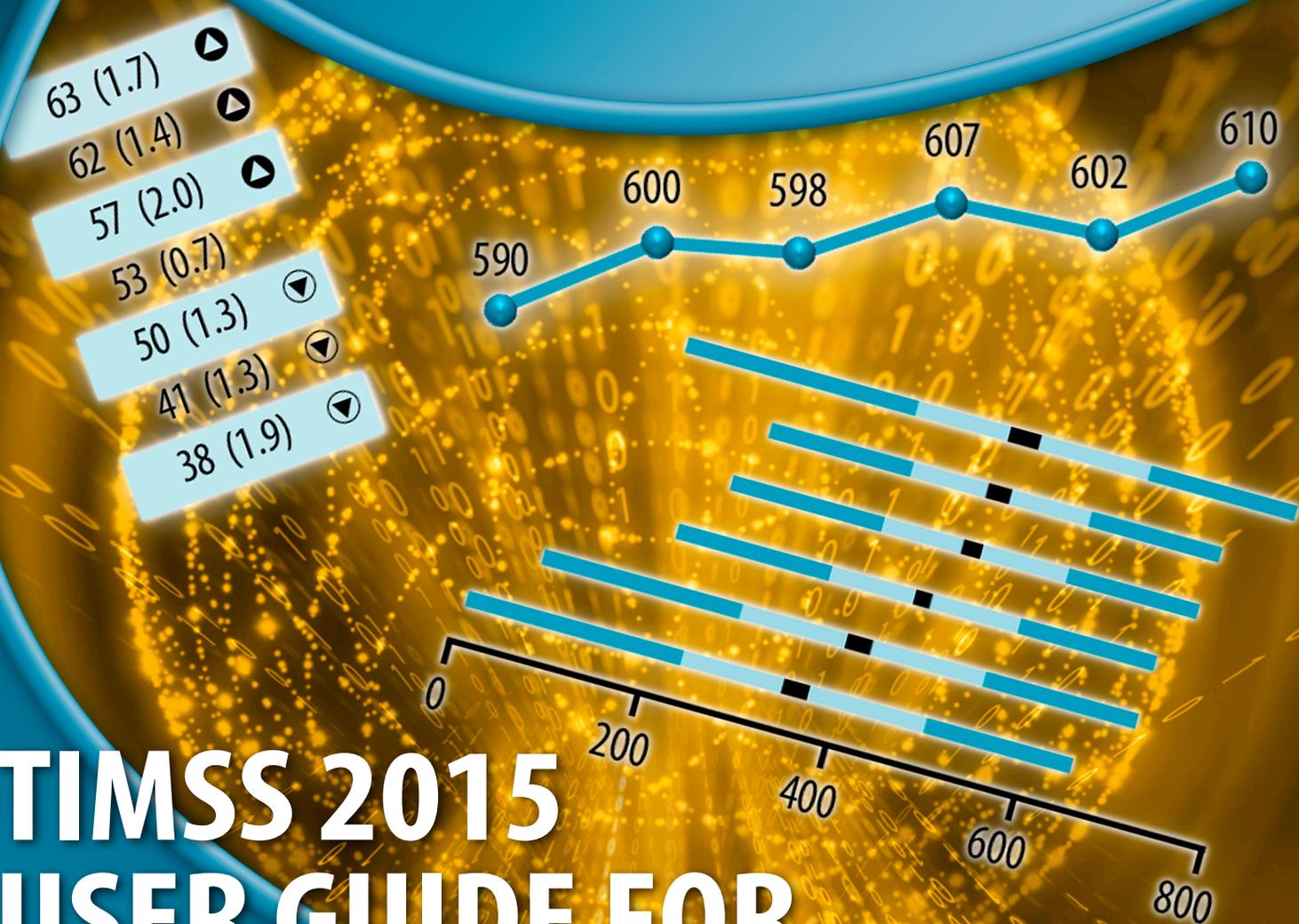


TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

TIMSS



TIMSS 2015 USER GUIDE FOR THE INTERNATIONAL DATABASE

Pierre Foy

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TIMSS 2015 User Guide for the International Database

Pierre Foy

*Contributors: Victoria A.S. Centurino , Kerry E. Cotter, Bethany G. Fishbein,
Martin Hooper, Hannah Köhler, Kamil Kowolik, Lauren Palazzo, & Erin Wry*



IEA

TIMSS & PIRLS
International Study Center
Lynch School of Education, Boston College

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Pierre Foy

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For more information about TIMSS contact:
TIMSS & PIRLS International Study Center
Lynch School of Education
Boston College
Chestnut Hill, MA 02467
United States

tel: +1-617-552-1600
fax: +1-617-552-1203
e-mail: timss@bc.edu
timss.bc.edu

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Chapter 1

Introduction

1.1 Overview of the TIMSS 2015 User Guide and International Database

IEA's TIMSS measures trends in mathematics and science achievement at the fourth and eighth grades in participating countries around the world, while also monitoring curricular implementation and identifying promising instructional practices. Conducted on a regular 4-year cycle, TIMSS has assessed mathematics and science in 1995, 1999, 2003, 2007, 2011, and 2015. TIMSS collects a rich array of background information to provide comparative perspectives on trends in achievement in the context of different educational systems, school organizational approaches, and instructional practices.

TIMSS 2015 introduced a new, less difficult mathematics assessment at the fourth grade called TIMSS Numeracy intended to assess fundamental mathematical knowledge, procedures, and problem-solving strategies that are prerequisite for success in the TIMSS mathematics assessment at the fourth grade. TIMSS Numeracy is designed to assess mathematics at the end of the primary school cycle for countries where most children are still developing fundamental mathematics skills. Seven countries and one benchmark participant participated in the TIMSS Numeracy 2015 assessment, six of which also participated in TIMSS 2015 at the fourth grade.

To support and promote secondary analyses aimed at improving mathematics and science education at the fourth and eighth grades, the TIMSS 2015 International Database makes available to researchers, analysts, and other users the data collected and processed by the TIMSS project, including the data from the TIMSS Numeracy assessment. This database comprises student achievement data as well as student, home, teacher, school, and curricular background data for 56 countries and 6 benchmarking participants. Across both grades, the database includes data from 604,950 students, 55,345 teachers, 20,491 school principals, and the National Research Coordinators of each country. All participating countries gave the IEA permission to release their national data.

For countries that participated in previous assessments, TIMSS 2015 (the sixth data collection in the TIMSS cycle of studies) provides trends for up to six cycles at the eighth grade—1995, 1999, 2003, 2007, 2011, and 2015—and data over five points in time at the fourth grade—1995, 2003, 2007, 2011, and 2015. In countries new to the study, the 2015 results can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of their mathematics and science programs. Results of the assessments conducted in 2015 can be found in *TIMSS 2015 International Results in Mathematics and Science* (Mullis, Martin, Foy, & Hooper, 2016; and Martin, Mullis, Foy, & Hooper, 2016).

TIMSS 2015 was an ambitious and demanding study, involving complex procedures for drawing student samples, assessing students' achievement, analyzing the data, and reporting the results. In

order to work effectively with the TIMSS data, it is necessary to have an understanding of the characteristics of the study, which are described fully in *Methods and Procedures in TIMSS 2015* (Martin, Mullis, & Hooper, 2016). It is intended, therefore, that this User Guide be used in conjunction with the *Methods and Procedures* documentation. Whereas the User Guide describes the organization and content of the database, the *Methods and Procedures* documentation provides the rationale for the techniques used and for the variables created in the process of data collection and compilation.

1.2 The TIMSS 2015 User Guide

This User Guide describes the content and format of the data in the TIMSS 2015 International Database. In addition to this introduction, the User Guide includes the following chapters:

- Chapter 2—This chapter introduces the IEA International Database (IDB) Analyzer software (IEA, 2017) and presents examples of analyses with the TIMSS 2015 data using this software in conjunction with SPSS (IBM Corporation, 2013) and SAS (SAS Institute, 2012).
- Chapter 3—This chapter describes special SPSS and SAS programs needed to make full use of the TIMSS 2015 International Database.
- Chapter 4—This chapter serves as a reference for important details about the structure and content of the TIMSS 2015 International Database.

The User Guide is accompanied by the following supplements:

- Supplement 1—This supplement contains the international version of all TIMSS 2015 context questionnaires.
- Supplement 2—This supplement describes all adaptations to the questions in the context questionnaires made by individual TIMSS 2015 participants.
- Supplement 3—This supplement describes how derived variables were constructed for reporting the TIMSS 2015 data.

The User Guide and its supplements are available from the TIMSS 2015 International Database and User Guide webpage: <http://timssandpirls.bc.edu/timss2015/international-database/>. The primary purpose of this user guide is to introduce users to the TIMSS 2015 International Database and demonstrate the basic functionality of the IEA IDB Analyzer through simple examples of results published in *TIMSS 2015 International Results in Mathematics and Science*. The IEA IDB Analyzer comes with its own manual, available through its Help Module, which describes the full functionality and features of the IEA IDB Analyzer.

1.3 The TIMSS 2015 International Database

The TIMSS 2015 International Database is available from the TIMSS 2015 International Database and User Guide webpage: <http://timssandpirls.bc.edu/timss2015/international-database/>. The TIMSS 2015 International Database also is available for download from the IEA Study Data Repository website: <http://www.iea.nl/data.html>. The repository allows users to download subsets of

files and the corresponding support material through customizable queries from all recent IEA studies, including TIMSS 2015.

The Database contains the TIMSS 2015 student achievement data files and student, home, teacher, and school context questionnaire data files, along with support materials. Exhibit 1.1 displays the general structure of the International Database and a brief description of the support materials available for download on the TIMSS 2015 International Database and User Guide webpage.

Exhibit 1.1 Contents of the TIMSS 2015 International Database

User Guide	This User Guide with its supplements	
Items	The TIMSS 2015 item information files, IRT item parameters, and item percent correct statistics	
International Database	SPSS Data	TIMSS 2015 student, home, teacher, and school data files in SPSS format
	SAS Data	TIMSS 2015 student, home, teacher, and school data files in SAS format
	Curriculum Data	TIMSS 2015 curriculum questionnaires data files
	Codebooks	Codebook files describing all variables in the TIMSS 2015 International Database
	Almanacs	Data almanacs with summary statistics for all TIMSS 2015 items and background variables
	TCMA	National item selection data for the Text-Curriculum Matching Analysis
		SPSS and SAS programs

1.4 Two Versions of the TIMSS 2015 International Database

The TIMSS 2015 International Database is available in two versions: a public use version and a restricted use version. In the public use version, some variables are removed to minimize the risk of disclosing confidential information. The list of variables removed from the public use version is given in Chapter 4. The public use version is available for immediate access from the TIMSS 2015 International Database website, as well as from the IEA Study Data Repository, and users should be able to replicate all published TIMSS 2015 results with this version of the TIMSS 2015 International Database. Users who require any of the removed variables to conduct their analyses should contact the IEA through its Study Data Repository (<http://www.iea.nl/data.html>) to obtain permission and access to the restricted use version of the TIMSS 2015 International Database.

References

IBM Corporation. (2013). *IBM SPSS Statistics* (version 22.0). Somers, NY: IBM Corporation.

International Association for the Evaluation of Educational Achievement. (2017). *IDB Analyzer* (version 4.0). Hamburg, Germany: IEA Hamburg. Available online at <http://www.iea.nl/data.html>.

Martin, M. O., Mullis, I. V. S., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Science*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/timss2015/international-results/>.

Martin, M. O., Mullis, I. V. S., & Hooper, M. (Eds.). (2016). *Methods and Procedures in TIMSS 2015*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timss.bc.edu/publications/timss/2015-methods.html>.

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Chapter 2

Using the IEA IDB Analyzer to Analyze the TIMSS 2015 International Database

2.1 Overview

This chapter describes the general use of the IEA International Database Analyzer software (IEA, 2017) for analyzing the TIMSS 2015 and TIMSS Numeracy 2015 data. Used in conjunction with either SPSS (IBM Corporation, 2013) or SAS (SAS Institute, 2012), the IEA IDB Analyzer provides a user-friendly interface to easily merge the various data file types of the TIMSS 2015 International Database and seamlessly takes into account the sampling information and the multiple imputed achievement scores to produce accurate statistical results.

Example analyses will illustrate some of the capabilities of the IEA IDB Analyzer (version 4.0) to compute a variety of statistics, including means and percentages of students in specified subgroups, mean student achievement in specified subgroups, regression coefficients, and percentages of students reaching benchmark levels. The examples use student, home, teacher, and school background data to replicate some of the TIMSS 2015 results included in *TIMSS 2015 International Results in Mathematics and Science* (Mullis, Martin, Foy, & Hooper, 2016; and Martin, Mullis, Foy, & Hooper, 2016).

Users should be able to perform statistical analyses with the IEA IDB Analyzer with a basic knowledge of the TIMSS 2015 International Database. Chapter 4 gives a more detailed description of the data files contained in the International Database, including their structure and contents, along with a description of all the supporting documentation provided with the International Database.

2.2 The IEA IDB Analyzer

Developed by the IEA Data Processing and Research Center (IEA DPC), the IEA IDB Analyzer is an interface for SPSS and SAS, both well-known statistical analysis software. The IEA IDB Analyzer enables users to combine data files, either SPSS or SAS, from IEA's large-scale assessments and conduct analyses using either SPSS or SAS, without actually writing programming code. The IEA IDB Analyzer generates SPSS and SAS syntax that takes into account information from the sampling design in the computation of statistics and their standard errors. In addition, the generated syntax makes appropriate use of plausible values for calculating estimates of achievement scores and their standard errors, combining both sampling variance and imputation variance.

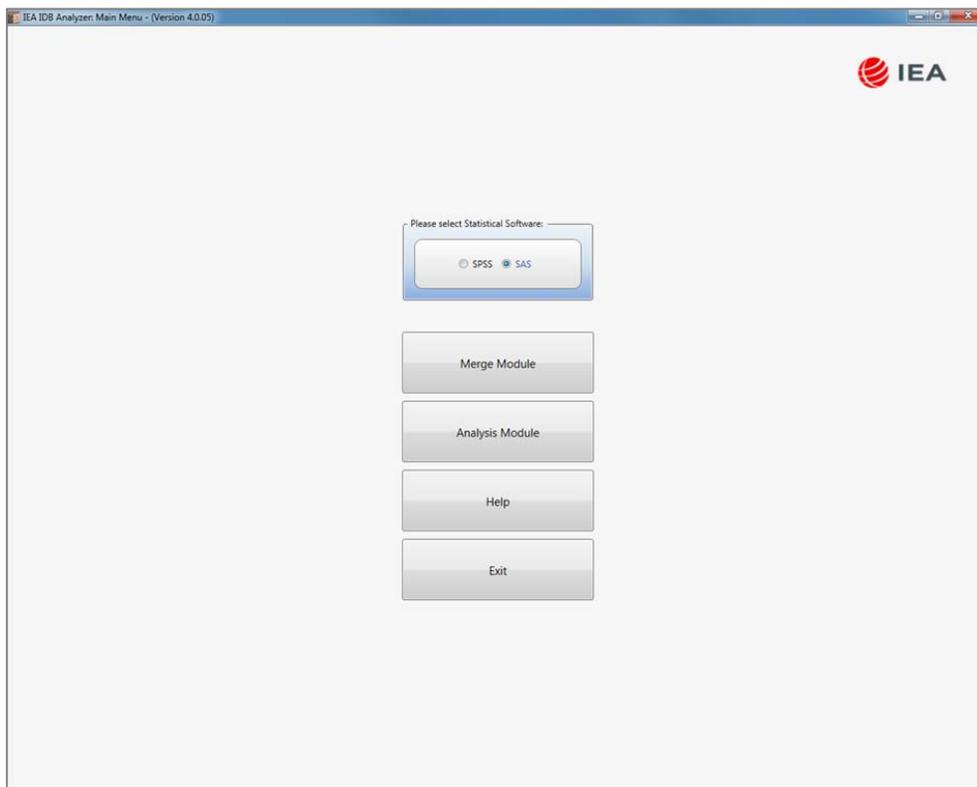
The IEA IDB Analyzer consists of two modules—the merge module and the analysis module—which are integrated and executed in one common application. The merge module is used to create analysis datasets by combining data files of different types and from different countries, and

selecting subsets of variables for analysis. The analysis module provides procedures for computing various statistics and their standard errors. The latest version of the IEA IDB Analyzer (version 4.0) is available for download from the IEA website: <http://www.iea.nl/data.html>. Once installed, the IEA IDB Analyzer can be accessed by using the START menu in Windows:

Start ⇒ All Programs ⇒ IEA ⇒ IDB AnalyzerV4 ⇒ IEA IDBAnalyzer

When the IEA IDB Analyzer application is launched, the main window will appear, as shown in Exhibit 2.1. Users are first directed to choose either SPSS or SAS as their statistical software of choice. For the examples in this chapter, we will use the SAS software. The main window also will direct users to the **Merge Module**, the **Analysis Module**, the **Help** manual, 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.

Exhibit 2.1 IEA IDB Analyzer Main Window



2.3 Merging Files with the IEA IDB Analyzer

The IEA IDB Analyzer uses the data files available from the TIMSS 2015 International Database and User Guide webpage (<http://timssandpirls.bc.edu/timss2015/international-database/>) and from the IEA Study Data Repository (<http://www.iea.nl/data.html>). The TIMSS 2015 and TIMSS Numeracy 2015 data files are disseminated separately by file type and for each country. In

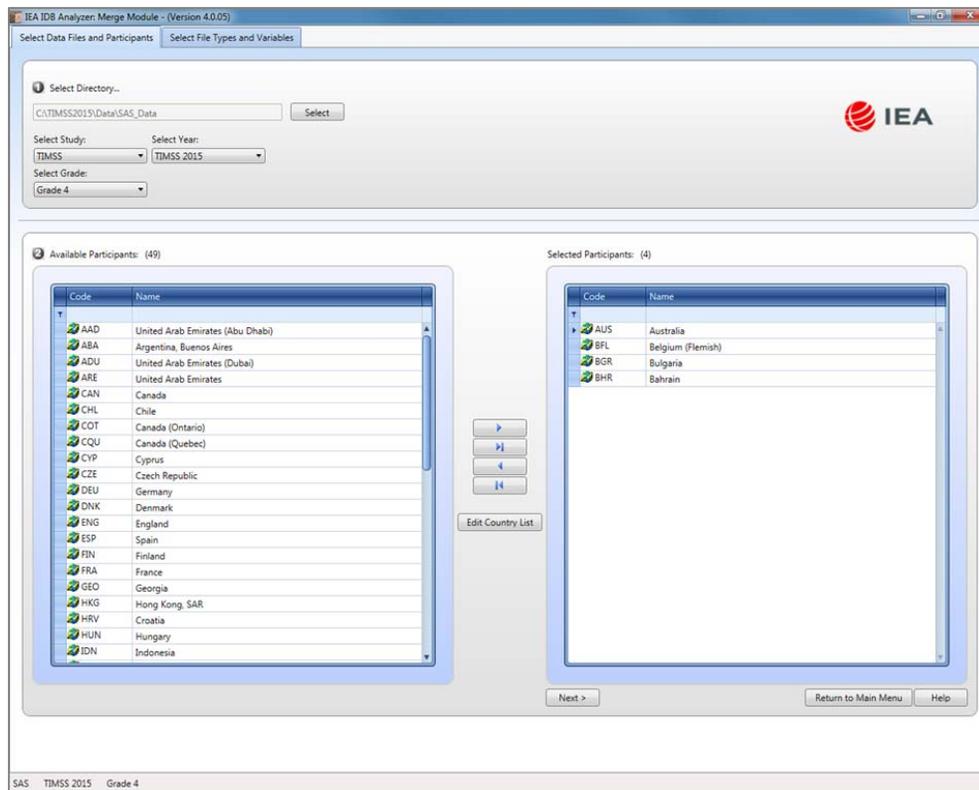
addition to allowing users to combine like datasets from more than one country for cross-country analyses, the merge module allows for the combination of data from different sources (e.g., student, home, teacher, and school) into one SPSS or SAS dataset for subsequent analyses.

Before doing any statistical analyses with the TIMSS 2015 International Database, users should download and copy the contents of the International Database either on their computer or on a server. For the purposes of this chapter, we will assume all data files have been copied within the folder titled “C:\TIMSS2015\.” Additionally, users who plan to analyze TIMSS 2015 data with SAS will need to convert the SAS export files provided in the TIMSS 2015 International Database into SAS data files. This process is described in Chapter 3 of this User Guide.

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

1. Start the IEA IDB Analyzer from the START menu 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 2.2, all SAS data files are located in the folder titled “C:\TIMSS2015\Data\SAS_Data.” The program will automatically recognize and complete the **Select Study**, **Select Year**, and **Select Grade** fields and list all countries available in this folder as possible candidates for merging. If the folder contains data from more than one IEA study, or from more than one grade, the IEA IDB Analyzer will prompt users to select files from the desired combination of study and grade for analyses. In Exhibit 2.2, the TIMSS 2015 fourth grade is selected.
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 them. To select multiple countries, hold the CTRL key of the keyboard when clicking countries. Click the **tab-right arrow** button (▶) to move all countries to the **Selected Participants** panel. In Exhibit 2.2, Australia, Bahrain, Belgium (Flemish), and Bulgaria 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 2.3, to select the file types and the variables to be included in the merged data file.
5. Select the files for merging by checking the appropriate boxes to the left of the window. For example, in Exhibit 2.3, the student background data files are selected.
6. Select the variables of interest from the **Available Variables** list in the left panel. Supplement 1 to this User Guide provides the variable names for all questions in the context questionnaires. Variables are selected by clicking on them and then clicking the **right arrow** (▶) button. Clicking the **tab-right arrow** (▶) button selects all variables. Note that there are two tabs: “Background Variables and Scores” and “ID and Sampling Variables.” All achievement scores and all identification and sampling variables are selected automatically by the IEA IDB Analyzer.

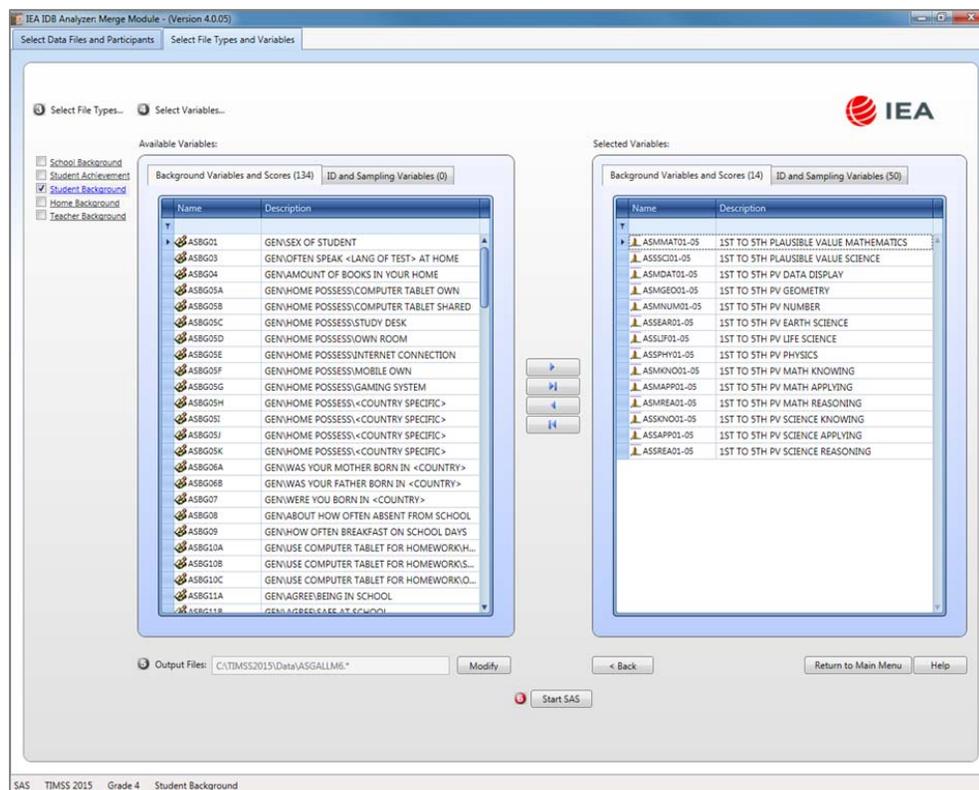
Exhibit 2.2 IEA IDB Analyzer Merge Module: Select Data files and Participants



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/Modify** button. The IEA IDB Analyzer also will create a 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 2.3, the merged data file ASGALLM6.SAS7BDAT and the syntax file ASGALLM6.SAS both will be created and stored in the folder titled “C:\TIMSS2015\Data.” In SPSS, it will be the merged data file ASGALLM6.SAV and the syntax file ASGALLM6.SPS. The merged data file will contain all the variables listed in the **Selected Variables** panel on the right.
8. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window ready for execution. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. In SPSS, it is the **All** option from the **Run** menu. The IEA IDB Analyzer will display a warning if it is about to overwrite an existing file in the specified folder.

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

Exhibit 2.3 IEA IDB Analyzer Merge Module: Select File Types and Variables



Merging Student and Teacher Data Files

The teachers in the TIMSS 2015 International Database 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 be made with students as the units of analysis and reported in terms of students who are taught by teachers with a particular attribute.

Teacher data are analyzed by linking the students to their teachers. The student-teacher linkage data files (AST/BST) are used for this purpose and the IEA IDB Analyzer will make use of them automatically. Thus, to analyze teacher data, it is sufficient to select the **Teacher Background** file type in the **Select File Types and Variables** tab of the IEA IDB Analyzer merge module. To analyze student and teacher background data simultaneously, however, both the **Student Background** and **Teacher Background** file types must be selected in the **Select File Types and Variables** tab. The variables of interest need to be selected separately for both file types, as follows:

1. Click the **Student Background** file type so that it appears checked and highlighted. The **Background Variables and Scores** listed in the left panel will include all available variables from the student background data files.
2. Select the 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. Next, click the **Teacher Background** file type (Math or Science at the eighth grade), selecting the variables of interest from the **Background Variables and Scores** panel on the left in the same manner.
4. Specify the folder and merged data file name in the **Output Files** field, as described earlier.
5. Click the **Start SAS** button to create the SAS syntax file that will produce the required merged data file, which can then be run by opening the **Run** menu of SAS and selecting the **Submit** menu option.

Steps 1 and 2 above are required only if student background data and teacher background data will be analyzed simultaneously. It is not recommended to combine both types of files and then analyze only student data; the results may not be correct (see the *Sampling and Weighting Variables* section in Chapter 4 of this User Guide).

Merging Student and School Data Files

Because TIMSS 2015 and TIMSS Numeracy 2015 have representative samples of schools, it is possible to compute reasonable 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-level variables as attributes of the students, rather than as elements in their own right. Therefore, analyzing school data should be done by linking the students to their schools.

To merge the student and school background data files, select both the **Student Background** and **School Background** file types in the **Select File Types and Variables** tab of the IEA IDB Analyzer merge module. The variables of interest to be included in the merged data file are selected separately by file type, as described above in “Merging Student and Teacher Data Files” and using the same set of instructions.

Merging Student and Home Data Files

The parents of the fourth grade students participating in TIMSS 2015 and TIMSS Numeracy 2015 responded to an Early Learning Survey usually called the Home Questionnaire. Their responses are included in the home background data files (ASH). Although home background variables are located in separate files, they are in essence attributes of the students and must be analyzed in the same manner as student background variables. This will require users to merge the home background data files with the student background data files by selecting both the **Home Background** and **Student Background** file types in the merge module of the IEA IDB Analyzer. Variables of interest to be included in the merged data file are chosen separately by file type, as described above in “Merging Student and Teacher Data Files” and using the same set of instructions.

Analyzing TIMSS 2015 Fourth Grade Mathematics

With the introduction of the TIMSS Numeracy assessment in 2015, proper analysis of fourth grade mathematics may require combining TIMSS Numeracy 2015 and TIMSS 2015 fourth grade data, especially for countries that participated in both assessments. This can be done using the **Merge Module** of the IEA IDB Analyzer to create a TIMSS 2015 data file (ASGALLM6 for example) and a TIMSS Numeracy 2015 data file (ASGALLN1 for example) as described above, and

then combining the two data files together. A short program, both in SPSS and SAS, is provided with the TIMSS 2015 International Database to perform this combination of files from both assessments and is described in Chapter 3 of this User Guide. The resulting combined file (ASGALLM6_CMB for example) can be used in the **Analysis Module** of the IEA IDB Analyzer to produce fourth grade mathematics results that combine data from both assessments.

Merged Data Files for the Examples

To conduct the analysis examples presented in this chapter, a number of merged data files were created following the instructions provided above. Because the examples presented in this User Guide are all about fourth grade achievement, we produced merged data files for both TIMSS 2015 at the fourth grade and for TIMSS Numeracy 2015 and then used the special program to combine files from both assessments. The following merged data files were created with all available background variables and achievement scores selected:

ASGALLM6_CMB	Merged fourth grade student background data files for all countries
ASHALLM6_CMB	Merged fourth grade home and student background data files for all countries
ATGALLM6_CMB	Merged fourth grade teacher background data files for all countries
ACGALLM6_CMB	Merged fourth grade school and student background data files for all countries

2.4 Performing Analyses with the IEA IDB Analyzer

The IEA IDB Analyzer can perform statistical analyses on any files created using the **Merge Module**. The following statistical procedures are available in the **Analysis Module** of the IEA IDB Analyzer.

Percentages and Means

Compute percentages, means, and standard deviations for selected analysis variables by subgroups defined by grouping variable(s). Plausible values can be included as analysis variables.

Percentages only

Compute percentages by subgroups defined by grouping variable(s).

Linear Regression

Compute linear regression coefficients for selected independent variables to predict a dependent variable by subgroups defined by grouping variable(s). Plausible values can be included as dependent or independent variables.

Logistic Regression

Compute logistic regression coefficients for selected independent variables to predict a dependent variable by subgroups defined by grouping variable(s). Plausible values can be included as dependent or independent variables. When used as a dependent variable, plausible values will be dichotomized using a specified cutpoint, such as one of the TIMSS international benchmarks.

Correlations

Compute means, standard deviations, and correlation coefficients for selected analysis variables by subgroups defined by grouping variable(s). Plausible values can be included as analysis variables.

Benchmarks

Compute percentages of students meeting a set of user-specified achievement benchmarks, in particular the TIMSS International Benchmarks, by subgroups defined by grouping variable(s).

Percentiles

Compute the score points that separate a given proportion of the distribution of a continuous analysis variable by subgroups defined by the grouping variable(s). Plausible values can be included as analysis variables.

All available features of the IEA IDB Analyzer are described extensively in its Help manual. All statistical procedures offered in the analysis module of the IEA IDB Analyzer make appropriate use of sampling weights, and standard errors are computed using the jackknife repeated replication (JRR) method.¹ Percentages, means, linear regressions, correlations, and percentiles may be specified with or without achievement scores. When achievement scores are used, the analyses are performed five times (once for each plausible value) and the results are aggregated to produce accurate estimates of achievement and standard errors that incorporate both sampling and imputation errors. To conduct analyses using achievement scores, select the **Use PVs** option from the **Plausible Value Option** drop-down menu. The various variables required to perform an analysis are input into specific variable fields according to their purpose.

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 IDCNTY used to distinguish the participating countries. Additional variables may 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, 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.

¹ Starting with TIMSS 2015, the jackknife repeated replication method has been modified to include both replicates within each sampling zone, as described in Chapter 4 of *Methods and Procedures in TIMSS 2015*.

Plausible Values

This section is used to identify the set of plausible values to be used when achievement scores are the analysis variable for computing statistics. Select the **Use PVs** option in the **Plausible Value Option** drop-down menu before specifying the achievement scores in the **Plausible Values** field.

Independent Variables

This is a list of variables to be treated as independent variables for a linear or logistic regression analysis. More than one independent variable can be selected. Categorical variables and continuous variables can be specified as independent variables. When specifying categorical variables as independent variables, they can be treated either as “effect coding” or “dummy coding” using the **Contrast** drop-down menu.² Achievement scores also can be included as an independent variable. To specify achievement scores as an independent variable, 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.

Dependent Variable

This is the variable to be used as the dependent variable when a linear or logistic regression analysis is specified. Only one dependent variable can be listed and can be either a background variable or achievement scores. To use achievement scores as the dependent variable, select the **Use PVs** option in the **Plausible Value Option** drop-down menu, click on the **Plausible Values** radio button in the **Dependent Variable** section, and select the achievement scores 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 TIMSS international benchmarks.

Percentiles

These are the percentiles that will be calculated from the distribution of a continuous analysis variable selected in the **Analysis Variables** section. Achievement scores can be selected as an analysis variable. 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. 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

² Effect coding and dummy coding of categorical variables are described in the Help manual of the IEA IDB Analyzer.

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 data. MATWGT will be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data. Chapter 4 of this User Guide provides more information on the TIMSS 2015 sampling weights.

2.5 TIMSS Analyses with Student Background Data

Many analyses of the TIMSS 2015 International Database can be undertaken using only student background data. This section presents examples of actual analyses used to produce exhibits from *TIMSS 2015 International Results in Mathematics*. Examples of linear regression analyses and computing percentages of students reaching the TIMSS International Benchmarks also are included in this section.

A first example computes national average achievement, whereas a second example computes national average achievement by gender. In both cases, the IEA IDB Analyzer uses the sampling weights, implements the jackknife repeated replication method to compute appropriate sampling errors, effectively performs the computations five times (once for each plausible value), and aggregates the results to produce accurate estimates of average achievement and standard errors that incorporate both sampling and imputation errors. A third example expands on the second example by performing a test of significance on the gender difference using linear regression. A fourth example computes the percentages of students reaching the TIMSS International Benchmarks.

Student Background Data Analysis with Achievement

In our first example, we want to replicate the analysis of the overall distribution of mathematics achievement. These results are presented in Exhibit 1.1 of *TIMSS 2015 International Results in Mathematics* and are repeated here in Exhibit 2.4. Because the results in this exhibit are based on plausible values, we need to make sure we include them when we create the file using the merge module, and also indicate that our analysis will make use of achievement scores.

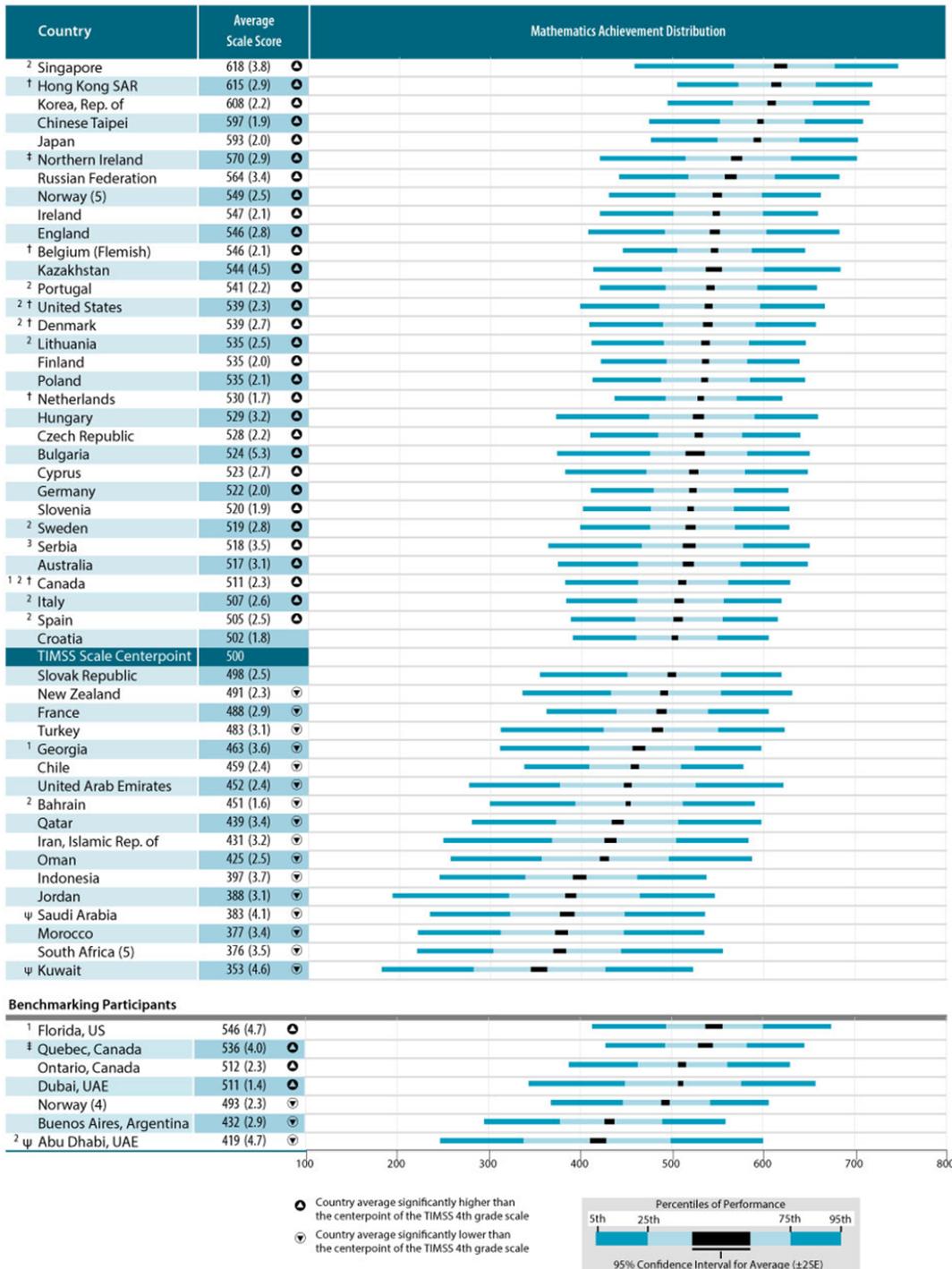
The **Percentages and Means** statistic type with the **Use PVs** Option selected will compute percentages and average achievement scores based on plausible values and their respective standard errors. Because we will be analyzing fourth grade mathematics achievement, we will create merged data files from both TIMSS 2015 (ASGALLM6) and TIMSS Numeracy 2015 (ASGALLN1) and then combine them into a single merged data file (ASGALLM6_CMB), as was explained earlier.

After creating the merged data file ASGALLM6_CMB, the analysis module of the IEA IDB Analyzer is used to perform the analysis in the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ASGALLM6_CMB as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS (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**.

Exhibit 2.4 Exhibit of Example Student Background Data Analysis with Achievement, Taken from TIMSS 2015 International Results in Mathematics (Exhibit 1.1)

Exhibit 1.1: Distribution of Mathematics Achievement



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Note: Seven countries and 1 benchmarking entity participated in the TIMSS Numeracy assessment: Bahrain, Indonesia, Iran, Jordan, Kuwait, Morocco, and South Africa as well as Buenos Aires. Except for Jordan and South Africa, they also participated in the TIMSS fourth grade assessment and their mathematics achievement results are based on an average of both assessments.

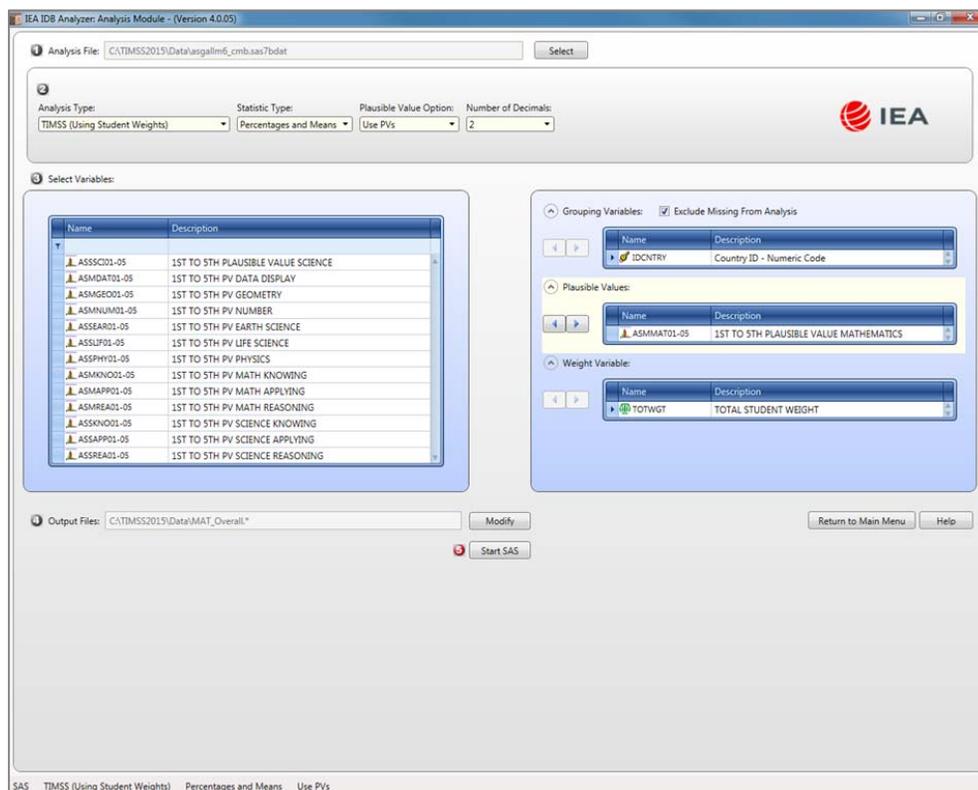
The TIMSS achievement scale was established in 1995 based on the combined achievement distribution of all countries that participated in TIMSS 1995. To provide a point of reference for country comparisons, the scale centerpoint of 500 was located at the mean of the combined achievement distribution. The units of the scale were chosen so that 100 scale score points corresponded to the standard deviation of the distribution.

ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

6. The variable IDCNTRY is selected automatically as **Grouping Variables**. No additional grouping variables are needed for this analysis.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field to activate it. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow** (▶) button in this section.
8. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
9. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
10. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS program editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.5 shows the completed analysis module for this example analysis, and Exhibit 2.6 displays the results with our four example countries.

Exhibit 2.5 IEA IDB Analyzer Setup for Example Student Background Data Analysis with Achievement



Each country’s results are presented on a single line. The countries are identified in the first column and the second column reports the number of valid cases. The third column identifies the sum of weights of the sampled students. The fourth column is the standard error of the sum of weights. The next four columns report the percentage of students in each category (Country) and its

standard error, followed by the estimated average mathematics achievement and its standard error. The standard deviation of the achievement scores and its standard error are reported in the next two columns and the last column reports the percentage of missing data.

Exhibit 2.6 SAS Output for Example Student Background Data Analysis with Achievement

Average of ASMMAT0 by (IDCNTRY)										
Country ID - Numeric Code	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se	mnpv	mnpv_se	sdpv	sdpv_se	pctmiss
Australia	6057	272907.47	8235.17	0.96	0.03	517.23	3.06	83.47	1.77	0.00
Bahrain	8575	32365.00	146.27	0.11	0.00	451.03	1.64	88.34	1.12	0.00
Belgium (Flemish)	5404	69902.74	1869.07	0.25	0.01	545.66	2.07	60.80	1.22	0.00
Bulgaria	4228	59707.81	1640.52	0.21	0.01	524.28	5.26	82.65	2.57	0.00

As shown in the first line of Exhibit 2.6, Australia had valid data for 6,057 fourth grade students and these sampled students represented a population of 272,907 fourth grade students. The average fourth grade mathematics achievement in Australia was 517.23 (standard error of 3.06) and its standard deviation was 83.47 (standard error of 1.77). It is important to note that the results shown for Bahrain are based on the combined samples from TIMSS 2015 and TIMSS Numeracy 2015 since Bahrain participated in both assessments and we used as input the ASGALLM6_CMB merged data file. This will be true for all the examples we will present in this chapter.

Student Background Data Analysis with Achievement by Gender

In our second example, we wish to replicate another set of results presented in *TIMSS 2015 International Results in Mathematics*. We are interested in investigating the relationship between fourth grade students' gender and mathematics achievement. These results, presented in Exhibit 1.10 of *TIMSS 2015 International Results in Mathematics*, are repeated here in Exhibit 2.7. Because the results in this exhibit are based on plausible values, we must ensure that these values are included when creating the input file, and also indicate that this analysis will make use of achievement scores.

After reviewing the appropriate codebook, we observe that the variable ITSEX contains categorical information on the gender of students, and this variable is found in the student background data files. The **Percentages and Means** statistic type and the **Use PVs** plausible value option will compute the percentages and average achievement based on plausible values and their respective standard errors. The analysis module of the IEA IDB Analyzer is used to perform the analysis using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ASGALLM6_CMB as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS (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**.

Exhibit 2.7 Exhibit of Example Student Background Data Analysis with Achievement by Gender, Taken from TIMSS 2015 International Results in Mathematics (Exhibit 1.10)

Exhibit 1.10: Average Mathematics Achievement by Gender

Country	Girls		Boys		Difference (Absolute Value)	Gender Difference	
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher	Boys Scored Higher
^ψ Saudi Arabia	49 (1.0)	405 (4.4)	51 (1.0)	363 (6.5)	43 (7.7)		
Oman	50 (0.7)	436 (3.0)	50 (0.7)	415 (2.8)	22 (2.9)		
Jordan	46 (2.4)	399 (3.3)	54 (2.4)	379 (4.9)	20 (5.8)		
South Africa (5)	48 (0.8)	384 (3.8)	52 (0.8)	368 (4.4)	15 (4.2)		
² Bahrain	50 (0.7)	459 (1.7)	50 (0.7)	443 (2.3)	15 (2.5)		
^ψ Kuwait	51 (2.0)	359 (5.4)	49 (2.0)	347 (5.6)	12 (6.2)		
Iran, Islamic Rep. of	50 (0.9)	437 (4.5)	50 (0.9)	426 (4.5)	10 (6.3)		
Indonesia	48 (0.6)	403 (4.0)	52 (0.6)	393 (3.9)	10 (2.7)		
Finland	48 (0.8)	540 (2.3)	52 (0.8)	531 (2.6)	9 (2.9)		
Bulgaria	49 (0.8)	527 (5.7)	51 (0.8)	522 (5.1)	5 (2.9)		
Norway (5)	49 (0.9)	551 (2.6)	51 (0.9)	547 (3.1)	4 (2.9)		
² Singapore	48 (0.5)	620 (3.9)	52 (0.5)	616 (4.3)	4 (3.0)		
United Arab Emirates	48 (2.2)	453 (3.9)	52 (2.2)	450 (3.4)	3 (5.4)		
¹ Georgia	49 (0.9)	465 (3.9)	51 (0.9)	461 (4.4)	3 (4.0)		
³ Serbia	48 (0.8)	520 (3.7)	52 (0.8)	517 (4.7)	3 (4.7)		
Qatar	51 (2.5)	440 (4.1)	49 (2.5)	438 (4.9)	3 (5.9)		
² Lithuania	50 (0.9)	537 (2.8)	50 (0.9)	534 (3.1)	2 (3.3)		
Kazakhstan	49 (0.8)	546 (4.6)	51 (0.8)	543 (4.8)	2 (2.8)		
Morocco	48 (0.7)	378 (3.5)	52 (0.7)	377 (3.9)	1 (2.8)		
² Sweden	49 (1.0)	519 (3.2)	51 (1.0)	518 (3.2)	1 (3.0)		
Russian Federation	49 (0.9)	564 (3.7)	51 (0.9)	564 (3.7)	1 (2.8)		
Japan	50 (0.5)	593 (2.0)	50 (0.5)	593 (2.5)	0 (2.3)		
Chile	49 (1.7)	458 (2.8)	51 (1.7)	459 (3.0)	1 (3.2)		
Poland	50 (0.8)	534 (2.3)	50 (0.8)	536 (2.7)	1 (2.5)		
Turkey	49 (0.6)	482 (3.2)	51 (0.6)	484 (3.5)	2 (2.7)		
[†] Northern Ireland	50 (1.1)	569 (3.8)	50 (1.1)	571 (3.1)	2 (3.8)		
New Zealand	49 (0.7)	489 (2.8)	51 (0.7)	492 (2.6)	2 (2.8)		
Germany	48 (0.7)	520 (2.4)	52 (0.7)	523 (2.3)	3 (2.3)		
Ireland	47 (1.5)	545 (2.6)	53 (1.5)	549 (2.9)	4 (3.4)		
Slovenia	49 (0.8)	518 (2.1)	51 (0.8)	522 (2.4)	4 (2.6)		
Chinese Taipei	49 (0.6)	594 (2.2)	51 (0.6)	599 (2.3)	6 (2.5)		
[†] Belgium (Flemish)	50 (0.9)	543 (2.4)	50 (0.9)	549 (2.4)	6 (2.4)		
Hungary	49 (0.9)	526 (3.4)	51 (0.9)	532 (3.8)	6 (3.4)		
France	49 (0.7)	485 (3.2)	51 (0.7)	491 (3.2)	6 (2.8)		
² [†] Denmark	49 (0.8)	536 (3.1)	51 (0.8)	542 (3.0)	6 (2.8)		
England	51 (0.7)	543 (3.0)	49 (0.7)	549 (3.3)	6 (2.9)		
Cyprus	49 (0.7)	520 (2.9)	51 (0.7)	526 (3.1)	6 (2.7)		
² [†] United States	51 (0.6)	536 (2.3)	49 (0.6)	543 (2.6)	7 (1.9)		
Czech Republic	49 (0.9)	525 (3.0)	51 (0.9)	532 (2.5)	7 (3.2)		
Korea, Rep. of	48 (0.5)	604 (2.3)	52 (0.5)	612 (2.5)	7 (1.9)		
[†] Netherlands	50 (0.9)	526 (1.8)	50 (0.9)	534 (2.2)	8 (2.2)		
Australia	49 (1.0)	513 (3.1)	51 (1.0)	522 (3.9)	9 (3.5)		
¹ ² [†] Canada	49 (0.5)	506 (2.5)	51 (0.5)	515 (2.6)	9 (2.1)		
[†] Hong Kong SAR	46 (1.5)	609 (3.8)	54 (1.5)	619 (2.8)	10 (3.3)		
² Portugal	49 (0.8)	536 (2.4)	51 (0.8)	547 (2.5)	11 (2.2)		
Slovak Republic	48 (0.9)	493 (3.0)	52 (0.9)	504 (2.6)	11 (2.6)		
² Spain	49 (0.9)	499 (2.7)	51 (0.9)	511 (2.7)	12 (2.4)		
Croatia	49 (0.8)	496 (2.1)	51 (0.8)	508 (2.3)	12 (2.7)		
² Italy	49 (0.7)	497 (2.7)	51 (0.7)	517 (3.0)	20 (2.7)		
International Avg.	49 (0.2)	505 (0.5)	51 (0.2)	505 (0.5)			

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Benchmarking Participants

² ^ψ Abu Dhabi, UAE	47 (3.7)	422 (8.0)	53 (3.7)	417 (6.6)	4 (11.2)		
¹ Florida, US	49 (1.1)	548 (4.9)	51 (1.1)	544 (5.5)	4 (4.5)		
Dubai, UAE	48 (3.3)	510 (3.1)	52 (3.3)	512 (2.7)	2 (5.0)		
Norway (4)	49 (0.9)	492 (2.9)	51 (0.9)	494 (3.0)	3 (3.6)		
Buenos Aires, Argentina	50 (1.0)	430 (3.5)	50 (1.0)	435 (2.9)	5 (2.8)		
Ontario, Canada	49 (0.8)	509 (2.6)	51 (0.8)	516 (2.8)	7 (2.9)		
[†] Quebec, Canada	50 (1.0)	531 (3.9)	50 (1.0)	541 (4.8)	11 (3.8)		



^ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

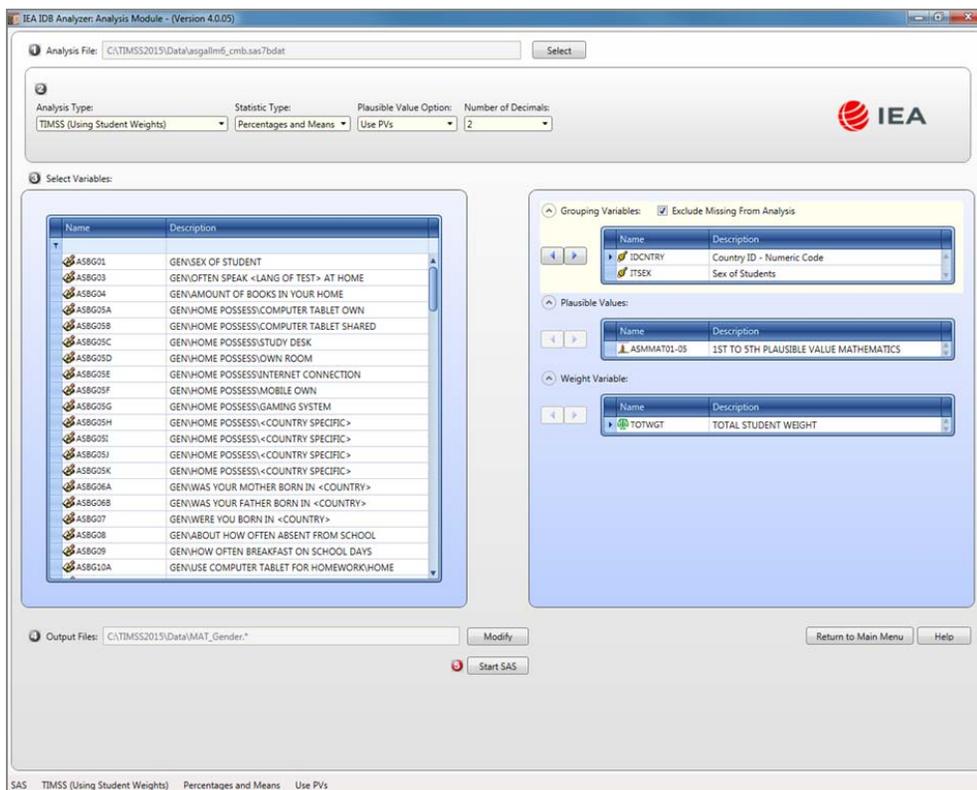
See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and §.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

6. Specify the variable ITSEX as a second grouping variable by clicking the **Grouping Variables** field to activate it. Select ITSEX from the list of available variables and move it to the **Grouping Variables** field by clicking the **right arrow (▶)** button in this section.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field to activate it. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
8. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
9. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
10. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.8 shows the completed analysis module for this example analysis and the results are presented in Exhibit 2.9.

Exhibit 2.8 IEA IDB Analyzer Setup for Example Student Background Data Analysis with Achievement by Gender



Each country’s results are displayed on two lines, one for each value of the ITSEX variable. The countries are identified in the first column and the second column describes the category of ITSEX being reported (1 for girls and 2 for boys). The third column reports the number of valid cases and

the fourth the sum of weights of the sampled students. The fifth column is the standard error of the sum of weights. The next four columns report the percentage of students in each category and its standard error, followed by the estimated average mathematics achievement and its standard error. The standard deviation of the achievement scores and its standard error are reported in the next two columns.

Exhibit 2.9 SAS Output for Example Student Background Data Analysis with Achievement by Gender

Average of ASMMAT0 by (IDCNTRY ITSEX)

Country ID - Numeric Code	Sex of Students	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se	mnpv	mnpv_se	sdpv	sdpv_se	pctmiss
Australia	1	2963	132639.62	4123.20	48.60	0.96	512.60	3.09	81.47	1.90	0.00
	2	3094	140267.85	5574.95	51.40	0.96	521.60	3.92	85.09	2.31	0.00
Bahrain	1	4358	16211.08	220.02	50.09	0.66	458.69	1.72	82.26	1.47	0.00
	2	4217	16153.91	229.71	49.91	0.66	443.35	2.33	93.43	1.54	0.00
Belgium (Flemish)	1	2732	35030.06	1145.36	50.11	0.93	542.82	2.44	60.34	1.51	0.00
	2	2672	34872.68	1134.41	49.89	0.93	548.51	2.36	61.12	1.41	0.00
Bulgaria	1	2081	29293.40	958.44	49.06	0.78	526.81	5.74	81.79	2.76	0.00
	2	2147	30414.41	923.91	50.94	0.78	521.85	5.15	83.39	2.88	0.00

From the first two lines of results, 48.60% of fourth grade students in Australia were girls and 51.40% were boys. The average fourth grade mathematics achievement of girls was 512.60 (standard error of 3.09) and it was 521.60 for boys (standard error of 3.92).

Linear Regression Analysis with Student Background Data

This example is an extension of the previous example (Student Background Data Analysis with Achievement by Gender), where we will examine the difference in fourth grade mathematics achievement between girls and boys and determine if it is statistically significant. The results of this example also are presented in Exhibit 1.10 of *TIMSS 2015 International Results in Mathematics* and shown in Exhibit 2.7, in the column labeled “Difference.”

It is worth noting that our previous example (Student Background Data Analysis with Achievement by Gender) the IEA IDB Analyzer performed the same gender difference significance test in the background. In the C:\TIMSS2015\Data\ folder, there is a CSV file (readable in Excel), MAT_Gender_ASMMAT0_by_ITSEX_Sig, with the same results we will produce using the linear regression statistical method in our example. The IEA IDB Analyzer’s Help manual provides a description of this CSV file and its contents.

ITSEX has a value of one (1) for girls and two (2) for boys. By using ITSEX as a categorical variable in the IEA IDB Analyzer with dummy coding and category 1 as the reference category, the regression intercept will be the estimated average mathematics achievement of girls, and the regression slope will be the estimated increase in average mathematics achievement for boys.

This example of a regression analysis is performed by the **Analysis Module** of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASGALLM6_CMB as the **Analysis File** by clicking the **Select** button.

3. Select **TIMSS (Using Student Weights)** as the **Analysis Type**.
4. Select **Linear Regression** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. The variable IDCNTRY is selected automatically as **Grouping Variables**. No additional grouping variables are needed for this analysis.
7. Click the **Categorical Variables** field in the **Independent Variables** section to activate it and select the variable ITSEX as the independent variable. This is done by selecting ITSEX from the list of available variables and moving it to the **Categorical Variables** field by clicking the **right arrow (▶)** button in this section. By clicking the **Contrast** field of ITSEX, its drop-down menu will appear, from which “Dummy Coding” should be selected. By default, the IEA IDB Analyzer will recognize that ITSEX has two categories and it will select category 1 as the reference category. These settings should not be changed.
8. Click the **Plausible Values** radio button in the **Dependent Variable** section and select ASMMAT01-05 as the analysis variable. This is done by selecting ASMMAT01-05 from the list of available variables and moving it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
9. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
10. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
11. Click the **Start SAS** button to create the SAS syntax file and open it in an SAS editor window. The syntax file will be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.10 shows the completed analysis module for this example analysis, and Exhibit 2.11 displays the results.

Each country’s results are displayed on two lines: the first for the intercept and the second for the ITSEX coefficient. Generally, there will be as many lines per country as there are regression coefficients, including the intercept. The first line of results in Exhibit 2.11 labeled “Intercept” is the estimated average mathematics achievement of fourth grade girls in Australia, which was 512.60 with a standard error of 3.09. This estimate concurs with the results obtained in the previous example (Exhibit 2.9). From the second line of results labeled “ITSEX_D2”, the fourth grade boys in Australia had a positive average mathematics achievement difference of 9.00. With an estimated standard error of 3.47, this achievement difference is statistically significant at the 95% confidence level. Adding the two regression coefficients together ($512.60 + 9.00$) yields the estimated average mathematics achievement of fourth grade boys in Australia, which was 521.60, the same estimate from the previous example. The IEA IDB Analyzer also computes standardized regression coefficients, whereby the independent variables are standardized to have a mean of zero (0) and standard deviation of one (1).

Exhibit 2.10 IEA IDB Analyzer Setup for Example Student Background Data Linear Regression Analysis

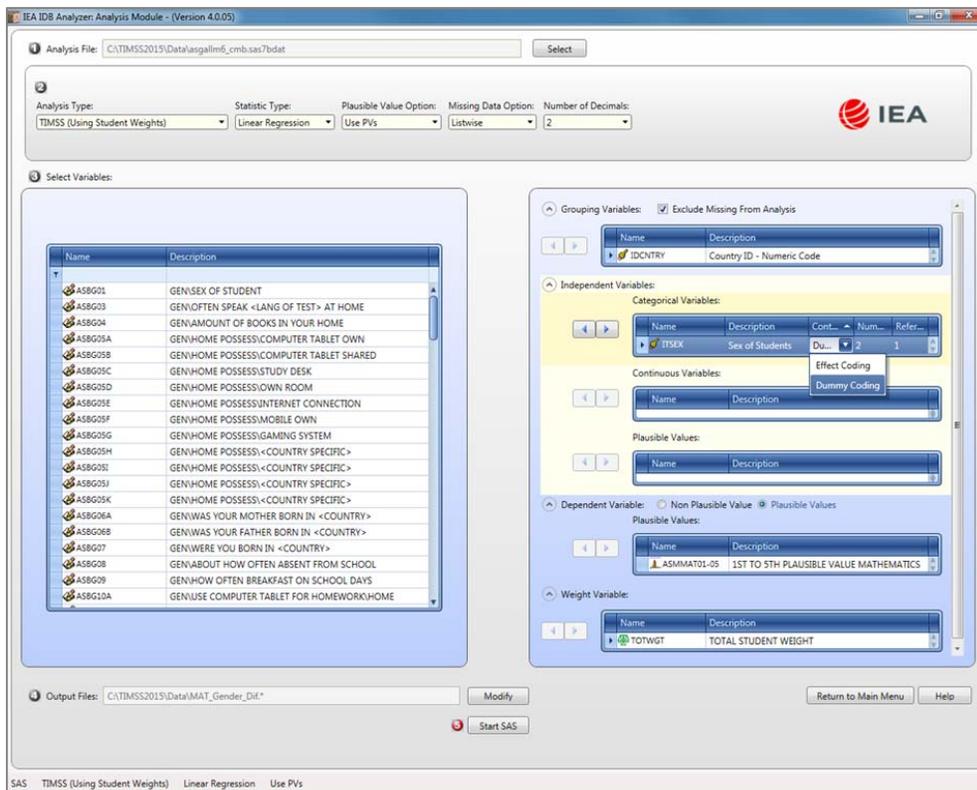


Exhibit 2.11 SAS Output for Example Student Background Data Linear Regression Analysis

Equation Coefficients of (ITSEX_D2) predicting (ASMMAT0) by (IDCNTRY)

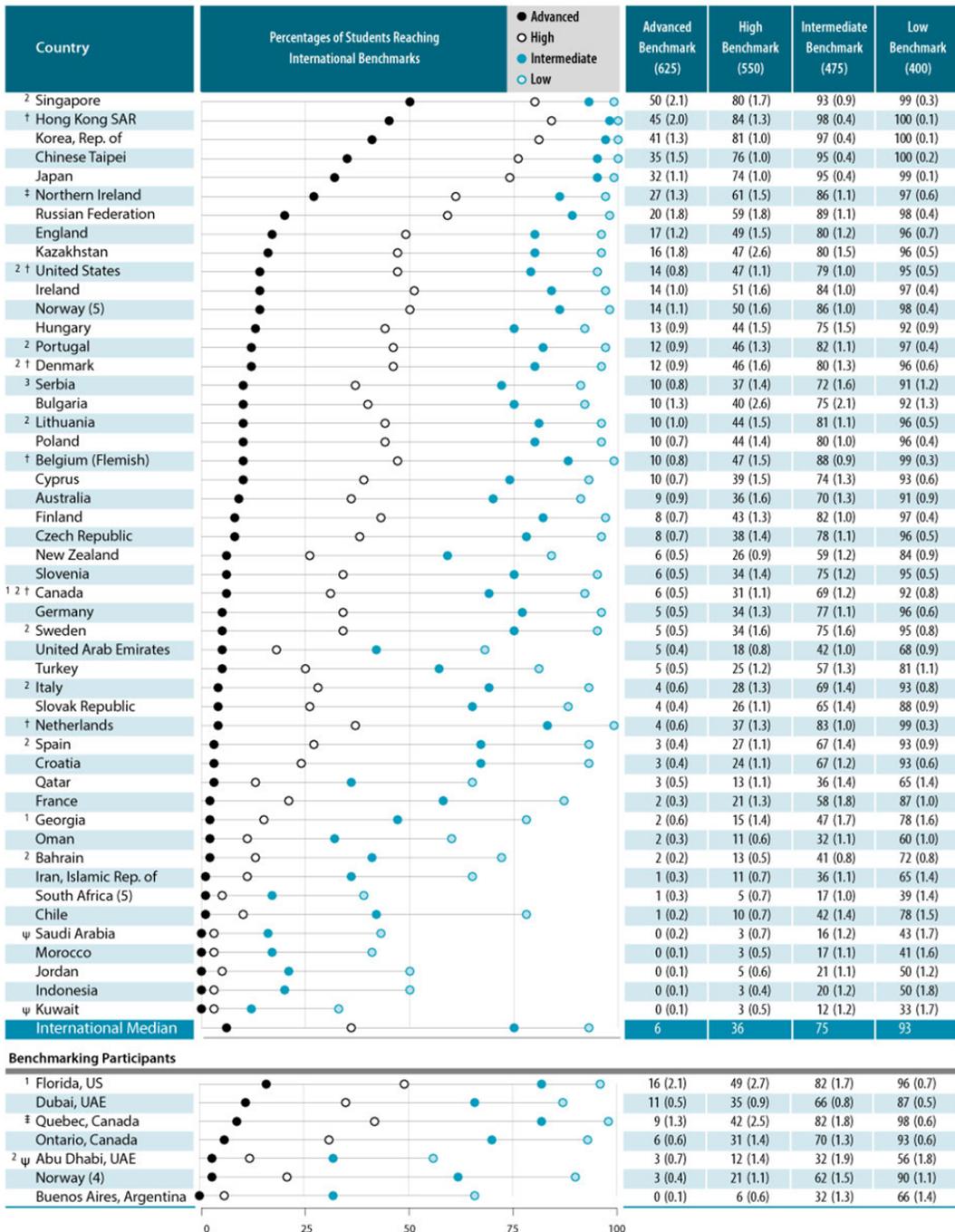
Country ID - Numeric Code	variable	label	Parameter Estimate	Estimate_se	Estimate_t	Standardized Estimate	StandardizedEst_se
Australia	Intercept	Intercept	512.60	3.09	165.91	0.00	0.00
	ITSEX_D2		9.00	3.47	2.59	0.05	0.02
Bahrain	Intercept	Intercept	458.69	1.72	266.24	0.00	0.00
	ITSEX_D2		-15.33	2.46	-6.24	-0.09	0.01
Belgium (Flemish)	Intercept	Intercept	542.82	2.44	222.86	0.00	0.00
	ITSEX_D2		5.68	2.42	2.35	0.05	0.02
Bulgaria	Intercept	Intercept	526.81	5.74	91.75	0.00	0.00
	ITSEX_D2		-4.95	2.89	-1.72	-0.03	0.02

The TIMSS International Benchmarks

This section describes how to use the IEA IDB Analyzer to perform analyses of student achievement in relation to the TIMSS International Benchmarks. As an example, we will compute the percentages of students reaching the four TIMSS 2015 International Benchmarks of fourth grade mathematics achievement (advanced, high, intermediate, and low) using the merged ASGALLM6_CMB data file. These results, presented in Exhibit 2.2 of *TIMSS 2015 International Results in Mathematics*, are shown here in Exhibit 2.12.

Exhibit 2.12 Example Exhibit of TIMSS International Benchmarks Analysis, Taken from TIMSS 2015 International Results in Mathematics (Exhibit 2.2)

Exhibit 2.2: Performance at the International Benchmarks of Mathematics Achievement



SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2015

^ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and §.
() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

This example is performed by the analysis module of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASGALLM6_CMB as the **Analysis File** by clicking the **Select** button.
3. Select **TIMSS (Using Student Weights)** as the **Analysis Type**.
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.
6. The variable IDCNTRY is selected automatically as **Grouping Variables**. No additional grouping variables are needed for this analysis.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
8. Specify the TIMSS 2015 International Benchmarks—400, 475, 550, and 625 (low, intermediate, high, and advanced, respectively). These values can be entered manually in the **Achievement Benchmarks** field, each separated by a blank space, or they can be selected by clicking on the drop-down menu available for this field.
9. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
10. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
11. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file will be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.13 shows the completed analysis module for this example analysis, and Exhibit 2.14 presents the results.

As shown in the first few lines of results, 91.37% of the fourth grade students in Australia performed at or above the Low International Benchmark of 400, with a standard error of 0.91; 70.23% of the students reached the Intermediate International Benchmark, with a standard error of 1.34; 36.18% of the students reached the High International Benchmark, with a standard error of 1.60; and 9.21% of the students reached the Advanced International Benchmark, with a standard error of 0.85.

Exhibit 2.13 IEA IDB Analyzer Setup for Example TIMSS International Benchmarks Analysis

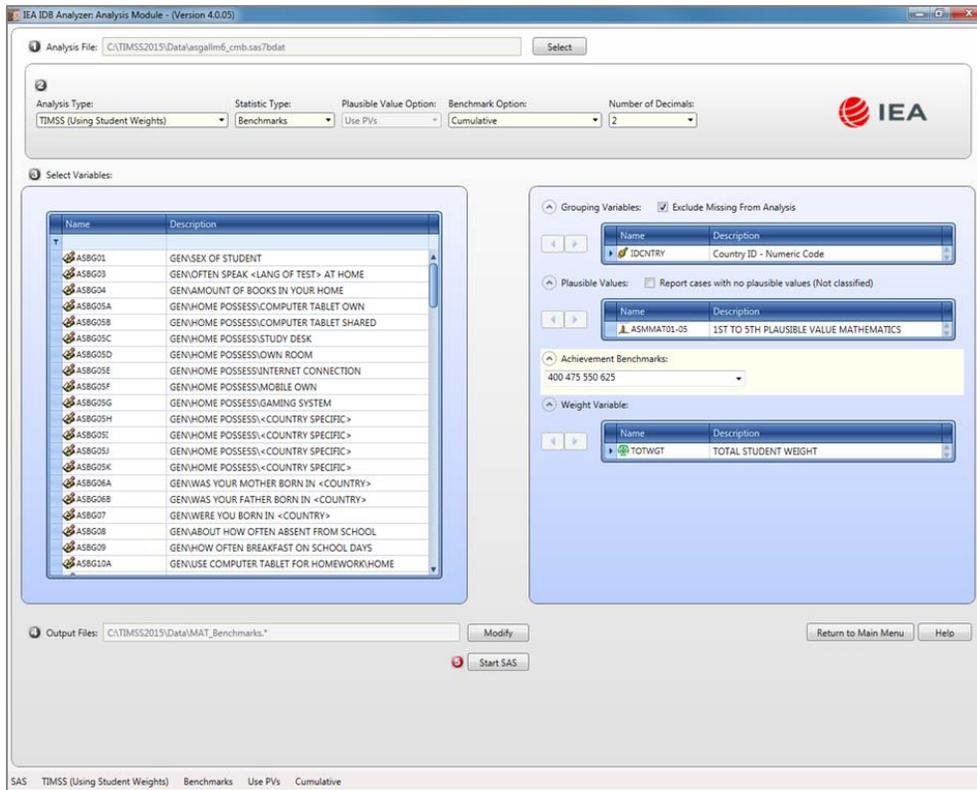


Exhibit 2.14 SAS Output for Example TIMSS International Benchmarks Analysis

Percent at or Above (400 475 550 625) of ASMMAT0 by (IDCNTRY)

Country ID - Numeric Code	cutvar	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se
Australia	At or above 400	5428.2	249348.30	6786.22	91.37	0.91
	At or above 475	4139.2	191671.09	5524.24	70.23	1.34
	At or above 550	2113	98750.18	4017.94	36.18	1.60
	At or above 625	515.2	25124.53	2281.47	9.21	0.85
Bahrain	At or above 400	6233	23438.42	285.06	72.42	0.75
	At or above 475	3550.2	13256.34	279.03	40.96	0.80
	At or above 550	1091.8	4081.04	162.88	12.61	0.49
	At or above 625	154	586.32	61.54	1.81	0.19
Belgium (Flemish)	At or above 400	5358.2	69222.73	1876.58	99.03	0.27
	At or above 475	4740.4	61430.09	1820.16	87.88	0.88
	At or above 550	2503	33164.94	1444.25	47.44	1.46
	At or above 625	479.8	6738.10	600.93	9.64	0.80
Bulgaria	At or above 400	3894	54889.79	1791.20	91.93	1.32
	At or above 475	3184.6	44850.75	1882.85	75.12	2.08
	At or above 550	1702.4	24047.27	1805.54	40.27	2.57
	At or above 625	416.8	5832.11	811.04	9.77	1.29

Computing Correlations

In addition to the analyses described above, the IEA IDB Analyzer is able to compute correlations among a set of variables. Thus it can compute correlations between background variables—such as the context questionnaire scales Students Like Learning Mathematics and Students Like Learning Science, between achievement scores—such as mathematics and science, and between a combination of both—such as students’ age and their mathematics achievement. While these types of analyses will not be demonstrated here, the steps for conducting them are similar to those described previously: select the grouping variables, the analysis variables, the achievement scores (if necessary), and confirm the weight variable. The output will display, for each group defined by the grouping variables, the correlation coefficients for each possible pair of variables.

Calculating Percentiles of a Distribution

The **Percentiles** statistic type is an additional tool provided by the IEA IDB Analyzer for analyzing the TIMSS 2015 data. This procedure will compute the percentiles of a distribution within any specified subgroups, along with appropriate standard errors. The distribution can be either a non-PV based analysis variable—such as a context questionnaire scale, of a specified set of plausible values.

Performing Logistic Regression

The IEA IDB Analyzer can perform a logistic regression, with or without plausible values. Logistic regression is used to predict a binary response based on one or more predictor variables. Users can specify grouping variables, independent variables—with or without interactions—that can be categorical, continuous, or plausible values, and a dependent variable. Users will find useful information on performing logistic regression in the IDB Analyzer's Help manual.

2.6 TIMSS Analyses with Home Background Data

The TIMSS 2015 International Database includes data from a home context questionnaire administered at the fourth grade, including TIMSS Numeracy 2015. Analyzing home background data from the TIMSS 2015 International Database requires that the home background data files (ASH) be merged with the student background data files (ASG) in order to retrieve the achievement scores and the required sample design variables. To illustrate how to perform analyses based on home background data, we will use an example that computes the average score on a context questionnaire scale, along with the percentages of students—with their average achievement—for the categories of the scale's corresponding index.

Analyses with a Context Questionnaire Scale

TIMSS 2015 reports some context questionnaire data by creating context questionnaire scales based on Rasch modeling.³ The context questionnaire scales are available in the International Database for analysis. Each context questionnaire scale variable is a Rasch score with an international centerpoint of 10 and an internationally set standard deviation of 2. From each context questionnaire scale, an index is derived that divides the range of scores on that scale into usually three categories: the most

³ The context questionnaire scales are described in Chapter 15 of *Methods and Procedures in TIMSS 2015*.

desirable scores (high values), the least desirable scores (low values), and the remaining scores in between.

These context questionnaire scales and their corresponding indices were reported in *TIMSS 2015 International Results in Mathematics and Science*. Exhibit 2.15 shows one such example, Exhibit 4.5 of *TIMSS 2015 International Results in Mathematics*, reporting Parental Attitude Toward Mathematics and Science, based on parents' responses to a set of eight statements on this topic. Results on the Rasch scale are reported for each country as an "Average Scale Score" and its corresponding index is reported as the percentages of fourth grade students in each category—Parents with Very Positive Attitude, Parents with Positive Attitude, and Parents with Less than Positive Attitude—along with their average mathematics achievement in each category.

This example will replicate both the average scale score of the Parental Attitude Toward Mathematics and Science scale and the percentages of students and their average achievement in each category of its index. This will be done in two steps, both using the merged ASHALLM6_CMB data file, where the student background data files were merged with the home background data files.

The first step will compute the average scale score using the scale variable ASBHAMS. It is performed by the analysis module of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASHALLM6_CMB as the **Analysis File**.
3. Select **TIMSS (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 we will not use any achievement scores for this part of the analysis.
6. Specify the variable ASBHAMS as the analysis variable by clicking the **Analysis Variables** field to activate it. Select ASBHAMS from the list of available variables and move it to the **Analysis Variables** field by clicking the **right arrow (►)** button in this section.
7. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
8. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
9. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

**Exhibit 2.15 Example Exhibit of a Context questionnaire Scale, Taken from
TIMSS 2015 International Results in Mathematics (Exhibit 4.5)**

Exhibit 4.5: Parental Attitude Toward Mathematics and Science

Reported by Parents

Country	Very Positive Attitude		Positive Attitude		Less than Positive Attitude		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	91 (0.6)	546 (4.6)	9 (0.6)	535 (7.0)	0 (0.1)	~ ~	11.4 (0.04)
Indonesia	89 (1.0)	399 (3.6)	10 (0.9)	396 (6.8)	1 (0.3)	~ ~	11.4 (0.06)
Portugal	87 (0.6)	543 (2.2)	13 (0.6)	538 (4.3)	0 (0.1)	~ ~	10.9 (0.02)
South Africa (5)	87 (0.8)	381 (3.4)	12 (0.8)	368 (6.6)	1 (0.1)	~ ~	11.2 (0.05)
Iran, Islamic Rep. of	85 (0.9)	436 (3.4)	15 (0.8)	415 (6.0)	1 (0.1)	~ ~	10.9 (0.05)
Turkey	82 (0.8)	488 (3.0)	17 (0.7)	473 (5.6)	1 (0.2)	~ ~	10.7 (0.05)
Oman	81 (0.5)	431 (2.7)	18 (0.5)	411 (4.0)	1 (0.1)	~ ~	10.6 (0.03)
Jordan	80 (0.9)	399 (3.2)	19 (0.9)	366 (5.9)	1 (0.2)	~ ~	10.6 (0.04)
Bahrain	80 (0.4)	459 (1.8)	20 (0.4)	435 (3.0)	1 (0.1)	~ ~	10.6 (0.02)
Singapore	79 (0.6)	624 (3.7)	20 (0.5)	603 (4.7)	1 (0.1)	~ ~	10.7 (0.03)
Qatar	r 79 (0.9)	454 (3.4)	20 (0.9)	423 (5.1)	1 (0.2)	~ ~	10.6 (0.04)
Kuwait	r 78 (0.9)	366 (5.4)	21 (0.9)	337 (3.8)	1 (0.1)	~ ~	10.6 (0.05)
Spain	77 (0.8)	512 (2.3)	22 (0.8)	501 (2.6)	1 (0.2)	~ ~	10.5 (0.03)
Northern Ireland	s 77 (1.1)	588 (3.7)	22 (1.1)	577 (5.3)	1 (0.3)	~ ~	10.4 (0.05)
Lithuania	76 (0.8)	542 (2.7)	24 (0.8)	530 (3.9)	0 (0.1)	~ ~	10.3 (0.03)
Ireland	76 (1.0)	555 (2.3)	24 (1.0)	536 (3.1)	1 (0.1)	~ ~	10.5 (0.04)
Chile	r 75 (0.7)	467 (2.6)	24 (0.7)	456 (3.5)	1 (0.2)	~ ~	10.4 (0.03)
Cyprus	75 (0.6)	529 (2.6)	24 (0.7)	521 (3.7)	1 (0.2)	~ ~	10.3 (0.02)
Morocco	75 (1.3)	386 (3.4)	22 (1.0)	364 (5.9)	3 (0.5)	342 (16.2)	10.4 (0.08)
Denmark	73 (0.8)	545 (2.7)	26 (0.8)	532 (3.8)	1 (0.2)	~ ~	10.2 (0.03)
United Arab Emirates	72 (0.5)	468 (2.6)	27 (0.4)	423 (3.0)	1 (0.1)	~ ~	10.4 (0.02)
Georgia	71 (1.1)	465 (3.4)	28 (1.1)	462 (5.5)	0 (0.1)	~ ~	10.3 (0.06)
Serbia	71 (1.2)	523 (3.4)	27 (1.1)	512 (6.9)	2 (0.3)	~ ~	10.3 (0.05)
Poland	71 (0.8)	541 (2.3)	29 (0.8)	523 (2.8)	1 (0.1)	~ ~	10.2 (0.04)
Saudi Arabia	70 (1.1)	391 (3.8)	28 (1.1)	377 (6.5)	2 (0.4)	~ ~	10.2 (0.06)
Canada	r 70 (1.1)	522 (2.1)	29 (1.0)	510 (2.4)	1 (0.2)	~ ~	10.2 (0.04)
New Zealand	s 70 (1.3)	520 (3.0)	28 (1.3)	493 (3.2)	2 (0.2)	~ ~	10.2 (0.05)
Bulgaria	69 (1.5)	532 (4.8)	28 (1.3)	518 (7.2)	3 (0.6)	493 (20.3)	10.1 (0.08)
Russian Federation	68 (1.0)	564 (3.3)	31 (1.0)	565 (4.5)	1 (0.1)	~ ~	10.1 (0.03)
Sweden	65 (1.0)	530 (2.9)	35 (1.0)	513 (3.5)	1 (0.1)	~ ~	9.9 (0.04)
Hungary	60 (1.1)	537 (3.7)	38 (0.9)	521 (3.8)	2 (0.2)	~ ~	9.7 (0.04)
Finland	60 (0.8)	545 (2.3)	38 (0.7)	527 (2.4)	2 (0.3)	~ ~	9.7 (0.04)
Hong Kong SAR	60 (1.2)	623 (3.5)	38 (1.2)	606 (3.2)	2 (0.3)	~ ~	9.7 (0.05)
Italy	52 (0.8)	511 (3.3)	45 (0.8)	508 (2.6)	3 (0.3)	497 (8.9)	9.3 (0.03)
Slovak Republic	51 (0.9)	497 (3.3)	46 (0.9)	505 (2.4)	3 (0.3)	487 (10.1)	9.3 (0.04)
France	50 (1.1)	501 (3.7)	48 (1.1)	482 (2.9)	1 (0.2)	~ ~	9.4 (0.05)
Chinese Taipei	49 (0.8)	605 (2.5)	48 (0.8)	592 (2.4)	4 (0.3)	573 (6.1)	9.2 (0.03)
Czech Republic	48 (0.8)	533 (2.8)	49 (0.8)	526 (2.6)	3 (0.3)	526 (8.6)	9.2 (0.03)
Germany	s 46 (1.0)	537 (2.8)	49 (1.1)	530 (2.2)	4 (0.5)	526 (6.2)	9.1 (0.04)
Belgium (Flemish)	42 (0.8)	553 (2.6)	54 (0.8)	547 (2.2)	4 (0.3)	520 (7.1)	8.9 (0.03)
Slovenia	s 34 (1.2)	538 (2.9)	63 (1.1)	525 (2.6)	3 (0.4)	510 (9.2)	8.8 (0.04)
Korea, Rep. of	34 (0.8)	625 (2.8)	62 (0.8)	602 (2.2)	5 (0.4)	583 (5.7)	8.7 (0.03)
Croatia	24 (0.8)	506 (3.3)	71 (0.8)	503 (1.6)	5 (0.5)	480 (6.2)	8.2 (0.03)
Japan	14 (0.6)	613 (4.3)	68 (0.7)	595 (2.0)	18 (0.7)	573 (3.1)	7.5 (0.03)
Australia	x x	x x	x x	x x	x x	x x	x x
Netherlands	x x	x x	x x	x x	x x	x x	x x
Norway (5)	x x	x x	x x	x x	x x	x x	x x
England	--	--	--	--	--	--	--
United States	--	--	--	--	--	--	--
International Avg.	66 (0.1)	510 (0.5)	32 (0.1)	495 (0.6)	2 (0.0)	509 (2.9)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Benchmarking Participants

Dubai, UAE	80 (0.6)	519 (1.8)	19 (0.6)	487 (3.2)	1 (0.1)	~ ~	10.7 (0.03)
Ontario, Canada	r 75 (2.0)	524 (2.5)	24 (1.8)	505 (3.4)	1 (0.3)	~ ~	10.4 (0.08)
Abu Dhabi, UAE	r 67 (1.4)	441 (5.3)	32 (1.4)	393 (5.4)	1 (0.2)	~ ~	10.2 (0.06)
Quebec, Canada	r 57 (1.5)	547 (4.4)	42 (1.4)	531 (4.0)	1 (0.3)	~ ~	9.6 (0.06)
Buenos Aires, Argentina	x x	x x	x x	x x	x x	x x	x x
Norway (4)	x x	x x	x x	x x	x x	x x	x x
Florida, US	--	--	--	--	--	--	--

This TIMSS questionnaire scale was established in 2015 based on the combined response distribution of all countries that participated in TIMSS 2015. 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.

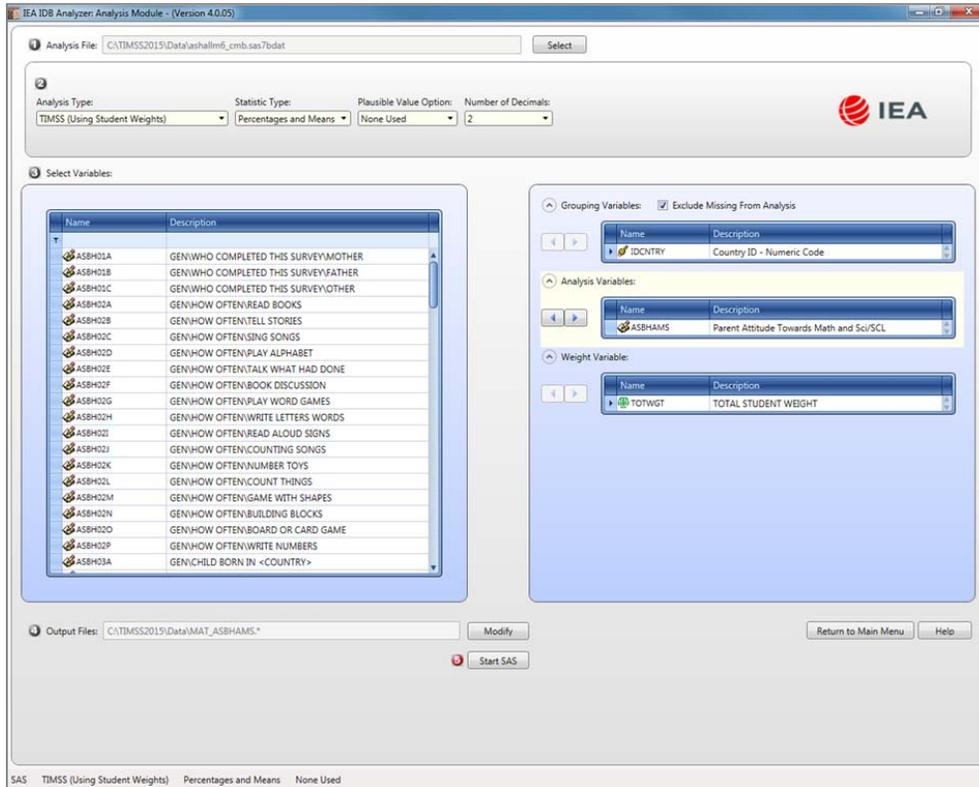
A dash (-) indicates comparable data not available. A tilde (~) indicates insufficient data to report achievement.

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.

An "x" indicates data are available for less than 50% of students.

Exhibit 2.16 shows the completed analysis module for this example analysis, and Exhibit 2.17 displays the results.

Exhibit 2.16 IEA IDB Analyzer Setup for Example Context Questionnaire Scale Analysis (Step 1)



As shown in the fourth line of the results, students in Bulgaria scored 10.08, with a standard error of 0.08, on the Parental Attitude Toward Mathematics and Science context questionnaire scale. Note that this is marginally above the international centerpoint of 10. The IEA IDB Analyzer also computes the standard deviation of the context questionnaire scale and its standard error.

Exhibit 2.17 SAS Output for Example Context Questionnaire Scale Analysis (Step 1)

Average of ASBHAMS by (IDCNTRY)

Country ID - Numeric Code	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se	mnx	mnx_se	sdx	sdx_se	pctmiss
Australia	2714	124451.52	4897.88	0.56	0.02	10.34	0.05	1.84	0.02	54.40
Bahrain	7739	29360.18	186.81	0.13	0.00	10.63	0.02	1.78	0.01	9.28
Belgium (Flemish)	4878	63247.19	1810.13	0.29	0.01	8.95	0.03	1.87	0.02	9.52
Bulgaria	4117	58208.58	1599.94	0.26	0.01	10.08	0.08	2.04	0.06	2.51

In the second step, we will compute the percentages of students—with their average mathematics achievement—in each category of the corresponding index variable ASDHAMS. It is performed by the analysis module of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Specify the data file ASHALLM6_CMB as the **Analysis File**.
3. Select **TIMSS (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**, because we will be computing average achievement by the grouping variable ASDHAMS.
6. Specify the variable ASDHAMS as a second grouping variable by clicking the **Grouping Variables** field to activate it. Select ASDHAMS from the list of available variables and move it to the **Grouping Variables** field by clicking the **right arrow (▶)** button in this section.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field to activate it. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
8. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses student background data.
9. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
10. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.18 shows the completed analysis module for this example analysis and the results are presented in Exhibit 2.19.

As shown in the three lines of the results for Bulgaria, 69.05% of fourth grade students in Bulgaria had parents with a very positive attitude (standard error of 1.49) and their average mathematics achievement was 531.52 (standard error of 4.84); 27.92% of students had parents with a positive attitude (standard error of 1.28) and their average mathematics achievement was 517.80 (standard error of 7.15); and 3.03% of students had parents with a less than positive attitude (standard error of 0.60) and their average mathematics achievement was 492.96 (standard error of 20.34).

Exhibit 2.18 IEA IDB Analyzer Setup for Example Context Questionnaire Scale Analysis (Step 2)

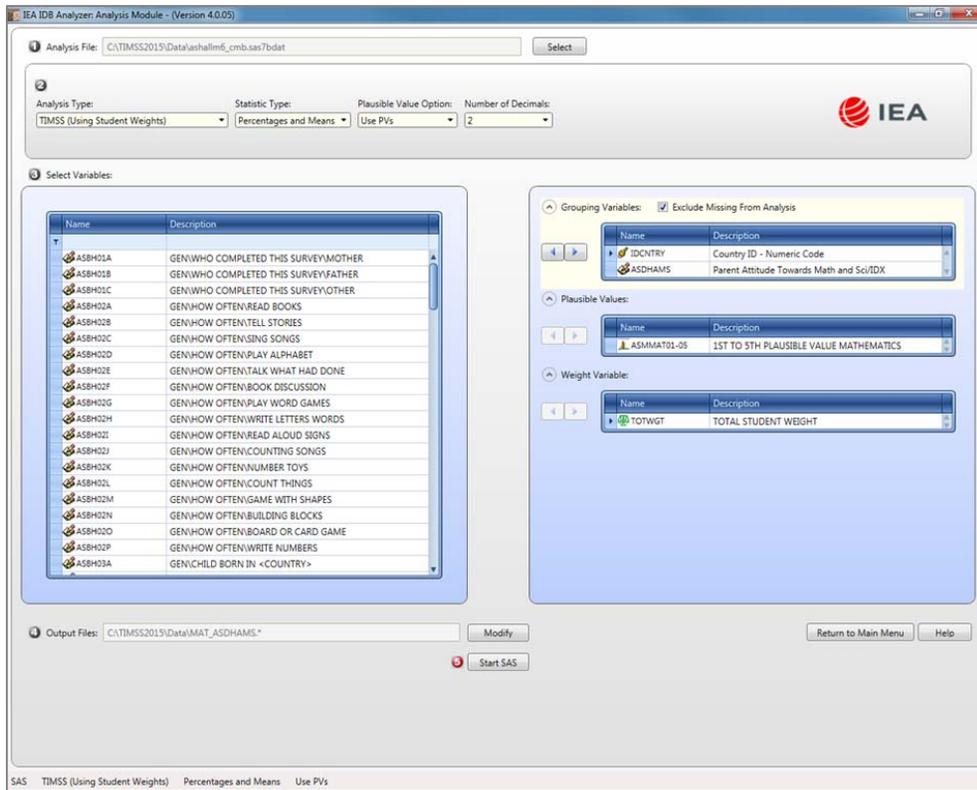


Exhibit 2.19 SAS Output for Example Context Questionnaire Scale Analysis (Step 2)

Average of ASMMAT0 by (IDCNTRY ASDHAMS)

Country ID - Numeric Code	ASDHAMS IDX	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se	mnpv	mnpv_se	sdpv	sdpv_se	pctmiss
Australia	1	1998	91464.10	3759.06	73.49	0.99	543.75	3.64	81.23	2.24	0.00
	2	695	32222.56	1815.76	25.89	0.98	518.40	4.27	81.05	3.49	0.00
	3	21	764.87	188.54	0.61	0.15	492.01	21.75	88.53	14.06	0.00
Bahrain	1	6141	23350.50	220.96	79.53	0.44	459.13	1.76	87.52	1.31	0.00
	2	1526	5760.97	124.79	19.62	0.44	434.64	2.99	85.76	2.43	0.00
	3	72	248.71	31.16	0.85	0.11	423.90	10.42	92.16	7.60	0.00
Belgium (Flemish)	1	2106	26701.56	942.99	42.22	0.81	552.52	2.60	61.04	1.59	0.00
	2	2606	34328.55	1074.97	54.28	0.78	546.50	2.19	59.77	1.49	0.00
	3	166	2217.08	190.78	3.51	0.28	520.06	7.05	57.39	4.34	0.00
Bulgaria	1	2888	40190.47	1277.71	69.05	1.49	531.52	4.84	78.40	2.11	0.00
	2	1109	16252.80	958.57	27.92	1.28	517.80	7.15	84.41	5.02	0.00
	3	120	1765.31	348.77	3.03	0.60	492.96	20.34	97.20	9.54	0.00

2.7 TIMSS Analyses with Teacher Background Data

Analyses with teacher background data seek to make statements about students whose teachers have a given characteristic, rather than statements about teachers with a given characteristic. As our example of an analysis using teacher background data, we will investigate the percentage of fourth grade students according to their mathematics teachers' major areas of study. The results of such an analysis are presented in Exhibit 8.3 of *TIMSS 2015 International Results in Mathematics* and are reproduced here in Exhibit 2.20.

We will use the **Percentages and Means** statistic type and select the **Use PVs** option to estimate the percentages of students with their average mathematics achievement by reporting categories of teachers' major areas of study.

As with the previous examples, we first proceed to identify the variables relevant to the analysis in the appropriate files, and review the documentation for any specific national adaptations to the questions of interest. Because we are using a teacher-level variable, we need to look in the teacher background data files for the variable that contains the information on the major areas of study of fourth grade mathematics teachers. The variable ATBG05, part A and part B, contains information on teachers' major areas of study. That information was collapsed into five reporting categories and stored in the derived variable ATDM05 (see Supplement 3 to this User Guide). The five categories of the ATDM05 variable are described in Exhibit 2.21.

The merged data file ATGALLM6_CMB will be used for this example teacher background data analysis, which will be performed by the analysis module of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ATGALLM6_CMB as the **Analysis File**.
3. Select **TIMSS (Using Math Teacher Weights)** as the **Analysis Type** since we want to analyze the responses of the mathematics teachers.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. Specify the variable ATDM05 as a second grouping variable by clicking the **Grouping Variables** field to activate it. Select ATDM05 from the list of available variables and move it to the **Grouping Variables** field by clicking the **right arrow (▶)** button in this section.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field to activate it. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
8. The **Weight Variable** is automatically selected by the software; MATWGT is selected by default because of the **Analysis Type** selected in step 3.
9. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.

**Exhibit 2.20 Exhibit of Example Teacher Background Data Analysis, Taken from
TIMSS 2015 International Results in Mathematics (Exhibit 8.3)**

Exhibit 8.3: Teachers Majored in Education and Mathematics
Reported by Teachers

Country	Major in Primary Education and Major (or Specialization) in Mathematics		Major in Primary Education but No Major (or Specialization) in Mathematics		Major in Mathematics but No Major in Primary Education		All Other Majors		No Formal Education Beyond Upper-Secondary*	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	13 (2.6)	536 (7.1)	80 (3.2)	514 (3.8)	1 (0.6)	~	6 (1.5)	531 (8.7)	0 (0.0)	~
Bahrain	30 (1.7)	451 (3.0)	4 (1.4)	516 (24.2)	59 (2.8)	449 (1.9)	7 (3.3)	439 (22.3)	0 (0.3)	~
Belgium (Flemish)	--	--	--	--	--	--	--	--	--	--
Bulgaria	r 27 (3.9)	540 (11.4)	70 (4.0)	516 (5.6)	1 (0.3)	~	2 (1.2)	~	0 (0.0)	~
Canada	6 (1.0)	495 (11.1)	79 (2.1)	513 (2.6)	3 (0.9)	518 (10.7)	12 (1.6)	501 (5.0)	0 (0.0)	~
Chile	r 46 (5.2)	463 (4.8)	51 (5.3)	466 (5.1)	2 (1.4)	~	1 (0.6)	~	1 (0.0)	~
Chinese Taipei	37 (3.8)	599 (2.8)	44 (3.6)	594 (3.0)	3 (1.4)	602 (14.6)	15 (2.7)	599 (5.0)	0 (0.0)	~
Croatia	--	--	--	--	--	--	--	--	--	--
Cyprus	22 (3.0)	527 (5.3)	75 (3.0)	521 (2.8)	1 (0.7)	~	2 (0.9)	~	0 (0.0)	~
Czech Republic	6 (1.4)	526 (8.3)	75 (2.7)	529 (2.8)	3 (1.4)	521 (13.7)	13 (2.0)	531 (3.3)	4 (1.2)	507 (12.6)
Denmark	r 38 (3.6)	534 (4.0)	12 (2.8)	527 (10.3)	30 (3.7)	536 (5.7)	13 (2.6)	548 (10.2)	7 (2.1)	551 (10.8)
England	12 (2.6)	548 (11.9)	57 (4.3)	543 (4.7)	4 (1.7)	582 (23.5)	27 (3.8)	552 (8.7)	0 (0.0)	~
Finland	10 (2.1)	538 (6.6)	82 (2.8)	536 (2.0)	0 (0.4)	~	7 (1.7)	521 (9.3)	1 (0.6)	~
France	s 10 (2.4)	484 (7.1)	28 (4.0)	492 (6.6)	20 (3.6)	485 (8.8)	38 (4.4)	481 (5.4)	4 (1.5)	489 (6.3)
Georgia	64 (4.2)	464 (5.5)	11 (3.0)	475 (7.3)	18 (3.5)	465 (9.8)	8 (2.2)	457 (12.5)	0 (0.0)	~
Germany	62 (3.4)	523 (2.6)	30 (3.0)	526 (3.8)	4 (1.2)	511 (12.5)	4 (1.4)	494 (10.7)	0 (0.0)	~
Hong Kong SAR	64 (4.3)	611 (3.3)	23 (3.8)	620 (8.0)	10 (2.9)	621 (14.4)	3 (1.4)	597 (14.4)	0 (0.0)	~
Hungary	r 5 (2.2)	563 (12.5)	94 (2.3)	528 (3.7)	1 (0.6)	~	0 (0.0)	~	0 (0.0)	~
Indonesia	24 (3.0)	389 (9.3)	42 (3.5)	402 (6.0)	9 (2.3)	413 (15.0)	17 (2.5)	405 (9.3)	8 (2.1)	373 (11.3)
Iran, Islamic Rep. of	15 (2.7)	432 (13.2)	43 (3.5)	434 (7.1)	6 (1.5)	447 (28.7)	27 (3.0)	436 (6.0)	9 (2.3)	413 (19.3)
Ireland	12 (2.6)	547 (4.8)	78 (3.6)	545 (2.7)	3 (2.0)	556 (5.9)	6 (2.1)	560 (5.2)	1 (0.6)	~
Italy	r 2 (0.7)	~	6 (2.0)	511 (9.5)	3 (1.4)	490 (23.8)	16 (3.2)	507 (7.6)	73 (3.7)	505 (3.1)
Japan	17 (2.8)	590 (3.1)	73 (3.1)	595 (2.5)	2 (1.2)	~	7 (2.0)	594 (7.3)	0 (0.0)	~
Jordan	10 (2.3)	378 (13.1)	1 (0.7)	~	77 (3.7)	390 (4.2)	6 (2.3)	398 (10.0)	5 (1.9)	333 (16.8)
Kazakhstan	54 (4.0)	548 (5.5)	33 (3.6)	552 (10.9)	3 (1.4)	541 (41.4)	2 (0.9)	~	8 (2.6)	531 (10.1)
Korea, Rep. of	12 (2.7)	609 (6.7)	86 (2.9)	608 (2.3)	0 (0.0)	~	~	~	~	~
Kuwait	41 (4.3)	348 (7.3)	2 (0.8)	~	48 (4.6)	350 (7.9)	7 (2.0)	374 (21.1)	3 (1.1)	346 (27.6)
Lithuania	18 (2.8)	526 (5.9)	79 (2.9)	539 (3.0)	1 (0.6)	~	2 (0.7)	~	0 (0.0)	~
Morocco	r 3 (1.2)	383 (16.1)	5 (1.4)	365 (21.0)	9 (2.0)	416 (14.4)	21 (3.4)	374 (10.1)	63 (3.8)	372 (4.8)
Netherlands	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
New Zealand	19 (2.1)	499 (6.8)	75 (2.5)	490 (3.0)	0 (0.3)	~	6 (1.3)	503 (12.6)	0 (0.0)	~
Northern Ireland	r 17 (4.0)	581 (11.2)	65 (4.7)	572 (4.2)	1 (1.0)	~	16 (3.7)	567 (5.6)	2 (0.9)	~
Norway (5)	47 (4.3)	552 (3.7)	44 (4.2)	548 (3.6)	4 (1.8)	553 (9.6)	5 (1.5)	552 (7.2)	0 (0.0)	~
Oman	64 (3.0)	432 (3.3)	10 (1.8)	414 (8.7)	23 (2.4)	413 (5.9)	2 (1.0)	~	1 (0.9)	~
Poland	7 (1.8)	544 (8.0)	0 (0.0)	~	93 (1.8)	534 (2.4)	0 (0.0)	~	0 (0.0)	~
Portugal	29 (2.9)	534 (5.4)	70 (2.9)	544 (2.8)	0 (0.0)	~	1 (0.7)	~	0 (0.0)	~
Qatar	28 (2.7)	433 (6.1)	11 (2.4)	508 (14.0)	45 (2.8)	421 (5.2)	13 (2.2)	440 (10.0)	2 (1.3)	~
Russian Federation	44 (4.6)	565 (4.8)	53 (5.0)	564 (5.7)	1 (0.7)	~	~	~	0 (0.0)	~
Saudi Arabia	34 (3.7)	380 (7.0)	4 (1.7)	373 (39.4)	45 (3.9)	384 (6.7)	5 (1.6)	411 (16.1)	12 (2.6)	373 (12.4)
Serbia	25 (3.8)	532 (5.5)	70 (3.6)	513 (4.8)	1 (0.9)	~	2 (1.3)	~	1 (0.6)	~
Singapore	59 (2.9)	621 (5.2)	14 (1.9)	629 (7.7)	14 (1.8)	611 (10.6)	11 (1.7)	598 (10.5)	1 (0.7)	~
Slovak Republic	23 (2.9)	502 (4.8)	70 (3.0)	499 (3.4)	3 (1.0)	453 (32.2)	4 (1.3)	481 (22.6)	0 (0.0)	~
Slovenia	5 (1.2)	520 (4.9)	94 (1.3)	521 (2.0)	0 (0.0)	~	0 (0.3)	~	0 (0.0)	~
South Africa (5)	47 (3.8)	382 (7.5)	30 (3.3)	370 (10.1)	11 (2.3)	374 (10.3)	9 (2.1)	376 (17.1)	4 (1.1)	343 (20.3)
Spain	22 (2.5)	508 (4.5)	62 (3.5)	504 (3.4)	4 (1.6)	499 (16.5)	10 (2.3)	505 (7.6)	1 (0.9)	~
Sweden	70 (4.1)	521 (3.6)	12 (2.8)	516 (9.0)	12 (3.2)	523 (8.1)	2 (0.9)	~	4 (1.7)	506 (12.7)
Turkey	r 17 (2.1)	495 (8.2)	68 (3.4)	484 (4.2)	2 (1.0)	~	13 (2.8)	482 (10.1)	0 (0.0)	~
United Arab Emirates	25 (1.8)	448 (7.1)	16 (1.5)	449 (9.2)	50 (2.1)	453 (3.8)	8 (1.2)	483 (9.7)	0 (0.3)	~
United States	13 (1.6)	537 (6.6)	73 (2.3)	540 (2.8)	2 (0.7)	~	12 (1.5)	541 (9.5)	0 (0.0)	~
International Avg.	27 (0.4)	505 (1.1)	46 (0.5)	512 (1.5)	14 (0.3)	487 (2.9)	8 (0.3)	495 (2.0)	5 (0.2)	434 (4.0)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Benchmarking Participants

Buenos Aires, Argentina	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Ontario, Canada	r 5 (1.5)	510 (9.0)	76 (3.0)	516 (2.8)	1 (0.5)	~	18 (2.7)	506 (6.2)	0 (0.0)	~
Quebec, Canada	6 (2.1)	519 (8.9)	86 (3.9)	537 (4.4)	5 (2.9)	531 (15.8)	3 (1.5)	530 (8.8)	0 (0.0)	~
Norway (4)	44 (4.4)	497 (3.6)	42 (4.5)	497 (3.0)	2 (1.2)	~	11 (2.6)	487 (11.4)	1 (0.8)	~
Abu Dhabi, UAE	r 29 (4.0)	407 (15.4)	29 (3.9)	391 (12.8)	33 (4.7)	449 (8.9)	9 (2.5)	472 (22.5)	1 (0.6)	~
Dubai, UAE	30 (2.7)	511 (4.0)	17 (1.3)	556 (4.3)	42 (3.0)	487 (3.7)	11 (2.0)	531 (10.0)	0 (0.0)	~
Florida, US	r 11 (3.5)	566 (12.9)	68 (3.8)	549 (5.6)	4 (2.5)	536 (25.1)	16 (3.6)	535 (18.6)	0 (0.0)	~

* Countries have been increasing their certification requirements and providing professional development to teachers certified under earlier guidelines.
() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (-) indicates comparable data not available. A tilde (~) indicates insufficient data to report achievement.
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.
An "x" indicates data are available for less than 50% of students.

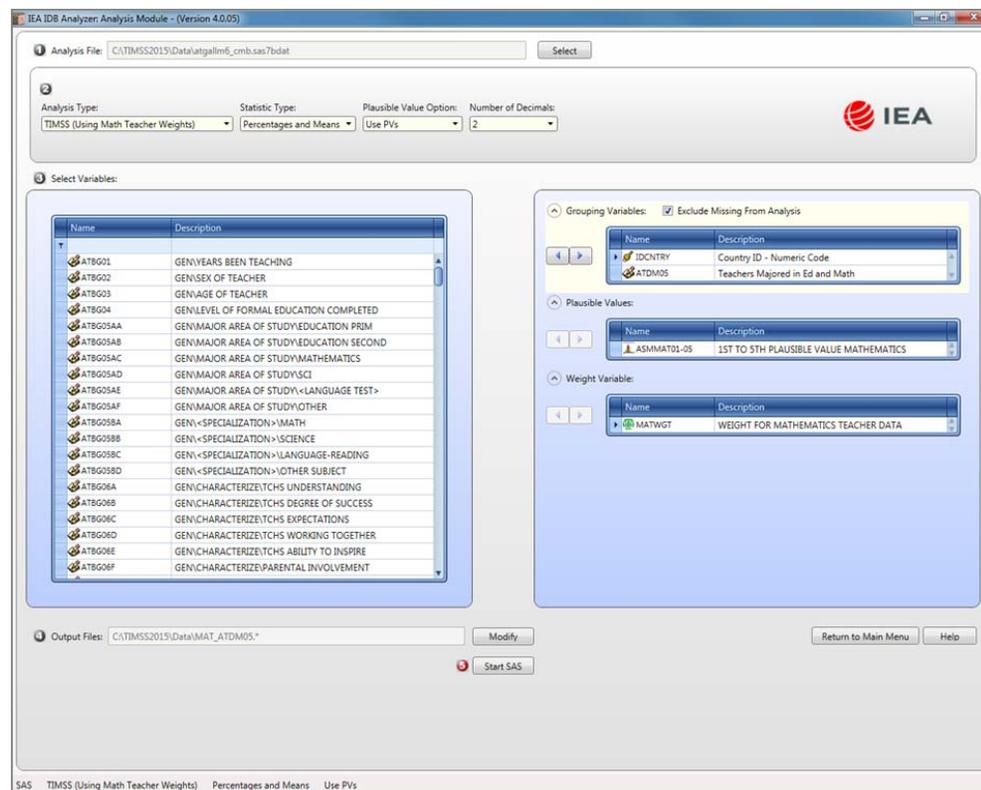
- Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.21 Categories of the ATDM05 Variable

Code	Description
1	Major in Primary Education and Major (or Specialization) in Mathematics
2	Major in Primary Education but No Major (or Specialization) in Mathematics
3	Major in Mathematics but No Major in Primary Education
4	All Other Majors
5	No Formal Education Beyond Upper-Secondary

Exhibit 2.22 shows the completed analysis module for this example analysis, and Exhibit 2.23 displays the results.

Exhibit 2.22 IEA IDB Analyzer Setup for Example Teacher Background Data Analysis



Each country’s results are displayed on up to five lines, one for each value of the ATDM05 variable. There will be fewer lines if any category does not have any observations. The results are presented in the same manner as in the previous examples, with countries identified in the first column and the second column describing the categories of the analysis variable ATDM05.

Exhibit 2.23 SAS Output for Example Teacher Background Data Analysis

Average of ASMMAT0 by (IDCNTRY ATDM05)

Country ID - Numeric Code	Teachers Majored in Ed and Math	n	WEIGHT FOR MATHEMATICS TEACHER DATA	sumw_se	pct	pct_se	mnpv	mnpv_se	sdpv	sdpv_se	pctmiss
Australia	1	785	34212.19	6358.77	13.38	2.57	535.54	7.12	78.47	3.40	0.00
	2	5280	205559.95	12224.31	80.41	3.17	514.11	3.85	84.03	1.96	0.00
	3	24	1509.97	1489.18	0.59	0.58	496.63	77.38	61.97	44.70	0.00
	4	467	14343.07	3926.82	5.61	1.54	530.62	8.73	81.12	5.21	0.00
Bahrain	1	2526	9099.00	519.64	29.53	1.67	451.44	2.97	88.64	1.96	0.00
	2	272	1197.00	426.44	3.89	1.39	515.93	24.25	96.39	11.35	0.00
	3	4967	18202.00	864.00	59.08	2.77	449.20	1.87	86.88	1.44	0.00
	4	283	2203.00	1005.75	7.15	3.26	439.44	22.32	82.64	7.37	0.00
	5	27	108.00	108.00	0.35	0.35	400.21	5.54	73.72	5.47	0.00
Bulgaria	1	855	13639.21	2232.92	27.02	3.87	540.06	11.37	78.79	4.41	0.00
	2	2539	35300.86	2197.47	69.93	3.96	515.86	5.64	83.41	3.58	0.00
	3	61	481.15	159.69	0.95	0.32	522.95	30.38	82.57	25.90	0.00
	4	76	1058.66	600.42	2.10	1.19	553.63	10.38	58.04	6.28	0.00

As shown in the five lines of results for Bahrain, 29.53% (standard error of 1.67) of fourth grade students were taught by teachers with majors in primary education and mathematics, 3.89% (standard error of 1.39) were taught by teachers with a major in primary education but not in mathematics, 59.08% (standard error of 2.77) by teachers with a major in mathematics but not in primary education, 7.15% (standard error of 3.26) by teachers with other majors, and 0.35% (standard error of 0.35) by teachers with no formal education beyond upper-secondary. Also, the estimated average mathematics achievement was 451.44 (standard error of 2.97) for fourth grade students taught by teachers with majors in primary education and mathematics, 515.93 (standard error of 24.25) for students taught by teachers with a major in primary education but not in mathematics, 449.20 (standard error of 1.87) for students taught by teachers with a major in mathematics but not in primary education, 439.44 (standard error of 22.32) for students taught by teachers with other majors, and 400.21 (standard error of 5.54) for students taught by teachers with no formal education beyond upper-secondary. The IEA IDB Analyzer also produces the standard deviations of achievement for all categories of ATDM05.

As a reminder, all results for Bahrain include the data from their TIMSS 2015 and TIMSS Numeracy 2015 assessments since we used the combined merged data file ATGALLM6_CMB.

2.8 TIMSS Analyses with School Background Data

When performing analyses with school background data, the data are analyzed to make statements about students attending schools with a given characteristic, rather than about schools with a given characteristic. Our example of an analysis using school background data will compute the percentages of fourth grade students and their average achievement who attend schools composed of students with different levels of economic background. The results of this analysis are presented in Exhibit 5.1 of *TIMSS 2015 International Results in Mathematics* and are replicated here in Exhibit 2.24.

**Exhibit 2.24 Exhibit of Example School Background Data Analysis, Taken from
TIMSS 2015 International Results in Mathematics (Exhibit 5.1)**

Exhibit 5.1: School Composition by Economic Background of the Student Body
Reported by Principals

Country	More Affluent - Schools where more than 25% of the student body comes from economically affluent homes and not more than 25% from economically disadvantaged homes		Neither More Affluent Nor More Disadvantaged		More Disadvantaged - Schools where more than 25% of the student body comes from economically disadvantaged homes and not more than 25% from economically affluent homes	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	35 (3.5)	551 (4.5)	34 (3.7)	519 (4.2)	31 (3.6)	479 (5.6)
Bahrain	r 31 (0.2)	457 (4.8)	45 (0.2)	451 (2.1)	24 (0.2)	442 (2.6)
Belgium (Flemish)	64 (3.5)	557 (2.7)	24 (3.4)	537 (4.2)	11 (2.2)	520 (11.6)
Bulgaria	17 (4.1)	555 (4.9)	48 (5.0)	528 (5.4)	35 (4.4)	507 (12.7)
Canada	42 (3.3)	528 (3.3)	33 (3.4)	507 (3.1)	25 (2.7)	484 (4.9)
Chile	r 14 (2.5)	512 (7.7)	18 (4.0)	475 (6.7)	68 (4.4)	446 (3.8)
Chinese Taipei	13 (2.6)	615 (4.0)	72 (3.5)	598 (2.1)	15 (2.4)	572 (5.1)
Croatia	35 (3.4)	508 (3.0)	46 (3.8)	505 (2.9)	18 (3.3)	485 (3.9)
Cyprus	39 (4.7)	536 (3.8)	45 (4.7)	522 (4.0)	15 (3.0)	498 (5.9)
Czech Republic	38 (4.3)	540 (3.8)	44 (4.4)	527 (2.9)	18 (3.3)	504 (7.1)
Denmark	s 63 (4.5)	549 (3.8)	30 (4.5)	533 (4.8)	7 (2.2)	523 (11.3)
England	31 (3.2)	569 (6.1)	32 (3.8)	550 (6.3)	37 (3.7)	522 (4.5)
Finland	34 (3.9)	537 (4.3)	59 (4.4)	537 (2.4)	7 (2.2)	524 (8.1)
France	r 34 (3.9)	511 (4.8)	34 (4.4)	492 (3.8)	32 (4.6)	459 (5.2)
Georgia	26 (3.5)	491 (9.4)	23 (4.0)	463 (7.7)	51 (4.4)	449 (5.6)
Germany	r 24 (2.8)	539 (3.3)	43 (3.8)	525 (3.2)	33 (3.3)	500 (5.0)
Hong Kong SAR	39 (3.6)	638 (4.9)	30 (3.8)	608 (4.7)	31 (4.0)	593 (6.3)
Hungary	27 (3.2)	564 (4.0)	33 (4.0)	544 (4.4)	40 (3.9)	494 (5.7)
Indonesia	r 16 (2.6)	433 (9.6)	32 (3.3)	405 (7.0)	52 (3.2)	387 (5.1)
Iran, Islamic Rep. of	14 (2.9)	465 (12.0)	44 (3.5)	445 (6.9)	42 (3.6)	405 (6.1)
Ireland	36 (4.2)	566 (3.7)	43 (4.7)	544 (3.0)	21 (2.9)	523 (5.0)
Italy	36 (4.2)	519 (4.0)	50 (4.7)	508 (4.1)	14 (2.9)	489 (6.9)
Japan	55 (4.4)	600 (2.7)	37 (4.2)	588 (2.5)	8 (2.3)	576 (4.8)
Jordan	r 14 (3.0)	434 (11.3)	25 (3.7)	389 (6.8)	61 (3.4)	377 (5.5)
Kazakhstan	69 (3.6)	553 (6.1)	25 (3.6)	535 (9.2)	6 (1.9)	513 (22.0)
Korea, Rep. of	29 (3.7)	630 (4.0)	51 (3.9)	605 (2.7)	21 (3.1)	584 (3.9)
Kuwait	r 23 (5.2)	389 (13.0)	40 (5.5)	348 (7.8)	37 (5.9)	342 (9.0)
Lithuania	55 (3.3)	546 (2.9)	29 (3.5)	527 (6.6)	16 (2.7)	513 (7.6)
Morocco	r 13 (1.9)	442 (8.9)	8 (1.9)	366 (10.6)	79 (2.8)	365 (4.5)
Netherlands	s 72 (4.5)	538 (2.4)	23 (4.5)	531 (3.4)	6 (2.8)	516 (4.5)
New Zealand	47 (3.2)	521 (3.7)	26 (3.5)	491 (4.6)	27 (2.7)	442 (6.8)
Northern Ireland	r 46 (5.1)	590 (4.4)	18 (4.2)	568 (9.4)	37 (3.8)	553 (6.6)
Norway (5)	59 (4.3)	554 (3.2)	34 (4.3)	546 (4.5)	7 (2.6)	513 (10.3)
Oman	35 (2.9)	426 (5.8)	42 (3.0)	430 (4.4)	23 (2.6)	419 (7.0)
Poland	17 (3.3)	548 (6.5)	57 (4.3)	538 (2.9)	25 (3.8)	514 (4.7)
Portugal	19 (2.9)	566 (5.9)	35 (4.3)	539 (4.3)	46 (3.9)	536 (3.7)
Qatar	r 72 (2.8)	447 (5.0)	16 (2.7)	411 (9.6)	12 (2.0)	436 (9.1)
Russian Federation	72 (3.6)	565 (3.1)	24 (3.8)	568 (10.9)	4 (1.2)	546 (16.1)
Saudi Arabia	r 46 (4.7)	400 (6.7)	36 (4.1)	365 (6.4)	19 (3.7)	369 (13.3)
Serbia	20 (3.3)	539 (5.6)	36 (4.5)	516 (5.3)	44 (4.6)	509 (6.9)
Singapore	44 (0.0)	633 (5.0)	46 (0.0)	614 (6.5)	10 (0.0)	576 (13.4)
Slovak Republic	31 (3.0)	515 (3.1)	48 (3.2)	508 (3.0)	21 (2.4)	448 (5.1)
Slovenia	35 (4.2)	523 (3.6)	41 (4.5)	521 (2.7)	23 (3.4)	516 (3.1)
South Africa (5)	9 (1.8)	531 (10.5)	15 (2.4)	370 (10.8)	77 (2.8)	366 (4.7)
Spain	46 (3.8)	518 (2.9)	34 (3.5)	506 (3.8)	20 (3.2)	477 (6.4)
Sweden	71 (4.3)	530 (3.1)	19 (3.6)	503 (5.6)	11 (3.0)	483 (14.3)
Turkey	22 (3.0)	519 (8.4)	27 (2.9)	499 (7.5)	51 (3.2)	459 (4.1)
United Arab Emirates	r 50 (1.9)	466 (4.3)	23 (1.9)	465 (7.0)	27 (1.8)	399 (4.4)
United States	19 (2.1)	585 (5.6)	23 (2.6)	555 (4.5)	59 (2.3)	519 (3.4)
International Avg.	37 (0.5)	527 (0.8)	35 (0.5)	505 (0.8)	29 (0.5)	483 (1.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Benchmarking Participants

Buenos Aires, Argentina	s 50 (6.2)	456 (5.2)	15 (3.7)	417 (9.2)	35 (6.2)	402 (8.9)
Ontario, Canada	37 (5.5)	520 (3.9)	32 (5.1)	517 (4.0)	31 (4.1)	497 (4.3)
Quebec, Canada	63 (5.7)	549 (4.3)	23 (5.4)	523 (5.1)	15 (4.6)	509 (9.2)
Norway (4)	59 (4.5)	501 (2.8)	36 (4.8)	486 (3.6)	5 (2.2)	457 (20.7)
Abu Dhabi, UAE	r 47 (5.0)	427 (11.9)	19 (4.1)	424 (22.8)	35 (3.9)	381 (8.4)
Dubai, UAE	r 61 (0.3)	524 (1.6)	26 (0.3)	521 (3.5)	13 (0.1)	419 (3.5)
Florida, US	r 13 (4.3)	582 (10.0)	19 (6.2)	575 (11.1)	67 (5.8)	532 (6.3)

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

We will use the **Percentages and Means** statistic type and select the **Use PVs** option to estimate the percentages of students with their average mathematics achievement by reporting categories of students' economic background as reported by school principals.

The information for this analysis is found in the school-level derived variable ACDG03 (see Supplement 3 to this User Guide), where schools are characterized as being composed of more affluent students than disadvantaged students, more disadvantaged students than affluent students, or neither more affluent nor more disadvantaged students.

The merged data file ACGALLM6_CMB will be used for this example analysis and it is performed by the analysis module of the IEA IDB Analyzer using the following steps:

1. Open the **Analysis Module** of the IEA IDB Analyzer.
2. Select the merged data file ACGALLM6_CMB as the **Analysis File**.
3. Select **TIMSS (Using Student Weights)** as the **Analysis Type** because we want to analyze school background data as student attributes.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. Specify the variable ACDG03 as a second grouping variable by clicking the **Grouping Variables** field to activate it. Select ACDG03 from the list of available variables and move it to the **Grouping Variables** field by clicking the **right arrow (▶)** button in this section.
7. Specify the achievement scores to be used for the analysis by clicking the **Plausible Values** field to activate it. Select ASMMAT01-05 from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow (▶)** button in this section.
8. The **Weight Variable** is automatically selected by the software; TOTWGT is selected by default because this example analysis uses school background data linked to student background data.
9. Specify the name and the folder of the output files in the **Output Files** field by clicking the **Define/Modify** button.
10. Click the **Start SAS** button to create the SAS syntax file and open it in a SAS editor window. The syntax file can be executed by opening the **Run** menu of SAS and selecting the **Submit** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.25 shows the completed analysis module for this example analysis and the results are presented in Exhibit 2.26.

In this example, each country's results are presented on three lines, one for each value of the ACDG03 variable. The results are presented in the same manner as in previous examples, with countries identified in the first column and the second column describing the categories of ACDG03.

As shown in the three lines of results for Belgium (Flemish), 64.43% (standard error of 3.52) of fourth grade students attended schools with more affluent than disadvantaged students, 24.19% (standard error of 3.39) attended schools with neither more affluent nor more disadvantaged students, and 11.39% (standard error of 2.24) attended schools with more disadvantaged than affluent students. Also, the estimated average mathematics achievement was 556.57 (standard error of 2.72)



for fourth grade students in schools with more affluent students, 536.98 (standard error of 4.20) for students in schools with neither more affluent nor more disadvantaged students, and 519.74 (standard error of 11.62) for students in schools with more disadvantaged students. The IEA IDB Analyzer also produces the standard deviations of achievement for all categories of ACDG03.

Exhibit 2.25 IEA IDB Analyzer Set-Up for Example School Background Data Analysis

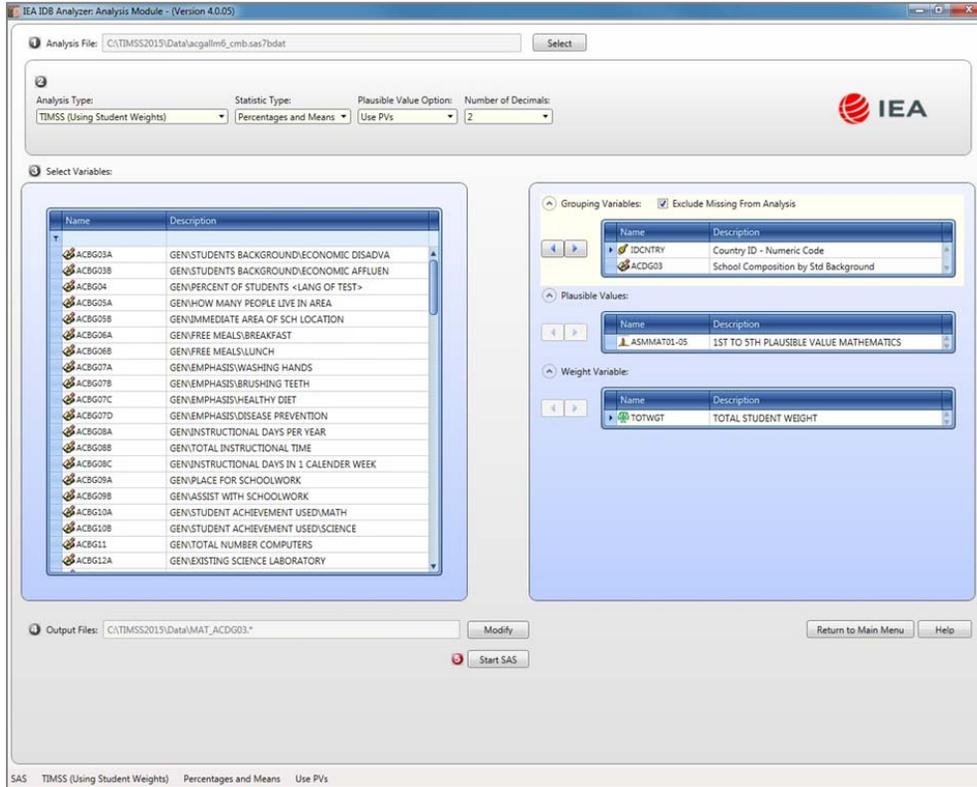


Exhibit 2.26 SAS Output for Example School Background Data Analysis

Average of ASMMAT0 by (IDCNTRY ACDG03)

Country ID - Numeric Code	School Composition by Std Background	n	TOTAL STUDENT WEIGHT	sumw_se	pct	pct_se	mnpv	mnpv_se	sdpv	sdpv_se	pctmiss
Australia	1	2073	88219.45	9174.06	34.53	3.48	551.13	4.46	76.88	1.91	0.00
	2	1953	87605.17	8675.69	34.29	3.68	518.95	4.22	77.42	2.31	0.00
	3	1657	79691.29	10746.11	31.19	3.57	478.62	5.59	81.81	2.50	0.00
Bahrain	1	1886	8407.00	62.69	30.72	0.18	457.19	4.79	86.15	3.33	0.00
	2	3640	12416.00	82.30	45.37	0.18	450.70	2.08	89.51	1.13	0.00
	3	1737	6546.00	59.98	23.92	0.19	441.92	2.65	84.09	2.16	0.00
Belgium (Flemish)	1	3045	39240.37	2599.24	64.43	3.52	556.57	2.72	58.47	1.36	0.00
	2	1225	14732.90	2074.99	24.19	3.39	536.98	4.20	57.62	2.13	0.00
	3	483	6935.32	1454.57	11.39	2.24	519.74	11.62	70.54	5.20	0.00
Bulgaria	1	698	9047.35	2130.80	16.90	4.07	555.36	4.93	66.86	2.20	0.00
	2	1816	25584.85	2875.23	47.80	5.03	527.75	5.35	75.31	3.10	0.00
	3	1288	18897.95	2623.51	35.30	4.38	506.74	12.74	94.47	5.17	0.00

References

IBM Corporation. (2013). *IBM SPSS Statistics* (version 22.0). Somers, NY: IBM Corporation.

International Association for the Evaluation of Educational Achievement. (2017). *IDB Analyzer* (version 4.0). Hamburg, Germany: IEA Hamburg. Available online at <http://www.iea.nl/data.html>.

Martin, M. O., Mullis, I. V. S., & Hooper, M. (Eds.). (2016). *Methods and Procedures in TIMSS 2015*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timss.bc.edu/publications/timss/2015-methods.html>.

Martin, M. O., Mullis, I. V. S., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Science*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/timss2015/international-results/>.

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Mathematics*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/timss2015/international-results/>.

SAS Institute. (2012). *SAS System for Windows* (version 9.4). Cary, NC: SAS Institute.

Chapter 3

Special SPSS and SAS Programs

3.1 Overview

This chapter presents special SPSS (IBM Corporation, 2013) and SAS (SAS Institute, 2012) programs essential to make full use of the TIMSS 2015 International Database. A first set of SAS programs converts the SAS export files into SAS data files, needed as input to the IEA IDB Analyzer (IEA, 2017). There is a second set of SPSS and SAS programs to recode the responses to the individual TIMSS 2015 and TIMSS Numeracy 2015 items from the achievement data files to their appropriate score levels. There is a third set of SPSS and SAS programs to combine TIMSS 2015 fourth grade data files and TIMSS Numeracy 2015 data files in order to properly estimate fourth grade mathematics results for countries that participated in both assessments.

Users who intend to run the IEA IDB Analyzer with SAS should execute the SAS programs described in this chapter, in particular the conversion programs. Users who intend to run the IEA IDB Analyzer with SPSS should execute the SPSS programs.

3.2 Converting the SAS Export Files

The TIMSS 2015 International Database provides two SAS programs—T15_CONVERT.SAS and TN15_CONVERT.SAS—to convert the SAS export files provided in the International Database into SAS data files. This conversion is necessary because the IEA IDB Analyzer (version 4.0) requires the use of SAS data files; it will not function with the SAS export files. The T15_CONVERT.SAS program will convert the TIMSS 2015 SAS export files and will work for both grades. The TN15_CONVERT.SAS program will convert the TIMSS Numeracy 2015 SAS export files. To convert SAS export files into SAS data files, users should perform the following steps:

1. Open T15_CONVERT.SAS or TN15_CONVERT.SAS with the SAS software.
2. At the end of the program, specify the data file types of interest, each separated by a blank space, in the parameter “TYPE.” By default, the T15_CONVERT program lists all fourth grade and eighth grade data file types; the TN15_CONVERT program lists all fourth grade data file types.
3. Specify the folder where the SAS export files are located in the parameter “INDIR.”
4. Specify the folder where the converted SAS data files will be located in the parameter “OUTDIR.”
5. List all the countries of interest in the parameter “COUNTRY.” By default, all TIMSS 2015 countries are listed and the program will automatically select the appropriate list by grade based on the file type specified.

6. Submit the edited code for processing by SAS.

The T15_CONVERT.SAS program is presented in Exhibit 3.1. The TN15_CONVERT.SAS program has a similar structure. This example converts the SAS export files of all fourth grade and eighth grade data file types for all countries. For this example, all SAS export files are located in the folder “C:\TIMSS2015\Data\SAS_Data,” where the converted SAS data files also will be located.

Exhibit 3.1 The T15_CONVERT SAS Program

```
%MACRO DOIT (TYPE = ,
             INDIR = ,
             OUTDIR = ) ;

. . .

%LET COUNTRY = <List of TIMSS 2015 countries> ;

. . .

PROC CIMPORT FILE="%INDIR.\&FTYPE&CTRY.M6.EXP"
             DATA=OUTDIR.&FTYPE&CTRY.M6 ;
RUN ;

. . .

%MEND DOIT ;

%DOIT (TYPE = ACG ASA ASG ASH ASR AST ATG
      BCG BSA BSG BSR BST BTM BTS ,
      INDIR = C:\TIMSS2015\Data\SAS_Data ,
      OUTDIR = C:\TIMSS2015\Data\SAS_Data ) ;
```

Users are advised to run the T15_CONVERT and TN15_CONVERT programs for all countries and all file types. The file types at the fourth grade (and TIMSS Numeracy) are ACG, ASA, ASG, ASH, ASR, AST, and ATG. At the eighth grade, the file types are BCG, BSA, BSG, BSR, BST, BTM, and BTS. These file types are described in Chapter 4 of this User Guide. In principle, this program needs to be run only once for all file types and countries and should be one of the first things users do with the TIMSS 2015 International Database before undertaking any data analyses with SAS and the IEA IDB Analyzer, in particular the data analysis examples in this User Guide.

3.3 Scoring the TIMSS 2015 Items

Student achievement in TIMSS 2015 is represented by sets of five plausible values for mathematics and science and their content and cognitive domains. They are the preferred scores for any analysis of student achievement. However, analyzing performance on individual items may be of interest to some users. Carrying out such analyses may require that the individual items in the TIMSS 2015 International Database be assigned their correctness score levels, rather than the actual response options selected by students for multiple choice items, or the two-digit codes given to students' responses on constructed response items. The International Database provides SPSS and SAS programs to perform this task.

For multiple choice items, the numbers 1 through 4 are used to represent response options A through D, respectively, in the TIMSS 2015 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 either a total of

one or two points, two-digit codes are used in the achievement data files to represent the students' written responses. These codes also must be recoded to represent the correct point values of the responses—either zero, one, or two points.

For both types of items, special codes are set aside to represent missing data as either “Not Administered,” “Omitted,” or “Not Reached.” These special missing codes also may be recoded in order to carry out specific item-level analyses. By default, the “Not Administered” response code is left as missing and the “Omitted” and “Not Reached” response codes are recoded as incorrect. These default settings can be modified within the programs, depending on the requirements of the item-level analyses. For example, “Not Reached” responses were treated as missing for the purpose of calibrating the TIMSS 2015 and TIMSS Numeracy 2015 items, whereas they were treated as incorrect when deriving achievement scores for students.

The TIMSS 2015 International Database includes three SPSS programs—ASASCRM6.SPS for the fourth grade items, BSASCRM6.SPS for the eighth grade items, and ASASCRN1.SPS for the TIMSS Numeracy items—and three SAS programs—ASASCRM6.SAS, BSASCRM6.SAS, and ASASCRN1.SAS—which will recode the responses to individual items from the achievement data files (ASA/BSA) to their appropriate score levels.

Before executing a scoring program, users first must create a merged data file of all required student achievement data files (ASA/BSA) using the merge module of the IEA IDB analyzer, as described in Chapter 2 of this User Guide. The scoring programs will then create a merged data file with scored achievement items that can be used by the analysis module of the IEA IDB Analyzer. Exhibit 3.2 shows a condensed version of the SAS program to score the individual TIMSS 2015 items. The TIMSS Numeracy 2015 program ASASCRN1.SAS has a similar structure.

Exhibit 3.2 The ASASCRM6/BSASCRM6 SAS Program

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

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

%LET ARIGHT = <List of multiple choice items where A is correct> ;
DO OVER ARIGHT ; %SCOREIT (ARIGHT, "MC", 1, .R, .A, ., .I) ; END ;
%LET BRIGHT = <List of multiple choice items where B is correct> ;
DO OVER BRIGHT ; %SCOREIT (BRIGHT, "MC", 2, .R, .A, ., .I) ; END ;
%LET CRIGHT = <List of multiple choice items where C is correct> ;
DO OVER CRIGHT ; %SCOREIT (CRIGHT, "MC", 3, .R, .A, ., .I) ; END ;
%LET DRIGHT = <List of multiple choice items where D is correct> ;
DO OVER DRIGHT ; %SCOREIT (DRIGHT, "MC", 4, .R, .A, ., .I) ; END ;
%LET CONSTR = <List of constructed response items> ;
DO OVER CONSTR ; %SCOREIT (CONSTR, "CR", , .R, .A, ., .I) ; END ;
. . .

%MEND DOIT ;

%DOIT (INDIR = C:\TIMSS2015\Data ,
      OUTDIR = C:\TIMSS2015\Data ,
      INFILE = ASAALLM6 ) ;
```

To score each individual TIMSS 2015 item, the program code in the SAS program must be adapted by completing the following steps:

1. Open ASASCRM6.SAS, BSASCRM6.SAS, or ASASCRN1.SAS with the SAS software.
2. At the end of the program, specify the folder where the merged SAS data file of student achievement data files is located in the parameter “INDIR.”
3. Specify the folder where the merged SAS data file of scored achievement items will be located in the parameter “OUTDIR.”
4. Specify the name of the merged SAS data file of student achievement data files in the parameter “INFILE.”
5. Submit the edited code for processing by SAS.

In this example, the merged SAS data file of student achievement data files is called ASAALLM6, located in the folder C:\TIMSS2015\Data, and contains the fourth grade achievement items. The resulting merged data file of scored achievement items will be called ASAALLM6_SCR and located in the same folder. The merged data file of scored achievement items will have the same data structure as the student achievement data files (ASA/BSA), but with the score levels 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 merged data file.

If not reached responses are to be treated as missing rather than incorrect, users should replace the following SAS statement (which appears twice in the program):

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

with this statement:

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

Users should be careful to use the score program appropriate for the student achievement data files under consideration; the ASASCRM6 program for the fourth grade achievement items, the BSASCRM6 program for the eighth grade achievement items, and the ASASCRN1 program for the TIMSS Numeracy 2015 achievement items.

Executing the equivalent SPSS program requires the same steps as the SAS program. Exhibit 3.3 shows a condensed version of the SPSS program to score the individual TIMSS 2015 items.

Exhibit 3.3 The ASASCRM6/BSASCRM6 SPSS Program

```

DEFINE SCOREIT <List of macro parameters> .
. . .
!ENDDFINIE .
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 = CR / ITEM = <List of constructed response items> /
RIGHT = 0 / NR = 6 / NA = SYSMIS / OM = 99 / OTHER = 90 .
. . .
!ENDDFINIE .
DOIT INDIR = C:\TIMSS2015\Data /
      OUTDIR = C:\TIMSS2015\Data /
      INFILE = ASAALLM6 .

```

If not reached responses are to be treated as missing rather than incorrect, users should replace the following SPSS statement (which appears twice in the program):

```
(!NR = 0) /* Not Reached */
```

with this statement:

```
(!NR = SYSMIS) /* Not Reached */
```

3.4 Combining TIMSS and TIMSS Numeracy Data

In *TIMSS 2015 International Results in Mathematics* (Mullis, Martin, Foy, & Hooper, 2016), all fourth grade exhibits report results from countries that participated in the TIMSS 2015 assessment and the TIMSS Numeracy 2015 assessment. Thus, Jordan and South Africa—that participated in TIMSS Numeracy 2015—appear in all TIMSS 2015 fourth grade mathematics exhibits. As well, fourth grade mathematics results for Bahrain, Indonesia, Iran, Kuwait, Morocco, and Buenos Aires—that participated in both assessments—include data from both assessments.

In order to replicate the published results, merged data files produced by the IEA IDB Analyzer must combine data from both assessments. The TIMSS 2015 International Database includes a short program, in both SPSS and SAS, to perform this function. Exhibit 3.4 shows the SAS version of this program.

Exhibit 3.4 The T15_TN15_COMBINE SAS Program

```
%MACRO CMB_T15_TN15 (T15FILE = ,
                    TN15FILE = ,
                    INDIR = ,
                    OUTDIR = ) ;

LIBNAME INDIR "&INDIR" ;
LIBNAME OUTDIR "&OUTDIR" ;

DATA OUTDIR.&T15FILE._CMB ;
  SET INDIR.&T15FILE
      INDIR.&TN15FILE ;
RUN ;

%MEND CMB_T15_TN15 ;

%CMB_T15_TN15 (T15FILE = ASGALLM6 ,
              TN15FILE = ASGALLN1 ,
              INDIR = C:\TIMSS2015\Data ,
              OUTDIR = C:\TIMSS2015\Data ) ;
```

Before this program can be executed, users must first create merged data files for both TIMSS 2015 fourth grade and TIMSS Numeracy 2015. To combine merged data files from both assessments, the program code in the SAS program must be adapted by completing the following steps:

1. Open T15_TN15_COMBINE.SAS with the SAS software.
2. At the end of the program, specify the name of the TIMSS 2015 fourth grade merged data file in the parameter “T15FILE.”
3. Specify the name of the TIMSS Numeracy 2015 merged data file in the parameter “TN15FILE.”
4. Specify the folder where the merged data files are located in the parameter “INDIR.” Both merged data files must be in the same folder. In this example, they are located in the folder C:\TIMSS2015\Data.
5. Specify the folder where the combined merged data file will be located in the parameter “OUTDIR.” In this example, it will be located in the same folder as the input merged data files.
6. Submit the edited code for processing by SAS.

The same set of instructions can be used to edit the SPSS program and execute it. Exhibit 3.5 shows the SPSS version of this program.

Exhibit 3.5 The T15_TN15_COMBINE SPSS Program

```
DEFINE CMB_T15_TN15 (T15FILE = !CHAREND('/') !DEFAULT("") /
                    TN15FILE = !CHAREND('/') !DEFAULT("") /
                    INDIR = !CHAREND('/') !DEFAULT("") /
                    OUTDIR = !CHAREND('/') !DEFAULT("") ) .

ADD FILES
/ FILE = !QUOTE(!CONCAT(!UNQUOTE(!INDIR), "\", !T15FILE, ".SAV"))
/ FILE = !QUOTE(!CONCAT(!UNQUOTE(!INDIR), "\", !TN15FILE, ".SAV")) .

SAVE OUTFILE = !QUOTE(!CONCAT(!UNQUOTE(!OUTDIR), "\", !T15FILE, "_CMB.SAV")) .

!ENDDDEFINE .

CMB_T15_TN15 T15FILE = ASGALLM6 /
            TN15FILE = ASGALLN1 /
            INDIR = C:\TIMSS2015\Data /
            OUTDIR = C:\TIMSS2015\Data .
```

References

IBM Corporation. (2013). *IBM SPSS Statistics* (version 22.0). Somers, NY: IBM Corporation.

International Association for the Evaluation of Educational Achievement. (2017). *IDB Analyzer* (version 4.0). Hamburg, Germany: IEA Hamburg. Available online at <http://www.iea.nl/data.html>.

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Mathematics*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/timss2015/international-results/>.

SAS Institute. (2012). *SAS System for Windows* (version 9.4). Cary, NC: SAS Institute.

Chapter 4

The TIMSS 2015 International Database Files

4.1 Overview

The TIMSS 2015 International Database contains student achievement data and student, home, teacher, and school background data collected in the 56 countries and 6 benchmarking participants that took part in TIMSS 2015, including the TIMSS Numeracy assessment.¹ Exhibit 4.1 lists all of the TIMSS 2015 countries and benchmarking participants included in the International Database, along with the identification codes used in the International Database. The database also contains materials that provide additional information on its structure and contents.

This chapter describes the contents of the International Database with a special emphasis on the actual data files used in Chapter 2 of this User Guide to analyze the TIMSS 2015 assessment results. The next section introduces the Supplements to this User Guide. The following section describes the item-related materials included in the international database. The next five sections present the different data files and related materials included in the database, as described in Exhibit 1.1 of Chapter 1.

Exhibit 4.1 Countries Included in the TIMSS 2015 International Database

Countries	Identification Codes		TIMSS		TIMSS Numeracy
	Alpha	Numeric	Fourth Grade	Eighth Grade	
Australia	AUS	036	●	●	
Bahrain	BHR	048	●	●	●
Belgium (Flemish)	BFL	956	●		
Botswana	BWA	072		●	
Bulgaria	BGR	100	●		
Canada	CAN	124	●	●	
Chile	CHL	152	●	●	
Chinese Taipei	TWN	158	●	●	
Croatia	HRV	191	●		
Cyprus	CYP	196	●		
Czech Republic	CZE	203	●		
Denmark	DNK	208	●		
Egypt	EGY	818		●	
England	ENG	926	●	●	

¹ Many aspects of the TIMSS Numeracy 2015 assessment are identical to the TIMSS 2015 fourth grade assessment in terms of database structure and contents. All references to TIMSS 2015 in general or to the TIMSS 2015 fourth grade assessment in particular also will apply to the TIMSS Numeracy 2015 assessment, unless explicitly stated otherwise.

Exhibit 4.1 Countries Included in the TIMSS 2015 International Database (Continued)

Countries	Identification Codes		TIMSS		TIMSS Numeracy
	Alpha	Numeric	Fourth Grade	Eighth Grade	
Finland	FIN	246	●		
France	FRA	250	●		
Georgia	GEO	268	●	●	
Germany	DEU	276	●		
Hong Kong SAR	HKG	344	●	●	
Hungary	HUN	348	●	●	
Indonesia	IDN	360	●		●
Iran, Islamic Rep. of	IRN	364	●	●	●
Ireland	IRL	372	●	●	
Israel	ISR	376		●	
Italy	ITA	380	●	●	
Japan	JPN	392	●	●	
Jordan	JOR	400		●	●
Kazakhstan	KAZ	398	●	●	
Korea, Rep. of	KOR	410	●	●	
Kuwait	KWT	414	●	●	●
Lebanon	LBN	422		●	
Lithuania	LTU	440	●	●	
Malaysia	MYS	458		●	
Malta	MLT	470		●	
Morocco	MAR	504	●	●	●
Netherlands	NLD	528	●		
New Zealand	NZL	554	●	●	
Northern Ireland	NIR	928	●		
Norway	NOR	578	●	●	
Oman	OMN	512	●	●	
Poland	POL	616	●		
Portugal	PRT	620	●		
Qatar	QAT	634	●	●	
Russian Federation	RUS	643	●	●	
Saudi Arabia	SAU	682	●	●	
Serbia	SRB	688	●		
Singapore	SGP	702	●	●	
Slovak Republic	SVK	703	●		
Slovenia	SVN	705	●	●	
South Africa	ZAF	710		●	●
Spain	ESP	724	●		
Sweden	SWE	752	●	●	
Thailand	THA	764		●	
Turkey	TUR	792	●	●	
United Arab Emirates	ARE	784	●	●	
United States	USA	840	●	●	

Exhibit 4.1 Countries Included in the TIMSS 2015 International Database (Continued)

Countries	Identification Codes		TIMSS		TIMSS Numeracy
	Alpha	Numeric	Fourth Grade	Eighth Grade	
Benchmarking Participants					
Buenos Aires, Argentina	ABA	32001	●	●	●
Ontario, Canada	COT	9132	●	●	
Quebec, Canada	CQU	9133	●	●	
Norway (4 th grade)	N04	5784	●		
Norway (8 th grade)	N08	5788		●	
Abu Dhabi, UAE	AAD	7842	●	●	
Dubai, UAE	ADU	7841	●	●	

4.2 The Supplements to the TIMSS 2015 User Guide

The TIMSS 2015 User Guide is an important resource to the TIMSS 2015 International Database. It provides a description of the structure and contents of the International Database, as well as instructions to make the best use of its data. The User Guide includes a series of supplements in printable PDF format:

- Supplement 1: International Version of the TIMSS 2015 Context Questionnaires—Supplement 1 includes the international version of all context questionnaires administered in TIMSS 2015, including the Curriculum Questionnaires. It is a good reference guide to know what questions were asked and the variable names under which the responses are recorded in the International Database.
- Supplement 2: National Adaptations of International Context Questionnaires—Supplement 2 provides details on all national adaptations that were applied to the national version of all TIMSS 2015 context questionnaires. Users should refer to this supplement for any special national adaptations to background variables that could potentially affect the interpretation of analysis results.
- Supplement 3: Variables Derived from the Student, Home, Teacher, and School Questionnaire Data—Supplement 3 describes how the derived background variables were computed to produce exhibits in *TIMSS 2015 International Results in Mathematics and Science* (Mullis, Martin, Foy, & Hooper, 2016; and Martin, Mullis, Foy, & Hooper, 2016).

4.3 The Restricted Use Version of the TIMSS 2015 International Database

There are two versions of the TIMSS 2015 International Database. The public use version is available for immediate access from the TIMSS 2015 International Database webpage (<http://timssandpirls.bc.edu/timss2015/international-database/>) and the IEA Study Data Repository (<http://www.iea.nl/data.html>). A number of variables have been removed from the public use version in order to minimize the risk of disclosing confidential information. Exhibit 4.2 lists the variables removed from the public use version of the TIMSS 2015 International Database. More details for all of these variables are available in the appropriate codebook files, described later in this chapter.

Users who require any of the removed variables to conduct their analyses should contact the IEA through its Study Data Repository (<http://www.iea.nl/data.html>) to obtain permission and access to the restricted use version of the TIMSS 2015 International Database. It is important to note that the students' age remains available in the public use version of the International Database.

Exhibit 4.2 TIMSS 2015 Variables Removed from Public Use Version of International Database

Variables	Description
ITBIRTHY / ITBIRTHM	Students' year and month of birth from the tracking forms
ASBG02A / ASBG02B BSBG02A / BSBG02B	Students' year and month of birth from student questionnaire
ITDATE	TIMSS 2015 testing date
ACBG01 / BCBG01	Total school enrollment
ACBG02 / BCBG02	School enrollment in the target grade
INOSS	Data collected through Online Survey System

4.4 TIMSS 2015 Achievement Items Documentation

A number of documents related to the TIMSS 2015 and TIMSS Numeracy 2015 achievement items are available for download along with the TIMSS 2015 International Database. They include summary information on the TIMSS 2015 items, the IRT item parameters estimated from the TIMSS 2015 item calibrations and their associated linear transformation constants, and percent correct statistics for the TIMSS 2015 and TIMSS Numeracy 2015 items.

Achievement item information files are provided to enable users of the TIMSS 2015 International Database to readily produce summaries of item characteristics. There are separate achievement item information files for the fourth and eighth grades, with separate tables by subject, as well as for TIMSS Numeracy. These files are available in Excel format and include the following information for each item in the TIMSS 2015 assessments:

- The item's unique identifier;
- The item's block and its sequential location within the block;
- The item's label;
- The item's content domain and cognitive domain;
- The item's type, either multiple choice or constructed response;
- The number of options for a multiple choice item;
- The correct response key for a multiple choice item;
- The item's point value;
- An indicator showing if the item was included in the IRT scaling; and
- An indicator showing if the item was secured after the 2015 assessment.

The information in the columns labeled “Topic Area,” “Topic,” and “Performance Objective” is described in *TIMSS 2015 Assessment Frameworks* (Mullis & Martin, 2013).

The International Database includes Excel and PDF files with the IRT item parameters estimated for all TIMSS 2011 and TIMSS 2015 items from the concurrent item calibrations. There are files for each grade and subject, as well as for the TIMSS Numeracy 2015 items. These same item parameters are presented in Chapter 13 of *Methods and Procedures in TIMSS 2015* (Martin, Mullis, & Hooper, 2016). The TIMSS 2015 International Database also includes files with the fourth grade and eighth grade linear transformation constants that were used to set the TIMSS 2015 achievement scores on the TIMSS trend scales. Users should note that the TIMSS 2015 fourth grade mathematics transformation constants also were used for the TIMSS Numeracy 2015 achievement scores.

The International Database also includes percent correct statistics for all TIMSS 2015 and TIMSS Numeracy 2015 items in Excel and PDF format. There are separate documents by grade and subject and also for TIMSS Numeracy 2015.

4.5 The TIMSS 2015 Data Files

The TIMSS 2015 International Database includes the actual data from all instruments administered to the students, their parents, their teachers, and their school principals. This includes the student responses to the achievement items and the responses to the student, home, teacher, and school context questionnaires. These data files also include the achievement scores estimated for participating students, as well as background variables derived for reporting in *TIMSS 2015 International Results in Mathematics and Science*. National Research Coordinators’ responses to the curriculum questionnaires also are part of the International Database and are described later in this chapter.

This section describes the format and contents of the TIMSS 2015 data files. With the exception of the curriculum data files, the TIMSS data files are provided in SPSS (IBM Corporation, 2013) format (.SAV) and SAS (SAS Institute, 2012) export format (.EXP). Data files are provided for each country that participated in TIMSS 2015 and for which internationally comparable data are available. The file names given to the various data file types in TIMSS 2015 and TIMSS Numeracy 2015 are shown in Exhibit 4.3. For example, ASGKORM6.SAV is an SPSS file that contains Korea’s TIMSS 2015 fourth grade student background 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.

Exhibit 4.3 TIMSS 2015 and TIMSS Numeracy 2015 Data File Names

Assessment	File Name	Description
TIMSS Fourth Grade	ACG●●●M6	Fourth grade school background data files
	ASA●●●M6	Fourth grade student achievement data files
	ASG●●●M6	Fourth grade student background data files
	ASH●●●M6	Fourth grade home background data files
	ASR●●●M6	Fourth grade within-country scoring reliability data files
	AST●●●M6	Fourth grade student-teacher linkage files
	ATG●●●M6	Fourth grade teacher background data files
TIMSS Eighth Grade	BCG●●●M6	Eighth grade school background data files
	BSA●●●M6	Eighth grade student achievement data files
	BSG●●●M6	Eighth grade student background data files
	BSR●●●M6	Eighth grade within-country scoring reliability data files
	BST●●●M6	Eighth grade student-teacher linkage files
	BTM●●●M6	Eighth grade mathematics teacher background data files
	BTS●●●M6	Eighth grade science teacher background data files
TIMSS Numeracy	ACG●●●N1	Numeracy school background data files
	ASA●●●N1	Numeracy student achievement data files
	ASG●●●N1	Numeracy student background data files
	ASH●●●N1	Numeracy home background data files
	ASR●●●N1	Numeracy within-country scoring reliability data files
	AST●●●N1	Numeracy student-teacher linkage files
	ATG●●●N1	Numeracy teacher background data files

●●● = 3-character country abbreviation based on the ISO 3166 coding scheme (the Identification Codes in Exhibit 4.1).

4.5.1 TIMSS 2015 Student Achievement Data Files (ASA/BSA)

The TIMSS 2015 student achievement data files contain the student responses to the individual achievement items in the TIMSS 2015 assessments. The student achievement data files are best suited for performing item-level analyses. Achievement scores (plausible values) for all of the TIMSS 2015 achievement scales are available in the student achievement data files, as well as in the student background data files and student-teacher linkage data files (described later in this chapter).

Students who participated in TIMSS 2015 were administered one of 14 assessment booklets, each with a series of mathematics and science items.² Students who participated in

² The TIMSS 2015 assessment design is described in Chapter 4 of *TIMSS 2015 Assessment Frameworks* (Mullis & Martin, 2013).

TIMSS Numeracy 2015 were administered one of 10 assessment booklets, consisting entirely of mathematics items. Some of these items were multiple choice items and some were constructed response items. The student achievement data files contain the actual responses to the multiple choice questions and the codes assigned to the constructed response items through the TIMSS 2015 scoring guides.³

Item Variable Naming Convention

The achievement item variable names are based on a 9-character alphanumeric code, which observes the following rules:

- The first character is either “M” for mathematics items, or “S” for science items.
- The second and third characters indicate the assessment cycle when the item was first presented in TIMSS. The code “01” was used for items introduced in TIMSS 1995. The items in the TIMSS 2015 assessment have either “04” for items introduced in 2007, “05” for items introduced in 2011, or “06” for new items in 2015. The TIMSS Numeracy 2015 items have the code “N1”, with the exception of the items from the two TIMSS blocks shared with TIMSS Numeracy.
- The fourth character is either “1” for fourth grade items (including TIMSS Numeracy), or “2” for eighth grade items.
- The fifth through seventh characters represent a unique three-digit number used to identify the items.
- The eighth character indicates the item part, and appears only when required. It is generally a letter from “A” to “F,” depending how many parts there are to a particular item. The letter “Z” is used to represent a derived item from past TIMSS assessments (derived items are described later in this chapter).
- A ninth character is present when an item part itself consists of further parts, usually used to define a derived item.

For example, M061265A is the first part of a fourth grade mathematics item introduced in 2015 and whose unique sequence number is 265.

Item Response Code Values

A series of conventions also were adopted to code the data included in the TIMSS 2015 data files. This section describes these conventions for the achievement items. The values assigned to each of the achievement item variables depend on the item format.

For multiple choice items, numerical values from 1 through 4 were used to correspond to the response options A through D, respectively. For these items, the correct response key is included in the item information files (described earlier) and as part of the variable label in the achievement codebook files (described later in this chapter). SPSS and SAS programs are included as part of the TIMSS 2015 International Database to derive correctness response codes for these items (see Chapter 3).

³ The TIMSS 2015 scoring guides are described in *TIMSS 2015 Item Writing Guidelines* (Mullis & Martin, 2013).

Each constructed response item had its own scoring guide that relied on a two-digit coding scheme to provide diagnostic information. The first digit designated the correctness level of the response: 2 for a response worth 2 points, 1 for a response worth 1 point, and 7 for an incorrect response. The second digit, combined with the first, represented a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions in responding to the item. A second digit of 0 through 5 was used for pre-defined international codes at each correctness level, while a second digit of 9 corresponded to “other” types of responses which fell within the appropriate correctness level but which did not fit any of the pre-defined international codes. A special two-digit code, 99, was used for responses left completely blank. Chapter 3 describes SPSS and SAS programs that convert the two-digit response codes into correctness response codes.

Derived Items Code Values

For some items, students were asked to provide more than one answer, each one being scored appropriately. The pattern of responses across these item parts determined the score on the item as a whole. These multi-part items can be worth either 1 point or 2 points, according to their scoring rubric. For two-point derived items, code 20 was used to award 2 points, code 10 was used to award 1 point, and code 70 for no points. One-point derived items were awarded either code 10 for 1 point, or code 70 for no points. The total score for the item is contained in a derived variable, usually identified by word "DERIVED" in the item label.

For example, derived variable S061018 contains the combined score for its four parts labeled S061018A through S061018D. This derived item was awarded 1 point (code 10) if all four parts were answered correctly and no points (code 70) otherwise. All derived items in the TIMSS 2015 assessments are described in Appendix E of Chapter 11 of *Methods and Procedures in TIMSS 2015*.

Codes for Missing Values

A subset of values was reserved for specific codes related to different categories of missing data. We recommend that the user read the following section with particular care because the way in which these missing codes are used may have implications for analyses.

Not Administered Response Codes (SAS: .A ; SPSS: sysmis)

Special codes were given to items that were “Not Administered” to distinguish these cases from data that were missing due to non-response. In general, the not administered code was used when an item was not administered, either by design arising from the rotation of items across the assessment booklets, or unintentionally when an item was misprinted or otherwise unavailable for a student to respond. The not administered code was used in the following cases:

- Achievement item not assigned to the student—All students participating in TIMSS 2015 received one of 14 available test booklets; students participating in TIMSS Numeracy 2015 received one of 10 test booklets. All variables corresponding to items that were not present in a student’s assigned booklet were coded as “Not Administered.”
- Student absent from session—When a student was not present for a particular testing session, either part 1 or part 2 of an assessment booklet, all items relevant to that session were coded as “Not Administered.”

- Item left out or misprinted—When a particular item (or a whole page) was misprinted or otherwise not available to the student, the corresponding variable was coded as “Not Administered.”
- Item mistranslated or deleted—An item identified during translation verification or item review as having a translation error such that the nature of the question was altered, or as having poor psychometric properties, was coded as “Not Administered.”

Omitted Response Codes (SAS: . ; SPSS: 9, 99)

“Omitted” response codes were used for items that a student should have answered but did not. An omitted response code was given when an item was left blank or when two or more response options were checked for a multiple choice item. Omitted responses generally are treated as incorrect responses.

Not Reached Response Codes (SAS: .R ; SPSS: 6, 96)

An item was considered “Not Reached” when, within part 1 or part 2 of a booklet, the item itself and the item immediately preceding it were not answered, and there were no other items completed in the remainder of that part of the booklet. For most purposes, TIMSS 2015 treated the not-reached items as incorrect responses, except during the item calibration step of the IRT scaling, when not-reached items were considered to have not been administered (see Chapter 13 of *Methods and Procedures in TIMSS 2015*).

TIMSS Achievement Scores

Achievement scales were produced for mathematics and science and their content and cognitive domains at both grades, including TIMSS Numeracy, as shown in Exhibit 4.4. A total of 14 achievement scales were produced at the fourth grade and 16 at the eighth grade. A detailed description of the TIMSS 2015 scaling approach and how these achievement scales were created is available in Chapter 13 of *Methods and Procedures in TIMSS 2015*. For each achievement scale, the TIMSS 2015 database provides five separate estimates of each student’s score on that scale. The five estimated scores are known as “plausible values” and the variability between them encapsulates the uncertainty inherent in the scale estimation process.

The plausible values for any given scale are the best available measures of student achievement on that scale in the TIMSS 2015 International Database, and should be used as the outcome measure in any study of student achievement. Plausible values can be analyzed readily using the IEA IDB Analyzer (IEA, 2017), as described in Chapter 2 of this User Guide.

The achievement score variable names are based on an 8-character alphanumeric code, which adheres to the following rules:

- The first character is either “A” for a fourth grade score (including TIMSS Numeracy), or “B” for an eighth grade score;
- The second character is always “S” to indicate it is a student score variable;
- The third character is either “M” for a mathematics score, or “S” for a science score, whether it is an overall score, a content domain score, or cognitive domain score;

- The fourth through sixth characters are a three-character code describing the achievement scale, as shown in Exhibit 4.4; and
- The seventh and eighth characters are a two-digit number indicating the plausible value—01, 02, 03, 04, or 05.

For example, ASMAPP01 is the first plausible value on the fourth grade mathematics applying cognitive domain achievement scale.

Exhibit 4.4 TIMSS 2015 Achievement Scales at Fourth and Eighth Grades

Fourth Grade (including TIMSS Numeracy)	Overall	MAT	Mathematics	SCI	Science	
	Content Domains	NUM	Number	LIF	Life Science	
		GEO	Geometric Shapes and Measures	PHY	Physical Science	
		DAT	Data Display	EAR	Earth Science	
	Cognitive Domains	KNO	Knowing	KNO	Knowing	
		APP	Applying	APP	Applying	
		REA	Reasoning	REA	Reasoning	
	Eighth Grade	Overall	MAT	Mathematics	SCI	Science
		Content Domains	NUM	Number	BIO	Biology
ALG			Algebra	CHE	Chemistry	
GEO			Geometry	PHY	Physics	
DAT			Data and Chance	EAR	Earth Science	
Cognitive Domains		KNO	Knowing	KNO	Knowing	
		APP	Applying	APP	Applying	
		REA	Reasoning	REA	Reasoning	

TIMSS International Benchmarks of Achievement

To help users of the TIMSS 2015 International Database 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. As shown in Exhibit 4.5, the TIMSS International Benchmark scores are 625, 550, 475, and 400, which correspond to the Advanced International Benchmark, the High International Benchmark, the Intermediate International Benchmark, and the Low International Benchmark, respectively. TIMSS used a technique known as scale anchoring to summarize and describe student achievement at these four points on the scale.⁴ The *TIMSS 2015 International Results in Mathematics and Science* present the results of this scale anchoring, and

⁴ The scale anchoring procedure is described in Chapter 14 of *Methods and Procedures in TIMSS 2015*.

report the percentage of students in each country reaching each of the TIMSS International Benchmarks.

Exhibit 4.5 TIMSS 2015 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 2015 International Database contains a set of variables indicating which International Benchmark the students have reached. There is a benchmark variable for each plausible value of the overall mathematics and overall science scales at both grades, including TIMSS Numeracy. The International Benchmark variables follow the achievement score variable naming convention where the fourth through sixth positions have the letters “IBM.” Thus, ASMIBM01-05 are the five benchmark variables for fourth grade overall mathematics (also available for TIMSS Numeracy), ASSIBM01-05 the five benchmark variables for fourth grade overall science, BSMIBM01-05 for eighth grade overall mathematics, and BSSIBM01-05 for eighth grade overall science. The codes defined for all the benchmark variables are described in Exhibit 4.6.

Exhibit 4.6 TIMSS 2015 International Benchmark Variable Codes

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

4.5.2 TIMSS 2015 Within-Country Scoring Reliability Data Files (ASR/BSR)

The TIMSS 2015 within-country scoring reliability data files contain data that can be used to investigate the reliability of the TIMSS constructed response item scoring. The scoring reliability data files contain one record for each assessment booklet that was double scored during the within-country scoring reliability exercise (see Chapter 11 of *Methods and Procedures in TIMSS 2015*). For each constructed response item in the assessment, the following three variables are included in the scoring reliability data files:

- Original Score (two-digit score assigned by the first scorer);

- Second Score (two-digit score assigned by the second scorer); and
- Score Agreement (degree of agreement between the two scorers).

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 2015 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 that for the achievement item variables discussed earlier. The second character in the variable name differentiates between the three reliability variables:

- The Original Score variable has the number “0” as the second character (the letter "N" for TIMSS Numeracy items), as in the achievement item naming convention (e.g., M061265A);
- The Second Score variable has the letter “R” as the second character (e.g., MR61265A); and
- The Score Agreement variable has the letter “I” as the second character (e.g., MI61265A).

Scoring Reliability Variable Score Values

The values contained in both the Original Score and Second Score variables are the two-digit diagnostic codes assigned using the TIMSS 2015 scoring guides. The Score Agreement variable may have one of three values, depending on the degree of agreement between the two scorers, as described in Exhibit 4.7.

Exhibit 4.7 TIMSS 2015 Score Agreement Variable Codes

Code	Description
0	Identical codes (both digits in the original and second scores)
1	Identical score levels, but different diagnostic codes (first digit of both scores are the same; second digits are different)
2	Different score levels (first digit of both scores are different)

4.5.3 TIMSS 2015 Context Questionnaire Data Files

There are six usual types of TIMSS 2015 context questionnaire data files: four (student, parent, teacher, and school) data files correspond to the four types of context questionnaires administered in TIMSS 2015, the fifth corresponds to the curriculum questionnaire administered to the TIMSS National Research Coordinators, and the sixth serves to link the student and teacher background data. The first four types of data files contain the responses to the questions asked in their respective context questionnaires. The parent questionnaire—the Early Learning Survey questionnaire—is administered only at the fourth grade, including TIMSS Numeracy.

TIMSS 2015 Student Background Data Files (ASG/BSG)

Students who participated in TIMSS 2015 were administered a context questionnaire with questions related to their home background, school experiences, and attitudes towards mathematics and

science. The student background data files contain students' responses to these questions. They also contain students' mathematics and science achievement scores (plausible values) to facilitate analyses of relationships between student background characteristics and achievement.

Two versions of the student questionnaire were administered at the eighth grade. One version was for educational systems where science is taught as an integrated subject (integrated science version). The other version was for educational systems where the sciences (biology or life science, physics, chemistry, and earth science) are taught separately (separate science version). For eighth grade students who were administered the 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 integrated science version were coded as "Not Administered." At the fourth grade, there was a single version of the student questionnaire, tailored for general science.

The student background data files also contain a number of identification variables, tracking variables, sampling and weighting variables, and derived variables that were used for producing exhibits in *TIMSS 2015 International Results in Mathematics and Science*. These variables are described later in this chapter.

TIMSS 2015 Home Background Data Files (ASH)

Countries participating in TIMSS 2015 at the fourth grade and TIMSS Numeracy 2015 administered an Early Learning Survey questionnaire, which was completed by the students' parents or guardians. This questionnaire is usually called the Home Questionnaire. It asked questions about preparations for primary schooling, including attendance in preschool and literacy and numeracy activities in the home before the child began school, such as reading books, writing letters or words, and adding and subtracting. Parents answered questions about home resources in addition to information about their highest level of education and their employment situations. Analyzing data from the home questionnaires requires that the home background data files be merged with the student background data files using the country and student identification variables. Details of the merging procedure with the IEA IDB Analyzer are described in Chapter 2 of this User Guide.

TIMSS 2015 School Background Data Files (ACG/BCG)

The school background data files contain school principals' responses to the questions in the TIMSS 2015 school context questionnaires. 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 background data files must be merged with the student background data files using the country and school identification variables. Details of the merging procedure with the IEA IDB Analyzer are described in Chapter 2 of this User Guide.

TIMSS 2015 Teacher Background Data Files (ATG/BTM/BTS)

The mathematics and science teachers of the students that were sampled in TIMSS 2015 were administered at least one questionnaire with questions pertaining to their background and their teaching practices in the classes of the sampled students. Each teacher was asked to respond to a

questionnaire for each class taught that contained sampled students. The teacher background 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, they were expected to complete only one part A (general background questions) and a separate part B (class-specific questions) for each class they taught. In some cases, although the teacher was to respond to more than one questionnaire, responses to only one were obtained. In these cases, there were as many records entered in the teacher background data file as sampled classes were taught by the teacher, and the background information in part A from the completed questionnaire was entered into these teacher records.

There were two types of teacher questionnaires administered at the eighth grade: one for the mathematics teachers, and one for the science teachers. The responses of teachers to the mathematics questionnaire are found in the BTM files and the responses of teachers to the science questionnaire are found in the BTS files. At the fourth grade, the situation was more straightforward, with a single teacher questionnaire requesting information on both mathematics and science, and all teachers' responses are found in the ATG files.

In the teacher background data files at both grades, each teacher has a unique identification number (IDTEACH) and a link number (IDLINK) that is specific to the sampled class taught by the teacher and to which the information in the data record corresponds. The IDTEACH and IDLINK combination uniquely identifies, within a country, a teacher teaching a specific class. Thus, students linked to teachers identified by the same IDTEACH but different IDLINK are taught by the same teacher but in different classes. The teacher background data files cannot be merged directly with the student data files and they do not contain sampling and weighting information, nor achievement scores. The student-teacher linkage data files serve that purpose.

It is important to note that the teachers in the teacher background 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, and should be analyzed only in conjunction with the student-teacher linkage data files. Chapter 2 of this User Guide describes student-level analyses combining the teacher data and the student-teacher linkage data files with the IEA IDB Analyzer software.

TIMSS 2015 Student-Teacher Linkage Data Files (AST/BST)

The TIMSS 2015 student-teacher linkage data files contain information required to link the student and teacher data files. The student-teacher linkage data files contain one entry per student-teacher linkage combination in the data. For instance, if three teachers are linked to a student, there are three entries in the file corresponding to that student. The sole purpose of the student-teacher linkage data files is to link teacher-level data with student-level data in order to perform appropriate student-level analyses where teacher characteristics are considered as attributes of the students. The student-teacher linkage data files also include sampling and weighting information and achievement scores.

TIMSS 2015 Curriculum Data Files

The TIMSS 2015 curriculum questionnaire data files contain the responses provided by the TIMSS National Research Coordinators of the participating countries to the TIMSS 2015 curriculum

questionnaires. There are two separate curriculum questionnaire data files for the two grades, fourth and eighth. These files are available as Excel files in the TIMSS 2015 International Database.

Background Variable Naming Convention

The background variable naming convention for the variables in the student, home, teacher, and school background data files is based on a 7- or 8-character string. The following rules are applied in naming the background variables:

- The first character is either “A” for fourth grade data, or “B” for eighth grade data.
- The second character indicates the type of respondent. The letter “C” identifies data from the school principals, the letter “T” for teacher data, and the letter “S” for student and parent data.
- The third character is used to indicate the source of the data. The letter “B” is used for all background variables. 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 index variables constructed from these context questionnaire scale Rasch scores.⁵
- The fourth character is used to indicate the subject or topic to which a background question refers. The following letters are used:⁶

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 or life science;

C—Questions related to chemistry;

E—Questions related to earth science; and

P—Questions related to physics of physical science.

- The fifth through eighth characters of all background variables represent the sequential numbering of the questions as presented in their respective questionnaires.⁷

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;

⁵ The context questionnaire scales are described in Chapter 15 of *Methods and Procedures in TIMSS 2015*.

⁶ The letters “B,” “C,” “E,” and “P” are used only in the eighth grade student background data files for variables corresponding to questions about separate sciences asked in the separate science version of the student questionnaire.

⁷ Because of the modular structure of the context questionnaires, the sequential numbering can be specific to each module.

- SC4—Questions related to fourth grade science;
- MA8—Questions related to eighth grade mathematics; and
- SC8—Questions related to eighth grade science.

The remaining characters in the curriculum data variable naming convention refer to the question location, as shown in Supplement 1 to this User Guide.

Background Variable Location Convention

The background variable naming convention shows explicitly the ordering of questions in the context questionnaires. Each question was assigned a unique location code as shown in Exhibit 4.8. This unique code includes the sequence number of the question within the questionnaire, the same sequence number found in the question’s variable name. For example, if the location variable is given as SQG-08, it refers to general question 8 in the student context questionnaire. This convention is followed in the codebooks, the data almanacs, and in the description of the variables included in the Supplements to this User Guide.

Exhibit 4.8 TIMSS 2015 Context Questionnaire Variable Location Convention

Questionnaire	Location Variable	
Student Questionnaire	SQG-●●●	Fourth grade general questions
	SQMS-●●●	Fourth grade mathematics and science questions
	SQIS-●●●	Eighth grade integrated science questionnaire
	SQSS-●●●	Eighth grade separate science questionnaire
Home Questionnaire	HQ-●●●	Fourth grade
Teacher Questionnaire	TQG-●●●	Both grades general questions
	TQM-●●●	Both grades mathematics questions
	TQS-●●●	Both grades science questions
School Questionnaire	SCQ-●●●	Both grades
Curriculum Questionnaire	CQG-●●●	Both grades general questions
	CQM4-●●●	Fourth grade mathematics questions
	CQS4-●●●	Fourth grade science questions
	CQM8-●●●	Eighth grade mathematics questions
	CQS8-●●●	Eighth grade science questions

●●● = sequential numbering of the question location in the questionnaire

Data Coding Conventions

A series of conventions also were adopted to code the data included in the background data files. This section describes these conventions.

Background Question Response Code Values

The values assigned to each of the background variables depend on the item format and the number of options available. For categorical questions, sequential numerical values were 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 was represented with a 1, the second response option with a 2, etcetera. Open-ended questions, such as “How many students are in this class?”, were coded with the actual number given as a response.

Codes for Missing Values

A subset of values is reserved for specific codes related to various categories of missing data.

Not Administered Response Codes (SAS: .A ; SPSS: sysmis)

Special codes were given to items that were “Not Administered” to distinguish these cases from data that were missing due to non-response. In general, the “Not Administered” code was used when an entire questionnaire was not completed or a specific question was not administered, such as when a question was left out of the instrument or misprinted. The “Not Administered” code was used in the following cases:

- Background questions removed: Variables corresponding to questions in the student, home, teacher, or school context questionnaires that were considered not appropriate in some countries were not included in the national versions of the questionnaires. These questions were coded as “Not Administered.”
- Background question left out or misprinted: When a particular question (or a whole page) was misprinted, or otherwise not available to the respondent, the corresponding variables were coded as “Not Administered.”
- Background questions mistranslated or not internationally comparable: In some cases, questions in the international version of the questionnaires were mistranslated or modified to fit the national context. Whenever possible, modified questions were recoded to match as closely as possible the international version. When this was not possible, modified questions were coded as “Not Administered.”

Omitted Response Codes (SAS: . ; SPSS: 9, 99, 999, ...)

“Omitted” response codes were used for questions that a student, parent, teacher, or school principal should have answered but did not. The length of the omitted response code given to a variable in the 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 9’s. For questionnaire data, no distinction was made between items left blank and items with invalid answers, such as checking two or more response options in a categorical question, or unreadable or uninterpretable responses to open-ended questions. In a few cases, data received from a country in an invalid or inconsistent manner also were coded as “Omitted.”

Not Applicable Response Codes (SAS: .B ; SPSS: 6, 96, 996, ...)

“Not Applicable” response codes were used for the context questionnaire items for which responses were dependent upon a filter question. Generally, a “No” response to a filter question lead to any follow-up questions being coded as “Not Applicable” because there were no appropriate responses to these follow-up questions.

Context Questionnaire Scales and Derived Variables

In the TIMSS 2015 context questionnaires, often several questions were asked about various aspects of a single construct. In these cases, responses to the individual items were combined to create a score, using Rasch scaling, which provided a more comprehensive picture 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 2015 International Database and described in Chapter 15 of *Methods and Procedures in TIMSS 2015*.

Additional variables were derived from responses to multiple questions to provide more pertinent 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. Supplement 3 to the User Guide provides a description of the derived variables included in the TIMSS 2015 International Database.

Sampling and Weighting Variables

Several sampling and weighting variables are included in the TIMSS 2015 data files; they are listed and described in Exhibit 4.9. Exhibit 4.10 illustrates the location of the various sampling and weighting variables among the different types of data files. It is important to note that the teacher background data files do not have any sampling and weighting variables, nor do the home background data files.

As a general rule, TOTWGT—the overall student sampling weight—is the preferred sampling weight to use when analyzing student-level data. Although TOTWGT has desirable properties, it may have drawbacks for some analyses. Because TOTWGT sums to the student population size in each country, analyses using TOTWGT that combine countries will have proportionately more students from larger countries and fewer from smaller countries, which may not be desirable for some purposes. For cross-country analyses in which countries should be treated equally, TIMSS provides SENWGT, a transformation of TOTWGT, that results in a weighted sample size of 500 in each country. Additionally, because TOTWGT inflates sample sizes to estimate the population size, software systems that use the actual sample size to perform significance tests may give misleading results for analyses weighted by TOTWGT. HOUWGT, another transformation of TOTWGT, ensures that the weighted sample corresponds to the actual sample size in each country.

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 background data files. The weight variable SCHWGT is designed for use in school-level analyses where the schools are the units of analysis.

Exhibit 4.9 TIMSS 2015 Sampling and Weighting Variables

Variable Names	Descriptions
TOTWGT	Total student weight—sums to the national population
SENWGT	Student senate weight—sums to 500 in each country
HOUWGT	Student house weight—sums to the national student sample size
TCHWGT	Overall teacher weight
MATWGT	Mathematics teacher weight
SCIWGT	Science teacher weight
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, MATWGT, and SCIWGT are specifically designed for using teacher background data in student-level analyses and are based on TOTWGT. Whereas TCHWGT is used for analyses using all teachers, MATWGT and SCIWGT are used for analyses of mathematics and science teachers, respectively. These teacher weights are located in the student-teacher linkage files (AST and BST), not in the actual teacher background 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.

The sampling variables beginning with the letters “JK” are used to compute standard errors based on the jackknife repeated replication methodology.⁸ All weighting variables beginning with the letters “WGT” provide insight into the multi-stage sampling and weighting methodology applied to the TIMSS data. All weighting variables are described in Chapter 3 of *Methods and Procedures in TIMSS 2015*.

⁸ Starting with TIMSS 2015, the jackknife repeated replication method has been modified to include both replicates within each sampling zone, as described in Chapter 4 of *Methods and Procedures in TIMSS 2015*.

Exhibit 4.10 Location of Sampling and Weighting Variables in the TIMSS 2015 Data Files

Sampling and Weighting Variables	Data File Types			
	ASG BSG	ASA BSA	AST BST	ACG BCG
JKREP	●	●	●	
JKZONE	●	●	●	
JKCREP				●
JKCZONE				●
TOTWGT	●	●		
SENWGT	●	●		
HOUWGT	●	●		
TCHWGT			●	
MATWGT			●	
SCIWGT			●	
SCHWGT				●
WGTFAC1	●			●
WGTADJ1	●			●
WGTFAC2	●			
WGTADJ2	●			
WGTFAC3	●			
WGTADJ3	●			

A word of caution to prospective users of the TIMSS 2015 International Database is in order. As tempting as it seems to merge all file types into one all-encompassing data file, analyses with student, home, and school background data may not produce correct results. This problem arises from the student-teacher linkage and how it apportions student weights (TOTWGT) to the student-teacher linkage records. Although unusual, there are instances of students not attending a mathematics class, or a science class, and consequently not physically linked to either a mathematics or science teacher. When this happens, the sampling weights of these students cannot be attributed to any of the teacher weights—TCHWGT, MATWGT, and SCIWGT. Thus using a teacher weight will not include the weights of these “unlinked” students, producing inaccurate results. Using TOTWGT also will lead to inaccurate results due to having some students linked to more than one mathematics or science teacher.

Structure and Design Variables

Besides the variables used to store responses to the context questionnaires and achievement booklets, the TIMSS 2015 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 TIMSS data files, several identification variables are included that provide information to identify countries, students, teachers, or schools. These variables also are used to link cases between the different data file types. The identification variables have the prefix “ID” and are described below.

IDCOUNTRY

IDCOUNTRY is a six-digit country identification code based on the ISO 3166 classification as shown in Exhibit 4.1. 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 and assigned specifically for TIMSS and are not meant to represent actual school identifiers in the participating countries. They are not unique across countries. Schools across countries can be identified uniquely only with the IDCOUNTRY 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 IDCOUNTRY and IDCLASS as linking variables.

IDSTUDENT

IDSTUDENT is an eight-digit identification code that uniquely identifies each sampled student in a country. The variable IDSTUDENT 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 IDCOUNTRY and IDSTUDENT as linking variables.

IDTEACHER

IDTEACHER 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.

IDGRADE

IDGRADE identifies the target grade of the participating students. In TIMSS 2015, the usual values are “4” and “8” for most countries.

IDBOOK

IDBOOK identifies the specific assessment booklet that was administered to each student. The booklets are given a numerical value from “1” through “14” in TIMSS 2015, from “1” through “10” in TIMSS numeracy 2015.

Exhibit 4.11 shows in which data files the various identification variables are located. It also highlights the combinations of variables used to identify uniquely the records contained in the different data file types. In the student background, home background, 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 variables in the teacher background data files is needed to identify uniquely all teachers and the classes they teach. Teacher background 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 background data to corresponding students or teachers.

Exhibit 4.11 Location of Identification Variables in the TIMSS 2015 Data Files

Identification Variables	Data File Types					
	ASA BSA	ASG BSG	AST BST	ATG BTM/BTS	ACG BCG	ASH
IDCNTRY	●	●	●	●	●	●
IDSCHOOL	●	●	●	●	●	●
IDCLASS	●	●	●	●		●
IDSTUD	●	●	●			●
IDTEACH			●	●		
IDLINK			●	●		
IDGRADE	●	●	●	●	●	●
IDBOOK	●	●				

Tracking Variables

Information about students, teachers, and schools provided by the survey tracking forms is stored in the tracking variables.⁹ These variables have the prefix “IT.” All tracking variables are included in the student background data files. ITLANG is included in the student achievement data files, student background data files, and home background data files.

ITSEX

Gender of each student as stated in the Student Tracking Forms.

ITBIRTHM and ITBIRTHY

Month and year of birth of each student as stated in the Student Tracking Forms. Both variables are available only in the restricted use version of the TIMSS 2015 International Database.

ITDATE

Testing date for each student. This variable is available only in the restricted use version of the TIMSS 2015 International Database.

ITLANG

Language of testing for each student. The valid codes for ITLANG are specified in the codebook files.

4.6 TIMSS 2015 Codebook Files

All information related to the structure of the TIMSS 2015 data files, as well as the source, format, descriptive labels, and response option codes for all variables, is contained in codebook files. There are three codebook files in Excel format:

T15_G4_Codebook TIMSS 2015 codebook for the fourth grade data files

T15_G8_Codebook TIMSS 2015 codebook for the eighth grade data files

TN15_Codebook TIMSS Numeracy 2015 codebook for the TIMSS Numeracy data files

In the codebook Excel files, there is a tab for each appropriate data file type in the TIMSS 2015 International Database. These tabs describe the contents and structure of the TIMSS 2015 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.

4.7 TIMSS 2015 Data Almanac Files

Data almanacs provide weighted summary statistics for all variables in the TIMSS 2015 data files. There are two basic types of data almanacs: achievement data almanacs for the achievement items

⁹ Survey tracking forms are lists of students, teachers, and schools used for sampling and administrative purposes.

and background data almanacs for the background variables. All data almanac files are provided in Word format and printable PDF format.

Achievement Data Almanacs

The achievement data almanacs provide weighted summary statistics for each participating country on each individual achievement item included in the TIMSS 2015 assessments. There are separate achievement data almanacs for fourth and eighth grades and for the two subjects, mathematics and science, and for the TIMSS Numeracy 2015 assessment.

The achievement data almanacs display for each item 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, the correct response key if it is a multiple choice item, and its point value if it is a constructed-response item.

The trend item almanacs provide summary statistics for achievement items used in both the 2011 and 2015 assessments. The achievement data almanac files available in the International Database are listed in Exhibit 4.12.

The achievement data almanacs also display the international averages for each item, with each country weighted equally. The benchmark participants, listed below the international averages, are not included in the calculation of international averages.

Exhibit 4.12 TIMSS 2015 Achievement Data Almanacs

Achievement Data Almanacs	Contents
T15_G4_MAT_ItemAlmanac	Almanac for fourth grade mathematics items
T15_G4_SCI_ItemAlmanac	Almanac for fourth grade science items
T15_G4_MAT_TrendItemAlmanac	Trend almanac for fourth grade mathematics items
T15_G4_SCI_TrendItemAlmanac	Trend almanac for fourth grade science items
T15_G8_MAT_ItemAlmanac	Almanac for eighth grade mathematics items
T15_G8_SCI_ItemAlmanac	Almanac for eighth grade science items
T15_G8_MAT_TrendItemAlmanac	Trend almanac for eighth grade mathematics items
T15_G8_SCI_TrendItemAlmanac	Trend almanac for eighth grade science items
TN15_ItemAlmanac	Almanac for TIMSS Numeracy mathematics items

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 displayed in these almanacs are as follows:

- N—The number of students to whom the item was administered.
- DIFF—Percent of students that responded correctly to a multiple choice item.
- A, B, C, and D—The percent of students choosing each one of the response options for a multiple choice item.

- Scoring Guide Codes (e.g., 20, 21, 10, 11, 70, 71)—The percent of student responses assigned each of the codes in the scoring guide for a constructed response item.
- OMITTED—The percent of students that omitted to respond to the item.
- NOT REACHED—The percent of students that did not reach the item.
- V1 and V2—The percent of students that scored 1 point or better on the item (V1) or 2 points (V2) for constructed-response items.
- GIRL PCT RIGHT and BOY PCT RIGHT—The percent of girls and boys that either got a multiple choice item right, or obtained the maximum score on a constructed response item.

Background Data Almanacs

Background data almanac files contain weighted summary statistics for each participating country on each variable in the student, home, teacher, and school context questionnaires, including the context questionnaire scales and their indices and the derived variables based on these background variables. Among the statistics reported are mean mathematics and science achievement by response category. The background 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 background data almanac files available in the International Database are listed in Exhibit 4.13.

The background data almanacs also display the international averages for each variable, with each country weighted equally. The benchmark participants, listed below the international averages, are not included in the calculation of international averages.

Exhibit 4.13 TIMSS 2015 Background Data Almanacs

Background Data Almanacs	Contents
T15_G4_MAT_StudentAlmanac	Fourth grade student background almanac with mathematics achievement
T15_G4_SCI_StudentAlmanac	Fourth grade student background almanac with science achievement
T15_G4_MAT_HomeAlmanac	Fourth grade home background almanac with mathematics achievement
T15_G4_SCI_HomeAlmanac	Fourth grade home background almanac with science achievement
T15_G4_MAT_TeacherAlmanac	Fourth grade teacher background almanac with mathematics achievement
T15_G4_SCI_TeacherAlmanac	Fourth grade teacher background almanac with science achievement
T15_G4_MAT_SchoolAlmanac	Fourth grade school background almanac with mathematics achievement
T15_G4_SCI_SchoolAlmanac	Fourth grade school background almanac with science achievement

Exhibit 4.13 TIMSS 2015 Background Data Almanacs (Continued)

Background Data Almanacs	Contents
T15_G8_MAT_StudentAlmanac	Eighth grade student background almanac with mathematics achievement
T15_G8_SCI_StudentAlmanac	Eighth grade student background almanac with science achievement
T15_G8_MAT_TeacherAlmanac	Eighth grade teacher background almanac with mathematics achievement
T15_G8_SCI_TeacherAlmanac	Eighth grade teacher background almanac with science achievement
T15_G8_MAT_SchoolAlmanac	Eighth grade school background almanac with mathematics achievement
T15_G8_SCI_SchoolAlmanac	Eighth grade school background almanac with science achievement
TN15_StudentAlmanac	Numeracy student background almanac with mathematics achievement
TN15_HomeAlmanac	Numeracy home background almanac with mathematics achievement
TN15_TeacherAlmanac	Numeracy teacher background almanac with mathematics achievement
TN15_SchoolAlmanac	Numeracy school background almanac with mathematics achievement

There are two types of displays in the background 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, teachers, or schools included in the sample);
- The number of valid cases (number of students, parents, teachers, or schools 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 the sample size);
- The weighted mean achievement values of students corresponding to each valid response option, as well as the “Not Administered” and “Omitted” codes; and
- 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, teachers, or schools included in the sample);
- The number of valid cases (number of students, parents, teachers, or schools 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 the sample size);
- The weighted mean, mode, minimum, maximum, and the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles across students (based on the students with valid data); and
- 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 background data almanacs, with the exception of the sample sizes and the number of valid cases, always are 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.

4.8 TIMSS 2015 Test-Curriculum Matching Analysis Data Files

The Test-Curriculum Matching Analysis (TCMA) was conducted to investigate the appropriateness of the TIMSS 2015 mathematics and science assessments for the fourth and eighth grade students in the participating countries.¹⁰ To that end, participating countries were asked to indicate which items on the TIMSS 2015 assessments were included in their national curricula. Thus, based on computations of average percent correct, each country was able to see the performance of all countries on the items appropriate for its curriculum, and also the performance of its students on the items judged appropriate for the curricula in other countries. The analytical method used and the results of the TCMA are presented in Appendix F of *TIMSS 2015 International Results in Mathematics and Science*.

The International Database contains four TCMA data files—one for each combination of grade and subject—in Excel format and printable PDF format, showing which items were selected by each participating country. Only those countries that submitted TCMA item selection information are included in the files and were presented in the reported results.

4.9 TIMSS 2015 Program Files

The TIMSS 2015 International Database includes a number of SPSS and SAS programs designed to facilitate the manipulation of the TIMSS 2015 data files. The International Database contains SAS programs that convert the SAS export files into SAS data files. It includes SPSS and SAS syntax files which will recode the responses to individual items from the achievement data files to their appropriate score levels. It also includes SPSS and SAS programs designed to combine TIMSS 2015

¹⁰ The Test-Curriculum Matching Analysis was not conducted for the TIMSS Numeracy 2015 assessment.

fourth grade data files and TIMSS Numeracy 2015 data files, which may be necessary when analyzing fourth grade mathematics results. All programs are described in Chapter 3 of this User Guide.

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Appendix

Organizations and Individuals Responsible for TIMSS 2015

Introduction

TIMSS 2015 was a collaborative effort involving hundreds of individuals around the world. This appendix acknowledges the individuals and organizations for their contributions. Given that work on TIMSS 2015 has spanned approximately four years and has involved so many people and organizations, this list may not include all who contributed. Any omission is inadvertent. TIMSS 2015 also acknowledges the students, parents, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

Management and Coordination

TIMSS is a major undertaking of IEA, and together with the Progress in International Reading Literacy Study (PIRLS), comprises the core of IEA's regular cycles of studies. The TIMSS assessment at the fourth grade complements PIRLS, which regularly assesses reading achievement at fourth grade.

TIMSS was conducted by IEA's TIMSS & PIRLS International Study Center at Boston College, which has responsibility for the overall direction and management of the TIMSS and PIRLS projects, including design, development, and implementation. Headed by Executive Directors Drs. Ina V.S. Mullis and Michael O. Martin, the study center is located in the Lynch School of Education. In carrying out the project, the TIMSS & PIRLS International Study Center worked closely with the IEA Secretariat in Amsterdam, which managed country participation, was responsible for verification of all translations produced by the participating countries, and coordinated the school visits by International Quality Control Monitors. Staff at the IEA Data Processing and Research Center in Hamburg worked closely with participating countries to organize sampling and data collection operations and to check all data for accuracy and consistency within and across countries; Statistics Canada in Ottawa was responsible for school and student sampling activities; and Educational Testing Service in Princeton, New Jersey consulted on psychometric methodology, provided software for scaling the achievement data, and replicated the achievement scaling for quality assurance.

The Project Management Team, comprising the study directors and representatives from the TIMSS & PIRLS International Study Center, IEA Secretariat and IEA Data Processing and Research

Center, Statistics Canada, and ETS met twice a year throughout the study to discuss the study's progress, procedures, and schedule. In addition, the study directors met with members of IEA's Technical Executive Group twice yearly to review technical issues.

To work with the international team and coordinate within-country activities, each participating country designates an individual to be the TIMSS National Research Coordinator (NRC). The NRCs have the challenging task of implementing TIMSS in their countries in accordance with the TIMSS guidelines and procedures. In addition, the NRCs provide feedback and contributions throughout the development of the TIMSS assessment. The quality of the TIMSS assessment and data depends on the work of the NRCs and their colleagues in carrying out the complex sampling, data collection, and scoring tasks involved. Continuing the tradition of exemplary work established in previous cycles of TIMSS, the TIMSS 2015 NRCs performed their many tasks with dedication, competence, energy, and goodwill, and have been commended by the IEA Secretariat, the TIMSS & PIRLS International Study Center, the IEA Data Processing and Research Center, and Statistics Canada for their commitment to the project and the high quality of their work.

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TIMSS & PIRLS International Study Center at Boston College

Ina V.S. Mullis, *Executive Director*

Michael O. Martin, *Executive Director*

Pierre Foy, *Director of Sampling, Psychometrics, and Data Analysis*

Paul Connolly, *Director, Graphic Design and Publications*

Ieva Johansone, *Associate Research Director, Operations and Quality Control*

Marcie Bligh, *Manager, Events and Administration*

Victoria A.S. Centurino, *Assistant Research Director, TIMSS Science*

Kerry Cotter, *Research Specialist, TIMSS Mathematics*

Susan Farrell, *Lead Web and Database Designer*

Bethany Fishbein, *Research Specialist, TIMSS Science*

Joseph Galia, *Lead Statistician/Programmer*

Shirley Goh, *Assistant Director, Communications and Media Relations*

Christine Hoage, *Manager of Finance*

Kathleen Holland, *Administrative Coordinator*

Martin Hooper, *Assistant Research Director, TIMSS and PIRLS Questionnaire Development and Policy Studies*

Jenny Liu, *Graduate Assistant*

Lauren Palazzo, *Research Associate, TIMSS and PIRLS Questionnaire Development and Technical Reporting*

Yenileis Pardini, *Lead Designer/Developer for eAssessments*

Mario A. Pita, *Lead Graphic Designer*

Jyothsnadevi Pothana, *Statistician/Programmer*

Betty Poulos, *Administrative Coordinator*

Katherine Reynolds, *Graduate Assistant*

Ruthanne Ryan, *Senior Graphic Designer*

Jennifer Moher Sepulveda, *Data Graphics Specialist (through 2015)*

Amy Semerjian, *Graduate Assistant (through 2015)*

Steven A. Simpson, *Senior Graphic Designer*

Erin Wry, *Research Associate, TIMSS and PIRLS Operations and Quality Control*

Liqun Yin, *Research Psychometrician*

IEA Secretariat

Dirk Hastedt, *Executive Director*

Hans Wagemaker, *Executive Director (through 2014)*

Paulína Koršňáková, *Director of the IEA Secretariat*

Barbara Malak, *Manager, Member Relations (through 2013)*

Gabriela Nausica Noveanu, *Senior Research Advisor*
 David Ebbs, *Research Officer*
 Michelle Djekić, *Research Officer*
 Roel Burgers, *Financial Manager*
 Juriaan Hartenberg, *Financial Manager (through 2013)*
 Isabelle Braun-Gémin, *Financial Officer*
 Dana Vizkova, *Financial Officer*
 Gillian Wilson, *Publications Officer*
 Manuel Butty, *Public Outreach Officer*

IEA Data Processing and Research Center

Heiko Sibberns, *IEA DPC Director*
 Oliver Neuschmidt, *Senior Research Analyst, Unit Head, International Studies*
 Milena Taneva, *Senior Research Analyst, Project Co-Manager, TIMSS and TIMSS Advanced Data Processing*
 Juliane Hencke, *Senior Research Analyst, Project Co-Manager, TIMSS and TIMSS Advanced Data Processing*
 Sebastian Meyer, *Research Analyst, Deputy Project Manager, TIMSS and TIMSS Advanced Data Processing*
 Mark Cockle, *Research Analyst, Deputy Project Manager, TIMSS and TIMSS Advanced Data Processing*
 Yasin Afana, *Research Analyst*
 Alena Becker, *Research Analyst*
 Clara Beyer, *Research Analyst*
 Christine Busch, *Research Analyst*
 Tim Daniel, *Research Analyst*
 Limiao Duan, *Programmer*
 Eugenio Gonzalez, *Senior Research Analyst*
 Michael Jung, *Research Analyst*
 Deepti Kalamadi, *Programmer*
 Hannah Köhler, *Research Analyst*
 Kamil Kowolik, *Research Analyst*
 Sabine Meinck, *Unit Head, Sampling & Research and Analyses Unit*
 Ekaterina Mikheeva, *Research Analyst*
 Dirk Oehler, *Research Analyst*
 Duygu Savaşci, *Research Analyst*
 Sabine Tieck, *Research Analyst*
 Meng Xue, *Unit Head, Software*

Statistics Canada

Sylvie LaRoche, *Senior Methodologist*
 Marc Joncas, *Senior Methodologist (through 2015)*
 Shou Xiang Chen, *Methodologist*

Educational Testing Service

Matthias Von Davier, *Senior Research Director*
 Edward Kulick, *Research Director*
 Jonathan Weeks, *Associate Research Scientist*
 Zhan Shu, *Psychometrician*
 Scott Davis, *Senior Data Analysis and Computational Research Specialist*
 Mei-Jang Lin, *Data Analysis and Computational Research Specialist*

Sampling Referee

Keith Rust, *Vice President and Associate Director of the Statistical Group, Westat, Inc.*

TIMSS 2015 Science and Mathematics Item Review Committee

Mathematics

Kiril Bankov
 Faculty of Mathematics and Informatics
 University of Sofia

Bulgaria

Sean Close
 Educational Research Centre
 St. Patrick's College

Ireland

Khattab M. A. Abulibdeh
 National Center for Human Resources
 Development

Jordan

Sun Sook Noh
 Department of Mathematics Education
 Ewha Women's University

Korea, Republic of

Liv Sissel Grønmo
 Chief Mathematics Consultant
 Department of Teacher Education and
 School Research
 ILS, University of Oslo

Norway

Torgeir Onstad
 Department of Teacher Education and
 School Research
 ILS, University of Oslo

Norway

Mary Lindquist

United States



Science

Newman Burdett (through 2014)
National Foundation for Educational
Research (NFER)

England

Jouni Viiri
University of Jyväskylä

Finland

Siu Ling Alice Wong
Faculty of Education
University of Hong Kong

Honk Kong SAR

Berenice Michels
Faculty of Science
Utrecht University

The Netherlands

Vitaly Gribov
Physics Faculty
Moscow Lomonosov State University

Russian Federation

Galina Kovaleva
Center for Evaluating the Quality of
Education
Federal Institute of the Strategy of
Education Development of the Russian
Academy of Education
Ministry of Education and Science

Russian Federation

Gabriela Noveanu (through 2013)
Institute of Educational Science
Curriculum Department

Romania

Gorazd Planinsic
Faculty of Mathematics & Physics
University of Ljubljana

Slovenia

Wolfgang Dietrich
National Agency for Education

Sweden

Lee Jones
Chief Science Consultant

United States

Christopher Lazzaro
The College Board

United States

Gerry Wheeler

United States

TIMSS 2015 Item Development Task Forces

Mathematics

Ina V.S. Mullis, *TIMSS & PIRLS International Study Center Executive Director*
Kerry Cotter, *Research Specialist, TIMSS Mathematics*
Liv Sissel Grønmo, *Chief Mathematics Consultant (ILS, University of Oslo)*
Mary Lindquist, *Mathematics Consultant (United States)*
Torgeir Onstad, *Mathematics Consultant (ILS, University of Oslo)*
Ray Philpot, *Mathematics Consultant (ACER)*

Science

Victoria A.S. Centurino, *Assistant Research Director, TIMSS Science*

Lee R. Jones, *Chief Science Consultant (United States)*

Ron Martin, *Science Consultant (ACER)*

Gerry Wheeler, *Science Consultant (United States)*

Questionnaire Item Review Committee

Sue Thomson

Australian Council for Educational
Research

Australia

Josef Basl

Czech School Inspectorate

Czech Republic

Wilfried Bos

Institute for School Development
Research (IFS)

TU Dortmund University

Germany

Martina Meelissen

Department of Research Methodology,
Measurement, and Data Analysis

Faculty of Behavioral Sciences

University of Twente

Netherlands

Chew Leng Poon

Planning Division, Research and
Evaluation Section

Ministry of Education

Singapore

Peter Nyström

National Center for Mathematics
Education

University of Gothenburg

Sweden

Jack Buckley

The College Board

United States

TIMSS 2015 National Research Coordinators

Armenia

Arsen Baghdasaryan

Assessment and Testing Center

Australia

Sue Thomson

Australian Council for Educational
Research

Bahrain

Huda Al-Awadi

Ministry of Education

Belgium (Flemish)

Kim Bellens

Centrum voor Onderwijseffectiviteit en
evaluatie

Katholieke Universiteit Leuven

Botswana

Trust Mbako-Masole

Monamodi Kesamang (through 2014)

Botswana Examinations Council



Bulgaria

Marina Vasileva Mavrodieva
Center for Control and Assessment of the
Quality in School Education (CCAQSE)

Canada

Pierre Brochu
Council Ministers of Education

Chile

Elisa Salinas
Victoria Martinez (through 2016)
Gabriela Cares Osorio (through 2015)
Departamento de Estudios Internacionales
División de Estudios
Daniel Rodriguez (through 2014)
Agencia de Calidad de la Educación

Chinese Taipei

Chun-Yen Chang
Che-Di Lee
National Taiwan Normal University

Croatia

Jasminka Buljan Culej
National Centre for External Evaluation in
Education

Cyprus

Yiasemina Karagiorgi
Center of Educational Research and
Evaluation Pedagogical Institute

Czech Republic

Vladislav Tomasek
Czech School Inspectorate

Denmark

Peter Allerup
Department of Education
Aarhus University

Egypt

Abd Alkareem Badran
Khaled Mohamed Sayad Ahmed (through
2014)
National Center for Examinations and
Educational Evaluation

England

Jamie Jackson
Dawn Pollard
RM Education

Finland

Jouni Vettenranta
Finnish Institute for Educational Research
University of Jyväskylä

France

Marc Colmant
Ministère de l'éducation nationale
Direction de l'évaluation, de la prospective
et de la performance (DEPP)

Georgia

David Gabelaia
Mamuka Jibladze
National Assessment and Examinations
Center

Germany

Wilfried Bos
Heike Wendt
Institute for School Development
Research (IFS)
TU Dortmund University

Hong Kong SAR

Frederick Leung
Siu Ling Alice Wong
Faculty of Education
The University of Hong Kong



Hungary

Ildiko Szepesi
Educational Authority
Department of Assessment and Evaluation

Indonesia

Ir. Nizam
Center for Educational Assessment
Ministry of National Education

Iran, Islamic Republic of

Abdol'azim Karimi
Research Institute for Education (RIE)
Ministry of Education

Ireland

Aidan Clerkin
Rachel Perkins
Educational Research Centre
St. Patrick's College, Dublin

Israel

Hadas Gelbert
Inbal Ron-Kaplan
National Authority for Measurement and
Evaluation in Education (RAMA)

Italy

Laura Palmerio
Istituto Nazionale per la Valutazione del
Sistema Educativo di Istruzione e di
Formazione (INVALSI)

Japan

Fumi Ginshima
Kenji Matsubara (through 2016)
Department for Curriculum Research
Curriculum Research Center
National Institute for Educational Policy
Research (NIER)

Jordan

Khattab M. A. Abulibdeh
National Center for Human Resources
Development

Kazakhstan

Algerim Kopeyeva
Zhanara Zhumabayeva (2016)
Ministry of Education and Science JSC
Information-Analytic Center
Zhanat Bazarbekova (through 2016)
National Center for Assessment of the
Quality of Education

Korea, Republic of

Kyongah Sang
Center for Global Education, Korea
Institute for Curriculum & Evaluation
Soojin Kim (through 2015)
Korea Institute for Curriculum &
Evaluation

Kuwait

Noor Al-Saadoon
Aalla'a A. Al-Shaheen (through 2014)
National Centre for Education
Development

Lebanon

Nada Owejjane
Leila Maliha Fayad (through 2015)
Educational Center for Research and
Development
Ministry of Education

Lithuania

Mindaugas Stundza
Irina Mackeviciene
Olga Kostina (through 2015)
National Examination Centre
Ministry of Education and Science

Malaysia

Azlina Osman
Dato' Sulaiman Wak
Azian T.S. Abdullah (through 2016)
Educational Planning and Research
Division
Ministry of Education

Malta

Gaetano Bugeja
Frank Fabri (through 2015)
Research and Development Department
Ministry of Education and Employment

Morocco

Mohammed Sassi
Departement de l'Education Nationale
Centre Nationale de l'Evaluation et des
Examens

Netherlands

Martina Meelissen
Marjolein Drent (through 2014)
Department of Educational Organization
and Management
Faculty of Behavioral Sciences
University of Twente

New Zealand

Robyn Caygill
Comparative Education Research Unit
Ministry of Education

Northern Ireland

Bethan Burge
National Foundation for Educational
Research

Norway

Ole Kristian Bergem
Department of Teacher Education and
School Research
ILS, University of Oslo

Oman

Zuwaina Saleh Al-Maskari
Ministry of Education

Poland

Krzysztof Konarzewski
Polish Academy of Sciences

Portugal

João Maroco
Instituto de Avaliação Educativa, I. P.

Qatar

Asma Yousef Alharqan
Supreme Education Council
Evaluation Institute

Russian Federation

Galina Kovaleva
Center for Evaluating the Quality of
Education
Federal Institute of the Strategy of
Education Development of the Russian
Academy of Education
Ministry of Education and Science

Saudi Arabia

Mohammed Majre Al-Sobeiy
Ministry of Education
General Directorate of Evaluation

Serbia

Milica Marusi
Institute for Educational Research

Singapore

Hui Leng Ng
Chew Leng Poon
Planning Division, Research and
Evaluation Section
Ministry of Education

Slovak Republic

Andrea Galadova
National Institute for Certified
Educational Measurements

Slovenia

Barbara Japelj Pavesic
Educational Research Institute

South Africa

Vijay Reddy
Human Sciences Research Council
(HSRC)

Spain

Francisco Javier Garcia Crespo
Ministerio de Educación, Cultura y
Deporte
Instituto Nacional de Evaluación Educativa

Sweden

Maria Axelsson
Swedish National Agency for Education

Thailand

Precharn Dechsri (through 2015)
Praweena Tira
The Institute for the Promotion of
Teaching Science and Technology

Turkey

Muhsin Polat
Mehmet Emin Gunaydin (through 2015)
Osman Celik (through 2014)
The General Directorate of Measurement,
Evaluation and Examination Services
The Ministry of National Education

United Arab Emirates

Moza Rashid Ghufli
Nada Abu Baker Husain Ruban (through
2015)
Assessment Department

Ministry of Education

United States

Stephen Provasnik
National Center for Education Statistics
U.S. Department of Education

Benchmarking Participants

Buenos Aires, Argentina

Tamara Vinacur
Ines Cruzalegui (2015)
Ignacio Frea (2015)
Silvia Beatriz Montoya (through 2015)
Ministry of Education, Government of the
City of Buenos Aires

Ontario, Canada

Richard Jones
Education Quality and Accountability
Office

Quebec, Canada

Joanne Latourelle
Sanction des études, Ministère de
l'Éducation, et de l'Enseignement
Supérieur

Abu Dhabi, United Arab Emirates

Shaikha Ali Al Zaabi
Abu Dhabi Education Council

Dubai, United Arab Emirates

Mariam Al Ali
Rabaa Al Sumalti
Knowledge and Human Development
Authority

Florida, United States

Stephen Provasnik
National Center for Education Statistics
U.S. Department of Education

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