
ITMODE_x_23 and ITMODE_x_24 indicate the mode of administration (paper or digital) for the TIMSS assessments and context questionnaires in 2023 and 2024, respectively, where "x" can take the values "SA," "HQ," "SQ," "CQ," and "TQ" to denote the various survey instruments. These are available only in the restricted-use data.

ITDEV_23 / ITDEV_24
ITDEV_23 and ITDEV_24 indicate the type of digital device used for the TIMSS assessment in 2023 and 2024, respectively. These are available only in the restricted-use data.

ITADMINI_23 / ITADMINI_24
ITADMINI_23 and ITADMINI_24 indicate the position of the test administrator who conducted the students' test session in 2023 and 2024, respectively: national center staff, teacher, or other.

ITCOURSE
ITCOURSE indicates the subject taught by the teacher in the teacher and student-teacher linkage files. The valid codes for ITCOURSE are specified in the codebook files.

Test-Curriculum Matching Analysis (TCMA) Data

The Test-Curriculum Matching Analysis (TCMA) was conducted to investigate the degree to which the mathematics and science assessments matched mathematics and science curricula of the participating countries at the target grade levels assessed. To that end, participating countries were asked to indicate which items in the assessments measured topics that were covered by their national curricula. Countries provided this information for all target grade levels assessed (Grades 4 and 5; Grades 8 and 9). The International Database contains TCMA data downloads for the Grades 4–5 and Grades 8–9 TCMA files in Excel format.

Supplemental Material

In addition to the data files, a number of supplemental documents are available for download along with the TIMSS 2023 Longitudinal International Database to aid users in analyzing the data.

Codebooks

Codebooks contain information related to the structure of the TIMSS 2023 Longitudinal data files, as well as the source, format, descriptive labels, and response option codes for all variables. Codebooks are available as Excel files.

In the codebook files, there is a sheet for each data file type (see Exhibit 2.4 for the naming convention). These sheets describe the contents and structure of the individual data files. Important codebook fields include LABEL, which contains extended textual information for all variables, QUESTION LOCATION, which provides the location of questions and achievement items within their respective survey instruments, and VALUE SCHEME DETAILED, which lists the acceptable responses allowed for each variable.

Data Almanacs

Data almanacs provide weighted summary statistics for variables in the TIMSS 2023 Longitudinal data files. There are two basic types of data almanacs: achievement data almanacs for the achievement items and context data almanacs for the context variables. All data almanac files are provided in PDF format and Excel format.

Achievement Data Almanacs

The achievement data almanacs provide weighted summary statistics for each participating country on each individual achievement item included in the assessments by assessment year. The achievement data almanac files available in the International Database are listed in Exhibit 2.13.

Exhibit 2.13: TIMSS 2023 Longitudinal Achievement Data Almanacs

Assessment	Mathematics Items	Science Items
Grades 4 & 5	T23L_G4-5_MAT_ItemAlmanac	T23L_G4-5_SCI_ItemAlmanac
Grades 8 & 9	T23L_G8-9_MAT_ItemAlmanac	T23L_G8-9_SCI_ItemAlmanac

For each item, the achievement data **Item Almanacs** display its classification in the content and cognitive domains, the item block to which it belongs, a brief description of the item, its variable name, whether it is a multiple-choice or constructed-response item, its point value for constructed-response items, and the correct response key if it is a multiple-choice item. Statistics are reported based on data collected in 2023 (Grade 4 or Grade 8) and data collected in 2024 (Grade 5 or Grade 9).

There are two types of displays in the achievement data almanacs, depending on whether an item is a multiple-choice item or a constructed-response item. The statistics in these almanacs include the following:

- N: The number of students to whom the item was administered
- DIFF: The percentage of students that responded correctly to the item. In the case of constructed-response items worth 0,1, or 2 points, the percentages are weighted across each of the possible score point categories. Omitted and Not Reached responses are excluded from this calculation.

- A, B, C, D, etc.: The percentage of students choosing each one of the response options for a multiple-choice item
- 0pt, 1pt, 2pt: The percentage of students that scored 0 points,1 point, or 2 points on the item for a constructed-response item
- OMITTED: The percentage of students that omitted a response to the item
- NOT REACHED: The percentage of students that did not reach the item
- GIRL PCT RIGHT and BOY PCT RIGHT: The percentage of girls and boys that either got a multiple-choice item right or obtained the maximum score on a constructed-response item. Omitted and Not Reached responses are excluded from this calculation.

Context Data Almanacs

Context data almanac files for each data collection year contain weighted summary statistics for each participating country on each variable in the student, home, school, and teacher context questionnaires, including the context questionnaire scales and their indices and the derived variables based on context variables. Among the statistics reported is mean growth in achievement between years by response category. The context data almanacs also display for each variable the question as it was asked, its location in the corresponding questionnaire, and its variable name in the data files. The context data almanac files available in the International Database are listed in Exhibit 2.14. Separate files are provided for context questionnaires administered in 2023 and in 2024. There are separate sets of context almanacs to report average change in mathematics achievement and average change in science achievement by response category.

Exhibit 2.14: TIMSS 2023 Longitudinal Context Data Almanacs

Assessment	Year	Mathematics	Science
Grades 4 & 5	2023	T23L_G4_MAT_StudentAlmanac_2023 T23L_G4_MAT_HomeAlmanac_2023 T23L_G4_MAT_TeacherAlmanac_2023 T23L_G4_MAT_SchoolAlmanac_2023	T23L_G4_SCI_StudentAlmanac_2023 T23L_G4_SCI_HomeAlmanac_2023 T23L_G4_SCI_TeacherAlmanac_2023 T23L_G4_SCI_SchoolAlmanac_2023
	2024	T23L_G5_MAT_StudentAlmanac_2024 T23L_G5_MAT_HomeAlmanac_2024 T23L_G5_MAT_TeacherAlmanac_2024 T23L_G5_MAT_SchoolAlmanac_2024	T23L_G5_SCI_StudentAlmanac_2024 T23L_G5_SCI_HomeAlmanac_2024 T23L_G5_SCI_TeacherAlmanac_2024 T23L_G5_SCI_SchoolAlmanac_2024
Grades 8 & 9	2023	T23L_G8_MAT_StudentAlmanac_2023 T23L_G8_MAT_TeacherAlmanac_2023 T23L_G8_MAT_SchoolAlmanac_2023	T23L_G8_SCI_StudentAlmanac_2023 T23L_G8_SCI_TeacherAlmanac_2023 T23L_G8_SCI_SchoolAlmanac_2023
	2024	T23L_G9_MAT_StudentAlmanac_2024 T23L_G9_MAT_TeacherAlmanac_2024 T23L_G9_MAT_SchoolAlmanac_2024	T23L_G9_SCI_StudentAlmanac_2024 T23L_G9_SCI_TeacherAlmanac_2024 T23L_G9_SCI_SchoolAlmanac_2024

In addition to country-level statistics, the context data almanacs also display the table averages for each variable, with each country weighted equally.

There are two types of displays in the context data almanacs, depending on whether the data are categorical (i.e., have a small number of discrete values) or continuous. The almanac display for categorical variables includes the following:

- The sample size (number of students, parents, schools, or teachers included in the sample)
- The number of valid cases (number of students, parents, schools, or teachers for whom valid data were obtained)
- The weighted percentages of students corresponding to each valid response option (percentages based only on the students with valid data, as well as Not Applicable codes when used)
- The weighted percentages of students for whom none of the valid response options were selected, coded as Not Administered or Omitted (percentages based on all students)
- The weighted mean growth in achievement for students corresponding to each valid response option, as well as the Not Administered and Omitted codes
- In cases where a variable can be coded as Not Applicable because of an earlier filter question, the weighted percentage of students for whom the variable is coded as Not Applicable also is displayed, along with the corresponding weighted mean achievement

The almanac display for continuous variables includes the following:

- The sample size (number of students, parents, schools, or teachers included in the sample)
- The number of valid cases (number of students, parents, schools, or teachers for whom valid data were obtained)
- The weighted percentages of students for whom the variable is coded as Not Administered or Omitted (percentages based on all students)
- The weighted mean, minimum, maximum, and the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, and 95^{th} percentiles across students (based on students with valid data)
- In cases where a variable can be coded as Not Applicable because of an earlier filter question, the weighted percentage of students for whom the variable is coded as Not Applicable also is displayed

It is important to note that all statistics reported in the context data almanacs, with the exception of the sample sizes and the number of valid cases, are always based on student-

level calculations—for example, the percentage of students whose teachers or schools gave a particular response to a question, because teacher data and school data usually are analyzed as student attributes.

Achievement Item Information

Achievement Item information files include characteristics of each achievement item in the assessments. For each grade level, the file includes the following information for all items:

- **Item ID (2023)** and **Item ID (2024)**, the item's unique identifier corresponding to the achievement variable name storing 2023 and 2024 data, respectively
- The **Screen ID** for each data collection year, used as the basis for storing derived process variables in ASP/BSP files
- A **Subject** column showing if the item was a mathematics (M) item or science (S) item
- An indicator for the **Grade** of the TIMSS 2023 assessment for which the item was developed (4 or 8)
- An indicator for the TIMSS assessment **Cycle** when the item and its text was first presented (see earlier section on Achievement Item Variable Naming Convention)
- The item's **Block** and **Block Seq**, its sequential location within the block
- The item's **Secure Status**, indicating whether the item is available for "restricted use" after the 2023 assessment, or "secured" for use in future assessments
- The **Content Domain**, **Topic Area**, **Topic**, **Cognitive Domain**, and **Cognitive Area** assessed by the item, according to the *TIMSS 2023 Assessment Frameworks*
- For science items, an indicator of whether the item was classified as **Environmental Knowledge**
- The item's **Maximum Points** value
- The **Item Type**, either multiple-choice (MC) or constructed-response (CR)
- The number of **Response Options** for multiple-choice items
- The correct response **Key** for multiple-choice items
- **Scaling Status**, indicating whether the item was included in the IRT scaling
- A **Label** for the item

Context Questionnaire Variables

The International Database provides information about the items in the context questionnaires administered in TIMSS 2023 Longitudinal, including the Curriculum Questionnaires. ZIP files can be downloaded containing international versions of each questionnaire, annotated with the variable names under which responses are recorded in the data files. In addition, an Excel file provided for each questionnaire contains a list with detailed information for each question, including the question location, the corresponding variable name, and the question text, as well as whether the question was asked between 2023 and 2024 data collections with matching information.

More information about the TIMSS 2023 Longitudinal Context Questionnaires is provided in Section 2 of *TIMSS 2023 Longitudinal Technical Report*. The TIMSS questionnaires were designed to provide an opportunity for individual countries to make modifications to some questions or response options. This allowed countries to include the appropriate wording or options most consistent with their own national systems. In the international version of the questionnaires, such questions contain instructions to the National Research Coordinators (NRCs) to substitute the appropriate wording for their country and/or modify or delete any inappropriate questions or options. These instructions were indicated in the questionnaires by text inserted within carets (e.g., <country-specific>). The NRCs were to substitute, if necessary, an appropriate national adaptation that would retain the same basic interpretation as the text within the carets. These adaptations are documented in a National Adaptations Database available from the TIMSS 2023 Longitudinal International Database webpage, described below.

National Adaptations to the Context Questionnaires

The National Adaptations Database available through the International Database describes the adaptations countries made to the international versions of the context questionnaires administered in 2023 and 2024. This information provides users with a guide to evaluate the availability of internationally comparable data for use in secondary analyses involving the context variables. National adaptations to context questionnaires include questions that countries were required to adapt, questions that were not administered, and questions that countries modified to suit their national context.

For each grade, ZIP files are available containing Excel files for each questionnaire, with sheets for each assessment year with a list of adaptations. For each question that was adapted, a national entry is included if the version of the question administered was different from the international version in meaning or in context. The following information is provided:

- Question number
- Question stem and response options

- Variable name(s)
- National adaptation, listed by country.

Each national adaptation entry is assigned either code “D” or code “X,” representing the following:

D The question is still considered comparable to the international version, and the corresponding data are included in the international database

X The corresponding data are not included in the international database. The question was not administered, not applicable, or deleted for any of several reasons (e.g., deemed not internationally comparable, removed per country request, or a data problem)

Derived Context Variables

The International Database includes data for variables derived from other source variables in the database, including individual questionnaire items. Derived context variables are used for reporting or conducting other secondary analysis. Descriptions of how these variables were derived can be downloaded from the TIMSS 2023 Longitudinal International Database webpage.

The student context data files (ASG/BSG) contain additional variables derived from achievement item responses used to evaluate the reliability of each country’s achievement data as reported in Appendix C of *TIMSS 2023 Longitudinal International Results in Mathematics and Science*. Information about these variables and their value scheme is provided in the codebooks.

Special Programs

The International Database includes R, SPSS, and SAS scripts or syntax files which will recode the responses to individual items from the achievement data files to their appropriate score levels. These programs are described in Chapter 3 of this User Guide.

CHAPTER 3

Special Programs

Overview

This chapter describes special programs available in the TIMSS 2023 Longitudinal International Database that recode the responses to the individual achievement item variables in the student achievement data files to their corresponding score levels and can apply user-customized values for item nonresponse. Programs are provided in ZIP files for each grade in R, SPSS, and SAS formats.

Scoring the TIMSS 2023 Longitudinal Items

The ASA/BSA files contain variables for responses to the test items that need to be converted to score points for the purpose of calculating percent correct statistics or other scores. Users may also wish to apply certain values to item-level nonresponse codes for Omitted and Not Reached item responses (see section on Codes for Missing Values for achievement data files in Chapter 2). The International Database provides R, SPSS, and SAS programs to perform this task.

For multiple-choice items and some item parts of digital item types, the numbers 1 through 6 are used to represent response options A through F in the achievement data files. These responses must be converted to their appropriate score level ("1" for correct and "0" for incorrect) based on each multiple-choice item's correct response key. For constructed-response items, worth a total of 1 or 2 score points, one- or two-digit diagnostic codes are used to represent the students' response. These codes must be recoded to represent the correct score-point value of the responses.

The International Database includes two R scripts, two SPSS programs, and two SAS programs to recode the responses to individual items from the achievement data files (ASA/BSA) to their appropriate score levels. The ASASCRM8L programs score the 2023 and 2024 items for the Grades 4–5 data files. The BSASCRM8L programs score the items for the Grades 8–9 data files.

Exhibit 3.1 shows a condensed version of the ASASCRM8L.R program to score the individual Grades 4–5 items. All R, SPSS, and SAS programs have a similar structure (see Exhibits 3.2 and 3.3).

Exhibit 3.1: The ASASCRM8L.R Program (Condensed)

```
scoreit <- function(data, item, type, right, NR, OM, other){

. . .

}

Doit <- function(indir=getwd(), outdir=getwd(), infile=""){

 . . .

    #  Score multiple-choice items with A key
    Aright <- c(<List of multiple-choice items where A is correct>)
    Data <- scoreit(data, item=Aright, type="MC", right=1, NR=6, OM=9, other=7)

    #  Score multiple-choice items with B key
    Bright <- c(<List of multiple-choice items where B is correct>)
    Data <- scoreit(data, item=Bright, type="MC", right=2, NR=6, OM=9, other=7)

    #  Score multiple-choice items with C key
    Cright <- c(<List of multiple-choice items where C is correct>)
    Data <- scoreit(data, item=Cright, type="MC", right=3, NR=6, OM=9, other=7)

    #  Score multiple-choice items with D key
    Dright <- c(<List of multiple-choice items where D is correct>)
    Data <- scoreit(data, item=Dright, type="MC", right=4, NR=6, OM=9, other=7)

    #  Score multiple-choice items with E key
    Eright <- c(<List of multiple-choice items where E is correct>)
    Data <- scoreit(data, item=Eright, type="MC", right=5, NR=6, OM=9, other=7)

    #  Score multiple-choice items with F key
    Fright <- c(<List of multiple-choice items where F is correct>)
    Data <- scoreit(data, item=Fright, type="MC", right=6, NR=69, OM=99, other=90)

    #  Score constructed-response items
    Constr <- c(<List of constructed-response items>)
    Data <- scoreit(data, item=constr, type="CR", right="", NR=c(6,96), OM=c(9,99), other=c(7,90))

 . . .

}

doit(indir =  "C:/TIMSS-L2023/Data/",
     outdir = "C:/TIMSS-L2023/Data/",
     infile = "ASAALLM8L")
```

To score each individual item, the program code in the R score program must be adapted by completing the following steps:

1. Open ASASCRM8L.R or BSASCRM8L.R with R or RStudio
2. At the end of the program, specify the folder where the merged R data file of student achievement data files is located in the argument **indir**
3. Specify the folder where the merged R data file of scored achievement items will be located in the argument **outdir**
4. Specify the name of the merged student achievement R data file in the argument **infile**
5. Submit the edited code for processing by R

In this example, the merged R data file of student achievement data files is called ASAALLM8L, located in the folder C:\TIMSS-L2023\Data. The resulting data file of scored achievement items will be called ASAALLM8L_SCR and saved in the location specified in the **outdir** argument. In this case, the same folder was used for both **indir** and **outdir**. Note that in R, forward slashes (/) should be used instead of backslashes in the file path, so the folder path in Exhibit 3.1 is given as: C:/TIMSS-L2023/Data/. If using SPSS or SAS, backslashes should be used.

The data file of scored achievement items will have the same data structure as the student achievement data files, but with the scores stored in the item variables instead of the student responses. The analysis module of the IEA IDB Analyzer will be able to conduct analyses with this data file.

By default, the score programs treat Omitted and Not Reached responses as missing. If Omitted and/or Not Reached responses are to be treated as incorrect rather than missing, users should replace the following lines of R code (which appear twice in the programs, once for multiple-choice items and once for constructed-response items):

```
#  Code for multiple-choice items
                                                . == NR     ~ NaN, # Not Reached
                                                . == OM     ~ NaN, # Omitted

#  Code for constructed-response items
                                               . %in% NR    ~ NaN, # Not Reached
                                               . %in% OM    ~ NaN, # Omitted
```

with these statements:

```
#  Code for multiple-choice items
                                                . == NR     ~ 0, # Not Reached
                                                . == OM     ~ 0, # Omitted

#  Code for constructed-response items
                                               . %in% NR    ~ 0, # Not Reached
                                               . %in% OM    ~ 0, # Omitted
```

Executing the equivalent SPSS programs (Exhibit 3.2) requires the same steps as the R programs.

Exhibit 3.2: The ASASCRM8L.SPS Program (Condensed)

```
DEFINE SCOREIT <List of macro parameters> .
. . .

!ENDDEFINE .

DEFINE DOIT (INDIR  = !CHAREND('/') /
             OUTDIR = !CHAREND('/') /
              INFILE = !CHAREND('/') ) .
. . .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where A is correct> /
       RIGHT = 1 / NR = 6 / NA = SYSMIS / OM =  9 / OTHER =  7 .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where B is correct> /
       RIGHT = 2 / NR = 6 / NA = SYSMIS / OM =  9 / OTHER =  7 .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where C is correct> /
       RIGHT = 3 / NR = 6 / NA = SYSMIS / OM =  9 / OTHER =  7 .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where D is correct> /
       RIGHT = 4 / NR = 6 / NA = SYSMIS / OM =  9 / OTHER =  7 .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where E is correct> /
       RIGHT = 5 / NR = 6 / NA = SYSMIS / OM =  9 / OTHER =  7 .

SCOREIT TYPE = MC / ITEM = <List of multiple-choice items where F is correct> /
       RIGHT = 6 / NR = 96 / NA = SYSMIS / OM = 99 / OTHER = 90 .

SCOREIT TYPE = CR / ITEM = <List of constructed-response items> /
       RIGHT = 0 / NR = 6 96 / NA = SYSMIS / OM = 9 99 / OTHER = 7 90 .
  . . .

!ENDDEFINE .

DOIT INDIR  = C:\TIMSS-L2023\Data /
       OUTDIR = C:\TIMSS-L2023\Data /
       INFILE = ASAALLM8L .
```

If Omitted and Not Reached responses are to be treated as incorrect rather than missing, users should replace the following SPSS statements:

```
* Code for multiple-choice items .

        (!NR = SYSMIS) /* Not Reached */
        (!OM = SYSMIS) /* Omitted */

* Code for constructed-response items .

      !DO !N !IN (!NR) (!N = SYSMIS) !DOEND  /* Not Reached      */
      !DO !M !IN (!OM) (!M = SYSMIS) !DOEND  /* Omitted      */
```

with these statements:

```
* Code for multiple-choice items .

        (!NR = 0) /* Not Reached */
        (!OM = 0) /* Omitted */

* Code for constructed-response items .

      !DO !N !IN (!NR) (!N = 0) !DOEND  /* Not Reached      */
      !DO !M !IN (!OM) (!M = 0) !DOEND  /* Omitted      */
```

Executing the equivalent SAS programs (Exhibit 3.3) requires the same steps as the R and SPSS programs.

Exhibit 3.3: The ASASCRM8L.SAS Program (Condensed)

```
%MACRO SCOREIT (ITEM, TYPE, RIGHT, NR, NA, OM, OTHER) ;

   .  .  .

%MEND SCOREIT ;

%MACRO DOIT (INDIR  = ,
             OUTDIR = ,
             INFILE = ) ;

   .  .  .

  ARRAY ARIGHT <List of multiple-choice items where A is correct> ;
  DO OVER ARIGHT ; %SCOREIT (ARIGHT, "MC", 1, .R, .A, ., .I) ; END ;

  ARRAY BRIGHT <List of multiple-choice items where B is correct> ;
  DO OVER BRIGHT ; %SCOREIT (BRIGHT, "MC", 2, .R, .A, ., .I) ; END ;

  ARRAY CRIGHT <List of multiple-choice items where C is correct> ;
  DO OVER CRIGHT ; %SCOREIT (CRIGHT, "MC", 3, .R, .A, ., .I) ; END ;

  ARRAY DRIGHT <List of multiple-choice items where D is correct> ;
  DO OVER DRIGHT ; %SCOREIT (DRIGHT, "MC", 4, .R, .A, ., .I) ; END ;

  ARRAY ERIGHT <List of multiple-choice items where E is correct> ;
  DO OVER ERIGHT ; %SCOREIT (ERIGHT, "MC", 5, .R, .A, ., .I) ; END ;

  ARRAY FRIGHT <List of multiple-choice items where F is correct> ;
  DO OVER FRIGHT ; %SCOREIT (FRIGHT, "MC", 6, .R, .A, ., .I) ; END ;

  ARRAY CONSTR <List of constructed-response items> ;
  DO OVER CONSTR ; %SCOREIT (CONSTR, "CR",  , .R, .A, ., .I) ; END ;

   .  .  .

%MEND DOIT ;

%DOIT (INDIR  = C:\TIMSS-L2023\Data ,
       OUTDIR = C:\TIMSS-L2023\Data ,
       INFILE = ASAALLM8L ) ;
```

If Omitted and Not Reached responses are to be treated as incorrect rather than missing, users should replace the following SAS statements (which appear twice in the programs, once for multiple-choice items and once for constructed-response items):

```
    IF &ITEM = &NR THEN SCORE = . ; * Not Reached ;
    IF &ITEM = &OM THEN SCORE = . ; * Omitted ;
```

with these statements:

```
    IF &ITEM = &NR THEN SCORE = 0 ; * Not Reached ;
    IF &ITEM = &OM THEN SCORE = 0 ; * Omitted ;
```

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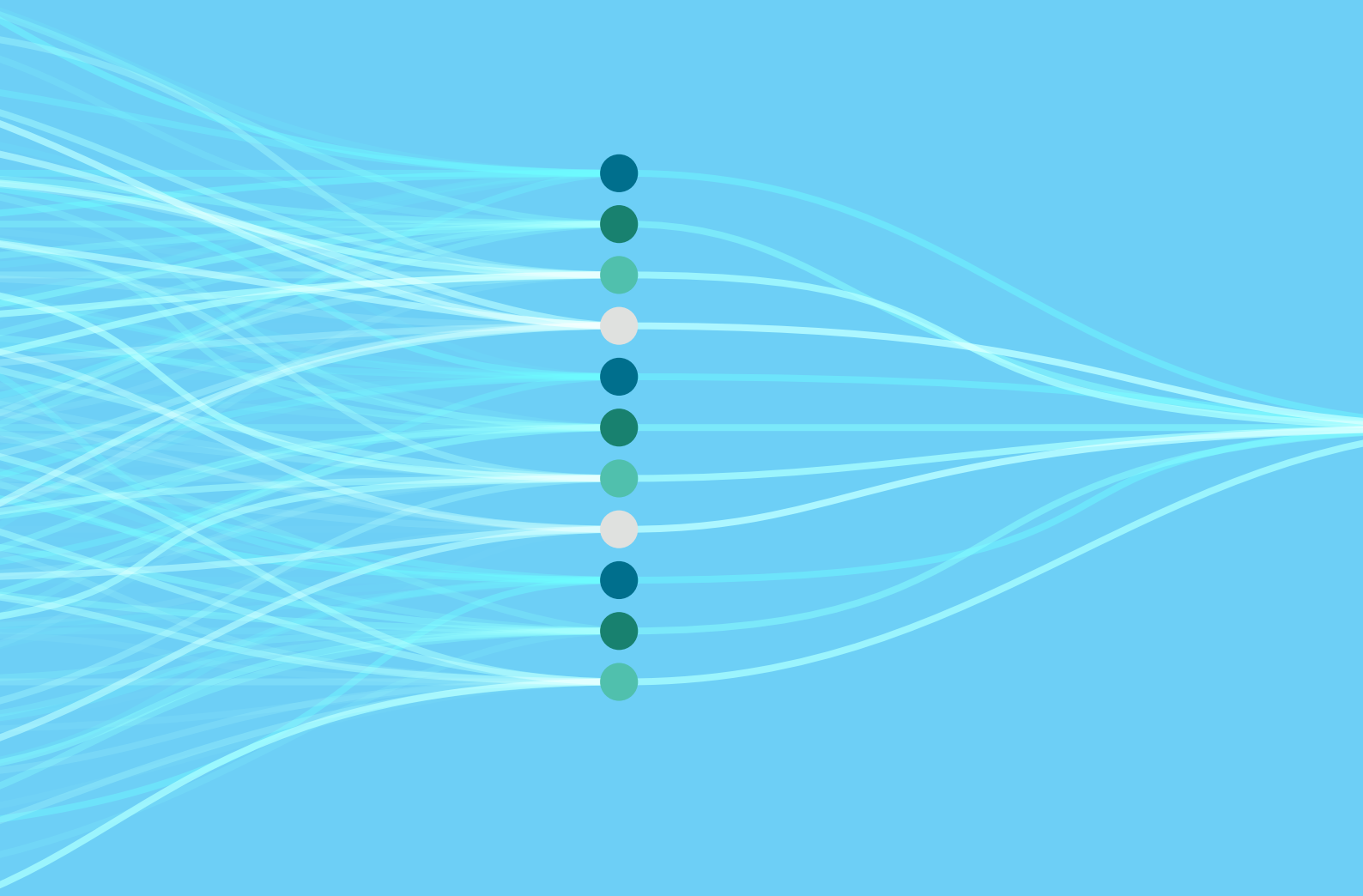

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