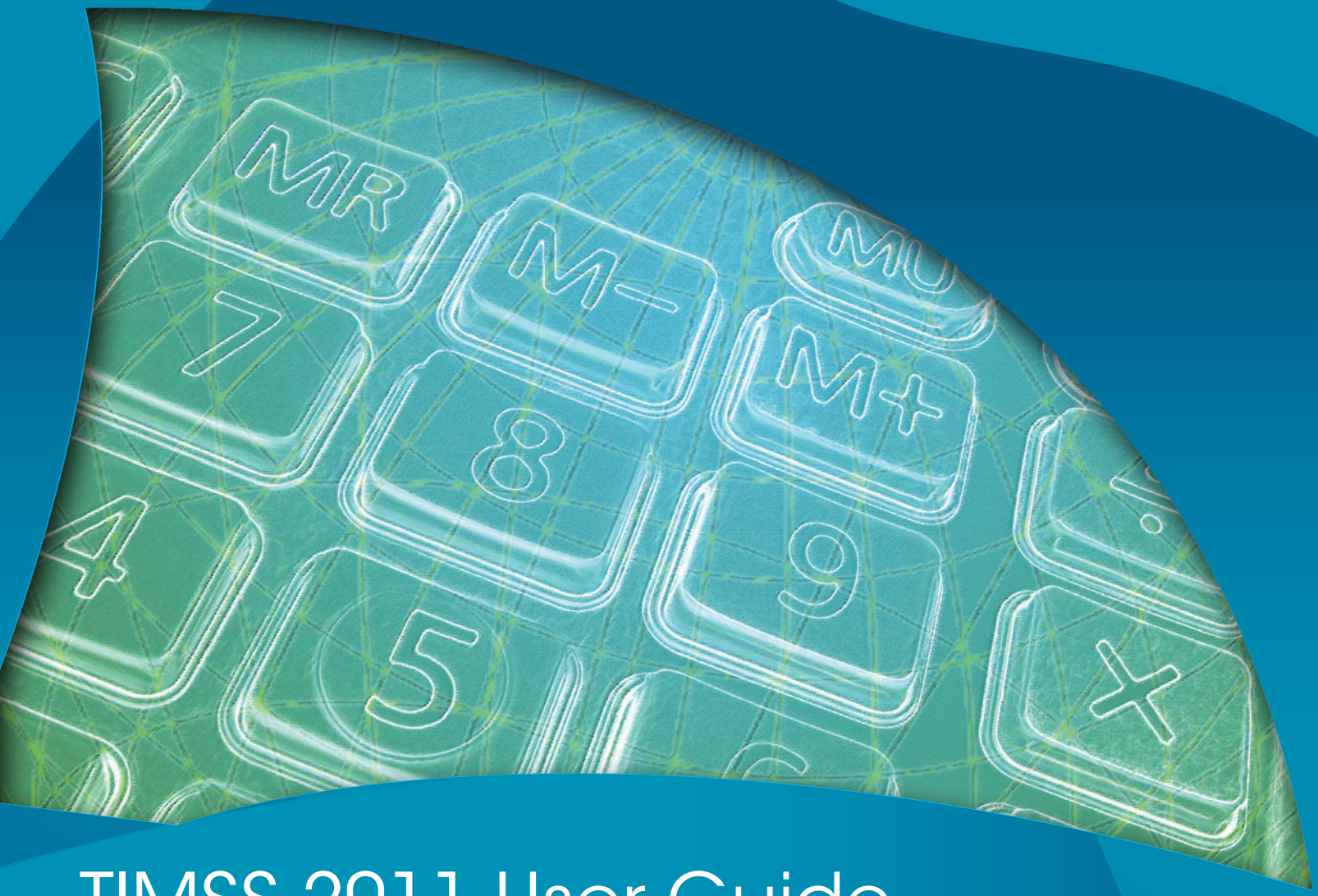
TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

TIMSS

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



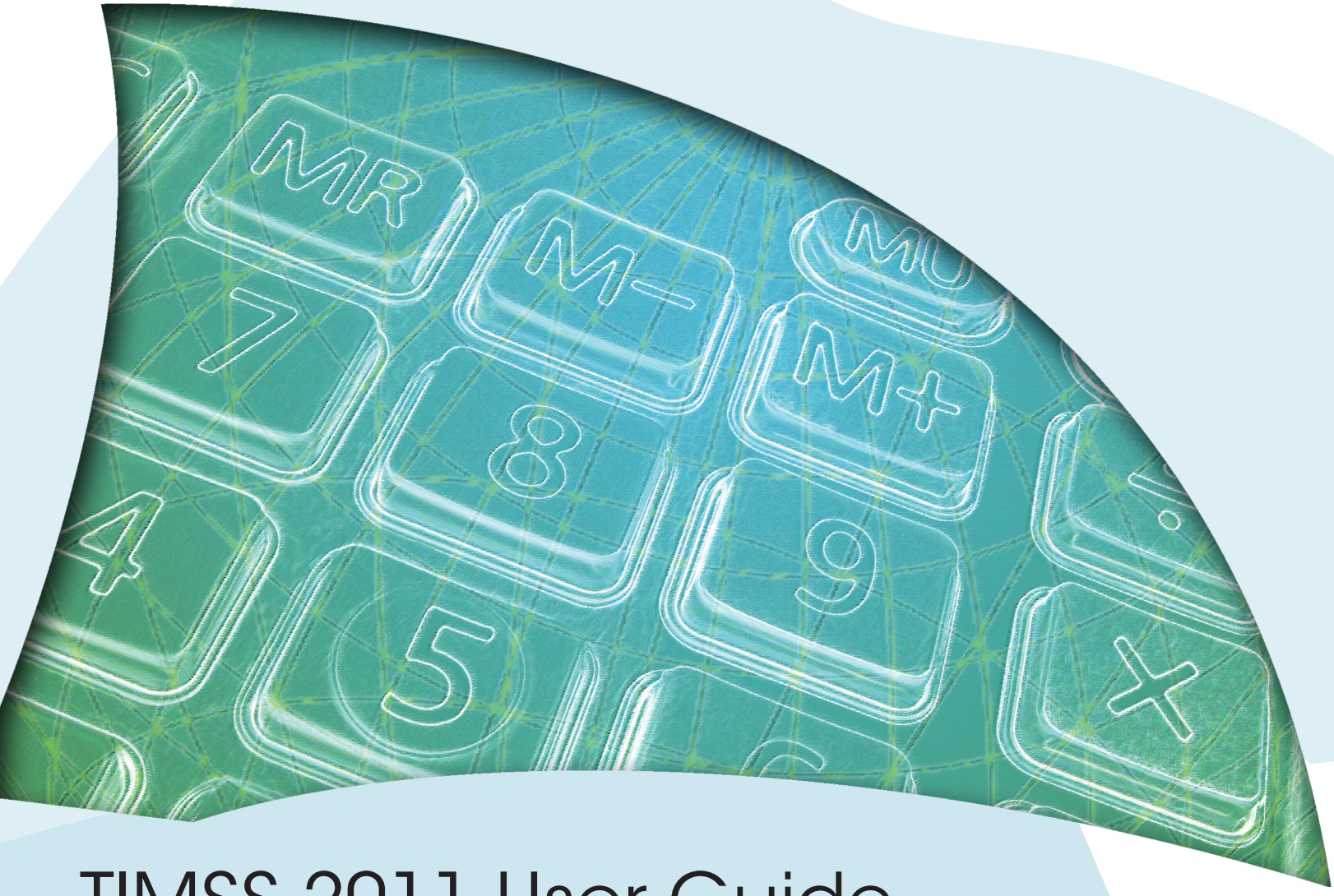
TIMSS 2011 User Guide for the International Database

Edited by: Pierre Foy, Alka Arora, and Gabrielle M. Stanco

TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

TIMSS

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



TIMSS 2011 User Guide for the International Database

Edited by: Pierre Foy, Alka Arora, and Gabrielle M. Stanco

TIMSS 2011 User Guide for the International Database
Edited by Pierre Foy, Alka Arora, and Gabrielle M. Stanco

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

Library of Congress Catalog Card Number: 2013930046
ISBN-13: 978-1-889938-13-4

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

Printed and bound in the United States.

Contents

Chapter 1

Introduction 1

Chapter 2

Using the IEA IDB Analyzer to Analyze the TIMSS 2011 International Database 5

Chapter 3

Using SAS to Analyze the TIMSS 2011 International Database 39

Chapter 4

The TIMSS 2011 International Database Files 77

Appendix

Organizations and Individuals Responsible for TIMSS 2011 105

Chapter 1

Introduction

1.1 Overview of the TIMSS 2011 User Guide and International Database

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.[1] Conducted on a regular 4-year cycle, TIMSS has assessed mathematics and science in 1995, 1999, 2003, 2007, and 2011. TIMSS collects a rich array of background information to provide comparative perspectives on trends in mathematics and science achievement in the context of different educational systems, school organizational approaches, and instructional practices.

To support and promote secondary analyses aimed at improving mathematics and science education at the fourth and eighth grades, the TIMSS 2011 International Database makes available to researchers, analysts, and other users the data collected and processed by the TIMSS project. This database comprises student achievement data as well as student, home, teacher, school, and curricular background data for 63 countries and 14 benchmarking participants.[2] Across both grades, the database includes data from 608,641 students, 49,429 teachers, 19,612 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 2011 (the fifth data collection in the TIMSS cycle of studies) provides trends for up to five cycles at the eighth grade—1995, 1999, 2003, 2007, and 2011—and data over four points in time at the fourth grade—1995, 2003, 2007, and 2011. In countries new to the study, the 2011 results can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of their mathematics and science programs. Details of the assessments conducted in 2011 can be found in the *TIMSS 2011 International Reports* (Mullis, Martin, Foy, & Arora, 2012; and Martin, Mullis, Foy, & Stanco, 2012).

TIMSS 2011 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 and PIRLS 2011* (Martin & Mullis, 2012). It is intended, therefore, that this User Guide be used in

---

[1] The Trends in International Mathematics and Science Study is a project of the International Association for the Evaluation of Educational Achievement (IEA); TIMSS together with PIRLS, the Progress in International Reading Literacy Study, comprise IEA's core cycle of studies.

[2] The TIMSS 2011 International Database also includes data from the PIRLS 2011 "Learning to Read" survey (a home questionnaire administered to parents) for countries that administered the TIMSS and PIRLS 2011 fourth grade assessments to the same sample of students.

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 Overview of the TIMSS 2011 User Guide and International Database

This User Guide describes the content and format of the data in the TIMSS 2011 International Database. In addition to this introduction, the User Guide includes the following three chapters:

- Chapter 2—This chapter introduces the IEA International Database (IDB) Analyzer software (IEA, 2012) and presents examples of analyses with the TIMSS 2011 data using this software in conjunction with SPSS (IBM Corporation, 2012).
- Chapter 3—This chapter presents examples of analyses with the PIRLS 2011 data using the SAS statistical software system (SAS Institute, 2011) and the SAS programs and macros included with the database.
- Chapter 4—This chapter describes the structure and content of the database.

The User Guide is accompanied by the following four supplements:

- Supplement 1—This supplement comprises the international version of all TIMSS 2011 background questionnaires.
- Supplement 2—This supplement describes any adaptations to the questions in the background questionnaires made by individual TIMSS participants.
- Supplement 3—This supplement describes how derived variables were constructed for reporting the TIMSS data.
- Supplement 4—This supplement describes the sampling stratification variables for each country.

The User Guide and its four supplements are available on the TIMSS 2011 International Database and User Guide webpage: *http://timssandpirls.bc.edu/timss2011/international-database.html.*

1.3 Contents of the TIMSS 2011 International Database

The entire TIMSS 2011 International Database is available on the TIMSS 2011 International Database and User Guide webpage: *http://timssandpirls.bc.edu/timss2011/international-database.html.* The Database contains the TIMSS 2011 student achievement data files and student, home, teacher, and school background 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 International Database and User Guide webpage.

The TIMSS 2011 International Database also is available for download at the IEA Study Data Repository website: *http://rms.iea-dpc.org/*. The repository allows users to download subsets of files and the corresponding support material through customizable queries from all recent IEA studies, including TIMSS 2011.

Exhibit 1.1: Contents of the TIMSS 2011 International Database

User Guide	This User Guide with its four supplements	
Items	The TIMSS 2011 released items, item information files, and IRT item parameters	
International Database	**SPSS Data**	TIMSS 2011 student, home, teacher, and school data files in SPSS format
	SAS Data	TIMSS 2011 student, home, teacher, and school data files in SAS format
	Curriculum Data	TIMSS 2011 curriculum questionnaires data files
	Codebooks	Codebook files describing all variables in the TIMSS 2011 International Database
	Almanacs	Data almanacs with summary statistics for all TIMSS 2011 items and background variables
	TCMA	National item selection data for the Text-Curriculum Matching Analysis (see Appendix C of the *TIMSS 2011 International Reports* for more details)
	Programs	SAS and SPSS programs and macros

References

IBM Corporation. (2012). *IBM SPSS statistics* (version 20.0). Somers, NY: Author.

International Association for the Evaluation of Educational Achievement. (2012). *International database analyzer* (version 3.0). Hamburg, Germany: IEA Data Processing and Research Center.

Martin, M.O. & Mullis, I.V.S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). *TIMSS 2011 international results in science.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

SAS Institute. (2011). *SAS system for Windows* (version 9.3). Cary, NC: Author.

Chapter 2

Using the IEA IDB Analyzer to Analyze the TIMSS 2011 International Database

2.1 Overview

This chapter describes the use of the IEA International Database (IDB) Analyzer software (IEA, 2012) for analyzing the TIMSS 2011 data. Used in conjunction with SPSS (IBM Corporation, 2012), the IEA IDB Analyzer provides a user-friendly interface to easily merge the various data file types of the TIMSS 2011 database and seamlessly takes into account the sampling information and the multiple imputed achievement scores to produce accurate statistical results.

Example analyses will illustrate the capabilities of the IEA IDB Analyzer (version 3.0) to compute a variety of statistics, including percentages of students in specified subgroups, mean student achievement in those subgroups, correlations, regression coefficients, percentages of students reaching benchmark levels, and percentiles of achievement distributions. The examples use student, teacher, and school background data to replicate some of the TIMSS 2011 results included in the *TIMSS 2011 International Reports* (Mullis, Martin, Foy, & Arora, 2012; and Martin, Mullis, Foy, & Stanco, 2012).

Users should be able to perform statistical analyses with the IEA IDB Analyzer with a basic knowledge of the TIMSS 2011 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 a plug-in for SPSS, a well-known statistical analysis program. The IEA IDB Analyzer enables users to combine SPSS data files from IEA's large-scale assessments and conduct analyses using SPSS without actually writing programming code. The IEA IDB Analyzer generates SPSS syntax that takes into account information from the sample design in the computation of statistics and their standard errors. In addition, the generated SPSS 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 (3.0) of the IEA IDB analyzer is available for download at 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 AnalyzerV3 ⇨ IEA IDBAnalyzer

2.3 Merging Files with the IEA IDB Analyzer

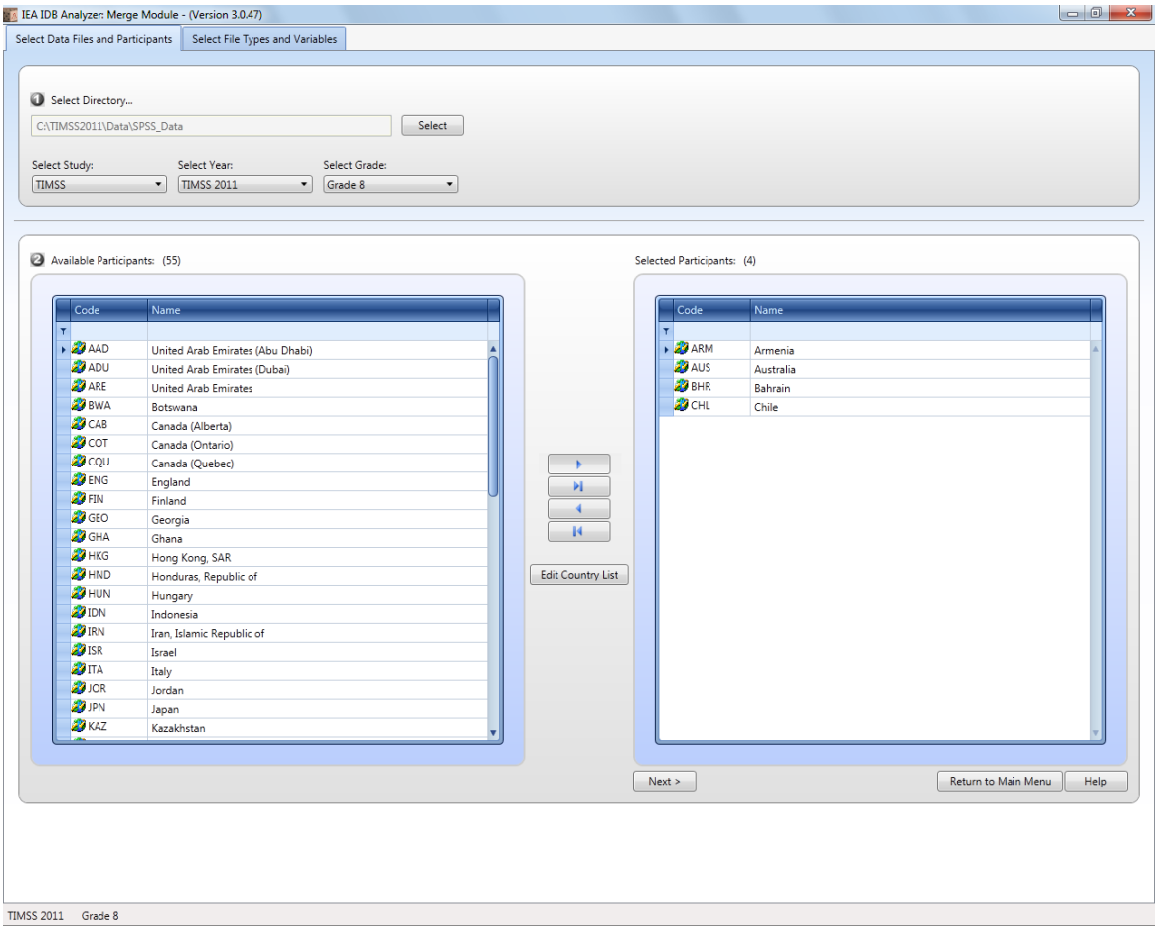
The IEA IDB Analyzer uses the SPSS data files available on the TIMSS 2011 International Database and User Guide webpage: *http://timssandpirls.bc.edu/timss2011/international-database.html*.[1] The TIMSS 2011 data files are disseminated separately by file type and for each country. In addition to allowing 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 dataset for subsequent analyses. Before conducting any statistical analyses with the TIMSS 2011 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 files have been copied to the folder titled "C:\TIMSS2011\."

The following steps will create an SPSS 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 in the **Select Directory** field, browse to the folder where all SPSS data files are located. For example, in Exhibit 2.1, all SPSS data files are located in the folder titled "C:\TIMSS2011\Data\SPSS_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 2.1, the TIMSS 2011 eighth 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 2.1, Armenia, Australia, Bahrain, and Chile are selected.

[1] The TIMSS 2011 International Database also is available for download on the IEA Study Data Repository website: *http://rms.iea-dpc.org/*.

Exhibit 2.1: IEA IDB Analyzer Merge Module—Select Data Files and Participants

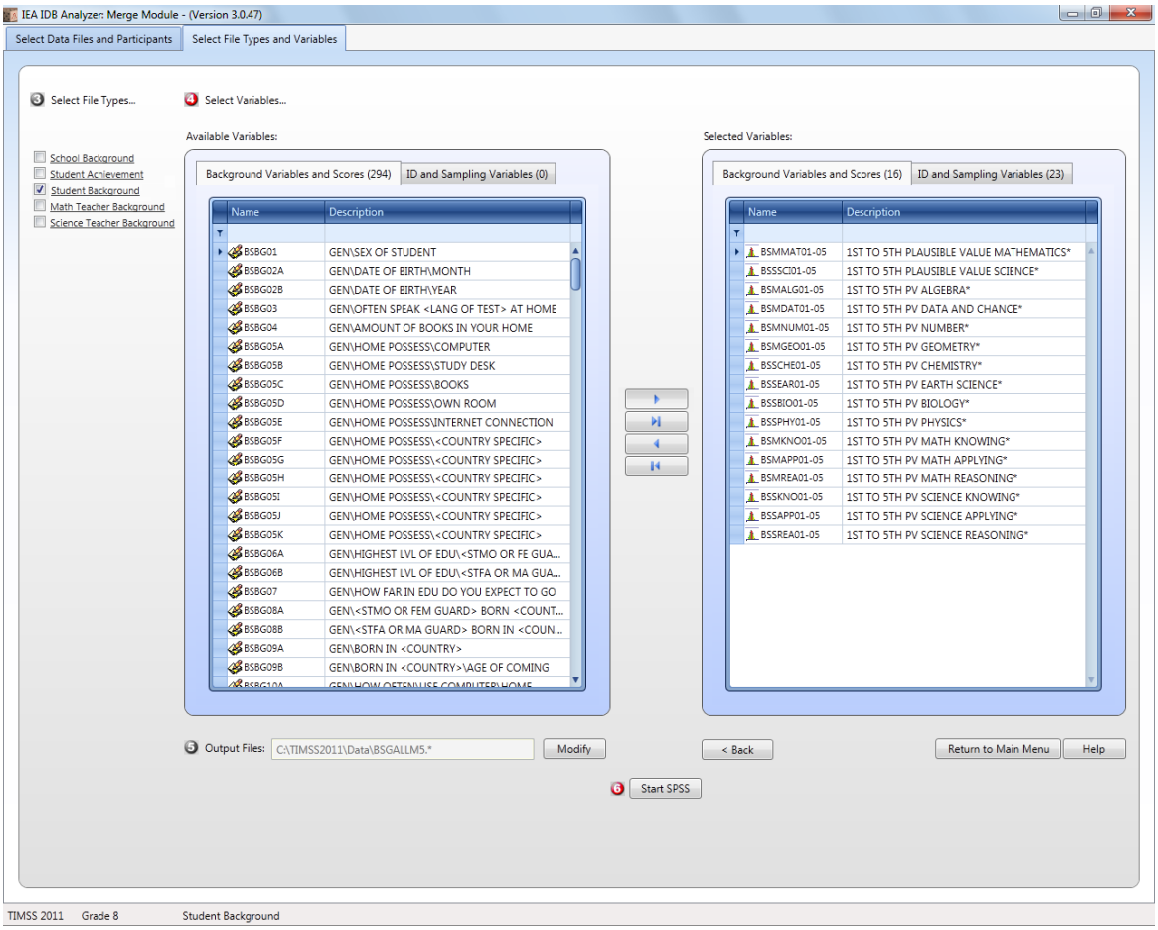


4. Click the **Next >** button to proceed to the next step in the **Select File Types and Variables** tab. The software will open the second tab of the merge module, as shown in Exhibit 2.2, to select the file types and the variables to be included in the merged data file.

5. Select the files for merging by checking the appropriate boxes to the left of the window. For example, in Exhibit 2.2, the student background data files are selected.

6. Select the variables of interest from the **Available Variables** list in the left panel. Note that Supplement 1 provides the variable names for all questions in the background 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 File Types and Variables



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 an SPSS syntax file (*.SPS) of the same name and in the same folder with the code necessary to perform the merge. In the example shown in Exhibit 2.2, the merged file BSGALLM5.SAV and the syntax file BSGALLM5.SPS both will be created and stored in the folder titled "C:\TIMSS2011\Data." The merged data file will contain all the variables listed in the **Selected Variables** panel to the right.
8. Click the **Start SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window ready for execution. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** menu option. The IEA IDB Analyzer will display a warning if it is about to overwrite an existing file in the specified folder.

Once SPSS has completed its execution, it is important to check the SPSS output window 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.

Merging Student and Teacher Data Files

The teachers in the TIMSS 2011 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 types 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 of the IEA IDB Analyzer merge module. The variables of interest need to be selected separately for both file types, as follows:

1. Click the **Teacher Background** file type (Math or Science at the eighth grade) so that it appears checked and highlighted. The **Background Variables and Scores** listed in the left panel will include all available variables from the teacher 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. If necessary, click the **Student Background** file type and 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 SPSS** button to create the SPSS syntax file that will produce the required merged data file, which can then be run by opening the **Run** menu of SPSS and selecting the **All** menu option.

Merging Student and School Data Files

Because TIMSS 2011 has 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 estimates. 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.

Merged Data Files for the Examples

To conduct the analysis examples presented in this chapter, the following merged data files should be created with all available background variables and achievement scores selected:

BSGALLM5.SAV—Merged eighth grade student background data files for all countries.

BTMALLM5.SAV—Merged eighth grade mathematics teacher background data files for all countries.

BCGALLM5.SAV—Merged eighth grade school and student background data files for all countries.

2.4 Performing Analyses with the IEA IDB Analyzer

The analysis module of 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 variables by subgroups defined by grouping variable(s).

Percentages Only

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

Regression

Compute 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.

Correlations

Compute means, standard deviations, and correlation coefficients for selected variables by subgroups defined by grouping variable(s).

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 achievement scores, by subgroups defined by the grouping variable(s).

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.[2] Percentages, means, regressions, and correlations 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. The list must consist of at least one grouping variable. By default, the IEA IDB Analyzer includes the variable IDCNTRY used to distinguish the participating countries. Additional variables 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 or percentages are to be computed. More than one analysis variable can be selected. To compute means for 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.

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 percentages and means. 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 regression analysis. More than one independent variable can be selected. Achievement scores also can be included as an independent variable. To specify achievement scores as the 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 regression analysis is specified. Only one dependent variable can be listed and can be either a background variable or the set of five scores associated with an achievement scale. To use achievement scores as the dependent variable, it is

[2] See *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012).

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.

Weight Variable

This is the sampling weight variable that will be used in the analysis. The IEA IDB Analyzer automatically selects the appropriate weight variable for analysis based on the file types included in the merged data file. Generally, this will be TOTWGT, but SENWGT and HOUWGT also are available for student-level analyses with student or school data. MATWGT will be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data. Chapter 4 provides more information on the TIMSS sampling weights.

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. 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.

Percentiles

These are the percentiles that will be calculated from the distribution of the achievement scores selected in the **Plausible Values** section. Multiple percentiles can be specified, each separated by a blank space. 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.

2.5 TIMSS Analyses with Student-level Data

Many analyses of the TIMSS 2011 International Database can be undertaken using only student-level data. This section presents examples of actual analyses used to produce exhibits from *TIMSS 2011 International Results in Mathematics*. Examples of 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 regression. A fourth example computes the percentages of students reaching the TIMSS International Benchmarks. Finally, a fifth example computes the average scale score for one of the newly developed contextual scales, along with the percentages of students, with their average achievement, for the categories of the scale's corresponding index.

Student-level 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 1.2 of *TIMSS 2011 International Results in Mathematics* and are repeated here in Exhibit 2.3. Because the results in this exhibit are based on plausible values, we must ensure that 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 mathematics achievement based on plausible values and their respective standard errors. After creating the merged data file BSGALLM5, 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 BSGALLM5 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.**
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 and activate them by clicking the **Plausible Values** field. Select BSMMAT01–05 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 selected automatically 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.3: Exhibit of Example Student-level Analysis with Achievement, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 1.2)

Exhibit 1.2: Distribution of Mathematics Achievement

TIMSS 2011 Mathematics 8th Grade

Country	Average Scale Score	Mathematics Achievement Distribution
Korea, Rep. of	613 (2.9) ▲	
2 Singapore	611 (3.8) ▲	
Chinese Taipei	609 (3.2) ▲	
Hong Kong SAR	586 (3.8) ▲	
Japan	570 (2.6) ▲	
2 Russian Federation	539 (3.6) ▲	
3 Israel	516 (4.1) ▲	
Finland	514 (2.5) ▲	
2 United States	509 (2.6) ▲	
‡ England	507 (5.5)	
Hungary	505 (3.5)	
Australia	505 (5.1)	
Slovenia	505 (2.2) ▲	
1 Lithuania	502 (2.5)	
TIMSS Scale Centerpoint	500	
Italy	498 (2.4)	
New Zealand	488 (5.5) ▼	
Kazakhstan	487 (4.0) ▼	
Sweden	484 (1.9) ▼	
Ukraine	479 (3.9) ▼	
Norway	475 (2.4) ▼	
Armenia	467 (2.7) ▼	
Romania	458 (4.0) ▼	
United Arab Emirates	456 (2.1) ▼	
Turkey	452 (3.9) ▼	
Lebanon	449 (3.7) ▼	
Malaysia	440 (5.4) ▼	
1 Georgia	431 (3.8) ▼	
Thailand	427 (4.3) ▼	
Ψ Macedonia, Rep. of	426 (5.2) ▼	
Tunisia	425 (2.8) ▼	
Chile	416 (2.6) ▼	
Ψ Iran, Islamic Rep. of	415 (4.3) ▼	
Ψ Qatar	410 (3.1) ▼	
Ψ Bahrain	409 (2.0) ▼	
Ψ Jordan	406 (3.7) ▼	
Ψ Palestinian Nat'l Auth.	404 (3.5) ▼	
Ψ Saudi Arabia	394 (4.6) ▼	
Ψ Indonesia	386 (4.3) ▼	
Ψ Syrian Arab Republic	380 (4.5) ▼	
⁂ Morocco	371 (2.0) ▼	
Ψ Oman	366 (2.8) ▼	
⁂ Ghana	331 (4.3) ▼	

100 200 300 400 500 600 700 800

Country	Average Scale Score	Mathematics Achievement Distribution
Ninth Grade Participants		
Ψ Botswana	397 (2.5) ▼	
⁂ South Africa	352 (2.5) ▼	
2 ⁂ Honduras	338 (3.7) ▼	
Benchmarking Participants		
1 2 Massachusetts, US	561 (5.3) ▲	
1 Minnesota, US	545 (4.6) ▲	
1 3 North Carolina, US	537 (6.8) ▲	
Quebec, Canada	532 (2.3) ▲	
1 2 Indiana, US	522 (5.1) ▲	
1 Colorado, US	518 (4.9) ▲	
1 2 Connecticut, US	518 (4.8) ▲	
1 2 Florida, US	513 (6.4) ▲	
2 Ontario, Canada	512 (2.5) ▲	
2 Alberta, Canada	505 (2.6)	
1 2 California, US	493 (4.9)	
Dubai, UAE	478 (2.1) ▼	
1 Alabama, US	466 (5.9) ▼	
Abu Dhabi, UAE	449 (3.7) ▼	

100 200 300 400 500 600 700 800

▲ Country average significantly higher than the centerpoint of the TIMSS 8th grade scale

▼ Country average significantly lower than the centerpoint of the TIMSS 8th grade scale

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

⁂ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

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

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and ǂ.

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

Exhibit 2.4 shows the completed analysis module for this example analysis, and Exhibit 2.5 displays the results with our four example countries.

Exhibit 2.4: IEA IDB Analyzer Setup for Example Student-level Analysis with Achievement

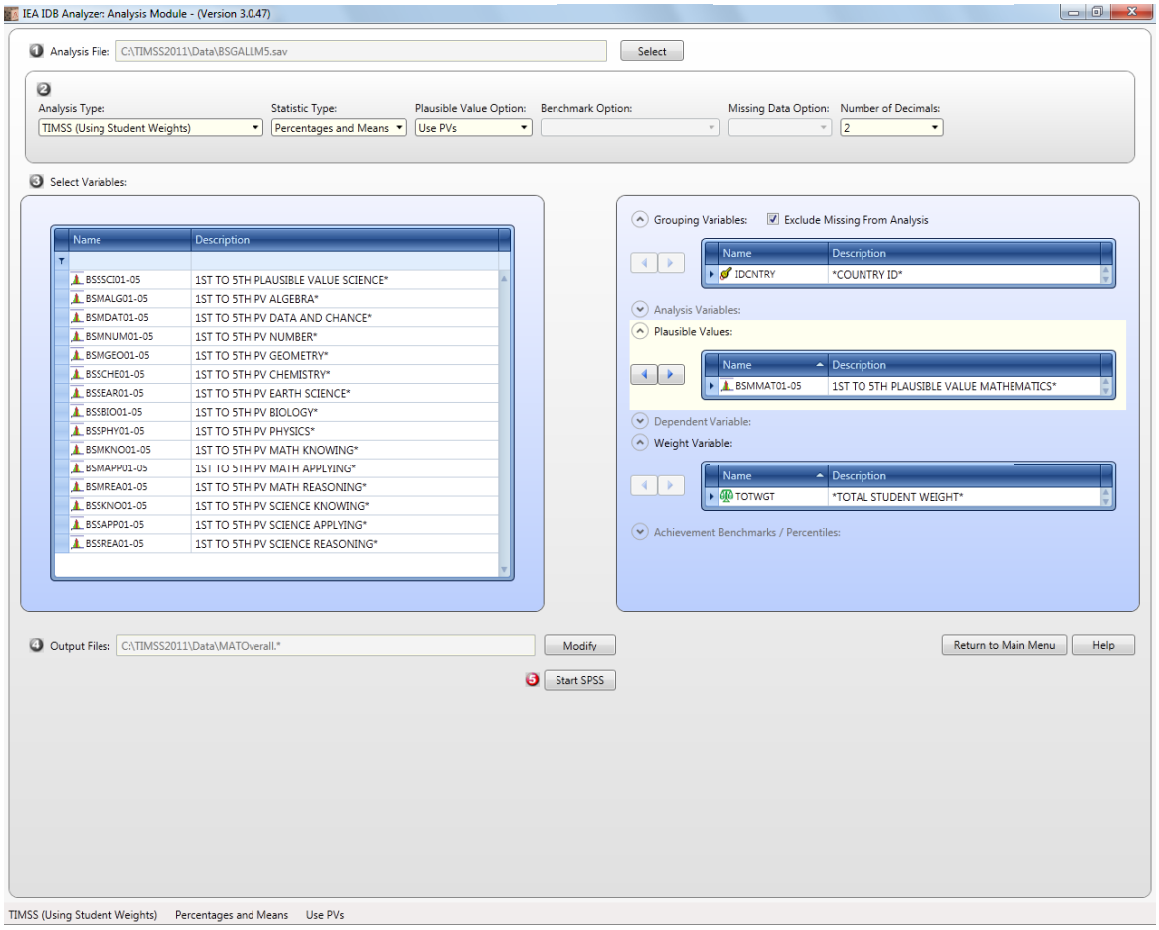


Exhibit 2.5: Output for Example Student-level Analysis with Achievement

Average for BSMMAT0 by IDCNTRY

COUNTRY ID	N of Cases	Sum of TOTWGT	Percent	Percent (s.e.)	BSMMAT0 (Mean)	BSMMAT0 (s.e.)	Std.Dev	Std.Dev. (s.e.)
Australia	7556	251985	1.18	.02	504.80	5.09	85.42	3.36
Bahrain	4640	12625	.06	.00	409.22	1.96	99.57	1.72
Armenia	5846	36181	.17	.00	466.59	2.73	90.68	1.73
Chile	5835	251180	1.18	.03	416.27	2.59	79.65	1.85

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 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 last two columns report the standard deviation of the achievement scores and its standard error.

As shown in the first line in Exhibit 2.5, Australia had valid data for 7,556 students and that these sampled students represented a population of 251,985 students. The average mathematics achievement in Australia was 504.80 (standard error of 5.09), and its standard deviation was 85.42 (standard error of 3.36).

Student-level Analysis with Achievement by Gender

In our second example, we want to replicate another set of results presented in *TIMSS 2011 International Results in Mathematics*. We are interested in investigating the relationship between eighth grade student gender and mathematics achievement. These results, presented in Exhibit 1.11 of *TIMSS 2011 International Results in Mathematics*, are repeated here in Exhibit 2.6. 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 BSGALLM5 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.**
6. Specify the variable ITSEX as a second grouping variable and activate it by clicking the **Grouping Variables** field. 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 and activate them by clicking the **Plausible Values** field. Select BSMMAT01–05 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 selected automatically 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

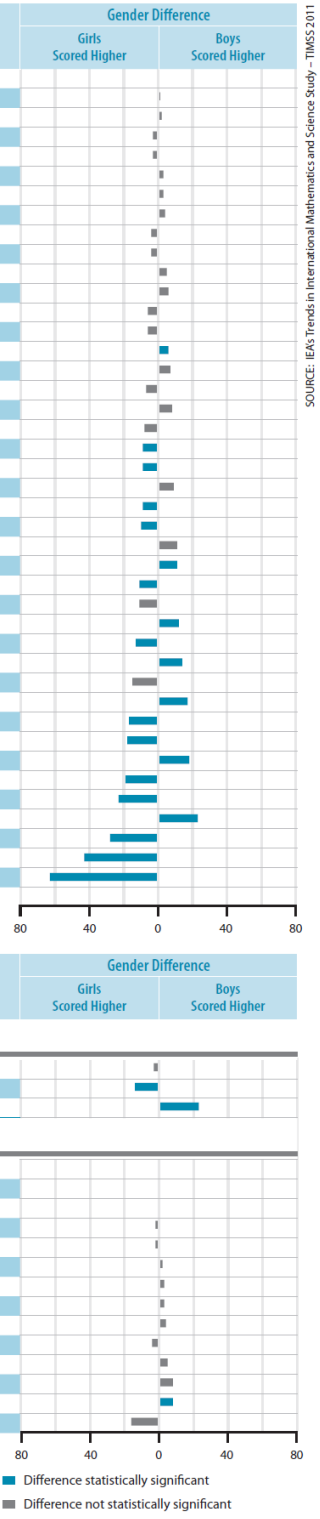
Exhibit 2.6: Exhibit of Example Student-level Analysis with Achievement by Gender, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 1.11)

Exhibit 1.11: Average Mathematics Achievement by Gender

TIMSS 2011 Mathematics 8th Grade

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
ЖMorocco	47 (0.8)	371 (2.3)	53 (0.8)	371 (2.7)	0 (3.2)		
2 Russian Federation	49 (0.9)	539 (3.8)	51 (0.9)	539 (3.9)	1 (2.9)		
Kazakhstan	49 (0.8)	486 (4.1)	51 (0.8)	488 (4.5)	2 (3.3)		
Norway	49 (0.7)	476 (2.9)	51 (0.7)	473 (2.9)	3 (3.1)		
‡ England	48 (2.0)	508 (5.7)	52 (2.0)	505 (6.6)	3 (5.6)		
1 Georgia	47 (0.9)	430 (4.1)	53 (0.9)	432 (4.4)	3 (4.0)		
Ukraine	50 (1.0)	478 (4.0)	50 (1.0)	481 (4.9)	3 (4.4)		
2 United States	51 (0.6)	508 (2.9)	49 (0.6)	511 (2.8)	4 (2.2)		
Sweden	48 (0.9)	486 (2.1)	52 (0.9)	482 (2.4)	4 (2.4)		
Finland	48 (1.1)	516 (2.7)	52 (1.1)	512 (2.7)	4 (2.3)		
Slovenia	49 (0.9)	502 (2.4)	51 (0.9)	507 (2.8)	5 (2.8)		
Hungary	49 (1.1)	502 (3.9)	51 (1.1)	508 (3.9)	6 (3.5)		
Hong Kong SAR	49 (1.6)	588 (5.0)	51 (1.6)	583 (4.3)	6 (5.5)		
Chinese Taipei	48 (1.0)	613 (3.7)	52 (1.0)	606 (3.8)	6 (4.1)		
Korea, Rep. of	52 (2.5)	610 (3.5)	48 (2.5)	616 (3.1)	6 (3.1)		
Ψ Iran, Islamic Rep. of	46 (2.3)	411 (5.9)	54 (2.3)	418 (5.9)	7 (8.1)		
Ψ Macedonia, Rep. of	49 (0.9)	430 (5.8)	51 (0.9)	423 (5.6)	7 (4.7)		
Japan	49 (1.1)	566 (3.1)	51 (1.1)	574 (3.5)	8 (4.1)		
3 Israel	50 (1.6)	520 (3.9)	50 (1.6)	512 (5.2)	8 (4.4)		
2 Singapore	49 (0.7)	615 (3.7)	51 (0.7)	607 (4.5)	9 (3.5)		
Turkey	49 (0.7)	457 (3.8)	51 (0.7)	448 (4.7)	9 (3.5)		
Australia	50 (1.6)	500 (4.7)	50 (1.6)	509 (7.3)	9 (6.9)		
1 Lithuania	49 (0.7)	507 (2.6)	51 (0.7)	498 (3.2)	9 (3.0)		
Armenia	49 (0.8)	472 (3.1)	51 (0.8)	462 (3.2)	10 (3.1)		
Ψ Syrian Arab Republic	50 (1.7)	375 (5.3)	50 (1.7)	385 (5.3)	11 (5.7)		
Italy	49 (0.9)	493 (2.9)	51 (0.9)	504 (2.8)	11 (2.9)		
Romania	48 (0.9)	464 (4.6)	52 (0.9)	453 (4.2)	11 (3.6)		
Ψ Qatar	50 (3.3)	415 (5.8)	50 (3.3)	404 (5.5)	11 (9.5)		
Lebanon	55 (1.9)	444 (4.2)	45 (1.9)	456 (4.7)	12 (4.7)		
Ψ Indonesia	50 (1.2)	392 (4.9)	50 (1.2)	379 (4.5)	13 (4.0)		
Chile	53 (1.5)	409 (3.2)	47 (1.5)	424 (3.0)	14 (3.6)		
Ψ Saudi Arabia	48 (1.2)	401 (4.1)	52 (1.2)	387 (8.0)	15 (8.9)		
Tunisia	52 (0.7)	417 (3.1)	48 (0.7)	433 (3.1)	17 (2.5)		
United Arab Emirates	50 (1.7)	464 (2.7)	50 (1.7)	447 (3.1)	17 (4.2)		
Thailand	55 (1.6)	435 (4.2)	45 (1.6)	417 (5.3)	18 (4.4)		
New Zealand	47 (2.0)	478 (5.5)	53 (2.0)	496 (6.2)	18 (4.7)		
Malaysia	51 (1.2)	449 (5.2)	49 (1.2)	430 (6.2)	19 (4.4)		
Ψ Palestinian Nat'l Auth.	52 (1.7)	415 (4.2)	48 (1.7)	392 (5.6)	23 (7.0)		
ЖGhana	47 (0.8)	318 (4.8)	53 (0.8)	342 (4.3)	23 (2.9)		
Ψ Jordan	49 (1.7)	420 (4.3)	51 (1.7)	392 (5.9)	28 (7.4)		
Ψ Bahrain	50 (0.8)	431 (2.5)	50 (0.8)	388 (3.1)	43 (4.0)		
Ψ Oman	51 (2.1)	397 (3.1)	49 (2.1)	334 (3.8)	63 (4.6)		
International Avg.	50 (0.2)	469 (0.6)	50 (0.2)	465 (0.7)			

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
Ninth Grade Participants							
ЖSouth Africa	48 (1.0)	354 (3.0)	52 (1.0)	350 (3.4)	3 (4.0)		
Ψ Botswana	51 (0.6)	403 (2.9)	49 (0.6)	390 (3.0)	14 (3.1)		
2 ЖHonduras	55 (1.0)	328 (4.1)	45 (1.0)	351 (4.1)	23 (3.5)		
Benchmarking Participants							
2 Ontario, Canada	49 (0.9)	512 (2.7)	51 (0.9)	512 (3.1)	0 (3.1)		
Quebec, Canada	51 (1.4)	531 (2.9)	49 (1.4)	532 (2.5)	0 (2.7)		
1 Minnesota, US	52 (1.5)	545 (4.9)	48 (1.5)	545 (5.1)	0 (3.9)		
1 Alabama, US	51 (1.6)	467 (6.3)	49 (1.6)	465 (6.2)	2 (3.9)		
Abu Dhabi, UAE	47 (2.7)	450 (3.9)	53 (2.7)	448 (5.7)	2 (6.4)		
2 Alberta, Canada	50 (0.9)	504 (3.3)	50 (0.9)	506 (2.7)	2 (3.0)		
1 3 North Carolina, US	52 (1.0)	535 (6.2)	48 (1.0)	539 (8.3)	3 (5.1)		
1 2 California, US	49 (1.1)	491 (5.6)	51 (1.1)	494 (5.0)	3 (4.1)		
1 Colorado, US	51 (1.5)	516 (5.4)	49 (1.5)	520 (5.0)	4 (3.4)		
1 2 Connecticut, US	49 (1.0)	520 (5.2)	51 (1.0)	516 (5.4)	4 (4.5)		
1 2 Massachusetts, US	50 (1.0)	558 (6.0)	50 (1.0)	563 (5.5)	5 (4.5)		
1 2 Florida, US	49 (1.9)	509 (6.6)	51 (1.9)	517 (7.3)	8 (5.5)		
1 2 Indiana, US	52 (1.1)	518 (5.1)	48 (1.1)	526 (5.9)	8 (4.0)		
Dubai, UAE	48 (4.6)	486 (4.3)	52 (4.6)	470 (5.4)	16 (8.9)		



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Ж Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and ‡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.7 shows the completed analysis module for this example analysis and the results are presented in Exhibit 2.8.

Exhibit 2.7: IEA IDB Analyzer Setup for Example Student-level Analysis with Achievement by Gender

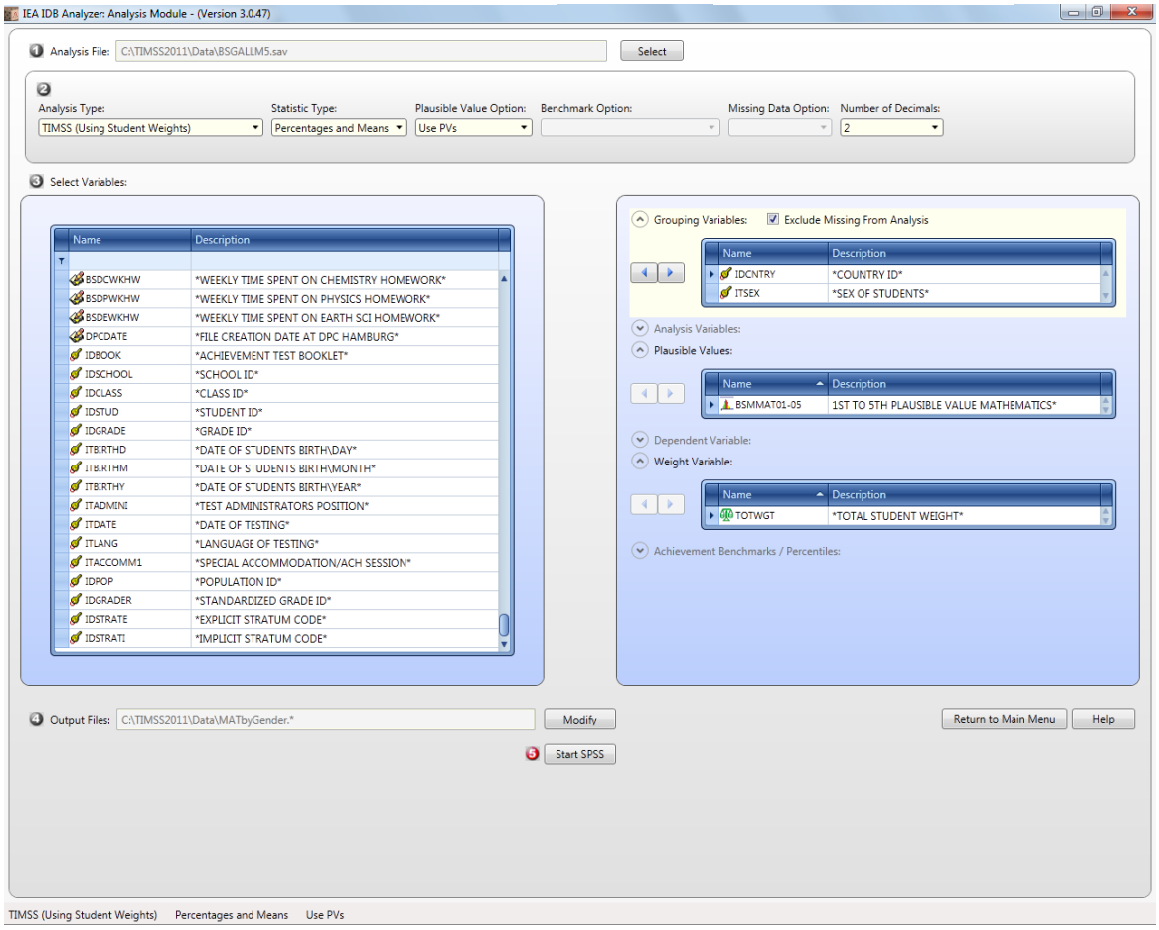


Exhibit 2.8: Output for Example Student-level Analysis with Achievement Scores by Gender

```
Average for BSMMAT0 by IDCNTRY ITSEX

*COUNTRY ID*     *SEX OF STUDENTS*   N of Cases   Sum of TOTWGT   Percent   Percent (s.e.)   BSMMAT0 (Mean)   BSMMAT0 (s.e.)   Std.Dev   Std.Dev. (s.e.)
Australia        GIRL                  3747         125555          49.83          1.61           500.41            4.72          82.72          3.59
                 BOY                   3809         126429          50.17          1.61           509.16            7.26          87.80          4.82

Bahrain          GIRL                  2288           6276          49.72           .85           430.78            2.51          87.23          1.93
                 BOY                   2352           6348          50.28           .85           387.89            3.07         106.20          2.26

Armenia          GIRL                  2894          17702          48.93           .78           471.52            3.07          87.13          1.81
                 BOY                   2952          18479          51.07           .78           461.86            3.21          93.72          2.24

Chile            GIRL                  3133         133160          53.01          1.46           409.46            3.23          79.97          2.39
                 BOY                   2702         118020          46.99          1.46           423.94            3.05          78.59          2.03
```

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. The third column reports the number of valid cases and the fourth the sum of weights

of the sampled students. 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 last two columns report the standard deviation of the achievement scores and its standard error. From the first two lines of results, 49.83 percent of students in Australia were girls, and 50.17 percent were boys. The average mathematics achievement was 500.41 for girls (standard error of 4.72) and 509.16 for boys (standard error of 7.26).

Student-level Regression Analysis

This example is an extension of the previous example (Student-level Analysis with Achievement by Gender), where we will examine the difference in mathematics achievement between girls and boys using regression and determine if it is statistically significant. The results of this example also are presented in Exhibit 1.11 of *TIMSS 2011 International Results in Mathematics* and shown in Exhibit 2.6, in the column labeled "Difference."

For this example, the values of the variable ITSEX are recoded into variable REGSEX by running the special SPSS syntax file SYNTAX_BSGALLM5.SPS shown in Exhibit 2.9 and provided in the International Database.

Exhibit 2.9: Example SPSS Program to Recode Variables for Student-level Regression Analysis

```
* Compute new variable REGSEX from ITSEX .

get file = "<datpath>\BSGALLM5.sav" .

compute REGSEX = ITSEX - 1 .

value labels
    REGSEX 0 "GIRL"
           1 "BOY" .

variable labels
    REGSEX "Recoded ITSEX (Girls = 0; Boys = 1)" .

save outfile = "<datpath>\BSGALLM5.sav" .
```

The parameter <datpath> in the SPSS syntax shown in Exhibit 2.9 needs to be edited to specify the location of the input and output data files.

REGSEX has a value of zero for girls and one for boys. By using REGSEX, the regression intercept (or constant) will be the estimated average mathematics achievement of girls, whereas the regression slope (called REGSEX in the SPSS output) will be the estimated increase in the average mathematics achievement of boys.[3] 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 BSGALLM5 as the **Analysis File** by clicking the **Select** button, after having run the SPSS syntax file SYNTAX_BSGALLM5.SPS to create the variable REGSEX.
3. Select **TIMSS (Using Student Weights)** as the **Analysis Type**.

[3] This form of variable recoding, known as "dummy coding," makes the interpretation of regression coefficients easier. It essentially transforms a regression analysis into an analysis of variance to test for differences among groups.

4. Select **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 **Non-Plausible Values** field in the **Independent Variables** section to activate it and select the variable REGSEX as the analysis variable. This is done by selecting REGSEX from the list of available variables and moving it to the **Non-Plausible Values** field by clicking the **right arrow** (▸) button in this section.
8. Click the **Plausible Values** button in the **Dependent Variable** section and click the **Plausible Values** field to activate it. Select BSMMAT01-05 as the analysis variable from the list of available variables and move it to the **Plausible Values** field by clicking the **right arrow** (▸) button in this section.
9. The **Weight Variable** is selected automatically 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file will be executed by opening the **Run** menu of SPSS and selecting the **All** 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 (CONSTANT), and the second for the REGSEX 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 "(CONSTANT)," is the estimated average mathematics achievement of eighth grade girls in Armenia, which was 471.52 with a standard error of 3.07. This estimate concurs with the results obtained in the previous example (Exhibit 2.8). The eighth grade boys in Armenia had a negative average achievement difference of -9.66. With an estimated standard error of 3.10, this achievement difference is statistically significant at the 95% confidence level. Adding the two regression coefficients together (471.52 - 9.66) yields the estimated average achievement of eighth grade boys in Armenia, which was 461.86, the same estimate from the previous example. As a note of interest, the IEA IDB Analyzer also computes standardized regression coefficients, whereby the independent variables are standardized to have a mean of zero and standard deviation of one (1).

Exhibit 2.10: IDB Analyzer Setup for Example Student-level Regression Analysis

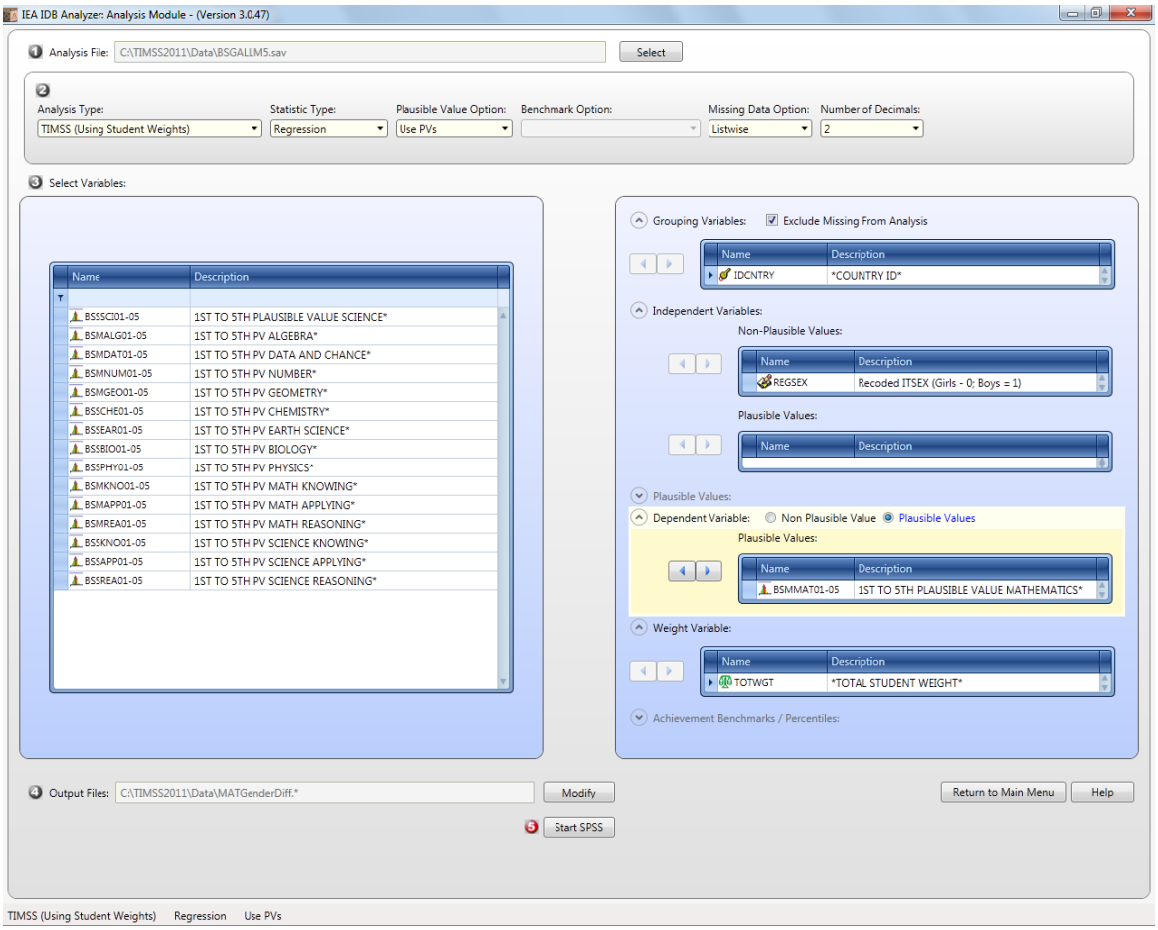


Exhibit 2.11: Output for Example Student-level Regression Analysis

Regression Coefficients

IDCNTRY	Variable	Regression Coefficient	Regression Coefficient (s.e.)	Regression Coefficient (t-value)	Stndrdzd. Coefficient	Stndrdzd. Coefficient (s.e.)	Stndrdzd. Coefficient (t-value)
Armenia	(CONSTANT)	471.52	3.07	153.75	.	.	.
	REGSEX	-9.66	3.10	-3.12	-.05	.02	-3.11
Australia	(CONSTANT)	500.41	4.72	105.93	.	.	.
	REGSEX	8.75	6.90	1.27	.05	.04	1.28
Bahrain	(CONSTANT)	430.78	2.51	171.50	.	.	.
	REGSEX	-42.89	3.99	-10.74	-.22	.02	-11.16
Chile	(CONSTANT)	409.46	3.23	126.86	.	.	.
	REGSEX	14.48	3.63	3.99	.09	.02	3.88

Percentages of Students Reaching 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 TIMSS 2011 students reaching the four TIMSS International Benchmarks of eighth grade mathematics achievement—Advanced, High, Intermediate, and Low—using the merged BSGALLM5 data file. These results, presented in Exhibit 2.19 of *TIMSS 2011 International Results*

in Mathematics, are shown here in Exhibit 2.12. 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 BSGALLM5 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 BSMMAT01–05 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 International Benchmarks—400, 475, 550, and 625 (Low, Intermediate, High, and Advanced, respectively). Enter these four values in the **Achievement Benchmarks** field, each separated by a blank space.
9. The **Weight Variable** is selected automatically 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file will be executed by opening the **Run** menu of SPSS and selecting the **All** 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.

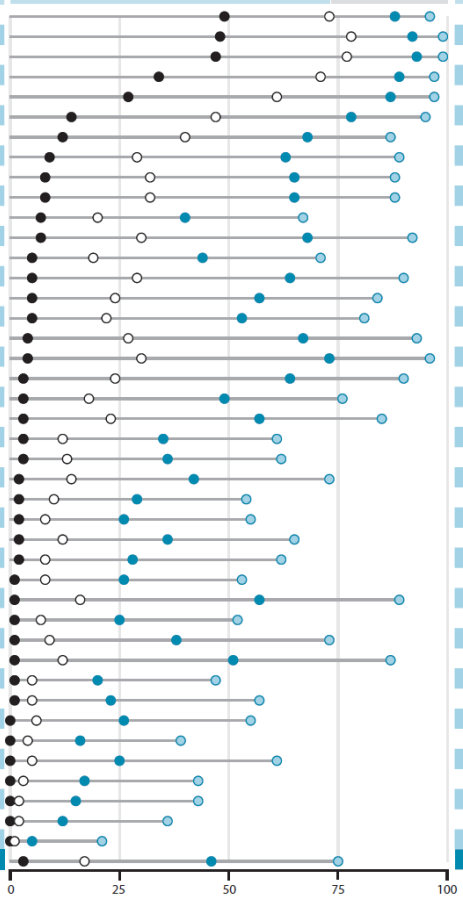
As shown in the first few lines of results, 89.17 percent of the eighth grade students in Australia performed at or above the Low International Benchmark of 400, with a standard error of 1.08; 62.94 percent reached the Intermediate International Benchmark, with a standard error of 2.40; 28.65 percent reached the High International Benchmark, with a standard error of 2.63; and 8.68 percent of the students reached the Advanced International Benchmark, with a standard error of 1.68.

Exhibit 2.12: Example Exhibit of International Benchmark Analysis, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 2.19)

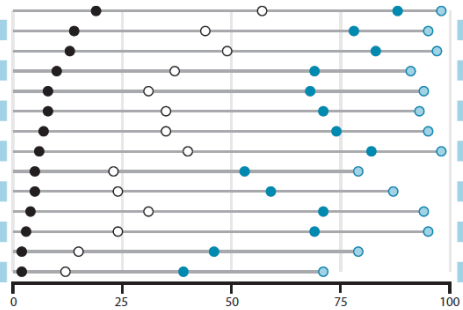
Exhibit 2.19: Performance at the International Benchmarks of Mathematics Achievement

TIMSS 2011 Mathematics 8th Grade

Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
Chinese Taipei	49 (1.5)	73 (1.0)	88 (0.7)	96 (0.4)
2 Singapore	48 (2.0)	78 (1.8)	92 (1.1)	99 (0.3)
Korea, Rep. of	47 (1.6)	77 (0.9)	93 (0.6)	99 (0.2)
Hong Kong SAR	34 (2.0)	71 (1.7)	89 (1.4)	97 (0.8)
Japan	27 (1.3)	61 (1.3)	87 (0.7)	97 (0.3)
2 Russian Federation	14 (1.2)	47 (2.0)	78 (1.4)	95 (0.7)
3 Israel	12 (1.2)	40 (1.7)	68 (1.8)	87 (1.2)
Australia	9 (1.7)	29 (2.6)	63 (2.4)	89 (1.1)
‡ England	8 (1.4)	32 (2.9)	65 (2.7)	88 (1.6)
Hungary	8 (0.7)	32 (1.4)	65 (1.6)	88 (1.2)
Turkey	7 (0.9)	20 (1.2)	40 (1.5)	67 (1.3)
2 United States	7 (0.8)	30 (1.4)	68 (1.3)	92 (0.7)
Romania	5 (0.8)	19 (1.3)	44 (1.7)	71 (1.5)
1 Lithuania	5 (0.6)	29 (1.3)	64 (1.4)	90 (0.7)
New Zealand	5 (0.8)	24 (2.6)	57 (2.8)	84 (1.6)
Ukraine	5 (0.6)	22 (1.6)	53 (2.0)	81 (1.4)
Slovenia	4 (0.4)	27 (1.2)	67 (1.4)	93 (0.7)
Finland	4 (0.5)	30 (1.5)	73 (1.5)	96 (0.6)
Italy	3 (0.5)	24 (1.1)	64 (1.4)	90 (1.1)
Armenia	3 (0.4)	18 (0.9)	49 (1.4)	76 (1.2)
Kazakhstan	3 (0.7)	23 (1.8)	57 (2.1)	85 (1.3)
Ψ Macedonia, Rep. of	3 (0.6)	12 (1.3)	35 (1.9)	61 (1.9)
1 Georgia	3 (0.3)	13 (1.0)	36 (1.5)	62 (1.6)
United Arab Emirates	2 (0.2)	14 (0.7)	42 (1.1)	73 (0.9)
Ψ Qatar	2 (0.3)	10 (0.8)	29 (1.2)	54 (1.4)
Ψ Iran, Islamic Rep. of	2 (0.5)	8 (1.1)	26 (1.6)	55 (1.8)
Malaysia	2 (0.4)	12 (1.5)	36 (2.4)	65 (2.5)
Thailand	2 (0.4)	8 (1.3)	28 (1.9)	62 (2.1)
Ψ Bahrain	1 (0.2)	8 (0.7)	26 (0.7)	53 (0.8)
Sweden	1 (0.3)	16 (0.9)	57 (1.1)	89 (0.7)
Ψ Palestinian Nat'l Auth.	1 (0.3)	7 (0.7)	25 (1.3)	52 (1.5)
Lebanon	1 (0.2)	9 (1.0)	38 (2.2)	73 (1.9)
Norway	1 (0.2)	12 (0.9)	51 (1.6)	87 (1.3)
Ψ Saudi Arabia	1 (0.2)	5 (0.8)	20 (1.7)	47 (2.0)
Chile	1 (0.2)	5 (0.6)	23 (1.1)	57 (1.6)
Ψ Jordan	0 (0.1)	6 (0.5)	26 (1.2)	55 (1.7)
Ψ Oman	0 (0.1)	4 (0.3)	16 (0.6)	39 (1.1)
Tunisia	0 (0.2)	5 (0.9)	25 (1.4)	61 (1.3)
Ψ Syrian Arab Republic	0 (0.1)	3 (0.5)	17 (1.4)	43 (1.9)
Ψ Indonesia	0 (0.1)	2 (0.5)	15 (1.2)	43 (2.1)
ж Morocco	0 (0.0)	2 (0.2)	12 (0.5)	36 (1.0)
ж Ghana	0 (0.0)	1 (0.2)	5 (0.8)	21 (1.8)
International Median	3	17	46	75



Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
Ninth Grade Participants				
ж South Africa	1 (0.1)	3 (0.4)	9 (0.7)	24 (1.0)
Ψ Botswana	0 (0.1)	2 (0.5)	15 (1.0)	50 (1.4)
2 ж Honduras	0 (0.0)	1 (0.3)	4 (0.9)	21 (1.7)
Benchmarking Participants				
1 2 Massachusetts, US	19 (3.0)	57 (3.2)	88 (1.4)	98 (0.3)
1 3 North Carolina, US	14 (2.6)	44 (3.6)	78 (2.5)	95 (1.3)
1 Minnesota, US	13 (2.3)	49 (2.8)	83 (1.9)	97 (0.7)
1 2 Connecticut, US	10 (1.3)	37 (2.9)	69 (2.5)	91 (1.4)
1 2 Florida, US	8 (1.6)	31 (3.2)	68 (3.3)	94 (1.3)
1 Colorado, US	8 (1.1)	35 (2.7)	71 (2.5)	93 (1.1)
1 2 Indiana, US	7 (1.2)	35 (3.3)	74 (2.3)	95 (1.0)
Quebec, Canada	6 (0.6)	40 (1.8)	82 (1.3)	98 (0.4)
Dubai, UAE	5 (0.7)	23 (1.2)	53 (1.0)	79 (0.8)
1 2 California, US	5 (0.9)	24 (2.5)	59 (2.8)	87 (1.7)
2 Ontario, Canada	4 (0.6)	31 (1.4)	71 (1.4)	94 (0.7)
2 Alberta, Canada	3 (0.5)	24 (1.3)	69 (1.6)	95 (0.7)
1 Alabama, US	2 (0.8)	15 (2.5)	46 (3.1)	79 (2.2)
Abu Dhabi, UAE	2 (0.5)	12 (1.2)	39 (1.8)	71 (1.5)



ж Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation is less than 25% but exceeds 15%.
See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and ‡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.13: IDB Analyzer Setup for Example International Benchmark Analysis

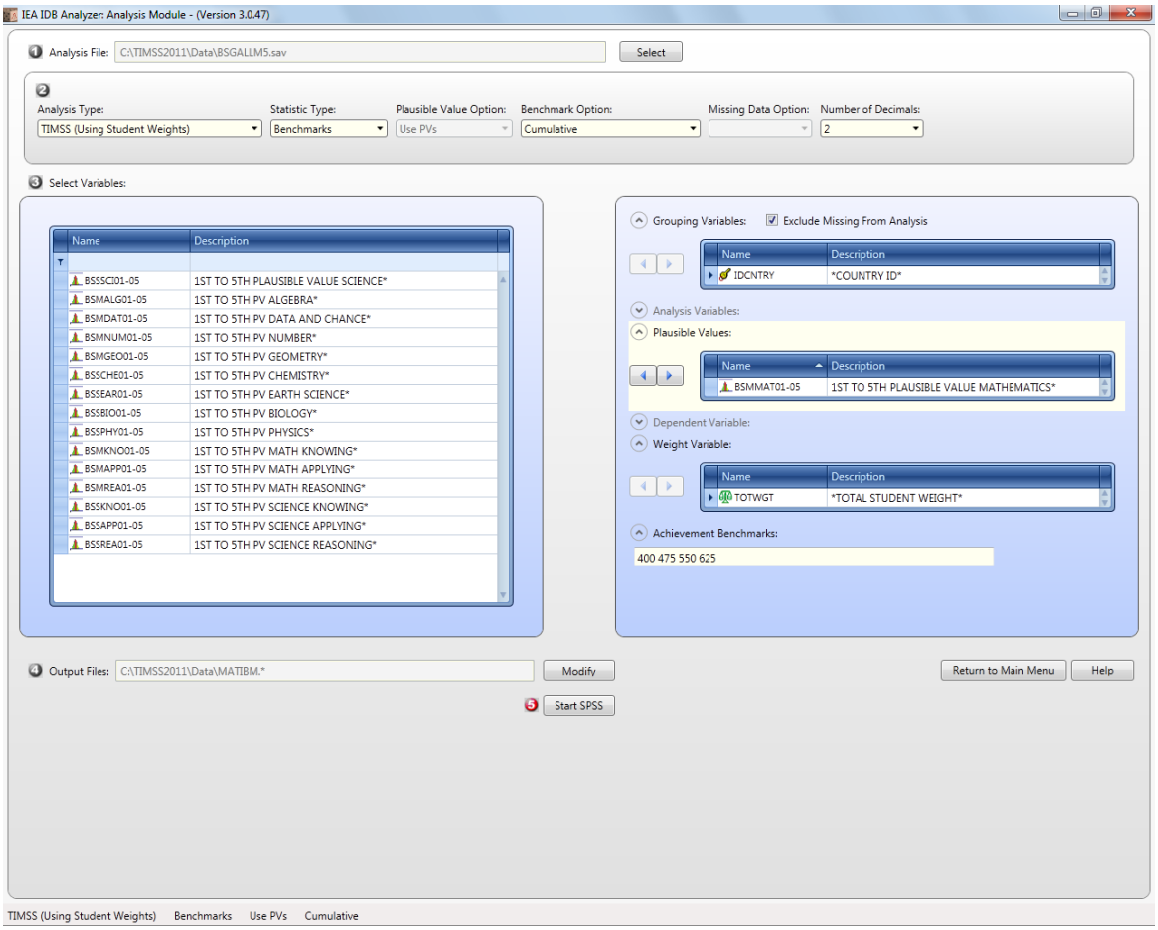


Exhibit 2.14: Output for Example International Benchmark Analysis

Percent reaching benchmarks (400 475 550 625) of BSMMAT0

COUNTRY ID	Performance Group	N of Cases	Sum of TOTWGT	Percent	Percent (s.e.)
Australia	At or Above 400	6540	224703	89.17	1.08
	At or Above 475	4479	158602	62.94	2.40
	At or Above 550	1980	72193	28.65	2.63
	At or Above 625	525	21868	8.68	1.68
Bahrain	At or Above 400	2603	6753	53.49	.79
	At or Above 475	1314	3307	26.19	.65
	At or Above 550	415	1007	7.97	.68
	At or Above 625	85	160	1.26	.25
Armenia	At or Above 400	4588	27636	76.38	1.16
	At or Above 475	2994	17735	49.02	1.37
	At or Above 550	1123	6386	17.65	.88
	At or Above 625	221	1167	3.23	.40
Chile	At or Above 400	3654	142826	56.86	1.57
	At or Above 475	1772	57652	22.95	1.11
	At or Above 550	541	13437	5.35	.62
	At or Above 625	66	1399	.56	.16

Student-level Analysis with a Contextual Scale

TIMSS 2011 has innovated in its reporting of contextual data by creating contextual scales based on Rasch modeling.[4] A number of contextual scales were reported in the *TIMSS 2011 International Reports* and are available in the International Database for analysis. Each contextual scale variable is a Rasch score with an international mean of 10 and an international standard deviation of 2. An index was derived from each scale that divides the range of scores into usually three categories: the most desirable scores (high values), the least desirable scores (low values), and the remaining scores in between.

These contextual scales and their corresponding indices were reported in the *TIMSS 2011 International Reports*. Exhibit 2.15 shows one such example, Exhibit 8.2 from *TIMSS 2011 International Results in Mathematics*, reporting how much students like learning mathematics. 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 students in each category—Like Learning Mathematics, Somewhat Like Learning Mathematics, and Do Not Like Learning Mathematics—along with the average achievement in each category.The Rasch scores for this contextual scale are contained in the BSBGSLM variable; the corresponding index is found in the BSDGSLM variable.

This example will replicate both the average scale score of the Students Like Learning Mathematics contextual scale and the percentages of students, with their average mathematics achievement, in each category of its index. This will be done in two steps, both using the merged BSGALLM5 data file.

The first step will compute the average scale score using the contextual scale variable BSBGSLM. 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 BSGALLM5 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 BSBGSLM as the analysis variable and activate it by clicking the **Analysis Variables** field. Select BSBGSLM 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 selected automatically 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.

[4] The contextual scales are described in the context questionnaire scales section of *Methods and Procedures in TIMSS and PIRLS 2011*.

Exhibit 2.15: Example Exhibit of a Contextual Scale, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 8.2)

Exhibit 8.2: Students Like Learning Mathematics

TIMSS 2011 Mathematics 8th Grade

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Students Like Learning Mathematics* scale. Students who **Like Learning Mathematics** had a score on the scale of at least 11.3, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who **Do Not Like Learning Mathematics** had a score no higher than 9.0, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students **Somewhat Like Learning Mathematics.**

Country	Like Learning Mathematics		Somewhat Like Learning Mathematics		Do Not Like Learning Mathematics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	48 (0.7)	398 (2.4)	40 (0.7)	353 (2.2)	12 (0.5)	340 (4.6)	11.2 (0.03)
Armenia	43 (1.0)	499 (3.1)	39 (0.8)	451 (3.4)	18 (1.0)	437 (4.8)	10.9 (0.05)
Jordan	42 (1.5)	442 (3.7)	39 (1.0)	388 (4.2)	19 (0.9)	376 (4.8)	10.9 (0.06)
Georgia	42 (1.3)	463 (5.0)	40 (1.0)	423 (4.1)	18 (1.0)	405 (6.2)	10.8 (0.06)
Malaysia	39 (1.3)	463 (5.0)	46 (0.9)	430 (5.6)	15 (0.9)	413 (8.1)	10.8 (0.05)
Iran, Islamic Rep. of	39 (1.1)	450 (5.4)	40 (0.8)	396 (4.2)	22 (0.9)	388 (4.5)	10.6 (0.05)
Ghana	38 (1.4)	370 (4.8)	51 (1.2)	314 (4.0)	10 (0.5)	299 (6.7)	10.9 (0.05)
Oman	38 (0.8)	420 (3.0)	45 (0.8)	342 (3.6)	17 (0.7)	324 (4.4)	10.8 (0.04)
Kazakhstan	38 (1.5)	506 (4.4)	52 (1.3)	478 (4.4)	10 (0.7)	475 (7.4)	10.9 (0.05)
Tunisia	38 (1.0)	448 (3.4)	40 (0.8)	415 (3.2)	23 (0.9)	405 (3.3)	10.6 (0.05)
Syrian Arab Republic	37 (1.1)	408 (5.2)	44 (1.0)	373 (4.8)	19 (0.9)	353 (6.3)	10.7 (0.05)
Ukraine	36 (1.7)	502 (4.9)	43 (1.2)	477 (4.1)	20 (1.2)	450 (4.9)	10.6 (0.07)
Lebanon	35 (1.2)	475 (4.6)	43 (1.0)	441 (4.2)	21 (1.1)	425 (5.6)	10.6 (0.06)
Singapore	32 (0.7)	637 (3.9)	44 (0.7)	610 (4.1)	23 (0.7)	578 (4.4)	10.4 (0.03)
Turkey	31 (1.0)	504 (6.0)	42 (0.7)	436 (3.9)	26 (1.0)	420 (3.5)	10.3 (0.05)
United Arab Emirates	31 (0.7)	488 (2.3)	42 (0.6)	448 (2.5)	27 (0.8)	432 (2.5)	10.2 (0.04)
Palestinian Nat'l Auth.	31 (1.1)	447 (5.0)	43 (1.0)	394 (4.1)	26 (1.1)	375 (5.1)	10.3 (0.05)
Russian Federation	29 (1.1)	567 (4.7)	49 (0.9)	537 (3.6)	22 (1.0)	509 (4.1)	10.3 (0.04)
Saudi Arabia	29 (1.3)	436 (5.6)	40 (1.0)	389 (5.4)	32 (1.4)	364 (4.1)	10.1 (0.07)
Qatar	27 (1.0)	456 (4.5)	43 (0.8)	401 (3.7)	31 (1.2)	386 (4.8)	10.0 (0.05)
Thailand	26 (1.1)	456 (5.6)	57 (0.9)	420 (4.5)	16 (1.0)	408 (5.1)	10.3 (0.05)
Israel	26 (0.8)	536 (5.1)	40 (0.7)	523 (4.3)	35 (1.0)	496 (5.1)	9.9 (0.04)
Macedonia, Rep. of	24 (1.0)	462 (6.2)	40 (1.0)	422 (6.3)	36 (1.4)	425 (6.0)	9.8 (0.06)
Bahrain	24 (0.6)	454 (4.6)	38 (0.9)	413 (2.7)	38 (0.8)	381 (3.4)	9.8 (0.03)
Lithuania	22 (1.0)	531 (3.7)	44 (1.0)	506 (2.7)	34 (1.1)	482 (3.3)	9.8 (0.05)
Chile	22 (0.9)	449 (3.5)	40 (0.9)	416 (2.9)	38 (1.0)	398 (2.9)	9.8 (0.04)
Indonesia	20 (1.4)	396 (6.1)	70 (1.2)	385 (4.5)	10 (0.8)	382 (6.3)	10.4 (0.04)
United States	19 (0.6)	536 (3.2)	40 (0.6)	515 (3.0)	40 (0.8)	494 (2.8)	9.5 (0.04)
Hong Kong SAR	19 (0.8)	635 (4.4)	44 (1.0)	595 (3.8)	37 (1.3)	551 (4.6)	9.6 (0.05)
Romania	18 (1.0)	516 (6.1)	40 (1.0)	459 (4.3)	41 (1.2)	438 (4.8)	9.5 (0.05)
Italy	18 (0.9)	538 (3.6)	42 (0.9)	507 (2.8)	40 (1.3)	472 (3.2)	9.6 (0.05)
New Zealand	17 (1.0)	525 (6.9)	41 (1.0)	497 (5.7)	42 (1.5)	467 (4.8)	9.5 (0.06)
Norway	17 (0.9)	511 (4.1)	42 (1.0)	482 (2.6)	42 (1.4)	453 (2.8)	9.4 (0.05)
Australia	16 (0.9)	553 (7.5)	40 (0.9)	520 (5.6)	45 (1.4)	476 (4.4)	9.3 (0.06)
Hungary	15 (0.7)	549 (5.6)	35 (1.0)	508 (4.8)	50 (1.3)	491 (3.8)	9.2 (0.05)
England	14 (1.0)	548 (8.9)	44 (1.3)	517 (5.7)	42 (1.7)	484 (5.2)	9.4 (0.07)
Chinese Taipei	14 (0.7)	681 (4.3)	33 (0.9)	645 (3.6)	53 (1.2)	568 (3.2)	9.0 (0.06)
Sweden	13 (0.6)	524 (4.0)	42 (0.7)	498 (1.8)	44 (1.0)	462 (2.1)	9.4 (0.04)
Finland	10 (0.6)	560 (4.1)	34 (1.0)	532 (2.8)	57 (1.1)	496 (2.6)	8.8 (0.05)
Japan	9 (0.6)	621 (5.1)	38 (1.1)	589 (3.3)	53 (1.4)	545 (3.1)	9.1 (0.05)
Korea, Rep. of	*8 (0.3)*	*677 (4.7)*	*36 (0.7)*	*649 (3.3)*	*56 (0.8)*	*581 (2.9)*	*8.9 (0.03)*
Slovenia	6 (0.4)	544 (5.3)	31 (1.1)	521 (3.0)	63 (1.3)	494 (2.4)	8.6 (0.05)
International Avg.	26 (0.2)	504 (0.8)	42 (0.1)	467 (0.6)	31 (0.2)	443 (0.7)	
Ninth Grade Participants							
Botswana	47 (1.1)	427 (2.5)	38 (0.8)	376 (2.6)	16 (0.8)	370 (4.3)	11.0 (0.05)
South Africa	41 (0.9)	378 (2.0)	44 (0.7)	339 (2.9)	15 (0.6)	348 (5.3)	10.8 (0.04)
Honduras	23 (1.0)	364 (4.6)	49 (0.9)	332 (4.2)	28 (1.1)	334 (4.8)	10.1 (0.06)
Benchmarking Participants							
Abu Dhabi, UAE	32 (1.2)	485 (4.4)	42 (1.0)	441 (3.6)	26 (1.4)	420 (4.9)	10.3 (0.06)
Dubai, UAE	29 (1.0)	508 (3.5)	41 (0.9)	473 (3.1)	30 (1.0)	456 (3.1)	10.1 (0.05)
Ontario, Canada	26 (1.1)	546 (3.5)	41 (1.0)	513 (3.4)	34 (1.4)	481 (3.0)	9.9 (0.06)
North Carolina, US	24 (1.8)	556 (7.6)	44 (1.1)	542 (7.8)	31 (2.3)	516 (7.0)	9.9 (0.11)
Connecticut, US	22 (1.5)	552 (6.0)	40 (1.2)	526 (5.2)	38 (1.8)	495 (5.4)	9.7 (0.08)
Colorado, US	20 (1.6)	548 (5.9)	38 (1.7)	528 (4.8)	42 (2.1)	495 (5.8)	9.4 (0.10)
Massachusetts, US	19 (1.3)	585 (6.1)	40 (1.0)	568 (5.4)	41 (1.7)	543 (5.4)	9.4 (0.09)
Minnesota, US	18 (1.5)	578 (6.8)	41 (0.9)	555 (4.7)	41 (1.6)	521 (4.6)	9.5 (0.08)
Alabama, US	18 (1.9)	475 (10.7)	37 (0.9)	471 (6.7)	45 (1.7)	460 (5.3)	9.3 (0.11)
Florida, US	17 (1.1)	552 (9.7)	38 (1.4)	525 (6.9)	45 (1.7)	493 (6.2)	9.4 (0.08)
California, US	17 (0.9)	519 (6.4)	42 (1.3)	496 (6.1)	41 (1.8)	480 (5.0)	9.4 (0.07)
Alberta, Canada	16 (0.9)	531 (4.7)	44 (1.0)	514 (2.5)	40 (1.4)	486 (3.1)	9.4 (0.06)
Indiana, US	16 (1.4)	547 (6.2)	39 (1.3)	529 (5.3)	45 (2.0)	507 (5.0)	9.3 (0.10)
Quebec, Canada	12 (0.7)	557 (3.9)	43 (0.9)	540 (2.4)	44 (1.2)	517 (2.6)	9.3 (0.05)

Centerpoint of scale set at 10.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

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

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

Exhibit 2.16: IDB Analyzer Setup for Example Student-level Analysis with a Contextual Scale (Step 1)

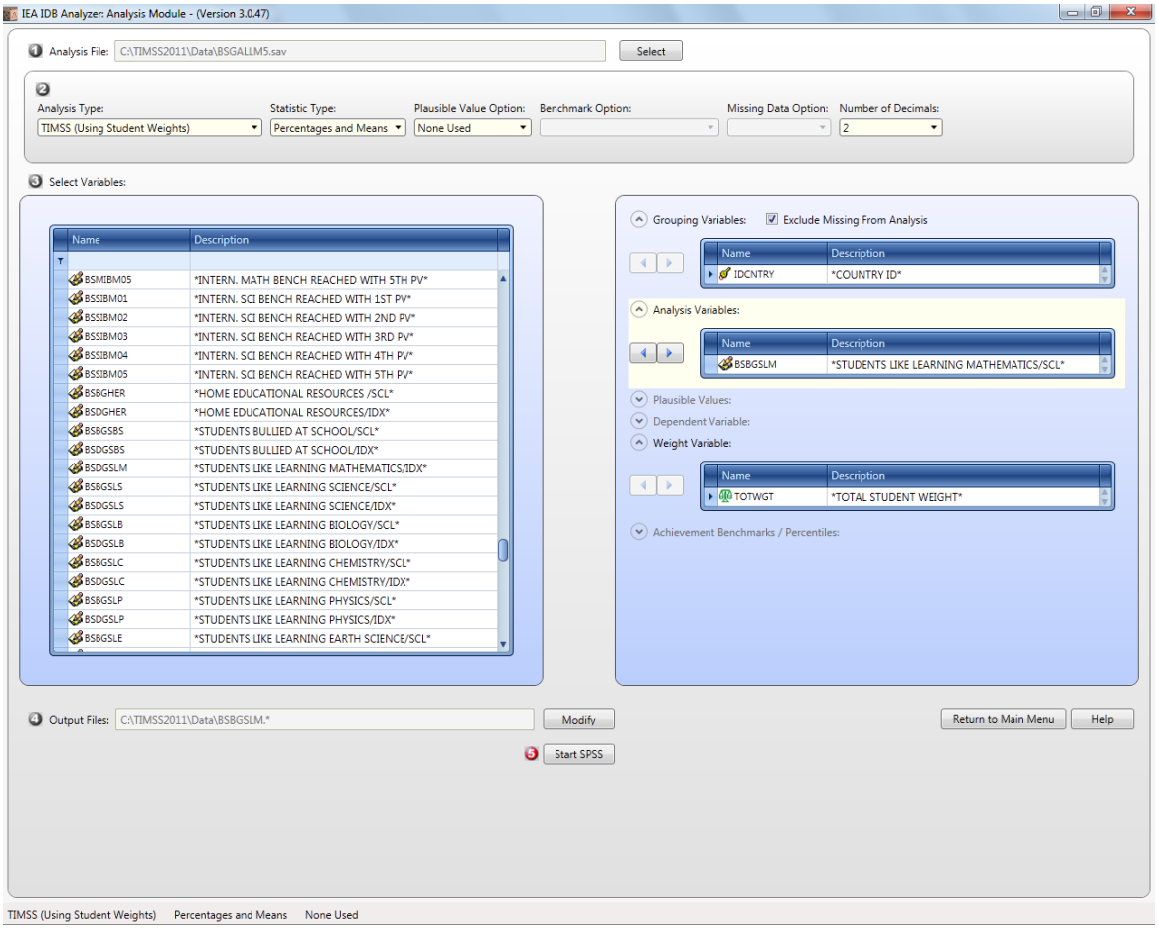


Exhibit 2.17: Output for Example Student-level Analysis with a Contextual Scale (Step 1)

```
Average for BSBGSLM by (IDCNTRY)

                 N of      Sum of                 Percent   BSBGSLM   BSBGSLM              Std.Dev.  Percent
*COUNTRY ID*   Cases     TOTWGT     Percent      (s.e.)    (Mean)    (s.e.)   Std.Dev.    (s.e.)   Missing
------------ -------  ----------  ---------  ----------  --------  --------  ---------  --------  --------
Australia       7389      248762      45.70         .74      9.32       .06       1.91       .03      1.28
Bahrain         4581       12458       2.29         .03      9.77       .03       2.05       .02      1.32
Armenia         5626       34775       6.39         .14     10.87       .05       1.92       .02      3.89
Chile           5772      248321      45.62         .77      9.76       .04       1.96       .03      1.14
```

As shown in the first line of the results, students in Australia scored 9.32 on the Students Like Learning Mathematics contextual scale, with a standard error of 0.06. Note that this is below the

international average of 10, the difference being statistically significant at the 95% confidence level. The IEA IDB Analyzer also computes the standard deviation of the contextual scale and its standard error.

In the second step, we will compute the percentages of students, with their average mathematics achievement, in each category of the index variable BSDGSLM. 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 BSGALLM5 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 mathematics achievement by the grouping variable BSDGSLM.
6. Specify the variable BSDGSLM as a second grouping variable by clicking the **Grouping Variables** field to activate it. Select BSDGSLM 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 BSMMAT01–05 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** 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 first three lines of the results, 15.67 percent of eighth grade students in Australia liked learning mathematics (standard error of 0.94) and their average mathematics achievement was 553.21 (standard error of 7.47); 39.81 percent somewhat liked learning mathematics (standard error of 0.87) and their average mathematics achievement was 519.53 (standard error of 5.58); and 44.53 percent of students did not like learning mathematics (standard error of 1.41) and their average mathematics achievement was 475.97 (standard error of 4.43).

Exhibit 2.18: IDB Analyzer Setup for Example Student-level Analysis with a Contextual Scale (Step 2)

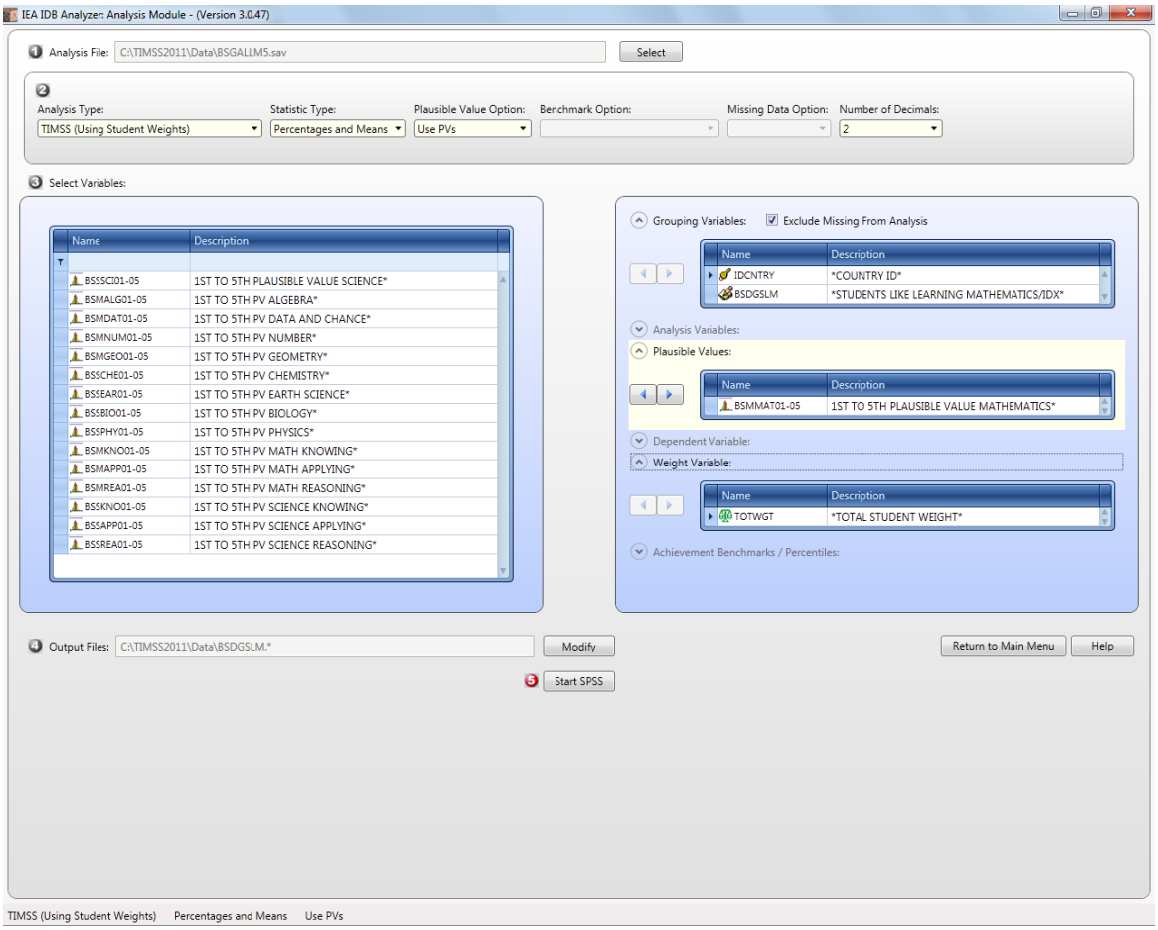


Exhibit 2.19: Output for Example Student-level Analysis with a Contextual Scale (Step 2)

Average for BSMMAT0 by IDCNTRY BSDGSLM

COUNTRY ID	*STUDENTS LIKE LEARNING MATHEMATICS/IDX*	N of Cases	Sum of TOTWGT	Percent	Percent (s.e.)	BSMMAT0 (Mean)	BSMMAT0 (s.e.)	Std.Dev	Std.Dev. (s.e.)
Australia	LIKE LEARNING MATHEMATICS	1068	38977	15.67	.94	553.21	7.47	85.05	4.87
	SOMEWHAT LIKE LEARNING MATHEMATICS	2985	99021	39.81	.87	519.53	5.58	84.86	3.87
	DO NOT LIKE LEARNING MATHEMATICS	3336	110764	44.53	1.41	475.97	4.43	74.27	2.84
Bahrain	LIKE LEARNING MATHEMATICS	1072	2959	23.75	.64	454.13	4.64	97.58	3.63
	SOMEWHAT LIKE LEARNING MATHEMATICS	1756	4780	38.37	.86	413.45	2.71	97.39	2.08
	DO NOT LIKE LEARNING MATHEMATICS	1753	4719	37.88	.84	380.58	3.37	90.05	2.59
Armenia	LIKE LEARNING MATHEMATICS	2421	14925	42.92	.97	499.36	3.07	85.95	2.49
	SOMEWHAT LIKE LEARNING MATHEMATICS	2181	13729	39.48	.76	451.39	3.37	86.66	1.75
	DO NOT LIKE LEARNING MATHEMATICS	1024	6121	17.60	.97	436.88	4.75	83.82	3.33
Chile	LIKE LEARNING MATHEMATICS	1289	54770	22.06	.86	449.31	3.52	81.08	2.78
	SOMEWHAT LIKE LEARNING MATHEMATICS	2291	99860	40.21	.89	416.42	2.93	78.34	2.19
	DO NOT LIKE LEARNING MATHEMATICS	2192	93691	37.73	.97	398.30	2.95	73.56	1.53

Computing Correlations with Background Variables and Achievement Scores

In addition to the analyses described above, the IEA IDB Analyzer (version 3.0) is able to compute correlations among background variables as well as between background variables and achievement scores. While these types of analyses will not be demonstrated here, the steps for conducting them are the same as 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. When using only background variables, the diagonal and elements above the diagonal of the correlation matrix are displayed with their corresponding standard errors. When using achievement scores, a single column is displayed containing the correlations between each of the background variables specified in the model and the achievement scores selected.

Calculating Percentiles of Achievement

The **Percentiles** statistic type is an additional tool provided by the IEA IDB Analyzer (version 3.0) for analyzing the TIMSS 2011 data. This procedure will compute the percentiles of a student achievement distribution for a specified set of plausible values and within any specified subgroups of students, along with appropriate standard errors.

2.6 TIMSS Analyses with Teacher-level Data

Analyses with teacher background data seek to make statements about students whose teachers have a given characteristic, rather than about teachers with a given characteristic. As our example of an analysis using teacher background data, we will investigate the percentage of eighth grade students according to the years of experience of their mathematics teachers. The results of such an analysis are presented in Exhibit 7.6 of *TIMSS 2011 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' years of experience.

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 mathematics teacher background data files for the variable that contains the information on the years of experience of eighth grade mathematics teachers. The variable BTBG01 contains information on teachers' years of experience. That information was collapsed into reporting categories and stored in the derived variable BTDG01.[5]

The merged data file BTMALLM5 will be used for this example teacher-level 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 BTMALLM5 as the **Analysis File**.

[5] Supplement 3 to this User Guide describes the construction of the teacher-level derived variable BTDG01.

Exhibit 2.20: Exhibit of Example Teacher-level Analysis, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 7.6)

Exhibit 7.6: Teachers' Years of Experience

TIMSS 2011 Mathematics 8th Grade

Reported by Teachers

Country	20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	63 (3.7)	467 (3.9)	30 (3.3)	464 (6.0)	4 (1.6)	473 (24.9)	3 (1.4)	474 (18.4)	24 (0.8)
Australia r	37 (4.0)	519 (8.1)	22 (3.4)	513 (10.8)	18 (3.2)	504 (17.1)	24 (3.4)	485 (8.4)	15 (0.9)
Bahrain	19 (2.2)	433 (7.0)	54 (3.6)	404 (3.7)	17 (2.7)	403 (5.8)	10 (1.9)	430 (9.1)	14 (0.4)
Chile	49 (3.8)	415 (4.6)	15 (2.9)	416 (10.0)	13 (2.8)	421 (12.1)	22 (3.4)	421 (6.3)	19 (1.0)
Chinese Taipei	24 (3.6)	621 (7.2)	41 (3.6)	607 (5.8)	26 (3.5)	608 (9.3)	9 (2.5)	593 (8.9)	14 (0.7)
England	21 (3.6)	510 (15.5)	25 (3.7)	516 (11.8)	22 (3.9)	495 (11.6)	32 (3.9)	503 (10.7)	12 (0.9)
Finland	41 (3.4)	517 (2.8)	27 (3.4)	511 (5.3)	18 (2.8)	515 (6.1)	15 (2.4)	510 (5.2)	16 (0.7)
Georgia	63 (3.9)	428 (5.2)	21 (3.5)	441 (10.1)	9 (2.4)	439 (15.0)	7 (2.3)	431 (18.5)	25 (1.1)
Ghana	6 (1.8)	360 (19.9)	23 (3.8)	340 (9.0)	28 (4.0)	334 (9.3)	43 (3.9)	321 (6.8)	8 (0.5)
Hong Kong SAR	18 (3.3)	570 (11.9)	39 (4.3)	590 (8.4)	25 (4.2)	589 (11.9)	18 (3.3)	588 (10.1)	12 (0.7)
Hungary	62 (3.5)	508 (4.4)	26 (3.0)	508 (6.2)	7 (1.9)	488 (18.6)	5 (1.5)	456 (21.5)	22 (0.7)
Indonesia	25 (3.9)	402 (9.1)	30 (4.0)	399 (9.1)	19 (3.3)	385 (8.0)	26 (4.5)	356 (9.1)	13 (0.8)
Iran, Islamic Rep. of	28 (3.2)	443 (8.9)	40 (3.8)	416 (6.0)	16 (2.6)	402 (10.4)	16 (2.8)	374 (10.7)	14 (0.6)
Israel	38 (2.8)	545 (6.6)	36 (2.8)	518 (6.6)	15 (2.0)	495 (10.7)	11 (1.8)	468 (14.4)	17 (0.5)
Italy	60 (4.1)	502 (3.2)	22 (3.3)	492 (7.3)	11 (2.5)	504 (9.1)	8 (2.1)	492 (13.6)	22 (0.9)
Japan	47 (3.9)	576 (3.7)	18 (3.1)	558 (5.5)	17 (2.3)	575 (9.1)	18 (3.1)	559 (7.5)	17 (0.8)
Jordan	16 (2.6)	406 (8.5)	29 (3.3)	410 (7.6)	29 (3.5)	394 (9.6)	26 (3.1)	413 (7.0)	11 (0.6)
Kazakhstan	62 (3.9)	492 (5.2)	21 (3.2)	468 (8.6)	9 (2.7)	489 (14.9)	8 (2.2)	493 (14.8)	22 (0.9)
Korea, Rep. of	34 (3.1)	618 (5.0)	22 (2.8)	616 (8.8)	17 (2.1)	625 (7.1)	27 (2.6)	594 (4.8)	13 (0.6)
Lebanon	27 (3.6)	454 (7.9)	32 (3.9)	445 (6.9)	21 (3.2)	460 (9.8)	20 (3.5)	445 (8.7)	14 (1.0)
Lithuania	73 (3.4)	501 (3.0)	17 (2.6)	509 (6.8)	7 (2.1)	504 (19.6)	3 (1.4)	506 (17.8)	25 (0.8)
Macedonia, Rep. of r	50 (4.4)	421 (9.1)	25 (4.2)	430 (12.0)	12 (2.7)	415 (15.3)	13 (2.9)	420 (18.6)	20 (0.9)
Malaysia	18 (3.0)	446 (12.2)	31 (3.4)	446 (9.5)	21 (3.0)	426 (11.4)	30 (3.3)	441 (10.5)	11 (0.7)
Morocco	69 (2.8)	374 (2.8)	11 (2.0)	373 (9.0)	5 (1.5)	358 (12.2)	15 (2.3)	363 (6.3)	22 (0.6)
New Zealand	36 (3.0)	492 (8.4)	22 (2.7)	486 (9.6)	25 (3.0)	489 (8.9)	17 (2.8)	482 (15.6)	15 (0.8)
Norway	30 (4.0)	478 (3.7)	25 (3.6)	474 (5.5)	19 (3.7)	475 (4.4)	26 (3.5)	474 (4.0)	15 (1.0)
Oman	7 (1.3)	362 (12.2)	25 (2.6)	385 (6.5)	46 (3.3)	363 (4.7)	21 (2.6)	360 (6.9)	9 (0.3)
Palestinian Nat'l Auth.	14 (3.1)	413 (11.9)	37 (3.9)	410 (7.3)	24 (3.6)	400 (7.6)	25 (3.2)	394 (7.5)	11 (0.7)
Qatar	23 (4.2)	432 (12.7)	36 (4.6)	425 (9.4)	25 (3.4)	388 (9.2)	16 (2.9)	386 (10.1)	13 (0.7)
Romania	66 (3.7)	466 (5.2)	24 (3.3)	449 (9.3)	6 (1.7)	420 (15.9)	4 (1.6)	423 (12.7)	25 (0.9)
Russian Federation	67 (3.3)	540 (4.4)	24 (3.1)	543 (7.0)	5 (1.2)	515 (15.2)	4 (1.2)	547 (23.5)	24 (0.6)
Saudi Arabia	13 (2.9)	386 (10.2)	41 (3.9)	406 (7.3)	25 (3.5)	402 (8.9)	21 (3.5)	367 (7.7)	11 (0.6)
Singapore	10 (1.4)	618 (10.6)	16 (2.1)	619 (9.3)	26 (2.4)	624 (7.3)	47 (2.5)	601 (5.0)	8 (0.4)
Slovenia	52 (2.9)	506 (3.2)	20 (2.6)	500 (5.0)	17 (2.0)	500 (4.1)	12 (1.9)	515 (4.9)	19 (0.6)
Sweden r	26 (2.7)	486 (5.4)	42 (3.4)	489 (3.9)	22 (2.7)	482 (3.7)	10 (2.0)	476 (5.1)	15 (0.6)
Syrian Arab Republic	16 (3.1)	400 (9.6)	26 (3.7)	375 (7.9)	24 (3.6)	370 (8.8)	35 (4.0)	378 (8.7)	10 (0.6)
Thailand	34 (3.4)	444 (8.4)	21 (3.1)	432 (11.0)	18 (2.7)	417 (11.6)	28 (3.2)	415 (8.7)	15 (0.8)
Tunisia	38 (3.3)	442 (5.6)	35 (3.3)	419 (5.4)	18 (2.8)	417 (7.5)	10 (2.1)	394 (7.2)	16 (0.7)
Turkey	11 (2.2)	471 (14.5)	24 (3.2)	481 (10.8)	38 (3.5)	445 (6.9)	27 (2.8)	431 (6.5)	9 (0.5)
Ukraine	68 (4.4)	477 (4.5)	20 (3.6)	491 (10.0)	9 (2.5)	473 (11.1)	3 (1.4)	473 (18.7)	25 (1.0)
United Arab Emirates	24 (2.0)	442 (6.4)	36 (2.4)	455 (4.0)	26 (2.3)	461 (4.8)	14 (1.8)	467 (6.8)	13 (0.4)
United States r	26 (2.2)	519 (6.8)	28 (2.4)	517 (5.1)	28 (2.8)	506 (7.2)	17 (2.2)	505 (6.7)	14 (0.6)
International Avg.	**36 (0.5)**	**474 (1.3)**	**28 (0.5)**	**470 (1.2)**	**19 (0.4)**	**463 (1.7)**	**18 (0.4)**	**458 (1.8)**	**16 (0.1)**
Ninth Grade Participants									
Botswana	2 (1.0)	~ ~	39 (4.5)	401 (5.3)	31 (4.3)	403 (4.2)	29 (3.9)	384 (5.2)	9 (0.4)
Honduras r	26 (3.8)	341 (6.5)	23 (4.2)	335 (10.8)	22 (4.4)	332 (8.4)	29 (4.2)	339 (11.1)	12 (0.9)
South Africa	30 (3.8)	344 (7.3)	33 (3.4)	358 (5.8)	18 (3.0)	364 (8.6)	19 (3.1)	345 (8.7)	14 (0.8)
Benchmarking Participants									
Alberta, Canada	25 (3.5)	506 (5.0)	37 (4.3)	504 (3.8)	15 (3.0)	504 (6.9)	23 (3.4)	505 (5.3)	13 (0.7)
Ontario, Canada	16 (2.8)	511 (7.5)	44 (4.2)	512 (3.8)	31 (3.5)	516 (4.9)	10 (2.5)	511 (9.4)	12 (0.5)
Quebec, Canada	19 (3.0)	544 (6.6)	47 (3.8)	536 (4.2)	22 (3.2)	524 (7.0)	12 (2.6)	521 (7.3)	13 (0.6)
Abu Dhabi, UAE	25 (4.1)	456 (14.3)	30 (4.1)	433 (6.3)	29 (4.6)	456 (8.5)	16 (3.2)	463 (9.2)	14 (0.9)
Dubai, UAE	19 (2.2)	443 (9.5)	42 (2.6)	491 (5.0)	25 (3.3)	488 (8.7)	13 (2.6)	471 (13.9)	13 (0.5)
Alabama, US r	16 (4.8)	494 (20.4)	35 (7.8)	473 (11.2)	32 (6.2)	450 (12.0)	17 (5.7)	464 (11.2)	12 (1.3)
California, US r	19 (5.4)	502 (25.5)	33 (6.9)	490 (9.2)	28 (6.4)	506 (10.2)	20 (5.9)	479 (21.5)	12 (1.3)
Colorado, US r	21 (4.9)	564 (9.3)	32 (5.6)	517 (11.3)	32 (5.8)	508 (14.0)	15 (3.5)	471 (13.3)	13 (1.0)
Connecticut, US	29 (6.2)	531 (17.9)	32 (5.6)	533 (9.2)	20 (4.8)	509 (18.9)	19 (5.5)	503 (14.5)	14 (1.3)
Florida, US r	18 (5.3)	530 (13.7)	43 (7.0)	521 (10.5)	26 (5.8)	514 (14.6)	13 (4.0)	524 (29.0)	13 (1.2)
Indiana, US r	34 (5.6)	526 (11.0)	22 (5.8)	533 (13.8)	27 (6.0)	516 (12.2)	17 (5.2)	494 (9.9)	15 (1.4)
Massachusetts, US	10 (4.1)	566 (20.3)	33 (5.8)	569 (10.9)	39 (5.2)	552 (8.5)	18 (5.5)	556 (17.9)	11 (1.3)
Minnesota, US	27 (6.4)	556 (9.3)	36 (5.2)	553 (8.9)	22 (4.5)	531 (15.3)	15 (4.3)	528 (17.9)	15 (1.5)
North Carolina, US r	26 (5.5)	559 (13.2)	30 (5.6)	530 (14.8)	33 (5.5)	545 (13.2)	11 (4.3)	517 (12.7)	14 (1.0)

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

3. Select **TIMSS (Using Math Teacher Weights)** as the **Analysis Type**.
4. Select **Percentages and Means** as the **Statistic Type**.
5. Select **Use PVs** as the **Plausible Value Option**.
6. Specify the variable BTDG01 as a second grouping variable and activate it by clicking the **Grouping Variables** field. Select BTDG01 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 and activate them by clicking the **Plausible Values** field. Select BSMMAT01–05 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 selected automatically by the software; MATWGT is selected by default because this example analysis uses mathematics teacher 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

Exhibit 2.21 shows the completed analysis module for this example analysis, and Exhibit 2.22 displays the results.

Each country's results are displayed on four lines, one for each value of the BTDG01 variable. 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 BTDG01.

As shown in the first four lines of results, 36.54 percent of eighth grade students in Australia were taught by teachers with 20 years or more of experience, 21.51 percent were taught by teachers with 10 to 19 years of experience, 17.73 percent by teachers with 5 to 9 years of experience, and 24.22 percent by teachers with less than 5 years of experience. Also, the estimated average mathematics achievement was 519.11 (standard error of 8.07) for eighth grade students taught by teachers with 20 years or more of experience, 513.05 (standard error of 10.77) for students taught by teachers with 10 to 19 years of experience, 503.68 (standard error of 17.14) for students taught by teachers with 5 to 9 years of experience, and 485.34 (standard error of 8.45) for students taught by teachers with less than 5 years of experience. The IEA IDB Analyzer also produces the standard deviations of achievement for all subgroups of BTDG01.

Exhibit 2.21: IDB Analyzer Setup for Example Teacher-level Analysis

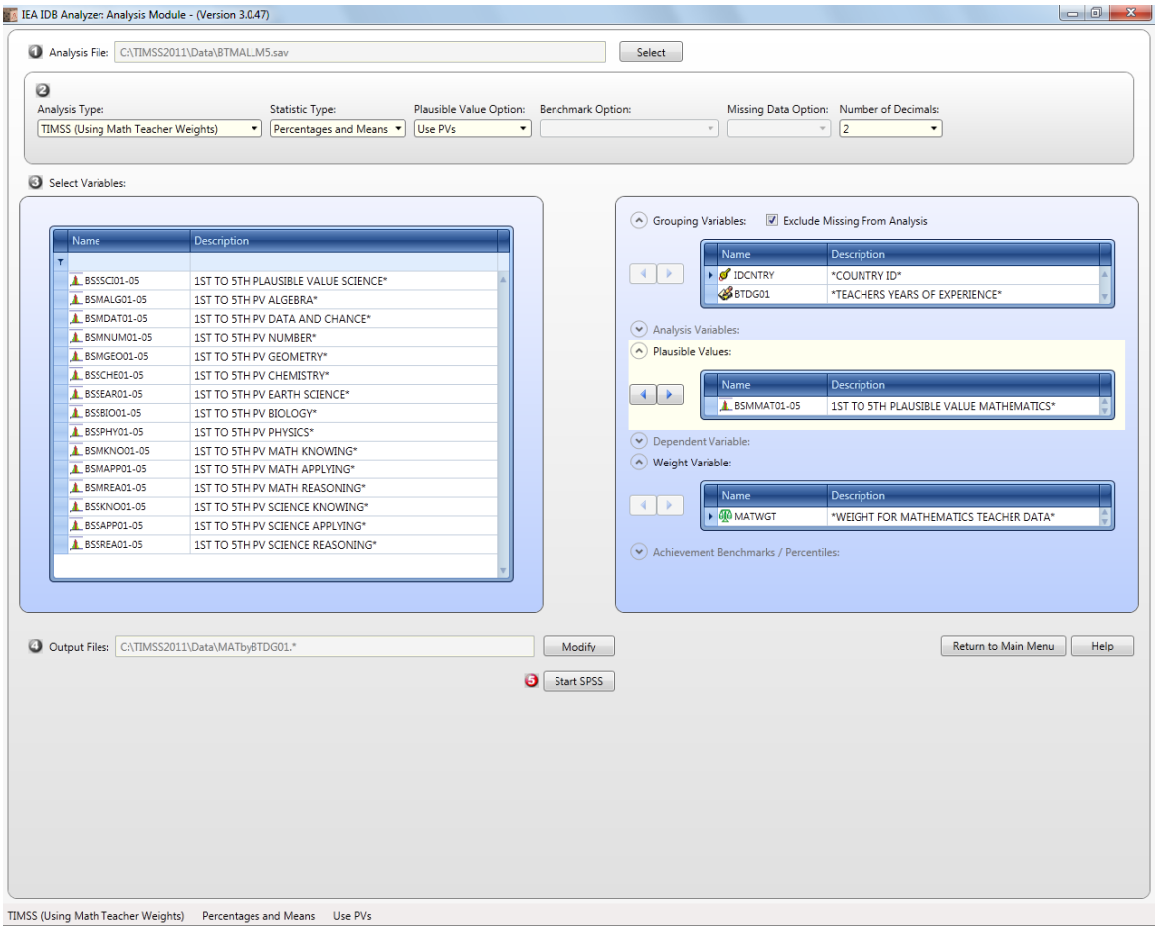


Exhibit 2.22: Output for Example Teacher-level Analysis

Average for BSMMAT0 by IDCNTRY BTDG01

COUNTRY ID	*TEACHERS YEARS OF EXPERIENCE*	N of Cases	Sum of MATWGT	Percent	Percent (s.e.)	BSMMAT0 (Mean)	BSMMAT0 (s.e.)	Std.Dev	Std.Dev. (s.e.)
Australia	20 YEARS OR MORE	2096	68987	36.54	4.03	519.11	8.07	86.49	5.53
	AT LEAST 10 BUT LESS THAN 20 YEARS	1395	40605	21.51	3.39	513.05	10.77	79.10	5.72
	AT LEAST 5 BUT LESS THAN 10 YEARS	888	33462	17.73	3.18	503.68	17.14	97.36	9.44
	LESS THAN 5 YEARS	1350	45721	24.22	3.38	485.34	8.45	72.00	3.51
Bahrain	20 YEARS OR MORE	966	2317	19.25	2.20	433.48	7.02	104.26	3.65
	AT LEAST 10 BUT LESS THAN 20 YEARS	2295	6492	53.93	3.56	404.07	3.72	96.64	2.72
	AT LEAST 5 BUT LESS THAN 10 YEARS	732	2077	17.25	2.68	403.36	5.83	95.74	3.79
	LESS THAN 5 YEARS	448	1152	9.57	1.93	429.50	9.09	98.49	4.97
Armenia	20 YEARS OR MORE	3508	21506	62.92	3.71	466.66	3.90	91.28	2.13
	AT LEAST 10 BUT LESS THAN 20 YEARS	1716	10255	30.00	3.34	464.48	6.02	91.23	2.67
	AT LEAST 5 BUT LESS THAN 10 YEARS	200	1423	4.16	1.56	473.15	24.95	101.02	19.86
	LESS THAN 5 YEARS	134	999	2.92	1.40	474.44	18.40	72.17	8.18
Chile	20 YEARS OR MORE	2788	116439	49.15	3.81	415.30	4.55	81.97	2.69
	AT LEAST 10 BUT LESS THAN 20 YEARS	878	35914	15.16	2.92	416.01	9.99	82.99	4.07
	AT LEAST 5 BUT LESS THAN 10 YEARS	689	31741	13.40	2.76	421.22	12.08	78.09	4.41
	LESS THAN 5 YEARS	1166	52819	22.29	3.36	421.27	6.30	74.84	3.82

2.7 TIMSS Analyses with School-level 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 eighth grade students, with their average mathematics achievement, who attended schools composed of students with different levels of economic background. The results of this analysis are presented in Exhibit 5.4 of *TIMSS 2011 International Results in Mathematics* and are replicated here in Exhibit 2.23.

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 BCDG03, where schools are characterized as being composed of more affluent students than disadvantaged students, composed of more disadvantaged students than affluent students, or composed of neither more affluent students nor more disadvantaged students.[6]

The merged data file BCGALLM5 will be used for this example school-level 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 BCGALLM5 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**.
6. Specify the variable BCDG03 as a second grouping variable and activate it by clicking the **Grouping Variables** field. Select BCDG03 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 and activate it by clicking the **Plausible Values** field. Select BSMMAT01–05 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 selected automatically 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 SPSS** button to create the SPSS syntax file and open it in an SPSS syntax window. The syntax file can be executed by opening the **Run** menu of SPSS and selecting the **All** menu option. If necessary, the IEA IDB Analyzer will display a prompt to confirm the overwriting of existing files.

[6] Supplement 3 to this User Guide describes the construction of the school-level derived variable BCDG03 from responses to questions posed to the school principals.

Exhibit 2.23: Exhibit of Example School-level Analysis, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 5.4)

Exhibit 5.4: School Composition by Student Economic Background

TIMSS 2011 Mathematics 8th Grade

Reported by Principals

Country		More Affluent - Schools Where More than 25% of Students Come 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 Students Come 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
Armenia		35 (3.7)	484 (5.9)	24 (3.6)	461 (7.5)	41 (3.7)	455 (5.0)
Australia		32 (3.4)	543 (11.2)	39 (3.7)	507 (6.1)	29 (3.1)	476 (7.5)
Bahrain		45 (0.3)	420 (3.2)	28 (0.2)	408 (2.7)	27 (0.3)	395 (3.7)
Chile	r	12 (2.3)	474 (13.0)	32 (4.1)	439 (6.0)	56 (3.9)	399 (4.8)
Chinese Taipei		17 (2.7)	649 (7.9)	69 (3.8)	604 (4.2)	14 (2.9)	577 (13.5)
England		28 (4.1)	553 (11.0)	50 (4.5)	498 (8.9)	22 (4.3)	487 (10.9)
Finland	r	30 (3.4)	519 (4.0)	67 (3.8)	513 (3.0)	3 (1.5)	486 (3.5)
Georgia		11 (2.0)	436 (13.7)	44 (4.4)	438 (6.8)	45 (4.2)	417 (6.8)
Ghana		7 (2.0)	392 (13.9)	18 (3.4)	331 (10.6)	75 (3.6)	321 (5.2)
Hong Kong SAR		11 (3.0)	628 (11.8)	37 (5.1)	609 (10.2)	53 (4.8)	561 (7.8)
Hungary		16 (2.7)	535 (7.4)	33 (4.1)	531 (4.9)	50 (4.3)	478 (5.6)
Indonesia		16 (3.3)	426 (9.9)	28 (4.6)	400 (8.1)	56 (4.6)	369 (6.0)
Iran, Islamic Rep. of		20 (2.7)	472 (11.2)	25 (3.5)	429 (9.1)	54 (3.8)	390 (5.2)
Israel		28 (3.5)	556 (7.8)	30 (4.5)	526 (8.8)	42 (3.9)	481 (8.8)
Italy		40 (3.7)	515 (3.7)	47 (3.9)	495 (3.8)	13 (2.6)	465 (8.9)
Japan		46 (4.4)	582 (4.5)	44 (4.5)	564 (4.1)	10 (2.9)	548 (9.0)
Jordan	r	32 (3.5)	431 (7.0)	25 (2.9)	402 (9.7)	43 (3.9)	388 (6.3)
Kazakhstan		75 (3.5)	487 (4.4)	20 (3.4)	493 (11.0)	5 (1.8)	462 (22.5)
Korea, Rep. of		18 (3.3)	653 (5.8)	51 (4.3)	612 (2.6)	32 (3.9)	591 (4.6)
Lebanon	r	21 (4.1)	491 (8.8)	34 (4.2)	455 (8.7)	45 (5.0)	435 (5.3)
Lithuania		23 (3.6)	537 (6.5)	39 (4.4)	499 (4.3)	38 (4.0)	487 (4.5)
Macedonia, Rep. of	r	38 (3.6)	458 (7.9)	30 (4.1)	428 (10.0)	32 (3.9)	401 (9.7)
Malaysia		26 (3.2)	467 (10.5)	23 (3.3)	452 (12.4)	52 (4.1)	424 (8.8)
Morocco	r	6 (1.4)	422 (15.0)	13 (2.5)	393 (9.8)	81 (2.9)	361 (2.6)
New Zealand		30 (5.6)	522 (6.9)	47 (5.8)	485 (7.4)	24 (4.0)	450 (10.6)
Norway		– –	– –	– –	– –	– –	– –
Oman		43 (3.1)	386 (4.6)	26 (2.6)	360 (5.6)	31 (3.1)	339 (5.8)
Palestinian Nat'l Auth.		44 (4.2)	411 (6.5)	23 (3.9)	402 (8.7)	33 (3.7)	393 (6.1)
Qatar	r	81 (0.2)	403 (4.3)	16 (0.2)	448 (6.6)	3 (0.1)	435 (18.2)
Romania		18 (2.9)	479 (12.7)	29 (4.2)	471 (8.1)	52 (4.3)	447 (6.2)
Russian Federation		58 (3.5)	553 (5.1)	25 (2.8)	527 (4.4)	16 (3.1)	513 (10.3)
Saudi Arabia	r	40 (4.4)	405 (7.5)	30 (4.4)	394 (10.5)	29 (4.1)	382 (8.2)
Singapore		27 (0.0)	643 (5.9)	61 (0.0)	604 (4.9)	11 (0.0)	569 (11.6)
Slovenia		40 (3.8)	510 (4.4)	45 (4.3)	506 (2.7)	15 (2.7)	489 (6.8)
Sweden	r	74 (4.4)	490 (2.6)	21 (4.1)	472 (5.5)	5 (1.8)	466 (11.9)
Syrian Arab Republic	r	37 (4.2)	388 (8.0)	27 (4.3)	392 (9.5)	36 (4.4)	371 (8.2)
Thailand		20 (3.0)	466 (13.9)	24 (3.6)	437 (9.5)	57 (4.4)	410 (5.7)
Tunisia		23 (3.3)	439 (9.6)	29 (3.3)	432 (3.9)	48 (3.5)	411 (3.0)
Turkey		17 (2.6)	533 (11.6)	25 (3.3)	455 (6.0)	59 (3.8)	428 (5.1)
Ukraine		13 (2.7)	486 (14.1)	29 (3.9)	486 (7.4)	59 (4.5)	472 (5.1)
United Arab Emirates	r	70 (2.0)	459 (3.4)	17 (1.9)	442 (7.3)	13 (1.4)	441 (5.6)
United States		22 (1.9)	543 (5.8)	23 (1.9)	526 (6.1)	55 (1.9)	490 (3.4)
International Avg.		32 (0.5)	494 (1.4)	33 (0.6)	471 (1.2)	36 (0.5)	448 (1.3)
Ninth Grade Participants							
Botswana		13 (3.0)	432 (10.9)	24 (4.0)	401 (4.4)	63 (4.6)	384 (2.7)
Honduras	s	5 (1.6)	383 (12.5)	14 (3.4)	358 (12.3)	82 (3.6)	333 (4.4)
South Africa	r	8 (1.3)	487 (14.4)	12 (2.6)	356 (15.0)	80 (2.7)	339 (3.2)
Benchmarking Participants							
Alberta, Canada		39 (4.1)	517 (3.6)	43 (4.8)	505 (3.3)	18 (3.8)	482 (5.9)
Ontario, Canada		37 (4.1)	523 (5.1)	36 (4.7)	510 (3.8)	27 (4.5)	498 (5.2)
Quebec, Canada	r	51 (4.1)	542 (4.3)	32 (3.8)	523 (5.2)	17 (3.5)	514 (6.3)
Abu Dhabi, UAE	r	76 (4.1)	453 (6.1)	17 (3.6)	429 (10.3)	7 (2.4)	446 (14.9)
Dubai, UAE	r	71 (0.3)	484 (3.2)	12 (0.2)	449 (2.9)	16 (0.2)	434 (3.8)
Alabama, US	r	17 (4.4)	492 (19.0)	5 (3.4)	481 (41.0)	78 (5.6)	455 (6.1)
California, US	r	16 (4.2)	541 (12.3)	20 (5.2)	532 (16.7)	64 (5.4)	467 (5.8)
Colorado, US	r	21 (5.7)	525 (9.1)	34 (6.6)	526 (10.9)	46 (7.4)	500 (12.5)
Connecticut, US	r	43 (6.1)	565 (7.8)	27 (6.1)	528 (10.3)	30 (5.9)	455 (8.6)
Florida, US	r	6 (3.4)	500 (18.4)	37 (5.6)	535 (11.1)	58 (6.0)	499 (8.8)
Indiana, US	r	13 (4.5)	573 (7.5)	29 (5.3)	524 (10.1)	58 (5.9)	509 (6.6)
Massachusetts, US		29 (6.8)	589 (9.1)	45 (6.6)	562 (8.0)	26 (4.2)	521 (13.4)
Minnesota, US		18 (3.2)	583 (16.6)	45 (7.1)	546 (5.4)	37 (7.6)	530 (8.4)
North Carolina, US	r	14 (5.6)	560 (16.1)	23 (6.4)	551 (10.9)	63 (6.7)	519 (10.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (–) indicates comparable data not available.
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.24 shows the completed analysis module for this example analysis and the results are presented in Exhibit 2.25.

Exhibit 2.24: IDB-Analyzer Setup for Example School-Level Analysis

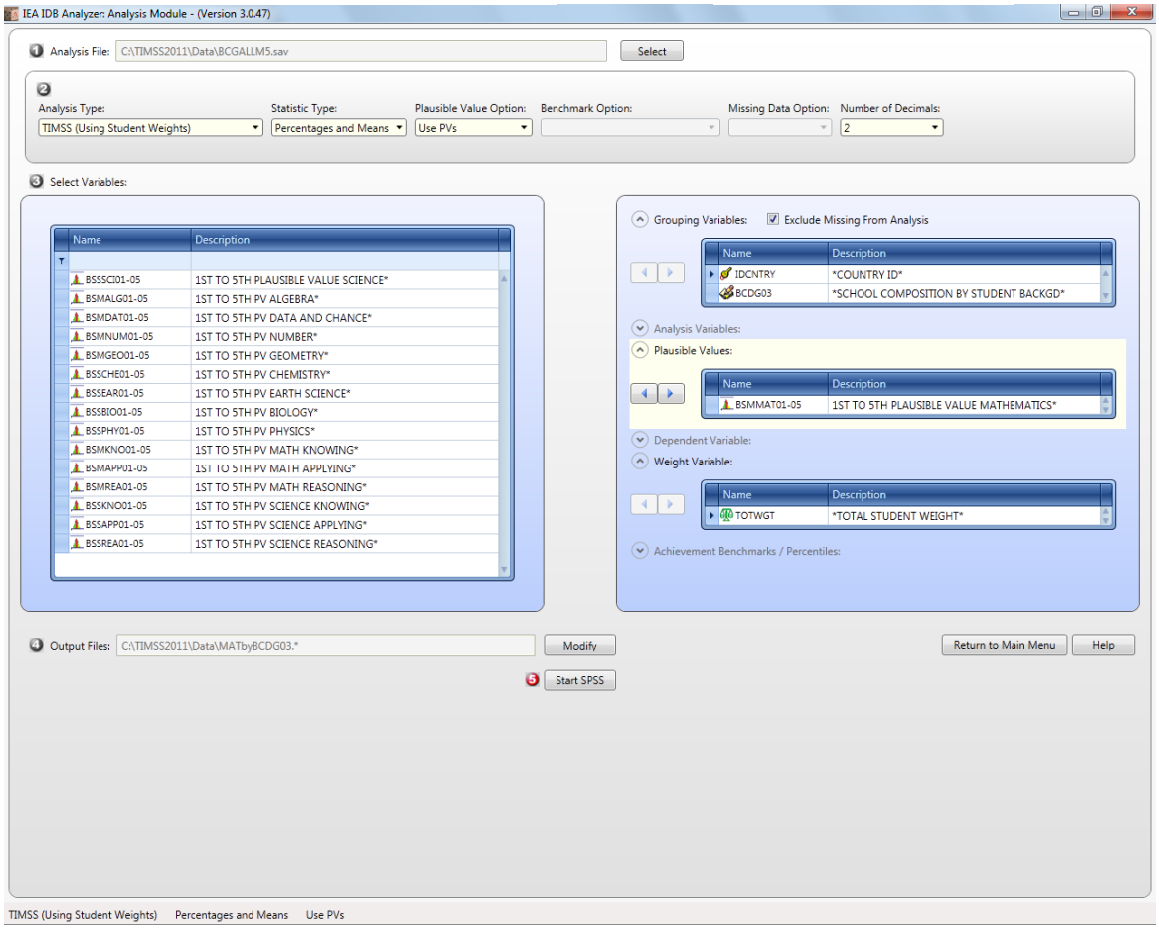


Exhibit 2.25: Output for Example School-level Analysis

Average for BSMMAT0 by IDCNTRY BCDG03

COUNTRY ID	*SCHOOL COMPOSITION BY STUDENT BACKGD*	N of Cases	Sum of TOTWGT	Percent	Percent (s.e.)	BSMMAT0 (Mean)	BSMMAT0 (s.e.)	Std.Dev	Std.Dev (s.e.)
Australia	MORE AFFLUENT	2118	71105	32.49	3.36	542.55	11.18	89.84	5.18
	NEITHER MORE AFFLUENT NOR MORE DISADVANT	2535	84358	38.54	3.74	507.36	6.08	71.47	3.66
	MORE DISADVANTAGED	1800	63400	28.97	3.11	475.74	7.50	81.15	4.30
Bahrain	MORE AFFLUENT	1954	5157	45.30	.32	419.65	3.19	104.85	2.68
	NEITHER MORE AFFLUENT NOR MORE DISADVANT	1143	3173	27.87	.23	407.57	2.72	94.08	2.88
	MORE DISADVANTAGED	1051	3055	26.83	.34	395.48	3.69	92.29	2.29
Armenia	MORE AFFLUENT	2085	12047	34.78	3.70	483.52	5.89	88.70	3.54
	NEITHER MORE AFFLUENT NOR MORE DISADVANT	1329	8398	24.25	3.59	460.52	7.53	90.99	2.63
	MORE DISADVANTAGED	2158	14191	40.97	3.68	455.43	5.03	90.49	2.56
Chile	MORE AFFLUENT	811	22830	12.16	2.32	474.35	13.02	80.85	4.41
	NEITHER MORE AFFLUENT NOR MORE DISADVANT	1391	59452	31.66	4.07	439.36	5.98	72.78	3.02
	MORE DISADVANTAGED	2119	105493	56.18	3.86	398.81	4.76	71.93	3.08

In this example, each country's results are presented on three lines, one for each value of the BCDG03 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 BCDG03.

As shown in the first three lines of results, 32.49 percent of eighth grade students in Australia attended schools with more affluent students than disadvantaged students (standard error of 3.36), 38.54 percent attended schools with neither more affluent students nor more disadvantaged students (standard error of 3.74), and 28.97 percent attended schools with more disadvantaged students than affluent students (standard error of 3.11). Also, the estimated average mathematics achievement was 542.55 (standard error of 11.18) for eighth grade students in schools with more affluent students, 507.36 (standard error of 6.08) for students in schools with neither more affluent students nor more disadvantaged students, and 475.74 (standard error of 7.50) for students in schools with more disadvantaged students. The IEA IDB Analyzer also produces the standard deviations of achievement for all subgroups of BCDG03.

References

IBM Corporation. (2012). *IBM SPSS statistics* (version 20.0). Somers, NY: Author.

International Association for the Evaluation of Educational Achievement. (2012). *International database analyzer* (version 3.0). Hamburg, Germany: IEA Data Processing and Research Center.

Martin, M.O. & Mullis, I.V.S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). *TIMSS 2011 international results in science.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Ruddock, G.J., O'Sullivan, C.Y., & Preuschoff, C. (2009). *TIMSS 2011 assessment frameworks.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Chapter 3

Using SAS to Analyze the TIMSS 2011 International Database

3.1 Overview

This chapter presents some basic examples of analyses that can be performed with the TIMSS 2011 International Database using the SAS statistical analysis system (SAS Institute, 2012) and the SAS programs and macros provided. The SAS macros use sampling weights and the jackknifing algorithm to deal with the TIMSS complex sample design and take into account plausible values when analyzing student achievement.

Although some familiarity with the structure of the TIMSS 2011 database will be helpful, the analyses presented in this chapter are simple in nature and are designed primarily to familiarize users with the various data files and their structure, as well as the variables to be used in most analyses. Chapter 4 provides a more detailed description of the data files contained in the International Database, including their structure and contents, along with detailed information on all the supporting documentation provided with the International Database.

In general, the examples in this chapter compute percentages of students in specified subgroups, average mathematics achievement in those subgroups, and appropriate standard errors for these statistics. Additional examples compute regression coefficients and their standard errors. The example analyses, using student, teacher and school data, replicate some of the analyses that are included in the *TIMSS 2011 International Reports* (Mullis, Martin, Foy, & Arora, 2012; and Martin, Mullis, Foy, & Stanco, 2012). Users are encouraged to practice analyzing the TIMSS 2011 data by replicating some of the exhibits presented in the *TIMSS 2011 International Reports*.

Before conducting any statistical analyses with the TIMSS 2011 International Database, users should download and copy the contents of the International Database either on their computer or on a server.[1] For the purposes of this chapter, we will assume all files have been copied to the folder titled "C:\TIMSS2011\." All SAS programs presented in this chapter are available in the International Database. They can be adapted to perform a variety of analyses with some basic knowledge of the SAS language. With a little experience and some practice with these programs, users should be able to make the necessary modifications to obtain the desired results. The example SAS programs invoke SAS macros that will be described in this chapter. Although users will be expected to modify the example programs, there is no need to make any changes within the SAS macros.

[1] The TIMSS 2011 International Database is available on the TIMSS 2011 International Database and User Guide webpage (*http://timssandpirls.bc.edu/timss2011/international-database.html*) and on the IEA Study Data Repository website (*http://rms.iea-dpc.org/*).

3.2 SAS Programs and Macros

The TIMSS 2011 International Database includes a number of SAS programs needed to process the SAS data files, compute survey results, and carry out example analyses. This chapter gives detailed instructions on how to adapt and make use of them. The following programs and macros are available:

CONVERT.SAS

This SAS program converts the SAS export files found in the International Database into SAS data files. All programs and macros described in this chapter require that the SAS export files be converted into SAS data files.

ASASCRM5.SAS, BSASCRM5.SAS

These two SAS programs can be used to convert the response codes to the TIMSS 2011 achievement items to their corresponding score levels.

JOIN.SAS

This SAS program combines files of the same type from more than one country.

JACKGEN.SAS (and SAMPLEJACKGEN.SAS)

This SAS macro program is used to compute weighted percentages of students within defined subgroups, along with their means on a specified continuous variable. This macro generates replicate weights and computes standard errors using the jackknife repeated replication (JRR) methodology. The analysis variable can be any continuous variable. When computing average achievement scores with plausible values, the macro JACKPV.SAS should be used.

JACKPV.SAS (and SAMPLEJACKGPV.SAS)

This SAS macro program is used to compute weighted percentages of students within defined subgroups, along with their average achievement on an achievement scale using the available plausible values. This macro generates replicate weights and computes standard errors using the jackknife repeated replication (JRR) and multiple imputation methodologies. This macro should be used when achievement plausible values are used in an analysis.

JACKREG.SAS (and SAMPLEJACKREG.SAS)

This SAS macro program is used to compute regression coefficients and their standard errors within defined subgroups. This macro can be used with any analysis variable, but is not appropriate for analyzing achievement with plausible values.

JACKREGP.SAS (and SAMPLEJACKREGP.SAS)

This SAS macro program is used to compute regression coefficients and their standard errors within defined subgroups when using achievement plausible values as the dependent variable.

EXAMPLE1.SAS, EXAMPLE2.SAS, EXAMPLE3.SAS,
EXAMPLE4.SAS, EXAMPLE5.SAS, EXAMPLE6.SAS

These are the programs used in the example analyses presented in this chapter.

The four SAS macros—JACKGEN, JACKPV, JACKREG, and JACKREGP—have a corresponding sample program that calls the respective macro and prints out the results. These sample programs are discussed later in this chapter (See 3.6 SAS Macros to Compute Statistics and their Standard Errors).

3.3 Converting the SAS Export Files

The TIMSS 2011 International Database provides a program called CONVERT.SAS that converts the SAS export files provided in the International Database into SAS data files. This conversion is necessary because all of the SAS macros and SAS programs presented in this chapter require the use of SAS data files. To convert SAS export files into SAS data files, users should apply the following steps:

1. Open the SAS program file CONVERT.SAS.
2. At the beginning of the program, specify the data file type in the parameter "TYPE."
3. Specify the path where the SAS export files are located in the parameter "EXPPATH."
4. Specify the folder where the converted SAS data files will be located in the parameter "DATPATH."
5. List all of the countries of interest in the parameter "COUNTRY." By default, all TIMSS 2011 countries are listed and the program will automatically select the appropriate list by grade based on the file type specified in step 2.
6. Submit the edited code for processing by SAS.

An example of the CONVERT program is presented in Exhibit 3.1. This example converts the SAS export files of type BSG for all countries. For this example, all SAS export files are located in the folder titled "C:\TIMSS2011\Data\SAS_Data," where the converted SAS data files also will be located.

Users are advised to run the CONVERT program for all countries and all file types. The file types at the fourth grade 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. In principle, this program needs to be run only once for each file type and should be one of the first thing users do with the TIMSS 2011 International Database before undertaking any data analyses, particularly the data analysis examples in this User Guide.

Exhibit 3.1: Example of CONVERT Program

```
%LET TYPE = BSG ;

%LET EXPPATH = C:\TIMSS2011\Data\SAS_Data\ ;

%LET DATPATH = C:\TIMSS2011\Data\SAS_Data\ ;

%MACRO DOIT ;

  %LET COUNTRY = < List of TIMSS 2011 countries > ;

  %LET I = 1 ;
  %DO %WHILE(%LENGTH(%SCAN(&COUNTRY,&I))) ;
    %LET CTRY = %SCAN(&COUNTRY,&i) ;

    PROC CIMPORT FILE = "&EXPPATH&TYPE&CTRY.M5.EXP"
                 DATA = "&DATPATH&TYPE&CTRY.M5" ;

    %LET I = %EVAL(&I + 1) ;
  %END ;

%MEND DOIT ;

%DOIT ;
```

3.4 Scores for the TIMSS 2011 Items

Student achievement in TIMSS 2011 is represented by sets of five plausible values for mathematics and science and their content and cognitive domains, and these 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 2011 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 to constructed response items. The International Database provides SAS programs to perform this task.

For multiple choice items, numbers 1 through 4 are used to represent response options A through D, respectively, in the TIMSS 2011 achievement data files. These responses must be converted to their appropriate score level ("1" for correct and "0" for incorrect) based on each multiple choice item's correct response key. For constructed response items, worth a total of one or two points, two-digit codes are used to represent the students' written responses in the achievement data files. 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 must 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 2011 items, whereas they were treated as incorrect when deriving achievement scores for students.

The TIMSS 2011 International Database includes two SAS programs—ASASCRM5.SAS for the fourth grade items, and BSASCRM5.SAS for the eighth grade items—which will recode the responses to individual items from the achievement data files to their appropriate score levels. To score each individual TIMSS 2011 item, the program code in the ASASCRM5 and BSASCRM5 programs must be adapted by doing the following steps:

1. Open the SAS program file ASASCRM5.SAS or BSASCRM5.SAS.
2. Specify the folder where the SAS data files are located in the "LIBNAME" statement.
3. List all of the countries of interest in the parameter "COUNTRY" (by default, all TIMSS 2011 countries are listed).
4. Submit the edited code for processing by SAS.

Each program uses the student achievement data files as input (ASA/BSA), recodes the individual items, and saves the results in SAS data files that have "ASC/BSC" instead of "ASA/BSA" as the first three characters in their file names. Exhibit 3.2 shows a condensed version of the ASASCRM5 and BSASCRM5 programs to score the individual TIMSS 2011 items.

Exhibit 3.2: Example of ASASCRM5/BSASCRM5 Programs

```
LIBNAME LIBDAT "C:\TIMSS2011\Data\SAS_Data\" ;

%LET COUNTRY = < List of TIMSS 2011 countries > ;

%LET ARIGHT = < List of multiple-choice items where A is correct > ;
%LET BRIGHT = < List of multiple-choice items where B is correct > ;
%LET CRIGHT = < List of multiple-choice items where C is correct > ;
%LET DRIGHT = < List of multiple-choice items where D is correct > ;
%LET CONSTR = < List of constructed-response items > ;

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

   .  .  .

%MEND SCOREIT ;

%MACRO DOIT ;

   .  .  .

  DO OVER ARIGHT ; %SCOREIT (ARIGHT, "MC", 1, .R, .A, ., .I) ; END ;
  DO OVER BRIGHT ; %SCOREIT (BRIGHT, "MC", 2, .R, .A, ., .I) ; END ;
  DO OVER CRIGHT ; %SCOREIT (CRIGHT, "MC", 3, .R, .A, ., .I) ; END ;
  DO OVER DRIGHT ; %SCOREIT (DRIGHT, "MC", 4, .R, .A, ., .I) ; END ;
  DO OVER CONSTR ; %SCOREIT (CONSTR, "CR",  , .R, .A, ., .I) ; END ;

   .  .  .

%MEND DOIT ;

%DOIT ;
```

If "Not Reached" responses are to be treated as missing rather than incorrect, users should replace the following statement (which appears twice in the programs):

```
IF &ITEM = &NR THEN SCORE = 0 ;
```

with this statement:

```
IF &ITEM = &NR THEN SCORE = . ;
```

3.5 Joining the TIMSS 2011 Data Files

The TIMSS 2011 International Database contains separate data files for each country. The International Database provides a SAS program called JOIN.SAS that joins individual country data files of a particular type into a single aggregated data file, facilitating joint analyses involving more than one country. The JOIN program, however, can only join SAS data files of the same type, and thus can be used for the following data file types: ACG/BCG, ASA/BSA, ASC/BSC, ASG/BSG, ASH, ASR/BSR, AST/BST, and ATG/BTM/BTS. To create a SAS data file with more than one country's data, users should do the following:

1. Open the SAS program file JOIN.SAS.
2. At the beginning of the program, specify the data file type in the parameter "TYPE."
3. Specify the folder where the SAS data files are located in the LIBDAT statement.
4. List all of the countries of interest in the parameter "COUNTRY" (by default, all TIMSS 2011 countries are listed).
5. Submit the edited code for processing by SAS.

An example of the JOIN program is displayed in Exhibit 3.3. It joins the eighth grade student background data files (BSG) of all countries. All country data files are located in the folder titled "C:\TIMSS2011\Data\SAS_Data" for the sake of this example. The resulting data file, BSGALLM5, also will be saved in this folder.

Exhibit 3.3: Example of JOIN Program

```
%LET TYPE = BSG ;

LIBNAME LIBDAT "C:\TIMSS2011\Data\SAS_Data\" ;

%MACRO DOIT ;

  %LET COUNTRY = < List of TIMSS 2011 countries > ;

  DATA &TYPE.ALLM5 ;
       SET  %LET I = 1 ;
            %DO %WHILE(%LENGTH(%SCAN(&COUNTRY,&I))) ;
              %LET CTRY = %SCAN(&COUNTRY,&I) ;
              LIBDAT.&TYPE&CTRY.M5
              %LET I = %EVAL(&I + 1) ;
            %END ; ;

  PROC SORT DATA = &TYPE.ALLM5 OUT = LIBDAT.&TYPE.ALLM5 ;
       BY &SORTVARS ;

%MEND DOIT ;

%DOIT ;
```

3.6 SAS Macros to Compute Statistics and their Standard Errors

This section describes the four SAS macros—JACKGEN, JACKPV, JACKREG, and JACKREGP—needed to compute specific statistics with their correct standard errors, along with sample SAS programs to demonstrate their use. Users are encouraged to modify the sample SAS programs and familiarize themselves with their functioning. The four SAS macros, however, do not require any modifications.

Each SAS macro serves a specific analytical purpose. These macros ensure that analyses of the TIMSS 2011 data are done properly. Sampling weights are used and standard errors are computed using the jackknife repeated replication (JRR) method. Furthermore, achievement scores are based on sets of five plausible values that take into account the measurement error arising from the test design and the IRT scaling methodology. The macros that make use of these plausible values effectively perform five analyses—one for each plausible value—and aggregate the results to produce accurate estimates of achievement and standard errors that incorporate both sampling and imputation errors.

The sample SAS programs presented in this section all use as input the SAS data file BSGALLM5, which contains the eighth grade student background data files of all participating countries. In all sample programs, <datpath> must be edited to specify the folder where the BSGALLM5 file is located, as well as <macpath> to indicate the folder where the SAS macros are located.

Computing Means and their Standard Errors—JACKGEN

The JACKGEN macro is used to compute percentages and means of continuous variables with their standard errors. We will demonstrate its use with a sample SAS program that calls the macro JACKGEN to compute the percentages of students within specified subgroups and their mean on a variable of choice. The macro also computes the appropriate standard errors for the percentages and means. However, this macro is not appropriate for analyzing achievement scores based on plausible values; the JACKPV macro should be used for this purpose.

The JACKGEN macro is a self-contained program, located in the program file JACKGEN.SAS, and should not be modified. It essentially computes sets of replicate weights using the sampling and weighting variables, aggregates the data by subgroups using the replicate weights, and then computes and stores the desired statistics in a SAS working file called FINAL.

The macro JACKGEN is included in a SAS program by issuing the following command:

```
%INCLUDE "<macpath>JACKGEN.SAS" ;
```

where <macpath> points to the folder in which the SAS macro JACKGEN.SAS is located. This macro requires that the following several parameters be specified as input when it is invoked:

WGT — The sampling weight to be used in the analysis. Generally, TOTWGT should be used. MATWGT should be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data, and TCHWGT when analyzing all teacher data.

JKZ — The variable that captures the assignment of cases (typically students) to sampling zones. The name of this variable in the TIMSS data files is JKZONE.

JKR — The variable that captures whether the case is to be dropped or have its weight doubled for each set of replicate weights. The name of this variable in the TIMSS data files is JKREP.

NJKZ — The number of replicate weights to be generated when computing the standard errors. The value of NJKZ should be set to 75, the maximum possible value across all participating countries.

CVAR — The list of variables that are to be used to define the subgroups. The list can consist of one or more variables. We recommend that users always include IDCNTRY as the first classification variable.

DVAR — The variable for which averages are to be computed. Only one variable can be listed and it should be a continuous variable. Plausible values of achievement scores should not be specified here.

INFILE — The name of the SAS data file that contains the data being analyzed. It is important to emphasize that this SAS data file must include only those cases that are of interest in the analysis. If users want to have specific cases excluded from the analysis (e.g., students with missing data), this should be done prior to invoking the macro.

The JACKGEN macro is invoked by a SAS program using the conventional SAS notation for invoking macros. This involves listing the macro name followed by the list of parameters in parenthesis, each separated by a comma. For example, the JACKGEN macro invoked using the following statement:

```
%JACKGEN (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSDAGE, BSGALLM5) ;
```

will compute the average age (BSDAGE) of eighth grade students by gender (ITSEX) and their standard errors within each country (IDCNTRY), using the weighting variable TOTWGT. It also will compute the percentages of girls and boys and their standard errors within each country. The data will be read from the data file BSGALLM5 and the standard errors will be computed based on 75 sets of replicate weights.

The results of the JACKGEN macro are stored in a SAS working file called FINAL, which is stored in the default folder used by SAS. The following variables are contained in this results file:

Classification Variables

All classification variables are kept in the results file. In the example invocation above, there are two classification variables: IDCNTRY and ITSEX. There is one record in the results file for each subgroup defined by the categories of the classification variables.

N

This variable contains the number of valid cases for each subgroup defined by the classification variables. In the example, it is the number of girls and boys with valid data in each country's sample.

Weight Variable

The weight variable contains the sum of weights within each subgroup defined by the classification variables. In the example, this variable is TOTWGT, because TOTWGT was specified as the weighting variable. This variable will be an estimate of the total population within each subgroup.

MNX

This variable contains the estimated averages of the specified analysis variable by subgroup.

MNX_SE

This variable contains the standard errors of the estimated averages by subgroup.

PCT

This variable contains the estimated percentages of students in each subgroup for the last classification variable listed. In the example, it is the percentage of girls and boys within each country.

PCT_SE

This variable contains the standard errors of the estimated percentages.

The contents of the FINAL file can be printed using the SAS PRINT procedure. The sample SAS program that invokes the JACKGEN macro is presented in Exhibit 3.4, along with a printout of the results. This program is available in the International Database as the file called SAMPLEJACKGEN.SAS. It produces the average age of eighth grade girls and boys in all countries, although the exhibit shows the results only for the first four countries.

As shown in the first two lines of the results in Exhibit 3.4, there were 3,746 girls in Australia's eighth grade sample, representing 125,554 girls in the entire population. The average age of eighth grade girls in Australia was estimated to be 13.96, with a standard error of 0.01. Girls constituted 49.83 percent of Australia's eighth grade student population (standard error of 1.61). Conversely, Australia sampled 3,807 boys, representing 126,414 boys in the entire population. The estimated average age of eighth grade boys in Australia was 14.02, with a standard error of 0.01. Boys constituted 50.17 percent of Australia's eighth grade student population (standard error of 1.61).

Exhibit 3.4: Sample SAS Program Invoking the SAS Macro JACKGEN with Results

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKGEN.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (ITSEX, BSDAGE) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

 VALUE SEX
     1 = "GIRL"
     2 = "BOY" ;

%JACKGEN (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSDAGE, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY ITSEX N TOTWGT MNX MNX_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. ITSEX SEX. N 6.0 TOTWGT 10.0
            MNX MNX_SE PCT PCT_SE 6.2 ;
```

IDCNTRY	ITSEX	N	TOTWGT	MNX	MNX_SE	PCT	PCT_SE
AUSTRALIA	GIRLS	3746	125554	13.96	0.01	49.83	1.61
AUSTRALIA	BOYS	3807	126414	14.02	0.01	50.17	1.61
BAHRAIN	GIRLS	2284	6260	14.39	0.01	49.66	0.85
BAHRAIN	BOYS	2351	6346	14.47	0.01	50.34	0.85
ARMENIA	GIRLS	2894	17702	14.60	0.01	48.93	0.78
ARMENIA	BOYS	2951	18474	14.54	0.02	51.07	0.78
CHILE	GIRLS	3133	133160	14.15	0.01	53.01	1.46
CHILE	BOYS	2702	118020	14.26	0.02	46.99	1.46

Computing Achievement Means and their Standard Errors—JACKPV

The JACKPV macro computes percentages and average achievement scores using plausible values. It makes use of the sampling weights, the jackknifing algorithm to compute sampling variances, and the five plausible values to compute imputation variances. It effectively performs five analyses—one 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 second sample program demonstrates the use of the JACKPV macro, which computes the percentages of students within specified subgroups and their average achievement scores. This SAS macro also computes the appropriate standard errors for those percentages and achievement averages.

The JACKPV macro is a self-contained program, located in the program file JACKPV.SAS, and should not be modified. It essentially computes sets of replicate weights using the sampling and weighting variables, aggregates the data by subgroups using the replicate weights, and then computes and stores the desired statistics in a SAS working file called FINAL. The macro aggregates data across all plausible values to obtain the correct results.

The SAS macro JACKPV is included in a SAS program by issuing the following command:

```
%INCLUDE "<macpath>JACKPV.SAS" ;
```

where <macpath> points to the folder in which the SAS macro program JACKPV.SAS is located. This macro requires that the following several parameters be specified as input when it is invoked:

WGT	The sampling weight to be used in the analysis. Generally, TOTWGT should be used. MATWGT should be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data, and TCHWGT when analyzing all teacher data.
JKZ	The variable that captures the assignment of cases to sampling zones. The name of this variable in the TIMSS data files is JKZONE.
JKR	The variable that captures whether the case is to be dropped or have its weight doubled for each set of replicate weights. The name of this variable in the TIMSS data files is JKREP.
NJKZ	The number of replicate weights to be generated when computing the standard errors. The value of NJKZ should be set to 75, the maximum possible value across all participating countries.
CVAR	The list of variables that are to be used to define the subgroups. The list can consist of one or more variables. We recommend that users always include IDCNTRY as the first classification variable.
ROOTPV	The variable root used to identify the set of plausible values for the achievement score of interest. It corresponds to the first seven characters of the plausible values variable name. For example, the root of the eighth grade overall mathematics plausible values is BSMMAT0, the root of the eighth grade overall science plausible values is BSSSCI0.
NPV	The number of plausible values that will be used for the analysis. Generally, it is set to five in order to use all five available plausible values for analysis.
INFILE	The name of the SAS data file that contains the data being analyzed. It is important to emphasize that this SAS data file must include only those cases that are of interest in the analysis. If users want to have specific cases excluded from the analysis (e.g., students with missing data), this should be done prior to invoking the macro.

The JACKPV macro is invoked by a SAS program using the conventional SAS notation for invoking macros. This involves listing the macro name followed by the list of parameters in parenthesis, each separated by a comma. For example, the JACKPV macro invoked using the following statement:

```
%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSMMAT0, 5, BSGALLM5) ;
```

will compute the average eighth grade mathematics achievement (BSMMAT01 through BSMMAT05) by gender (ITSEX) within each country (IDCNTRY) and their standard errors, using the weighting variable TOTWGT. The macro uses all five plausible values to compute these statistics. It also will compute the percentages of girls and boys within each country, along with their

standard errors. The data will be read from the data file BSGALLM5 and the standard errors will be computed based on 75 sets of replicate weights.

The results of the JACKPV macro are stored in a SAS working file called FINAL, which is stored in the default folder used by SAS. The following variables are contained in this results file:

Classification Variables

All classification variables are kept in the results file. In this example, there are two classification variables: IDCNTRY and ITSEX. There is one record in the results file for each subgroup defined by the categories of the classification variables.

N

This variable contains the number of valid cases for each subgroup defined by the classification variables. In the example, it is the number of girls and boys with valid data in each country's sample.

Weight Variable

The weight variable contains the sum of weights within each subgroup defined by the classification variables. In the example, this variable is called TOTWGT, because TOTWGT was specified as the weighting variable. This variable will be an estimate of the total population within each subgroup.

MNPV

This variable contains the estimated average achievement by subgroup, based on the plausible values.

MNPV_SE

This variable contains the standard errors of the estimated average achievement by subgroup, based on the plausible values.

PCT

This variable contains the estimated percentages of students in each subgroup for the last classification variable listed. In the example, it is the percentage of girls and boys within each country.

PCT_SE

This variable contains the standard errors of the estimated percentages.

The contents of the FINAL file can be printed using the SAS PRINT procedure. The sample SAS program that invokes the JACKPV macro is shown in Exhibit 3.5, along with a printout of the results. This program is available in the International Database as the file called SAMPLEJACKPV.SAS. It produces the average eighth grade mathematics achievement for girls and boys in all countries, although Exhibit 3.5 gives the results only for the first four countries.

Exhibit 3.5: Sample SAS Program Invoking the SAS Macro JACKPV with Results

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (ITSEX) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

 VALUE SEX
     1 = "GIRL"
     2 = "BOY" ;

%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSMMAT0, 5, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY ITSEX N TOTWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. ITSEX SEX. N 6.0 TOTWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

IDCNTRY	ITSEX	N	TOTWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	GIRLS	3747	125555	500.41	4.72	49.83	1.61
AUSTRALIA	BOYS	3809	126429	509.16	7.26	50.17	1.61
BAHRAIN	GIRLS	2288	6276	430.78	2.51	49.72	0.85
BAHRAIN	BOYS	2352	6348	387.89	3.07	50.28	0.85
ARMENIA	GIRLS	2894	17702	471.52	3.07	48.93	0.78
ARMENIA	BOYS	2952	18479	461.86	3.21	51.07	0.78
CHILE	GIRLS	3133	133160	409.46	3.23	53.01	1.46
CHILE	BOYS	2702	118020	423.94	3.05	46.99	1.46

As shown in the first two lines of the results in Exhibit 3.5, the average mathematics achievement of eighth grade girls in Australia was estimated at 500.41, with a standard error of 4.72. The average mathematics achievement of eighth grade boys in Australia was estimated at 509.16, with a standard error of 7.26.

Computing Regression Coefficients and their Standard Errors—JACKREG

The JACKREG macro performs a multiple linear regression between a dependent variable and a set of independent variables. A third sample program demonstrates the use of the JACKREG macro, which computes the regression coefficients and their standard errors. This macro is not appropriate for regression analyses using achievement scores as the dependent variable. The JACKREGP macro should be used for this purpose.

The JACKREG macro is a self-contained program, located in the program file JACKREG.SAS, and should not be modified. It computes sets of replicate weights using the sampling and weighting variables, performs a linear regression by subgroup using the replicate weights, and then computes and stores the desired statistics in a SAS working file called REG.

The SAS macro JACKREG is included in a SAS program by issuing the following command:

```
%INCLUDE "<macpath>JACKREG.SAS" ;
```

where <macpath> points to the specific folder in which the SAS macro program JACKREG.SAS is located. This macro requires that the following several parameters be specified as input when it is invoked:

WGT	The sampling weight to be used in the analysis. Generally, TOTWGT should be used. MATWGT should be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data, and TCHWGT when analyzing all teacher data.
JKZ	The variable that captures the assignment of cases to sampling zones. The name of this variable in the TIMSS data files is JKZONE.
JKR	The variable that captures whether the case is to be dropped or have its weight doubled for each set of replicate weights. The name of this variable in the TIMSS data files is JKREP.
NJKZ	The number of replicate weights to be generated when computing the standard errors. The value of NJKZ should be set to 75, the maximum possible value across all participating countries.
CVAR	The list of variables that are to be used to define the subgroups. The list can consist of one or more variables. We recommend that users always include IDCNTRY as the first classification variable.
XVAR	The list of independent variables used as predictors in the regression model. The independent variables can be either continuous or categorical (e.g., ITSEX).
DVAR	The dependent variable to be predicted by the list of independent variables specified in XVAR. Only one variable can be listed, and plausible values of achievement scores should not be specified here.
INFILE	The name of the SAS data file that contains the data being analyzed. It is important to emphasize that this SAS data file must include only those cases that are of interest in the analysis. If users want to have specific cases excluded from the analysis, for example students with missing data, this should be done prior to invoking the macro.

The JACKREG macro is invoked by a SAS program using the conventional SAS notation for invoking macros. This involves listing the macro name followed by the list of parameters in parenthesis, each separated by a comma. For example, the JACKREG macro invoked using the following statement:

```
%JACKREG (TOTWGT, JKZONE, JKREP, 75, IDCNTRY, REGSEX, BSBGSLM, BSGALLM5) ;
```

will perform a linear regression with gender (REGSEX) as a predictor of the eighth grade students' score on the Students Like Learning Mathematics contextual scale (BSBGSLM), using the weighting variable TOTWGT.[2] It will compute the regression coefficients and their standard errors. The data

[2] The Students Like Learning Mathematics contextual scale is described in the section *Student-level Analysis with a Contextual Scale*.

will be read from the data file BSGALLM5 and the standard errors will be computed based on 75 replicate weights.

The results of the JACKREG macro are stored in a SAS working file called REG, which is stored in the default folder used by SAS. The following variables are contained in this results file:

Classification Variables

All classification variables are kept in the results file. In this example, there is a single classification variable IDCNTRY. There is one record in the results file for each subgroup defined by the categories of the classification variables.

N

This variable contains the number of valid cases for each subgroup defined by the classification variables. In the example, it is the number of students with valid data in each country's sample.

MULT_RSQ

The squared multiple correlation coefficient (R^2) for the regression model applied in each subgroup.

SS_RES, SS_REG, SS_TOTAL

The residual, regression, and total weighted sums of squares for the regression model applied in each subgroup.

Regression Coefficients and Standard Errors (B## and B##.SE)

The regression coefficients for the intercept and the predictor variables with their respective standard errors. The regression coefficients are numbered sequentially, starting with zero (B00) for the intercept, and based on the order of the predictor variables as specified in the parameter XVAR.

The contents of the REG file can be printed using the SAS PRINT procedure. The sample SAS program that invokes the JACKREG macro is displayed in Exhibit 3.6, along with a printout of the results. This program is available in the International Database as the file called SAMPLEJACKREG.SAS. It performs a linear regression in each country, with the variable REGSEX as a predictor of the eighth grade students' score on the Students Like Learning Mathematics contextual scale (BSBGSLM). The exhibit displays the results for the first four countries.

The regression performed by the sample program uses the independent variable REGSEX, which is a "dummy-coded" version of ITSEX, such that the value "0" represents the girls and the value "1" represents the boys. By performing this recoding, the intercept B00 will be the estimated average score of eighth grade girls, whereas the regression coefficient B01 will be the estimated increase in average score for boys. This will allow us to determine if the difference in average score between girls and boys is statistically significant.

As shown in the first line of the results in Exhibit 3.6, the estimated average score of eighth grade girls in Australia on the BSBGSLM scale (B00) was 9.10, with a standard error of 0.07. The eighth

grade boys in Australia were an estimated 0.28 points higher (B01) than the girls on that scale, with an estimated standard error of 0.08. Note that this difference is statistically significant at the 95% confidence level.

Exhibit 3.6: Sample SAS Program Invoking the SAS Macro JACKREG with Results

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKREG.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (ITSEX, BSBGSLM) = 0 ;

     SELECT (ITSEX) ;
       WHEN (1)  REGSEX = 0 ;  * GIRLS ;
       WHEN (2)  REGSEX = 1 ;  * BOYS ;
       OTHERWISE REGSEX = . ;
     END ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

%JACKREG (TOTWGT, JKZONE, JKREP, 75, IDCNTRY, REGSEX, BSBGSLM, BSGALLM5) ;

PROC PRINT DATA = REG NOOBS ;
     VAR IDCNTRY N MULT_RSQ SS_TOTAL SS_REG B00 B00_SE B01 B01_SE ;
     FORMAT IDCNTRY COUNTRY. N 6.0 MULT_RSQ 5.3 SS_TOTAL SS_REG 10.0
            B00 B00_SE B01 B01_SE 6.2 ;


IDCNTRY            N    MULT_RSQ   SS_TOTAL     SS_REG    B00 B00_SE    B01 B01_SE

AUSTRALIA       7389       0.005      910209       4882   9.18   0.07   0.28   0.08
BAHRAIN         4581       0.000       52295          6   9.75   0.05   0.05   0.07
ARMENIA         5626       0.001      128047        162  10.94   0.06  -0.14   0.06
CHILE           5772       0.012      949606      11772   9.56   0.05   0.44   0.06
```

Computing Regression Coefficients and their Standard Errors with Achievement—JACKREGP

The JACKREGP macro is used to perform a multiple linear regression between a set of plausible values as the dependent variable and a set of independent variables. It computes the regression coefficients and their standard errors, making use of the sampling weights, the jackknifing algorithm to compute sampling variances, and the five plausible values to compute imputation variances. It effectively performs five regression analyses—one for each plausible value—and aggregates the results to produce accurate estimates of the regression coefficients and standard errors that incorporate both sampling and imputation errors. Below, we present a fourth sample program to demonstrate the use of the JACKREGP macro.

The JACKREGP macro is a self-contained program, located in the program file JACKREGP.SAS, and should not be modified. It computes sets of replicate weights using the sampling and weighting variables, performs a multiple linear regression by subgroups using the replicate weights, and then computes and stores the desired statistics in a SAS working file called REG.

The SAS macro JACKREGP is included in a SAS program by issuing the following command:

```
%INCLUDE "<macpath>JACKREGP.SAS" ;
```

where <macpath> points to the specific folder in which the SAS macro program JACKREGP.SAS is located. This macro requires that the following several parameters be specified as input when it is invoked:

WGT	The sampling weight to be used in the analysis. Generally, TOTWGT should be used. MATWGT should be used when analyzing mathematics teacher data, SCIWGT when analyzing science teacher data, and TCHWGT when analyzing all teacher data.
JKZ	The variable that captures the assignment of cases to sampling zones. The name of this variable in the TIMSS data files is JKZONE.
JKR	The variable that captures whether the case is to be dropped or have its weight doubled for each set of replicate weights. The name of this variable in the TIMSS data files is JKREP.
NJKZ	The number of replicate weights to be generated when computing the standard errors. The value of NJKZ should be set to 75, the maximum possible value across all participating countries.
CVAR	The list of variables that are to be used to define the subgroups. The list can consist of one or more variables. We recommend that users always include IDCNTRY as the first classification variable.
XVAR	The list of independent variables used as predictors in the regression model. The independent variables can be either continuous or categorical, such as ITSEX for example.
ROOTPV	The variable root used to identify the set of plausible values for the achievement score of interest. It corresponds to the first seven characters of the plausible values variable name. For example, the root of the eighth grade overall mathematics plausible values is BSMMAT0, the root of the eighth grade overall science plausible values is BSSSCI0.
NPV	The number of plausible values that will be used for the analysis. Generally, it is set to five to use all five available plausible values for analysis.
INFILE	The name of the SAS data file that contains the data being analyzed. this number is important to emphasize that this SAS data file must include only those cases that are of interest in the analysis. If users want to have specific cases excluded from the analysis, for example students with missing data, this should be done prior to invoking the macro.

The JACKREGP macro is invoked by a SAS program using the conventional SAS notation for invoking macros. This involves listing the macro name followed by the list of parameters in parenthesis, each separated by a comma. For example, the JACKREGP macro invoked using the following statement:

```
%JACKREGP (TOTWGT, JKZONE, JKREP, 75, IDCNTRY, REGSEX, BSMMAT0, 5, BSGALLM5) ;
```

will perform a linear regression with gender (REGSEX) as a predictor of eighth grade mathematics achievement based on its five plausible values (BSMMAT01 through BSMMAT05), using the weighting variable TOTWGT. It will compute the regression coefficients and their standard errors. The data will be read from the data file BSGALLM5 and the standard errors will be computed based on 75 replicate weights.

The results of the JACKREGP macro are stored in a SAS working file called REG, which is stored in the default folder used by SAS. The following variables are contained in this results file:

Classification Variables

All classification variables are kept in the results file. In this example, there is a single classification variable IDCNTRY. There is one record in the results file for each subgroup defined by the categories of the classification variables.

N

This variable contains the number of valid cases for each subgroup defined by the classification variables. In the example, it is the number of students with valid data in each country's sample.

MULT_RSQ

The squared multiple correlation coefficient (R^2) for the regression model applied in each subgroup.

SS_RES, SS_REG, SS_TOTAL

The residual, regression, and total weighted sums of squares for the regression model applied in each subgroup.

Regression Coefficients and Standard Errors (B## and B##.SE)

The regression coefficients for the predictor variables and the intercept with their respective standard errors. The regression coefficients are numbered sequentially, starting with zero (B00) for the intercept, and based on the order of the predictor variables as specified in the parameter XVAR.

The contents of the REG file can be printed using the SAS PRINT procedure. The sample SAS program invoking the JACKREGP macro is presented in Exhibit 3.7, along with a printout of the results. This program is available in the International Database as the file called SAMPLEJACKREGP.SAS. It performs a linear regression in each country, with the variable REGSEX as a predictor of eighth grade mathematics achievement. The exhibit displays the results for the first four countries.

The regression performed by our sample program uses the variable REGSEX that was defined in our previous example. By using REGSEX, the intercept B00 will be the estimated average mathematics achievement of eighth grade girls, whereas the regression coefficient B01 will be the estimated difference in the average mathematics achievement of boys. This will allow us to determine if eighth grade mathematics achievement is significantly different between girls and boys.

Exhibit 3.7: Sample SAS Program Invoking the SAS Macro JACKREGP with Results

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKREGP.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (ITSEX) = 0 ;

     SELECT (ITSEX) ;
       WHEN (1)  REGSEX = 0 ;  * GIRLS ;
       WHEN (2)  REGSEX = 1 ;  * BOYS ;
       OTHERWISE REGSEX = . ;
     END ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

%JACKREGP (TOTWGT, JKZONE, JKREP, 75, IDCNTRY, REGSEX, BSMMAT0, 5, BSGALLM5) ;

PROC PRINT DATA = REG NOOBS ;
     VAR IDCNTRY N MULT_RSQ SS_TOTAL SS_REG B00 B00_SE B01 B01_SE ;
     FORMAT IDCNTRY COUNTRY. N 6.0 MULT_RSQ 5.3 SS_TOTAL SS_REG 10.0
            B00 B00_SE B01 B01_SE 6.2 ;


IDCNTRY            N    MULT_RSQ   SS_TOTAL     SS_REG    B00 B00_SE    B01 B01_SE

AUSTRALIA       7556      0.003   1838740030    4904428 500.41   4.72   8.75   6.90
BAHRAIN         4640      0.046    125166261    5807054 430.78   2.51 -42.89   3.99
ARMENIA         5846      0.003    297563160     853896 471.52   3.07  -9.66   3.10
CHILE           5835      0.008   1593853260   13134187 409.46   3.23  14.48   3.63
```

From the first line of the results shown in Exhibit 3.7, the estimated average mathematics achievement of eighth grade girls in Australia (B00) was 500.41, with a standard error of 4.72. Note that these are the same results obtained from the JACKPV sample program (Exhibit 3.5). The eighth grade boys had an estimated average mathematics achievement 8.75 points (B01) higher than girls, with an estimated standard error of 6.90. Note that this difference is not statistically significant at the 95% confidence level.

3.7 TIMSS Analyses with Student-level Variables

Many analyses of the TIMSS 2011 data can be undertaken using only student-level data. Examples in the previous section illustrated the functioning of the SAS macros. This section presents examples of actual analyses reported in *TIMSS 2011 International Results in Mathematics* (Mullis, Martin, Foy, & Arora, 2012), using SAS programs provided in the TIMSS 2011 International Database.

A first example computes national average achievement, whereas a second example computes national average achievement by gender. In both cases, the SAS macros use the sampling weights, implement the jackknife repeated replication method to compute appropriate sampling errors, effectively perform the computations five times (once for each plausible value), and aggregate 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 regression. Finally, a fourth example computes the average scale score for one of the newly developed contextual scales, along with the percentages of students, with their average achievement, for the categories of the scale's corresponding index.

In general, to perform student-level analyses using the student background data files, users should do the following:

1. Identify the variables of interest in the student background data files and note any specific national adaptations to the variables.
2. Retrieve the relevant variables from the student background data files, including the plausible values of achievement if required, classification variables, identification variables, sampling and weighting variables, and any other variables used in the selection of cases.
3. Perform any necessary variable transformations or recodes.
4. Use the macros JACKGEN and JACKREG, or JACKPV and JACKREGP if plausible values are involved, with the appropriate parameters.
5. Specify the location of the data files (<datpath>) and the macros (<macpath>).
6. Print the results file.

Student-level 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 1.2 of *TIMSS 2011 International Results in Mathematics* and are repeated here in Exhibit 3.8. Because the results in this exhibit are based on plausible values, we need to make sure that we include them when we create the file using the merge module, and also to indicate that our analysis will make use of achievement scores.

We will find all of the variables we need for this analysis in the student background data files, including the five plausible values of eighth grade mathematics achievement (BSMMAT01 through BSMMAT05), the student sampling weight (TOTWGT), the variables that contain the jackknife replication information (JKZONE and JKREP), and the variable containing the country identification code (IDCNTRY). In this analysis, we will use the data for all available countries. We used the JOIN program, described earlier in this chapter, to join the student background data files for all countries into a single file called BSGALLM5.

The SAS program used to perform this first example is presented in Exhibit 3.9 and is included in the International Database under the name EXAMPLE1.SAS. The results obtained from this program are displayed in Exhibit 3.10, although only the results of first four countries are shown for the sake of brevity.

In Exhibit 3.10, the results are displayed one line per country, with the countries identified in the first column. The second column reports the number of valid cases, and the third the sum of weights of the sampled students. The next four columns report the estimated average mathematics achievement and its standard error, followed by the percentage of students in each category and its standard error. As shown in the first line, the average mathematics achievement of eighth grade students in Australia was 504.80, with a standard error of 5.09. In this example, only IDCNTRY was used as a classification variable; thus, the estimated percentages are of little value because they represent the proportion of the TOTWGT column for each country.

Exhibit 3.8: Exhibit of Example Student-level Analysis with Achievement, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 1.2)

Exhibit 1.2: Distribution of Mathematics Achievement

TIMSS 2011 Mathematics 8th Grade

Country	Average Scale Score	Mathematics Achievement Distribution
Korea, Rep. of	613 (2.9) ▲	
2 Singapore	611 (3.8) ▲	
Chinese Taipei	609 (3.2) ▲	
Hong Kong SAR	586 (3.8) ▲	
Japan	570 (2.6) ▲	
2 Russian Federation	539 (3.6) ▲	
3 Israel	516 (4.1) ▲	
Finland	514 (2.5) ▲	
2 United States	509 (2.6) ▲	
‡ England	507 (5.5)	
Hungary	505 (3.5)	
Australia	505 (5.1)	
Slovenia	505 (2.2) ▲	
1 Lithuania	502 (2.5)	
TIMSS Scale Centerpoint	500	
Italy	498 (2.4)	
New Zealand	488 (5.5) ▼	
Kazakhstan	487 (4.0) ▼	
Sweden	484 (1.9) ▼	
Ukraine	479 (3.9) ▼	
Norway	475 (2.4) ▼	
Armenia	467 (2.7) ▼	
Romania	458 (4.0) ▼	
United Arab Emirates	456 (2.1) ▼	
Turkey	452 (3.9) ▼	
Lebanon	449 (3.7) ▼	
Malaysia	440 (5.4) ▼	
1 Georgia	431 (3.8) ▼	
Thailand	427 (4.3) ▼	
Ψ Macedonia, Rep. of	426 (5.2) ▼	
Tunisia	425 (2.8) ▼	
Chile	416 (2.6) ▼	
Ψ Iran, Islamic Rep. of	415 (4.3) ▼	
Ψ Qatar	410 (3.1) ▼	
Ψ Bahrain	409 (2.0) ▼	
Ψ Jordan	406 (3.7) ▼	
Ψ Palestinian Nat'l Auth.	404 (3.5) ▼	
Ψ Saudi Arabia	394 (4.6) ▼	
Ψ Indonesia	386 (4.3) ▼	
Ψ Syrian Arab Republic	380 (4.5) ▼	
⁂ Morocco	371 (2.0) ▼	
Ψ Oman	366 (2.8) ▼	
⁂ Ghana	331 (4.3) ▼	

100 200 300 400 500 600 700 800

Country	Average Scale Score	Mathematics Achievement Distribution
Ninth Grade Participants		
Ψ Botswana	397 (2.5) ▼	
⁂ South Africa	352 (2.5) ▼	
2 ⁂ Honduras	338 (3.7) ▼	
Benchmarking Participants		
1 2 Massachusetts, US	561 (5.3) ▲	
1 Minnesota, US	545 (4.6) ▲	
1 3 North Carolina, US	537 (6.8) ▲	
Quebec, Canada	532 (2.3) ▲	
1 2 Indiana, US	522 (5.1) ▲	
1 Colorado, US	518 (4.9) ▲	
1 2 Connecticut, US	518 (4.8) ▲	
1 2 Florida, US	513 (6.4) ▲	
2 Ontario, Canada	512 (2.5) ▲	
2 Alberta, Canada	505 (2.6)	
1 2 California, US	493 (4.9)	
Dubai, UAE	478 (2.1) ▼	
1 Alabama, US	466 (5.9) ▼	
Abu Dhabi, UAE	449 (3.7) ▼	

100 200 300 400 500 600 700 800

▲ Country average significantly higher than the centerpoint of the TIMSS 8th grade scale

▼ Country average significantly lower than the centerpoint of the TIMSS 8th grade scale

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

⁂ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

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

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and ‡.

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

Exhibit 3.9: Example SAS Program for Student-level Analysis with Achievement (EXAMPLE1.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSMMAT0, 5, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY N TOTWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. N 6.0 TOTWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

Exhibit 3.10: Output for Example Student-level Analysis with Achievement (EXAMPLE 1)

IDCNTRY	N	TOTWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	7556	251985	504.80	5.09	1.18	0.02
BAHRAIN	4640	12625	409.22	1.96	0.06	0.00
ARMENIA	5846	36181	466.59	2.73	0.17	0.00
CHILE	5835	251180	416.27	2.59	1.18	0.03

Student-level Analysis with Achievement by Gender

In our second example, we want to replicate another set of results presented in *TIMSS 2011 International Results in Mathematics*. We are interested in investigating the relationship between eighth grade students' gender and mathematics achievement. These results are presented in Exhibit 1.11 of *TIMSS 2011 International Results in Mathematics* and repeated here in Exhibit 3.11. Because the results in this exhibit are based on plausible values, we must make sure they are included when creating the input file, and also indicate that this analysis will make use of achievement scores.

After reviewing the appropriate codebook, the variable ITSEX in the student background data files contains information on the gender of students. We then proceed to read from the student background data files our variable of interest (ITSEX), the five plausible values of eighth grade mathematics achievement (BSMMAT01 through BSMMAT05), the student sampling weight (TOTWGT), the variables that contain the jackknifing information (JKZONE and JKREP), and the country identification variable (IDCNTRY). Again, we will use the data of all available countries contained in the file BSGALLM5.

The SAS program that implements this second example is presented in Exhibit 3.12 and is included in the International Database under the name EXAMPLE2.SAS. Note that one of the steps in this program is to select only those students who have non-missing data in our variable of interest ITSEX.

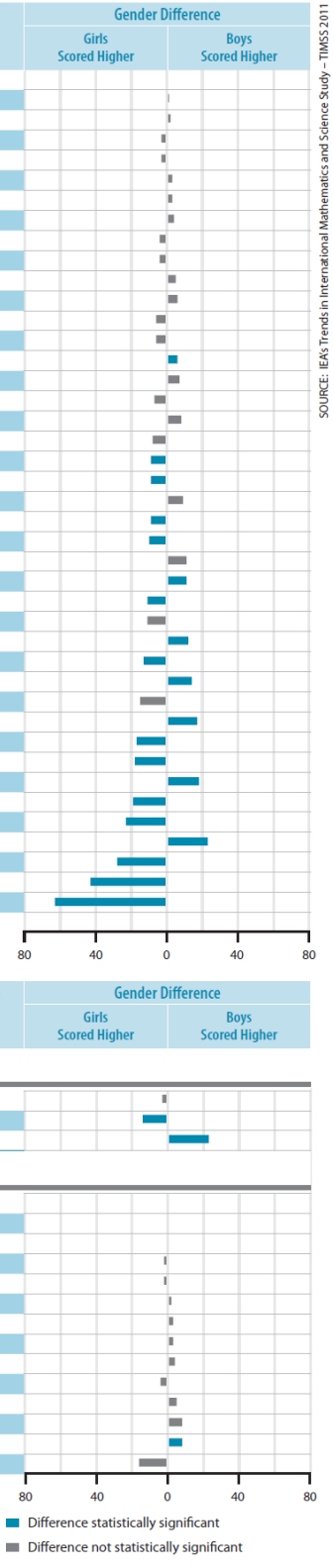
Exhibit 3.11: Exhibit of Example Student-level Analysis with Achievement by Gender, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 1.11)

Exhibit 1.11: Average Mathematics Achievement by Gender

TIMSS 2011 Mathematics 8th Grade

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
ЖMorocco	47 (0.8)	371 (2.3)	53 (0.8)	371 (2.7)	0 (3.2)	
2 Russian Federation	49 (0.9)	539 (3.8)	51 (0.9)	539 (3.9)	1 (2.9)	
Kazakhstan	49 (0.8)	486 (4.1)	51 (0.8)	488 (4.5)	2 (3.3)	
Norway	49 (0.7)	476 (2.9)	51 (0.7)	473 (2.9)	3 (3.1)	
‡ England	48 (2.0)	508 (5.7)	52 (2.0)	505 (6.6)	3 (5.6)	
1 Georgia	47 (0.9)	430 (4.1)	53 (0.9)	432 (4.4)	3 (4.0)	
Ukraine	50 (1.0)	478 (4.0)	50 (1.0)	481 (4.9)	3 (4.4)	
2 United States	51 (0.6)	508 (2.9)	49 (0.6)	511 (2.8)	4 (2.2)	
Sweden	48 (0.9)	486 (2.1)	52 (0.9)	482 (2.4)	4 (2.4)	
Finland	48 (1.1)	516 (2.7)	52 (1.1)	512 (2.7)	4 (2.3)	
Slovenia	49 (0.9)	502 (2.4)	51 (0.9)	507 (2.8)	5 (2.8)	
Hungary	49 (1.1)	502 (3.9)	51 (1.1)	508 (3.9)	6 (3.5)	
Hong Kong SAR	49 (1.6)	588 (5.0)	51 (1.6)	583 (4.3)	6 (5.5)	
Chinese Taipei	48 (1.0)	613 (3.7)	52 (1.0)	606 (3.8)	6 (4.1)	
Korea, Rep. of	52 (2.5)	610 (3.5)	48 (2.5)	616 (3.1)	6 (3.1)	
Ψ Iran, Islamic Rep. of	46 (2.3)	411 (5.9)	54 (2.3)	418 (5.9)	7 (8.1)	
Ψ Macedonia, Rep. of	49 (0.9)	430 (5.8)	51 (0.9)	423 (5.6)	7 (4.7)	
Japan	49 (1.1)	566 (3.1)	51 (1.1)	574 (3.5)	8 (4.1)	
3 Israel	50 (1.6)	520 (3.9)	50 (1.6)	512 (5.2)	8 (4.4)	
2 Singapore	49 (0.7)	615 (3.7)	51 (0.7)	607 (4.5)	9 (3.5)	
Turkey	49 (0.7)	457 (3.8)	51 (0.7)	448 (4.7)	9 (3.5)	
Australia	50 (1.6)	500 (4.7)	50 (1.6)	509 (7.3)	9 (6.9)	
1 Lithuania	49 (0.7)	507 (2.6)	51 (0.7)	498 (3.2)	9 (3.0)	
Armenia	49 (0.8)	472 (3.1)	51 (0.8)	462 (3.2)	10 (3.1)	
Ψ Syrian Arab Republic	50 (1.7)	375 (5.3)	50 (1.7)	385 (5.3)	11 (5.7)	
Italy	49 (0.9)	493 (2.9)	51 (0.9)	504 (2.8)	11 (2.9)	
Romania	48 (0.9)	464 (4.6)	52 (0.9)	453 (4.2)	11 (3.6)	
Ψ Qatar	50 (3.3)	415 (5.8)	50 (3.3)	404 (5.5)	11 (9.5)	
Lebanon	55 (1.9)	444 (4.2)	45 (1.9)	456 (4.7)	12 (4.7)	
Ψ Indonesia	50 (1.2)	392 (4.9)	50 (1.2)	379 (4.5)	13 (4.0)	
Chile	53 (1.5)	409 (3.2)	47 (1.5)	424 (3.0)	14 (3.6)	
Ψ Saudi Arabia	48 (1.2)	401 (4.1)	52 (1.2)	387 (8.0)	15 (8.9)	
Tunisia	52 (0.7)	417 (3.1)	48 (0.7)	433 (3.1)	17 (2.5)	
United Arab Emirates	50 (1.7)	464 (2.7)	50 (1.7)	447 (3.1)	17 (4.2)	
Thailand	55 (1.6)	435 (4.2)	45 (1.6)	417 (5.3)	18 (4.4)	
New Zealand	47 (2.0)	478 (5.5)	53 (2.0)	496 (6.2)	18 (4.7)	
Malaysia	51 (1.2)	449 (5.2)	49 (1.2)	430 (6.2)	19 (4.4)	
Ψ Palestinian Nat'l Auth.	52 (1.7)	415 (4.2)	48 (1.7)	392 (5.6)	23 (7.0)	
ЖGhana	47 (0.8)	318 (4.8)	53 (0.8)	342 (4.3)	23 (2.9)	
Ψ Jordan	49 (1.7)	420 (4.3)	51 (1.7)	392 (5.9)	28 (7.4)	
Ψ Bahrain	50 (0.8)	431 (2.5)	50 (0.8)	388 (3.1)	43 (4.0)	
Ψ Oman	51 (2.1)	397 (3.1)	49 (2.1)	334 (3.8)	63 (4.6)	
International Avg.	50 (0.2)	469 (0.6)	50 (0.2)	465 (0.7)		

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
Ninth Grade Participants						
ЖSouth Africa	48 (1.0)	354 (3.0)	52 (1.0)	350 (3.4)	3 (4.0)	
Ψ Botswana	51 (0.6)	403 (2.9)	49 (0.6)	390 (3.0)	14 (3.1)	
2 ЖHonduras	55 (1.0)	328 (4.1)	45 (1.0)	351 (4.1)	23 (3.5)	
Benchmarking Participants						
2 Ontario, Canada	49 (0.9)	512 (2.7)	51 (0.9)	512 (3.1)	0 (3.1)	
Quebec, Canada	51 (1.4)	531 (2.9)	49 (1.4)	532 (2.5)	0 (2.7)	
1 Minnesota, US	52 (1.5)	545 (4.9)	48 (1.5)	545 (5.1)	0 (3.9)	
1 Alabama, US	51 (1.6)	467 (6.3)	49 (1.6)	465 (6.2)	2 (3.9)	
Abu Dhabi, UAE	47 (2.7)	450 (3.9)	53 (2.7)	448 (5.7)	2 (6.4)	
2 Alberta, Canada	50 (0.9)	504 (3.3)	50 (0.9)	506 (2.7)	2 (3.0)	
1 3 North Carolina, US	52 (1.0)	535 (6.2)	48 (1.0)	539 (8.3)	3 (5.1)	
1 2 California, US	49 (1.1)	491 (5.6)	51 (1.1)	494 (5.0)	3 (4.1)	
1 Colorado, US	51 (1.5)	516 (5.4)	49 (1.5)	520 (5.0)	4 (3.4)	
1 2 Connecticut, US	49 (1.0)	520 (5.2)	51 (1.0)	516 (5.4)	4 (4.5)	
1 2 Massachusetts, US	50 (1.0)	558 (6.0)	50 (1.0)	563 (5.5)	5 (4.5)	
1 2 Florida, US	49 (1.9)	509 (6.6)	51 (1.9)	517 (7.3)	8 (5.5)	
1 2 Indiana, US	52 (1.1)	518 (5.1)	48 (1.1)	526 (5.9)	8 (4.0)	
Dubai, UAE	48 (4.6)	486 (4.3)	52 (4.6)	470 (5.4)	16 (8.9)	



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Ж Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and ‡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 3.12: Example SAS Program for Student-level Analysis with Achievement by Gender (EXAMPLE2.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (ITSEX) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

 VALUE SEX
     1 = "GIRL"
     2 = "BOY" ;

%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY ITSEX, BSMMAT0, 5, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY ITSEX N TOTWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. ITSEX SEX. N 6.0 TOTWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

The results obtained from this program are shown in Exhibit 3.13. For the sake of brevity, only the results of the first four countries are shown. The very same set of steps used in our first example apply here, adding ITSEX as a classification variable along with IDCNTRY.

Exhibit 3.13: Output for Example Student-level Analysis with Achievement by Gender (EXAMPLE 2)

IDCNTRY	ITSEX	N	TOTWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	GIRL	3747	125555	500.41	4.72	49.83	1.61
AUSTRALIA	BOY	3809	126429	509.16	7.26	50.17	1.61
BAHRAIN	GIRL	2288	6276	430.78	2.51	49.72	0.85
BAHRAIN	BOY	2352	6348	387.89	3.07	50.28	0.85
ARMENIA	GIRL	2894	17702	471.52	3.07	48.93	0.78
ARMENIA	BOY	2952	18479	461.86	3.21	51.07	0.78
CHILE	GIRL	3133	133160	409.46	3.23	53.01	1.46
CHILE	BOY	2702	118020	423.94	3.05	46.99	1.46

In Exhibit 3.13, each country's results are displayed on two lines, one for each value of the variable ITSEX. The countries are identified in the first column and the second column describes the category of ITSEX being reported. The third column reports the number of valid cases and the fourth the sum of weights of the sampled students. The next four columns report the estimated average mathematics achievement and its standard error, followed by the percentage of students in each category and its standard error. As shown in the first two lines, the average mathematics achievement was 500.41 for eighth grade girls in Australia (standard error of 4.72) and 509.16 (standard error of 7.26) for eighth grade boys. An estimated 49.83 percent (standard error of 1.61) of students in Australia were girls, and 50.17 percent were boys (standard error of 1.61).

Student-level Analysis with a Contextual Scale

TIMSS 2011 has innovated in its reporting of contextual data by creating contextual scales based on Rasch modeling.[3] A good number of contextual scales were reported in the *TIMSS 2011 International Reports* and are available in the International Database for analysis. Each contextual scale variable is a Rasch scale with an international mean of 10 and international standard deviation of 2. An index was derived from each scale that divides the range of scores into usually three categories: the most desirable scores (high values), the least desirable scores (low values), and the remaining scores in between.

These contextual scales and their corresponding indices were reported in the *TIMSS 2011 International Reports*. Exhibit 3.14 shows one such example, Exhibit 8.2 from *TIMSS 2011 International Results in Mathematics*, reporting how much students like learning mathematics. 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 students in each category—Like Learning Mathematics, Somewhat Like Learning Mathematics, and Do Not Like Learning Mathematics—along with the average achievement in each category.

This example will replicate both the average scale score of the Students Like Learning Mathematics contextual scale and the percentages of students, with their average mathematics achievement, in each category of its index. This will be done in two steps, both using the merged BSGALLM5 data file.

The first step, our third example, will compute the average scale score using the contextual scale variable BSBGSLM. After reviewing the appropriate codebook, we observe that the variable BSBGSLM in the student background data files contains information on the Students Like Learning Mathematics contextual scale. We then proceed to read from the student background data files our variable of interest (BSBGSLM), the student sampling weight (TOTWGT), the variables that contain the jackknifing information (JKZONE and JKREP), and the country identification variable (IDCNTRY). Again, we will use the data of all available countries contained in the file BSGALLM5.

The SAS program that implements our third example is presented in Exhibit 3.15 and is included in the International Database under the name EXAMPLE3.SAS. Note that one of the steps in this program is to select only those students who have non-missing data in our variable of interest BSBGSLM.

The results obtained from this program are shown in Exhibit 3.16. For the sake of brevity, only the results of the first four countries are shown.

[3] The contextual scales are described in the context questionnaire scales section of *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012).

Exhibit 3.14: Example Exhibit of a Contextual Scale, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 8.2)

Exhibit 8.2: Students Like Learning Mathematics

TIMSS 2011 Mathematics 8th Grade

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Students Like Learning Mathematics* scale. Students who **Like Learning Mathematics** had a score on the scale of at least 11.3, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who **Do Not Like Learning Mathematics** had a score no higher than 9.0, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students **Somewhat Like Learning Mathematics.**

Country	Like Learning Mathematics		Somewhat Like Learning Mathematics		Do Not Like Learning Mathematics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	48 (0.7)	398 (2.4)	40 (0.7)	353 (2.2)	12 (0.5)	340 (4.6)	11.2 (0.03)
Armenia	43 (1.0)	499 (3.1)	39 (0.8)	451 (3.4)	18 (1.0)	437 (4.8)	10.9 (0.05)
Jordan	42 (1.5)	442 (3.7)	39 (1.0)	388 (4.2)	19 (0.9)	376 (4.8)	10.9 (0.06)
Georgia	42 (1.3)	463 (5.0)	40 (1.0)	423 (4.1)	18 (1.0)	405 (6.2)	10.8 (0.06)
Malaysia	39 (1.3)	463 (5.0)	46 (0.9)	430 (5.6)	15 (0.9)	413 (8.1)	10.8 (0.05)
Iran, Islamic Rep. of	39 (1.1)	450 (5.4)	40 (0.8)	396 (4.2)	22 (0.9)	388 (4.5)	10.6 (0.05)
Ghana	38 (1.4)	370 (4.8)	51 (1.2)	314 (4.0)	10 (0.5)	299 (6.7)	10.9 (0.05)
Oman	38 (0.8)	420 (3.0)	45 (0.8)	342 (3.6)	17 (0.7)	324 (4.4)	10.8 (0.04)
Kazakhstan	38 (1.5)	506 (4.4)	52 (1.3)	478 (4.4)	10 (0.7)	475 (7.4)	10.9 (0.05)
Tunisia	38 (1.0)	448 (3.4)	40 (0.8)	415 (3.2)	23 (0.9)	405 (3.3)	10.6 (0.05)
Syrian Arab Republic	37 (1.1)	408 (5.2)	44 (1.0)	373 (4.8)	19 (0.9)	353 (6.3)	10.7 (0.05)
Ukraine	36 (1.7)	502 (4.9)	43 (1.2)	477 (4.1)	20 (1.2)	450 (4.9)	10.6 (0.07)
Lebanon	35 (1.2)	475 (4.6)	43 (1.0)	441 (4.2)	21 (1.1)	425 (5.6)	10.6 (0.06)
Singapore	32 (0.7)	637 (3.9)	44 (0.7)	610 (4.1)	23 (0.7)	578 (4.4)	10.4 (0.03)
Turkey	31 (1.0)	504 (6.0)	42 (0.7)	436 (3.9)	26 (1.0)	420 (3.5)	10.3 (0.05)
United Arab Emirates	31 (0.7)	488 (2.3)	42 (0.6)	448 (2.5)	27 (0.8)	432 (2.5)	10.2 (0.04)
Palestinian Nat'l Auth.	31 (1.1)	447 (5.0)	43 (1.0)	394 (4.1)	26 (1.1)	375 (5.1)	10.3 (0.05)
Russian Federation	29 (1.1)	567 (4.7)	49 (0.9)	537 (3.6)	22 (1.0)	509 (4.1)	10.3 (0.04)
Saudi Arabia	29 (1.3)	436 (5.6)	40 (1.0)	389 (5.4)	32 (1.4)	364 (4.1)	10.1 (0.07)
Qatar	27 (1.0)	456 (4.5)	43 (0.8)	401 (3.7)	31 (1.2)	386 (4.8)	10.0 (0.05)
Thailand	26 (1.1)	456 (5.6)	57 (0.9)	420 (4.5)	16 (1.0)	408 (5.1)	10.3 (0.05)
Israel	26 (0.8)	536 (5.1)	40 (0.7)	523 (4.3)	35 (1.0)	496 (5.1)	9.9 (0.04)
Macedonia, Rep. of	24 (1.0)	462 (6.2)	40 (1.0)	422 (6.3)	36 (1.4)	425 (6.0)	9.8 (0.06)
Bahrain	24 (0.6)	454 (4.6)	38 (0.9)	413 (2.7)	38 (0.8)	381 (3.4)	9.8 (0.03)
Lithuania	22 (1.0)	531 (3.7)	44 (1.0)	506 (2.7)	34 (1.1)	482 (3.3)	9.8 (0.05)
Chile	22 (0.9)	449 (3.5)	40 (0.9)	416 (2.9)	38 (1.0)	398 (2.9)	9.8 (0.04)
Indonesia	20 (1.4)	396 (6.1)	70 (1.2)	385 (4.5)	10 (0.8)	382 (6.3)	10.4 (0.04)
United States	19 (0.6)	536 (3.2)	40 (0.6)	515 (3.0)	40 (0.8)	494 (2.8)	9.5 (0.04)
Hong Kong SAR	19 (0.8)	635 (4.4)	44 (1.0)	595 (3.8)	37 (1.3)	551 (4.6)	9.6 (0.05)
Romania	18 (1.0)	516 (6.1)	40 (1.0)	459 (4.3)	41 (1.2)	438 (4.8)	9.5 (0.05)
Italy	18 (0.9)	538 (3.6)	42 (0.9)	507 (2.8)	40 (1.3)	472 (3.2)	9.6 (0.05)
New Zealand	17 (1.0)	525 (6.9)	41 (1.0)	497 (5.7)	42 (1.5)	467 (4.8)	9.5 (0.06)
Norway	17 (0.9)	511 (4.1)	42 (1.0)	482 (2.6)	42 (1.4)	453 (2.8)	9.4 (0.05)
Australia	16 (0.9)	553 (7.5)	40 (0.9)	520 (5.6)	45 (1.4)	476 (4.4)	9.3 (0.06)
Hungary	15 (0.7)	549 (5.6)	35 (1.0)	508 (4.8)	50 (1.3)	491 (3.8)	9.2 (0.05)
England	14 (1.0)	548 (8.9)	44 (1.3)	517 (5.7)	42 (1.7)	484 (5.2)	9.4 (0.07)
Chinese Taipei	14 (0.7)	681 (4.3)	33 (0.9)	645 (3.6)	53 (1.2)	568 (3.2)	9.0 (0.06)
Sweden	13 (0.6)	524 (4.0)	42 (0.7)	498 (1.8)	44 (1.0)	462 (2.1)	9.4 (0.04)
Finland	10 (0.6)	560 (4.1)	34 (1.0)	532 (2.8)	57 (1.1)	496 (2.6)	8.8 (0.05)
Japan	9 (0.6)	621 (5.1)	38 (1.1)	589 (3.3)	53 (1.4)	545 (3.1)	9.1 (0.05)
Korea, Rep. of	8 (0.3)	677 (4.7)	36 (0.7)	649 (3.3)	56 (0.8)	581 (2.9)	8.9 (0.03)
Slovenia	6 (0.4)	544 (5.3)	31 (1.1)	521 (3.0)	63 (1.3)	494 (2.4)	8.6 (0.05)
International Avg.	26 (0.2)	504 (0.8)	42 (0.1)	467 (0.6)	31 (0.2)	443 (0.7)	
Ninth Grade Participants							
Botswana	47 (1.1)	427 (2.5)	38 (0.8)	376 (2.6)	16 (0.8)	370 (4.3)	11.0 (0.05)
South Africa	41 (0.9)	378 (2.0)	44 (0.7)	339 (2.9)	15 (0.6)	348 (5.3)	10.8 (0.04)
Honduras	23 (1.0)	364 (4.6)	49 (0.9)	332 (4.2)	28 (1.1)	334 (4.8)	10.1 (0.06)
Benchmarking Participants							
Abu Dhabi, UAE	32 (1.2)	485 (4.4)	42 (1.0)	441 (3.6)	26 (1.4)	420 (4.9)	10.3 (0.06)
Dubai, UAE	29 (1.0)	508 (3.5)	41 (0.9)	473 (3.1)	30 (1.0)	456 (3.1)	10.1 (0.05)
Ontario, Canada	26 (1.1)	546 (3.5)	41 (1.0)	513 (3.4)	34 (1.4)	481 (3.0)	9.9 (0.06)
North Carolina, US	24 (1.8)	556 (7.6)	44 (1.1)	542 (7.8)	31 (2.3)	516 (7.0)	9.9 (0.11)
Connecticut, US	22 (1.5)	552 (6.0)	40 (1.2)	526 (5.2)	38 (1.8)	495 (5.4)	9.7 (0.08)
Colorado, US	20 (1.6)	548 (5.9)	38 (1.7)	528 (4.8)	42 (2.1)	495 (5.8)	9.4 (0.10)
Massachusetts, US	19 (1.3)	585 (6.1)	40 (1.0)	568 (5.4)	41 (1.7)	543 (5.4)	9.4 (0.09)
Minnesota, US	18 (1.5)	578 (6.8)	41 (0.9)	555 (4.7)	41 (1.6)	521 (4.6)	9.5 (0.08)
Alabama, US	18 (1.9)	475 (10.7)	37 (0.9)	471 (6.7)	45 (1.7)	460 (5.3)	9.3 (0.11)
Florida, US	17 (1.1)	552 (9.7)	38 (1.4)	525 (6.9)	45 (1.7)	493 (6.2)	9.4 (0.08)
California, US	17 (0.9)	519 (6.4)	42 (1.3)	496 (6.1)	41 (1.8)	480 (5.0)	9.4 (0.07)
Alberta, Canada	16 (0.9)	531 (4.7)	44 (1.0)	514 (2.5)	40 (1.4)	486 (3.1)	9.4 (0.06)
Indiana, US	16 (1.4)	547 (6.2)	39 (1.3)	529 (5.3)	45 (2.0)	507 (5.0)	9.3 (0.10)
Quebec, Canada	12 (0.7)	557 (3.9)	43 (0.9)	540 (2.4)	44 (1.2)	517 (2.6)	9.3 (0.05)

Centerpoint of scale set at 10.

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.15: Example SAS Program for Student-level Analysis with a Contextual Scale (EXAMPLE3.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKGEN.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (BSBGSLM) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

%JACKGEN (TOTWGT, JKZONE, JKREP, 75, IDCNTRY, BSBGSLM, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY N TOTWGT MNX MNX_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. N 6.0 TOTWGT 10.0
            MNX MNX_SE PCT PCT_SE 6.2 ;
```

In the first line of the results in Exhibit 3.16, we see that students in Australia scored 9.32, with a standard error of 0.06, on the Students Like Learning Mathematics contextual scale. Note that this is below the international average of 10, the difference being statistically significant at the 95% confidence level.

Exhibit 3.16: Output for Example Student-level Analysis with a Contextual Scale (EXAMPLE 3)

IDCNTRY	N	TOTWGT	MNX	MNX_SE	PCT	PCT_SE
AUSTRALIA	7389	248762	9.32	0.06	1.19	0.02
BAHRAIN	4581	12458	9.77	0.03	0.06	0.00
ARMENIA	5626	34775	10.87	0.05	0.17	0.00
CHILE	5772	248321	9.76	0.04	1.18	0.03

In the second step, our fourth example, we will compute the percentages of eighth grade students, with their average mathematics achievement, in each category of the index variable BSDGSLM. This analysis is similar to our earlier example of a student-level analysis with achievement by gender. Our variable of interest here is the BSDGSLM index variable of our contextual scale and it will be used to measure average mathematics achievement using the five plausible values BSMMAT01 through BSMMAT05.

The SAS program that implements this fourth example is presented in Exhibit 3.17 and is included in the International Database under the name EXAMPLE4.SAS. Note that one of the steps in this program is to select only those students who have non-missing data in our variable of interest BSDGSLM. The results obtained from this program are shown in Exhibit 3.18. For the sake of brevity, only the results of the first four countries are shown.

As shown in the first three lines of the results, 15.67 percent of students in Australia liked learning mathematics (standard error of 0.94), and their average mathematics achievement was 553.21 (standard error of 7.47); 39.81 percent somewhat liked learning mathematics (standard error of 0.87), and their average mathematics achievement was 519.53 (standard error of 5.58); and

44.53 percent of students did not like learning mathematics (standard error of 1.41), and their average mathematics achievement was 475.97 (standard error of 4.43).

Exhibit 3.17 Example SAS Program for Student-level Analysis with a Contextual Scale (EXAMPLE4.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

DATA BSGALLM5 ;
     SET T11.BSGALLM5 ;

     WHERE NMISS (BSDGSLM) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

VALUE SLM
     1 = "LIKE LEARNING MATHEMATICS"
     2 = "SOMEWHAT LIKE LEARNING MATHEMATICS"
     3 = "DO NOT LIKE LEARNING MATHEMATICS" ;

%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY BSDGSLM, BSMMAT0, 5, BSGALLM5) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY BSDGSLM N TOTWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. BSDGSLM SLM. N 6.0 TOTWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

Exhibit 3.18 Output for Example Student-level Analysis with a Contextual Scale (EXAMPLE 4)

IDCNTRY	BSDGSLM	N	TOTWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	LIKE LEARNING MATHEMATICS	1068	38977	553.21	7.47	15.67	0.94
AUSTRALIA	SOMEWHAT LIKE LEARNING MATHEMATICS	2985	99021	519.53	5.58	39.81	0.87
AUSTRALIA	DO NOT LIKE LEARNING MATHEMATICS	3336	110764	475.97	4.43	44.53	1.41
BAHRAIN	LIKE LEARNING MATHEMATICS	1072	2959	454.13	4.64	23.75	0.64
BAHRAIN	SOMEWHAT LIKE LEARNING MATHEMATICS	1756	4780	413.45	2.71	38.37	0.86
BAHRAIN	DO NOT LIKE LEARNING MATHEMATICS	1753	4719	380.58	3.37	37.88	0.84
ARMENIA	LIKE LEARNING MATHEMATICS	2421	14925	499.36	3.07	42.92	0.97
ARMENIA	SOMEWHAT LIKE LEARNING MATHEMATICS	2181	13729	451.39	3.37	39.48	0.76
ARMENIA	DO NOT LIKE LEARNING MATHEMATICS	1024	6121	436.88	4.75	17.60	0.97
CHILE	LIKE LEARNING MATHEMATICS	1289	54770	449.31	3.52	22.06	0.86
CHILE	SOMEWHAT LIKE LEARNING MATHEMATICS	2291	99860	416.42	2.93	40.21	0.89
CHILE	DO NOT LIKE LEARNING MATHEMATICS	2192	93691	398.30	2.95	37.73	0.97

3.8 TIMSS Analyses with Teacher-level Variables

The teachers in the TIMSS 2011 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.

When analyzing teacher data, it is first necessary to link the students to their respective teachers. The student–teacher linkage data files (AST/BST) were created for this purpose. Student achievement scores (plausible values), jackknife replication information, and teacher weighting variables—MATWGT for mathematics teachers, SCIWGT for science teachers, or TCHWGT for all

teachers—appropriate for conducting analyses with teacher variables are found in the student–teacher linkage data files in order to simplify the merging process for analyses that link teacher background variables to student achievement. For such analyses, it only is necessary to merge the teacher background data files (ATG/BTM/BTS) with the student–teacher linkage data files. For analyses linking teacher variables to student background variables, it also is necessary to merge the student background data files (ASG/BSG) with the teacher background data files combining the latter with the student–teacher linkage data files.

As our example of an analysis using teacher background data, we will investigate the years of experience of the TIMSS 2011 eighth grade mathematics teachers. The results of such an analysis are presented in Exhibit 7.6 of *TIMSS 2011 International Results in Mathematics* and are reproduced here in Exhibit 3.19.

Conducting analyses with teacher data requires a few extra steps. As before, 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 (Supplements 1 and 2 to this User Guide). Because we are using a teacher-level variable, we must use the teacher background data files and the student-teacher linkage data files to find the variables. From the teacher background data files, we need the variable that contains the information on the eighth grade mathematics teachers' years of experience (BTDG01), the variable that identifies the country (IDCNTRY), and the two teacher identification variables (IDTEACH and IDLINK) that will allow us to link the teacher data to the student data.[4]

We then proceed to retrieve the necessary information from the eighth grade student-teacher linkage data files. From these files, we need the country identification (IDCNTRY) and the two teacher identification variables (IDTEACH and IDLINK) to link the teacher data to the student data. We also need the jackknife replication variables (JKZONE and JKREP), the mathematics teacher weighting variable (MATWGT), and the eighth grade mathematics achievement plausible values (BSMMAT01 through BSMMAT05).

In general, to perform analyses using the teacher background data files, users should do the following:

1. Identify the variables of interest in the teacher background data files and note any specific national adaptations to the variables.
2. Retrieve the relevant variables from the teacher background data files, including analysis variables, classification variables, identification variables (IDCNTRY, IDTEACH, and IDLINK), and any other variables used in the selection of cases.
3. Retrieve the relevant variables from the student–teacher linkage data files, including plausible values of achievement, identification variables (IDCNTRY, IDSTUD, IDTEACH, and IDLINK), sampling (JKZONE and JKREP) and weighting (MATWGT, SCIWGT, or TCHWGT) variables, and any other variables used in the selection of cases.

[4] The information about teachers' years of experience found in the BTBG01 variable was collapsed into reporting categories and stored in the derived variable BTDG01 (see Supplement 3 to this User Guide).

Exhibit 3.19: Exhibit of Example Teacher-level Analysis, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 7.6)

Exhibit 7.6: Teachers' Years of Experience

TIMSS 2011 Mathematics 8th Grade

Reported by Teachers

Country		20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia		63 (3.7)	467 (3.9)	30 (3.3)	464 (6.0)	4 (1.6)	473 (24.9)	3 (1.4)	474 (18.4)	24 (0.8)
Australia	r	37 (4.0)	519 (8.1)	22 (3.4)	513 (10.8)	18 (3.2)	504 (17.1)	24 (3.4)	485 (8.4)	15 (0.9)
Bahrain		19 (2.2)	433 (7.0)	54 (3.6)	404 (3.7)	17 (2.7)	403 (5.8)	10 (1.9)	430 (9.1)	14 (0.4)
Chile		49 (3.8)	415 (4.6)	15 (2.9)	416 (10.0)	13 (2.8)	421 (12.1)	22 (3.4)	421 (6.3)	19 (1.0)
Chinese Taipei		24 (3.6)	621 (7.2)	41 (3.6)	607 (5.8)	26 (3.5)	608 (9.3)	9 (2.5)	593 (8.9)	14 (0.7)
England		21 (3.6)	510 (15.5)	25 (3.7)	516 (11.8)	22 (3.9)	495 (11.6)	32 (3.9)	503 (10.7)	12 (0.9)
Finland		41 (3.4)	517 (2.8)	27 (3.4)	511 (5.3)	18 (2.8)	515 (6.1)	15 (2.4)	510 (5.2)	16 (0.7)
Georgia		63 (3.9)	428 (5.2)	21 (3.5)	441 (10.1)	9 (2.4)	439 (15.0)	7 (2.3)	431 (18.5)	25 (1.1)
Ghana		6 (1.8)	360 (19.9)	23 (3.8)	340 (9.0)	28 (4.0)	334 (9.3)	43 (3.9)	321 (6.8)	8 (0.5)
Hong Kong SAR		18 (3.3)	570 (11.9)	39 (4.3)	590 (8.4)	25 (4.2)	589 (11.9)	18 (3.3)	588 (10.1)	12 (0.7)
Hungary		62 (3.5)	508 (4.4)	26 (3.0)	508 (6.2)	7 (1.9)	488 (18.6)	5 (1.5)	456 (21.5)	22 (0.7)
Indonesia		25 (3.9)	402 (9.1)	30 (4.0)	399 (9.1)	19 (3.3)	385 (8.0)	26 (4.5)	356 (9.1)	13 (0.8)
Iran, Islamic Rep. of		28 (3.2)	443 (8.9)	40 (3.8)	416 (6.0)	16 (2.6)	402 (10.4)	16 (2.8)	374 (10.7)	14 (0.6)
Israel		38 (2.8)	545 (6.6)	36 (2.8)	518 (6.6)	15 (2.0)	495 (10.7)	11 (1.8)	468 (14.4)	17 (0.5)
Italy		60 (4.1)	502 (3.2)	22 (3.3)	492 (7.3)	11 (2.5)	504 (9.1)	8 (2.1)	492 (13.6)	22 (0.9)
Japan		47 (3.9)	576 (3.7)	18 (3.1)	558 (5.5)	17 (2.3)	575 (9.1)	18 (3.1)	559 (7.5)	17 (0.8)
Jordan		16 (2.6)	406 (8.5)	29 (3.3)	410 (7.6)	29 (3.5)	394 (9.6)	26 (3.1)	413 (7.0)	11 (0.6)
Kazakhstan		62 (3.9)	492 (5.2)	21 (3.2)	468 (8.6)	9 (2.7)	489 (14.9)	8 (2.2)	493 (14.8)	22 (0.9)
Korea, Rep. of		34 (3.1)	618 (5.0)	22 (2.8)	616 (8.8)	17 (2.1)	625 (7.1)	27 (2.6)	594 (4.8)	13 (0.6)
Lebanon		27 (3.6)	454 (7.9)	32 (3.9)	445 (6.9)	21 (3.2)	460 (9.8)	20 (3.5)	445 (8.7)	14 (1.0)
Lithuania		73 (3.4)	501 (3.0)	17 (2.6)	509 (6.8)	7 (2.1)	504 (19.6)	3 (1.4)	506 (17.8)	25 (0.8)
Macedonia, Rep. of	r	50 (4.4)	421 (9.1)	25 (4.2)	430 (12.0)	12 (2.7)	415 (15.3)	13 (2.9)	420 (18.6)	20 (0.9)
Malaysia		18 (3.0)	446 (12.2)	31 (3.4)	446 (9.5)	21 (3.0)	426 (11.4)	30 (3.3)	441 (10.5)	11 (0.7)
Morocco		69 (2.8)	374 (2.8)	11 (2.0)	373 (9.0)	5 (1.5)	358 (12.2)	15 (2.3)	363 (6.3)	22 (0.6)
New Zealand		36 (3.0)	492 (8.4)	22 (2.7)	486 (9.6)	25 (3.0)	489 (8.9)	17 (2.8)	482 (15.6)	15 (0.8)
Norway		30 (4.0)	478 (3.7)	25 (3.6)	474 (5.5)	19 (3.7)	475 (4.4)	26 (3.5)	474 (4.0)	15 (1.0)
Oman		7 (1.3)	362 (12.2)	25 (2.6)	385 (6.5)	46 (3.3)	363 (4.7)	21 (2.6)	360 (6.9)	9 (0.3)
Palestinian Nat'l Auth.		14 (3.1)	413 (11.9)	37 (3.9)	410 (7.3)	24 (3.6)	400 (7.6)	25 (3.2)	394 (7.5)	11 (0.7)
Qatar		23 (4.2)	432 (12.7)	36 (4.6)	425 (9.4)	25 (3.4)	388 (9.2)	16 (2.9)	386 (10.1)	13 (0.7)
Romania		66 (3.7)	466 (5.2)	24 (3.3)	449 (9.3)	6 (1.7)	420 (15.9)	4 (1.6)	423 (12.7)	25 (0.9)
Russian Federation		67 (3.3)	540 (4.4)	24 (3.1)	543 (7.0)	5 (1.2)	515 (15.2)	4 (1.2)	547 (23.5)	24 (0.6)
Saudi Arabia		13 (2.9)	386 (10.2)	41 (3.9)	406 (7.3)	25 (3.5)	402 (8.9)	21 (3.5)	367 (7.7)	11 (0.6)
Singapore		10 (1.4)	618 (10.6)	16 (2.1)	619 (9.3)	26 (2.4)	624 (7.3)	47 (2.5)	601 (5.0)	8 (0.4)
Slovenia		52 (2.9)	506 (3.2)	20 (2.6)	500 (5.0)	17 (2.0)	500 (4.1)	12 (1.9)	515 (4.9)	19 (0.6)
Sweden	r	26 (2.7)	486 (5.4)	42 (3.4)	489 (3.9)	22 (2.7)	482 (3.7)	10 (2.0)	476 (5.1)	15 (0.6)
Syrian Arab Republic		16 (3.1)	400 (9.6)	26 (3.7)	375 (7.9)	24 (3.6)	370 (8.8)	35 (4.0)	378 (8.7)	10 (0.6)
Thailand		34 (3.4)	444 (8.4)	21 (3.1)	432 (11.0)	18 (2.7)	417 (11.6)	28 (3.2)	415 (8.7)	15 (0.8)
Tunisia		38 (3.3)	442 (5.6)	35 (3.3)	419 (5.4)	18 (2.8)	417 (7.5)	10 (2.1)	394 (7.2)	16 (0.7)
Turkey		11 (2.2)	471 (14.5)	24 (3.2)	481 (10.8)	38 (3.5)	445 (6.9)	27 (2.8)	431 (6.5)	9 (0.5)
Ukraine		68 (4.4)	477 (4.5)	20 (3.6)	491 (10.0)	9 (2.5)	473 (11.1)	3 (1.4)	473 (18.7)	25 (1.0)
United Arab Emirates		24 (2.0)	442 (6.4)	36 (2.4)	455 (4.0)	26 (2.3)	461 (4.8)	14 (1.8)	467 (6.8)	13 (0.4)
United States	r	26 (2.2)	519 (6.8)	28 (2.4)	517 (5.1)	28 (2.8)	506 (7.2)	17 (2.2)	505 (6.7)	14 (0.6)
International Avg.		36 (0.5)	474 (1.3)	28 (0.5)	470 (1.2)	19 (0.4)	463 (1.7)	18 (0.4)	458 (1.8)	16 (0.1)
Ninth Grade Participants										
Botswana		2 (1.0)	~ ~	39 (4.5)	401 (5.3)	31 (4.3)	403 (4.2)	29 (3.9)	384 (5.2)	9 (0.4)
Honduras	r	26 (3.8)	341 (6.5)	23 (4.2)	335 (10.8)	22 (4.4)	332 (8.4)	29 (4.2)	339 (11.1)	12 (0.9)
South Africa		30 (3.8)	344 (7.3)	33 (3.4)	358 (5.8)	18 (3.0)	364 (8.6)	19 (3.1)	345 (8.7)	14 (0.8)
Benchmarking Participants										
Alberta, Canada		25 (3.5)	506 (5.0)	37 (4.3)	504 (3.8)	15 (3.0)	504 (6.9)	23 (3.4)	505 (5.3)	13 (0.7)
Ontario, Canada		16 (2.8)	511 (7.5)	44 (4.2)	512 (3.8)	31 (3.5)	516 (4.9)	10 (2.5)	511 (9.4)	12 (0.5)
Quebec, Canada		19 (3.0)	544 (6.6)	47 (3.8)	536 (4.2)	22 (3.2)	524 (7.0)	12 (2.6)	521 (7.3)	13 (0.6)
Abu Dhabi, UAE		25 (4.1)	456 (14.3)	30 (4.1)	433 (6.3)	29 (4.6)	456 (8.5)	16 (3.2)	463 (9.2)	14 (0.9)
Dubai, UAE		19 (2.2)	443 (9.5)	42 (2.6)	491 (5.0)	25 (3.3)	488 (8.7)	13 (2.6)	471 (13.9)	13 (0.5)
Alabama, US	r	16 (4.8)	494 (20.4)	35 (7.8)	473 (11.2)	32 (6.2)	450 (12.0)	17 (5.7)	464 (11.2)	12 (1.3)
California, US	r	19 (5.4)	502 (25.5)	33 (6.9)	490 (9.2)	28 (6.4)	506 (10.2)	20 (5.9)	479 (21.5)	12 (1.3)
Colorado, US	r	21 (4.9)	564 (9.3)	32 (5.6)	517 (11.3)	32 (5.8)	508 (14.0)	15 (3.5)	471 (13.3)	13 (1.0)
Connecticut, US		29 (6.2)	531 (17.9)	32 (5.6)	533 (9.2)	20 (4.8)	509 (18.9)	19 (5.5)	503 (14.5)	14 (1.3)
Florida, US	r	18 (5.3)	530 (13.7)	43 (7.0)	521 (10.5)	26 (5.8)	514 (14.6)	13 (4.0)	524 (29.0)	13 (1.2)
Indiana, US	r	34 (5.6)	526 (11.0)	22 (5.8)	533 (13.8)	27 (6.0)	516 (12.2)	17 (5.2)	494 (9.9)	15 (1.4)
Massachusetts, US		10 (4.1)	566 (20.3)	33 (5.8)	569 (10.9)	39 (5.2)	552 (8.5)	18 (5.5)	556 (17.9)	11 (1.3)
Minnesota, US		27 (6.4)	556 (9.3)	36 (5.2)	553 (8.9)	22 (4.5)	531 (15.3)	15 (4.3)	528 (17.9)	15 (1.5)
North Carolina, US	r	26 (5.5)	559 (13.2)	30 (5.6)	530 (14.8)	33 (5.5)	545 (13.2)	11 (4.3)	517 (12.7)	14 (1.0)

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

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

4. Merge the teacher background data files with the student–teacher linkage data files using the variables IDCNTRY, IDTEACH, and IDLINK.
5. If student background variables also are needed, merge the student background data files with the merged student–teacher data files from the previous step using the variables IDCNTRY and IDSTUD.
6. Perform any necessary variable transformations or recodes.
7. Use the macros JACKGEN and JACKREG, or JACKPV and JACKREGP if plausible values are involved, with the appropriate parameters.
8. Specify the location of the data files (<datpath>) and the macros (<macpath>).
9. Print the results file.

The two file types are merged and the resulting merged file is then input to the JACKPV macro. The merging is done using the combination of identification variables IDCNTRY, IDTEACH, and IDLINK. The combination of values for these three variables is unique within the teacher background data files, but is repeated in the student–teacher linkage data files as many times as needed to link a teacher to all students in a classroom. After the files are merged, the JACKPV macro is invoked and the results can be printed.

For this analysis, we will again use the data for all available countries, making use of an aggregated teacher background data file, BTMALLM5, and an aggregated student–teacher linkage data file, BSTALLM5. These aggregated files were created with the JOIN macro.

The SAS program that executes this example is presented in Exhibit 3.20 and is included in the International Database under the name EXAMPLE5.SAS. Note that one of the steps in this program is to select only those students who have non-missing data in our variable of interest BTDG01. The results obtained from this program are displayed in Exhibit 3.21, edited to show only the first four countries for the sake of brevity.

Because our example uses data from mathematics teachers, the weighting variable MATWGT is specified. Analyses with science teachers require that SCIWGT be specified. For analyses with all teachers, TCHWGT should be specified. (See Chapter 4 for more information on sampling weights.)

Each country's results are displayed on four lines, one for each value of the BTDG01 variable. 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. As shown in the first four lines of results, 36.54 percent (standard error of 4.03) of eighth grade students in Australia were taught by teachers with 20 years or more of experience, 21.51 percent (standard error of 3.39) by teachers with 10 to 20 years of experience, 17.73 percent (standard error of 3.18) by teachers with 5 to 9 years of experience, and 24.22 percent (standard error of 3.38) by teachers with less than 5 years of experience. Also, the estimated average mathematics achievement was 519.11 (standard error of 8.07) for eighth grade students taught by teachers with 20 years or more of experience, 513.05 (standard error of 10.77) for students taught by teachers with 10 to 20 years of experience, 503.68 (standard error of 17.14) for students taught by teachers with 5 to 9 years of experience, and 485.34 (standard error of 8.45) for students taught by teachers with less than 5 years of experience.

Exhibit 3.20: Example SAS Program for Teacher-level Analysis (EXAMPLE5.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

PROC SORT DATA = T11.BTMALLM5 OUT = BTMALLM5 ;
     BY IDCNTRY IDTEACH IDLINK ;

PROC SORT DATA = T11.BSTALLM5 OUT = BSTALLM5 ;
     BY IDCNTRY IDTEACH IDLINK ;

DATA MERGED ;
     MERGE BTMALLM5 (IN = INBTM)
           BSTALLM5 (IN = INBST) ;
     BY IDCNTRY IDTEACH IDLINK ;
     IF INBTM AND INBST ;

DATA MERGED ;
     SET MERGED ;

     WHERE NMISS (BTDG01) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list TIMSS 2011 country formats > ;

VALUE BTDG
     1 = "20 YEARS OR MORE"
     2 = "AT LEAST 10 BUT LESS THAN 20 YEARS"
     3 = "AT LEAST 5 BUT LESS THAN 10 YEARS"
     4 = "LESS THAN 5 YEARS" ;

%JACKPV (MATWGT, JKZONE, JKREP, 75, IDCNTRY BTDG01, BSMMAT0, 5, MERGED) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY BTDG01 N MATWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. BTDG01 BTDG. N 6.0 MATWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

Exhibit 3.21: Output for Example Teacher-level Analysis (EXAMPLE 5)

IDCNTRY	BTDG01	N	MATWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	20 YEARS OR MORE	2096	68987	519.11	8.07	36.54	4.03
AUSTRALIA	AT LEAST 10 BUT LESS THAN 20 YEARS	1395	40605	513.05	10.77	21.51	3.39
AUSTRALIA	AT LEAST 5 BUT LESS THAN 10 YEARS	888	33462	503.68	17.14	17.73	3.18
AUSTRALIA	LESS THAN 5 YEARS	1350	45721	485.34	8.45	24.22	3.38
BAHRAIN	20 YEARS OR MORE	966	2317	433.48	7.02	19.25	2.20
BAHRAIN	AT LEAST 10 BUT LESS THAN 20 YEARS	2295	6492	404.07	3.72	53.93	3.56
BAHRAIN	AT LEAST 5 BUT LESS THAN 10 YEARS	732	2077	403.36	5.83	17.25	2.68
BAHRAIN	LESS THAN 5 YEARS	448	1152	429.50	9.09	9.57	1.93
ARMENIA	20 YEARS OR MORE	3508	21506	466.66	3.90	62.92	3.71
ARMENIA	AT LEAST 10 BUT LESS THAN 20 YEARS	1716	10255	464.48	6.02	30.00	3.34
ARMENIA	AT LEAST 5 BUT LESS THAN 10 YEARS	200	1423	473.15	24.95	4.16	1.56
ARMENIA	LESS THAN 5 YEARS	134	999	474.44	18.40	2.92	1.40
CHILE	20 YEARS OR MORE	2788	116439	415.30	4.55	49.15	3.81
CHILE	AT LEAST 10 BUT LESS THAN 20 YEARS	878	35914	416.01	9.99	15.16	2.92
CHILE	AT LEAST 5 BUT LESS THAN 10 YEARS	689	31741	421.22	12.08	13.40	2.76
CHILE	LESS THAN 5 YEARS	1166	52819	421.27	6.30	22.29	3.36

3.9 TIMSS Analyses with School-level Variables

Because TIMSS 2011 has 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 estimates. For this reason, it is preferable to analyze school-level variables as attributes of students, rather than as elements in their own right. Therefore, analyzing school data should be done by linking the students to their schools.

In general, to perform analyses using the school background data files, users should do the following:

1. Identify the variables of interest in the school and student background data files and note any specific national adaptations to the variables.
2. Retrieve the relevant variables from the school background data files, including analysis variables, classification variables, identification variables (IDCNTRY and IDSCHOOL), and any other variables used in the selection of cases.
3. Retrieve the relevant variables from the student background data files, including plausible values of achievement, classification variables, identification variables (IDCNTRY and IDSCHOOL), sampling (JKZONE and JKREP) and weighting (TOTWGT) variables, and any other variables used in the selection of cases.
4. Merge the school background data files with the student background data files using the variables IDCNTRY and IDSCHOOL.
5. Perform any necessary variable transformations or recodes.
6. Use the macros JACKGEN and JACKREG, or JACKPV and JACKREGP if plausible values are involved, with the appropriate parameters.
7. Specify the location of the data files (<datpath>) and the macros (<macpath>).
8. Print the results file.

Our example of an analysis using school background data will compute the percentages of eighth grade students, with their average mathematics achievement, who attended schools composed of students with different levels of economic background. The results of this analysis are presented in Exhibit 5.4 of *TIMSS 2011 International Results in Mathematics* and are replicated here in Exhibit 3.22.

The information for this analysis is found in the school-level derived variable BCDG03, where schools are characterized as being composed of more affluent students than disadvantaged students, composed of more disadvantaged students than affluent students, or composed of neither more affluent students nor more disadvantaged students.[5]

[5] Supplement 3 to this User Guide describes the construction of the school-level derived variable BCDG03 from responses to questions posed to the school principals.

Exhibit 3.22: Exhibit of Example School-level Analysis, Taken from *TIMSS 2011 International Results in Mathematics* (Exhibit 5.4)

Exhibit 5.4: School Composition by Student Economic Background

TIMSS 2011 Mathematics 8th Grade

Reported by Principals

Country		More Affluent - Schools Where More than 25% of Students Come 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 Students Come 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
Armenia		35 (3.7)	484 (5.9)	24 (3.6)	461 (7.5)	41 (3.7)	455 (5.0)
Australia		32 (3.4)	543 (11.2)	39 (3.7)	507 (6.1)	29 (3.1)	476 (7.5)
Bahrain		45 (0.3)	420 (3.2)	28 (0.2)	408 (2.7)	27 (0.3)	395 (3.7)
Chile	r	12 (2.3)	474 (13.0)	32 (4.1)	439 (6.0)	56 (3.9)	399 (4.8)
Chinese Taipei		17 (2.7)	649 (7.9)	69 (3.8)	604 (4.2)	14 (2.9)	577 (13.5)
England		28 (4.1)	553 (11.0)	50 (4.5)	498 (8.9)	22 (4.3)	487 (10.9)
Finland	r	30 (3.4)	519 (4.0)	67 (3.8)	513 (3.0)	3 (1.5)	486 (3.5)
Georgia		11 (2.0)	436 (13.7)	44 (4.4)	438 (6.8)	45 (4.2)	417 (6.8)
Ghana		7 (2.0)	392 (13.9)	18 (3.4)	331 (10.6)	75 (3.6)	321 (5.2)
Hong Kong SAR		11 (3.0)	628 (11.8)	37 (5.1)	609 (10.2)	53 (4.8)	561 (7.8)
Hungary		16 (2.7)	535 (7.4)	33 (4.1)	531 (4.9)	50 (4.3)	478 (5.6)
Indonesia		16 (3.3)	426 (9.9)	28 (4.6)	400 (8.1)	56 (4.6)	369 (6.0)
Iran, Islamic Rep. of		20 (2.7)	472 (11.2)	25 (3.5)	429 (9.1)	54 (3.8)	390 (5.2)
Israel		28 (3.5)	556 (7.8)	30 (4.5)	526 (8.8)	42 (3.9)	481 (8.8)
Italy		40 (3.7)	515 (3.7)	47 (3.9)	495 (3.8)	13 (2.6)	465 (8.9)
Japan		46 (4.4)	582 (4.5)	44 (4.5)	564 (4.1)	10 (2.9)	548 (9.0)
Jordan	r	32 (3.5)	431 (7.0)	25 (2.9)	402 (9.7)	43 (3.9)	388 (6.3)
Kazakhstan		75 (3.5)	487 (4.4)	20 (3.4)	493 (11.0)	5 (1.8)	462 (22.5)
Korea, Rep. of		18 (3.3)	653 (5.8)	51 (4.3)	612 (2.6)	32 (3.9)	591 (4.6)
Lebanon	r	21 (4.1)	491 (8.8)	34 (4.2)	455 (8.7)	45 (5.0)	435 (5.3)
Lithuania		23 (3.6)	537 (6.5)	39 (4.4)	499 (4.3)	38 (4.0)	487 (4.5)
Macedonia, Rep. of	r	38 (3.6)	458 (7.9)	30 (4.1)	428 (10.0)	32 (3.9)	401 (9.7)
Malaysia		26 (3.2)	467 (10.5)	23 (3.3)	452 (12.4)	52 (4.1)	424 (8.8)
Morocco	r	6 (1.4)	422 (15.0)	13 (2.5)	393 (9.8)	81 (2.9)	361 (2.6)
New Zealand		30 (5.6)	522 (6.9)	47 (5.8)	485 (7.4)	24 (4.0)	450 (10.6)
Norway		– –	– –	– –	– –	– –	– –
Oman		43 (3.1)	386 (4.6)	26 (2.6)	360 (5.6)	31 (3.1)	339 (5.8)
Palestinian Nat'l Auth.		44 (4.2)	411 (6.5)	23 (3.9)	402 (8.7)	33 (3.7)	393 (6.1)
Qatar	r	81 (0.2)	403 (4.3)	16 (0.2)	448 (6.6)	3 (0.1)	435 (18.2)
Romania		18 (2.9)	479 (12.7)	29 (4.2)	471 (8.1)	52 (4.3)	447 (6.2)
Russian Federation		58 (3.5)	553 (5.1)	25 (2.8)	527 (4.4)	16 (3.1)	513 (10.3)
Saudi Arabia	r	40 (4.4)	405 (7.5)	30 (4.4)	394 (10.5)	29 (4.1)	382 (8.2)
Singapore		27 (0.0)	643 (5.9)	61 (0.0)	604 (4.9)	11 (0.0)	569 (11.6)
Slovenia		40 (3.8)	510 (4.4)	45 (4.3)	506 (2.7)	15 (2.7)	489 (6.8)
Sweden	r	74 (4.4)	490 (2.6)	21 (4.1)	472 (5.5)	5 (1.8)	466 (11.9)
Syrian Arab Republic	r	37 (4.2)	388 (8.0)	27 (4.3)	392 (9.5)	36 (4.4)	371 (8.2)
Thailand		20 (3.0)	466 (13.9)	24 (3.6)	437 (9.5)	57 (4.4)	410 (5.7)
Tunisia		23 (3.3)	439 (9.6)	29 (3.3)	432 (3.9)	48 (3.5)	411 (3.0)
Turkey		17 (2.6)	533 (11.6)	25 (3.3)	455 (6.0)	59 (3.8)	428 (5.1)
Ukraine		13 (2.7)	486 (14.1)	29 (3.9)	486 (7.4)	59 (4.5)	472 (5.1)
United Arab Emirates	r	70 (2.0)	459 (3.4)	17 (1.9)	442 (7.3)	13 (1.4)	441 (5.6)
United States		22 (1.9)	543 (5.8)	23 (1.9)	526 (6.1)	55 (1.9)	490 (3.4)
International Avg.		**32 (0.5)**	**494 (1.4)**	**33 (0.6)**	**471 (1.2)**	**36 (0.5)**	**448 (1.3)**
Ninth Grade Participants							
Botswana		13 (3.0)	432 (10.9)	24 (4.0)	401 (4.4)	63 (4.6)	384 (2.7)
Honduras	s	5 (1.6)	383 (12.5)	14 (3.4)	358 (12.3)	82 (3.6)	333 (4.4)
South Africa	r	8 (1.3)	487 (14.4)	12 (2.6)	356 (15.0)	80 (2.7)	339 (3.2)
Benchmarking Participants							
Alberta, Canada		39 (4.1)	517 (3.6)	43 (4.8)	505 (3.3)	18 (3.8)	482 (5.9)
Ontario, Canada		37 (4.1)	523 (5.1)	36 (4.7)	510 (3.8)	27 (4.5)	498 (5.2)
Quebec, Canada	r	51 (4.1)	542 (4.3)	32 (3.8)	523 (5.2)	17 (3.5)	514 (6.3)
Abu Dhabi, UAE	r	76 (4.1)	453 (6.1)	17 (3.6)	429 (10.3)	7 (2.4)	446 (14.9)
Dubai, UAE	r	71 (0.3)	484 (3.2)	12 (0.2)	449 (2.9)	16 (0.2)	434 (3.8)
Alabama, US	r	17 (4.4)	492 (19.0)	5 (3.4)	481 (41.0)	78 (5.6)	455 (6.1)
California, US	r	16 (4.2)	541 (12.3)	20 (5.2)	532 (16.7)	64 (5.4)	467 (5.8)
Colorado, US	r	21 (5.7)	525 (9.1)	34 (6.6)	526 (10.9)	46 (7.4)	500 (12.5)
Connecticut, US	r	43 (6.1)	565 (7.8)	27 (6.1)	528 (10.3)	30 (5.9)	455 (8.6)
Florida, US	r	6 (3.4)	500 (18.4)	37 (5.6)	535 (11.1)	58 (6.0)	499 (8.8)
Indiana, US	r	13 (4.5)	573 (7.5)	29 (5.3)	524 (10.1)	58 (5.9)	509 (6.6)
Massachusetts, US		29 (6.8)	589 (9.1)	45 (6.6)	562 (8.0)	26 (4.2)	521 (13.4)
Minnesota, US		18 (3.2)	583 (16.6)	45 (7.1)	546 (5.4)	37 (7.6)	530 (8.4)
North Carolina, US	r	14 (5.6)	560 (16.1)	23 (6.4)	551 (10.9)	63 (6.7)	519 (10.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (–) indicates comparable data not available.
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Because we are using a school-level variable, we need to use the school background data files and the student background data files to find the variables. From the school background data files, we need the variable that contains the information on the schools' composition of students based on their economic background (BCDG03) and the identification variables IDCNTRY and IDSCHOOL that will allow us to link the school data to the student data.

Next, we retrieve the variables of interest from the student background data files. We need the country and school identification variables (IDCNTRY and IDSCHOOL) necessary to merge the school data to the student data. We also need the jackknife replication variables (JKZONE and JKREP), the student weighting variable (TOTWGT), and the eighth grade mathematics achievement plausible values (BSMMAT01 through BSMMAT05).

We then proceed to merge the school data with the student data using the variables IDCNTRY and IDSCHOOL and use the macro JACKPV to obtain the percentages of students, with their average mathematics achievement, in each category of the variable BCDG03 for each country. For this analysis, we will use the data for all available countries, making use of an aggregated school file BCGALLM5 and an aggregated student file BSGALLM5. These aggregated files were created with the JOIN macro.

The SAS program that implements this example is presented in Exhibit 3.23 and is included in the International Database under the name EXAMPLE6.SAS. The results of this program are displayed in Exhibit 3.24, edited to show only the first four countries for the sake of brevity. Note that one of the steps in this program is to select only those students who have non-missing data in our variable of interest BCDG03.

In Exhibit 3.24, each country's results are presented on three lines, one for each value of the BCDG03 variable. The results are presented much in the same manner as in previous examples, where the first column identifies the countries and the second column describes the category of BCDG03 being reported.

As shown in the first three lines of results, 32.49 percent of eighth grade students in Australia attended schools with more affluent students than disadvantaged students (standard error of 3.36), 38.54 percent attended schools with neither more affluent students nor more disadvantaged students (standard error of 3.74), and 28.97 percent attended schools with more disadvantaged students than affluent students (standard error of 3.11). Also, the estimated average mathematics achievement was 542.55 (standard error of 11.18) for eighth grade students in schools with more affluent students, 507.36 (standard error of 6.08) for students in schools with neither more affluent students nor more disadvantaged students, and it was 475.74 (standard error of 7.50) for students in schools with more disadvantaged students.

Exhibit 3.23: Example SAS Program for School-level Analysis (EXAMPLE6.SAS)

```
LIBNAME T11 "<datpath>" ;

%INCLUDE "<macpath>JACKPV.SAS" ;

PROC SORT DATA = T11.BCGALLM5 OUT = BCGALLM5;
     BY IDCNTRY IDSCHOOL ;

PROC SORT DATA = T11.BSGALLM5 OUT = BSGALLM5;
     BY IDCNTRY IDSCHOOL ;

DATA MERGED ;
     MERGE BCGALLM5 (IN = INBCG)
           BSGALLM5 (IN = INBSG) ;
     BY IDCNTRY IDSCHOOL ;
     IF INBCG AND INBSG ;

DATA MERGED ;
     SET MERGED ;

     WHERE NMISS (BCDG03) = 0 ;

PROC FORMAT LIBRARY = WORK ;

 VALUE COUNTRY
   < list 2011 country formats >

VALUE BCDG
     1 = "MORE AFFLUENT LESS DISADVANTAGED"
     2 = "NEITHER"
     3 = "MORE DISADVANTAGED LESS AFFLUENT" ;

%JACKPV (TOTWGT, JKZONE, JKREP, 75, IDCNTRY BCDG03, BSMMAT0, 5, MERGED) ;

PROC PRINT DATA = FINAL NOOBS ;
     VAR IDCNTRY BCDG03 N TOTWGT MNPV MNPV_SE PCT PCT_SE ;
     FORMAT IDCNTRY COUNTRY. BCDG03 BCDG. N 6.0 TOTWGT 10.0
            MNPV MNPV_SE PCT PCT_SE 6.2 ;
```

Exhibit 3.24: Output for Example School-level Analysis (EXAMPLE 6)

IDCNTRY	BCDG03	N	TOTWGT	MNPV	MNPV_SE	PCT	PCT_SE
AUSTRALIA	MORE AFFLUENT LESS DISADVANTAGED	2118	71105	542.55	11.18	32.49	3.36
AUSTRALIA	NEITHER	2535	84358	507.36	6.08	38.54	3.74
AUSTRALIA	MORE DISADVANTAGED LESS AFFLUENT	1800	63400	475.74	7.50	28.97	3.11
BAHRAIN	MORE AFFLUENT LESS DISADVANTAGED	1954	5157	419.65	3.19	45.30	0.32
BAHRAIN	NEITHER	1143	3173	407.57	2.72	27.87	0.23
BAHRAIN	MORE DISADVANTAGED LESS AFFLUENT	1051	3055	395.48	3.69	26.83	0.34
ARMENIA	MORE AFFLUENT LESS DISADVANTAGED	2085	12047	483.52	5.89	34.78	3.70
ARMENIA	NEITHER	1329	8398	460.52	7.53	24.25	3.59
ARMENIA	MORE DISADVANTAGED LESS AFFLUENT	2158	14191	455.43	5.03	40.97	3.68
CHILE	MORE AFFLUENT LESS DISADVANTAGED	811	22830	474.35	13.02	12.16	2.32
CHILE	NEITHER	1391	59452	439.36	5.98	31.66	4.07
CHILE	MORE DISADVANTAGED LESS AFFLUENT	2119	105493	398.81	4.76	56.18	3.86

References

Martin, M.O. & Mullis, I.V.S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). *TIMSS 2011 international results in science.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

SAS Institute. (2011). *SAS system for Windows* (version 9.3). Cary, NC: Author.

Chapter 4

The TIMSS 2011 International Database Files

4.1 Overview

The TIMSS 2011 International Database contains achievement data and student, home, teacher, and school background data collected in the 63 countries and 14 benchmarking participants that took part in TIMSS 2011.[1] Exhibit 4.1 lists all of the TIMSS 2011 countries and benchmarking participants, along with identifying 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 database with a special emphasis on the actual data files used in Chapters 2 and 3 of this User Guide to analyze the TIMSS 2011 assessment results. The next section introduces this User Guide and its supplements. The following section describes the item-related materials included in the international database. The final five sections present the different data files and related materials included in the database, as described in Exhibit 1.1 of Chapter 1.

4.2 The TIMSS 2011 User Guide

The *TIMSS 2011 User Guide* is an important resource to the TIMSS 2011 International Database because it provides a detailed description of its structure and contents, as well as instructions to make the best use of its data. The User Guide also includes a series of four supplements in printable PDF format:

- Supplement 1: International Version of the TIMSS 2011 Background and Curriculum Questionnaires—Supplement 1 includes the international version of all background and curriculum questionnaires administered in TIMSS 2011. It is a good reference guide to understand what questions were asked and the variable names under which the responses are recorded in the International Database.
- Supplement 2: National Adaptations of International Background Questionnaires—Supplement 2 provides details on all national adaptations that were applied to the national version of all TIMSS 2011 background questionnaires. Users should refer to this supplement for any special national adaptations to background variables that could potentially affect the results of analyses.

[1] The TIMSS 2011 International Database also includes data from the PIRLS 2011 "Learning to Read" survey (a home questionnaire administered to parents) for countries that administered the TIMSS and PIRLS 2011 fourth grade assessments to the same sample of students.

Exhibit 4.1: Countries Participating in TIMSS 2011

Country	ISO Code		Assessment	
	Alpha	Numeric	Fourth Grade	Eighth Grade
Armenia	ARM	051	●	●
Australia	AUS	036	●	●
Austria	AUT	040	●	
Azerbaijan	AZE	031	●	
Bahrain	BHR	048	●	●
Belgium (Flemish)	BFL	956	●	
Chile	CHL	152	●	●
Chinese Taipei	TWN	158	●	●
Croatia	HRV	191	●	
Czech Republic	CZE	203	●	
Denmark	DNK	208	●	
England	ENG	926	●	●
Finland	FIN	246	●	●
Georgia	GEO	268	●	●
Germany	DEU	276	●	
Ghana	GHA	288		●
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	●	●
Macedonia, Rep. of	MKD	807		●
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	●	●
Palestinian Nat'l Auth.	PSE	275		●

Exhibit 4.1: Countries Participating in TIMSS 2011 *(Continued)*

Country	ISO Code		Assessment	
	Alpha	Numeric	Fourth Grade	Eighth Grade
Poland	POL	616	●	
Portugal	PRT	620	●	
Qatar	QAT	634	●	●
Romania	ROM	642	●	●
Russian Federation	RUS	643	●	●
Saudi Arabia	SAU	682	●	●
Serbia	SRB	688	●	
Singapore	SGP	702	●	●
Slovak Republic	SVK	703	●	
Slovenia	SVN	705	●	●
Spain	ESP	724	●	
Sweden	SWE	752	●	●
Syrian Arab Republic	SYR	760		●
Thailand	THA	764	●	●
Tunisia	TUN	788	●	●
Turkey	TUR	792	●	●
Ukraine	UKR	804		●
United Arab Emirates	ARE	784	●	●
United States	USA	840	●	●
Yemen	YEM	887	●	
Out-of-grade Countries				
Botswana (6th and 9th)	BWA	072	●	●
Honduras (6th and 9th)	HND	340	●	●
South Africa (9th)	ZAF	710		●
Yemen (6th)	YE6	6887	●	
Benchmarking Participants				
Alberta, Canada	CAB	9134	●	●
Ontario, Canada	COT	9132	●	●
Quebec, Canada	CQU	9133	●	●
Abu Dhabi, UAE	AAD	7842	●	●
Dubai, UAE	ADU	7841	●	●
Alabama, US	UAL	10400		●
California, US	UCA	11100		●
Colorado, US	UCO	10800		●
Connecticut, US	UCT	10900		●
Florida, US	UFL	11200	●	●
Indiana, US	UIN	11800		●
Massachusetts, US	UMA	12500		●
Minnesota, US	UMN	12700		●
North Carolina, US	UNC	13700	●	●

- 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 the *TIMSS 2011 International Reports* (Mullis, Martin, Foy, & Arora, 2012; and Martin, Mullis, Foy, & Stanco, 2012).
- Supplement 4: TIMSS 2011 Sampling Stratification Information—Supplement 4 provides the labels assigned to the national explicit and implicit strata defined during the sampling process.

4.3 TIMSS 2011 Achievement Items Documentation

A number of documents related to the TIMSS 2011 achievement items are available for download along with the International Database. They include detailed information on the TIMSS 2011 released items, summary information on the TIMSS 2011 items, as well as the IRT item parameters estimated from the TIMSS 2011 concurrent item calibration.

The International Database includes PDF documents of the TIMSS 2011 released mathematics and science achievement items at the fourth and eighth grades. The documents include the items themselves with descriptive information and the scoring guides for the constructed response items. The International Database also includes percent correct statistics for all released items in Excel and PDF format. There are separate files by grade and subject.

Achievement item information files are provided to enable users of the TIMSS 2011 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 within. These files are available in Excel format and include the following information for each item in the TIMSS 2011 assessments:

- The item's permanent and 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 released after the 2011 assessment.

The International Database also includes Excel files with the IRT item parameters estimated for all TIMSS 2007 and TIMSS 2011 items from the concurrent item calibrations. There is an Excel file for each grade that contains separate tables for overall mathematics and overall science. These same item parameters are presented in the scaling section of *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012). Finally, the database also includes Excel tables with the scale transformations that were applied to the TIMSS 2011 mathematics and science scales.

4.4 The TIMSS 2011 Data Files

The TIMSS 2011 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 background questionnaires. These data files also include the achievement scores estimated for participating students as well as background variables derived for reporting in the *TIMSS 2011 International Reports*. 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 contents and format of the TIMSS 2011 data files. With the exception of the curriculum data files, the TIMSS data files are provided in SAS (SAS Institute, 2011) export format (.EXP) and SPSS (IBM Corporation, 2012) format (.SAV). Data files are provided for each country that participated in TIMSS 2011 and for which internationally comparable data are available. The file names given to the various data file types are shown in Exhibit 4.2. For example, ASGNORM5.SAV is an SPSS file that contains Norway's TIMSS 2011 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 4.2: TIMSS 2011 Data File Names

File Names	Descriptions
ACG●●●M5	Fourth grade school background data files
ASA●●●M5	Fourth grade student achievement data files
ASG●●●M5	Fourth grade student background data files
ASH●●●M5	Fourth grade home background data files
ASR●●●M5	Fourth grade within-country scoring reliability data files
AST●●●M5	Fourth grade student–teacher linkage files
ATG●●●M5	Fourth grade teacher background data files
BCG●●●M5	Eighth grade school background data files
BSA●●●M5	Eighth grade student achievement data files
BSG●●●M5	Eighth grade student background data files
BSR●●●M5	Eighth grade within-country scoring reliability data files
BST●●●M5	Eighth grade student–teacher linkage files
BTM●●●M5	Eighth grade mathematics teacher background data files
BTS●●●M5	Eighth grade science teacher background data files

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

4.4.1 TIMSS 2011 Student Achievement Data Files (ASA/BSA)

The TIMSS 2011 student achievement data files contain the student responses to the individual achievement items in the TIMSS 2011 assessments. The student achievement data files are best suited for performing item-level analyses. Achievement scores (plausible values) for all of the TIMSS 2011 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.

Students who participated in TIMSS 2011 were administered one of 14 assessment booklets, each with a series of mathematics and science items.[2] 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 scoring guides.

Item Variable Naming Convention

The achievement item variable names are based on an 8-character alphanumeric code (e.g., M051064A), which adheres to 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 used in TIMSS. The code "01" was used for items introduced in TIMSS 1995. The items in the TIMSS 2011 assessment have either "03" for items produced in 2003, "04" for items produced in 2007, or "05" for new items in 2011.
- The fourth character is either "1" for fourth grade items, or "2" for eighth grade items.
- The fifth through seventh characters are a three-digit number used to uniquely 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 where the scores of its item parts are combined into a single derived item.

For example, M051064A is the first part of a fourth grade mathematics item produced in 2011 whose unique sequence number is 064.

Item Response Code Values

A series of conventions also were adopted to code the data included in the TIMSS 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 code is included as part of the variable label in the achievement codebook file, and SAS and SPSS programs are included as part of the International Database to score these items.[3]

---

[2] The TIMSS 2011 booklet design is described in Chapter 4 of the *TIMSS 2011 Assessment Frameworks* (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009).

[3] The SPSS version of these programs function much like their SAS counterparts, described in Section 3.4 of Chapter 3.

Each constructed response item had its own scoring guide that relied on a two-digit scoring scheme to provide diagnostic information.[4] The first digit designated the correctness level of the response: 2 for a two-point response, 1 for a one-point response, 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 code, 99, was used for completely blank responses.

For some items, students were asked to provide more than one answer, each one being scored separately. The pattern of responses across these item parts determined the score on the item as a whole. These multi-part items fell into one of two categories. In the first instance, students provided two answers and the score on the item was the number of correct responses. In the second instance, students provided more than one answer and the item received a score of one if all responses were correct. The total score for the item is contained in a derived variable, indicated by a final character of Z in its item variable name. For example, derived variable S051188Z contains the combined score for its five parts labeled S051188A through S051188E. For all of these items, each item part was worth one point, and the derived items were given the code values shown in Exhibit 4.3.

Exhibit 4.3: TIMSS 2011 Derived Item Variable Codes

Code	Description
For 2-point Derived Items:	
20	Full credit (1 point on both part A and part B)
10	Partial credit (1 point on either part A or part B)
70	No credit (no points on both part A and part B)
For 1-point Derived Items:	
10	Full credit (all parts correct)
70	No credit (at least one part incorrect)

Codes for Missing Values

A subset of the values for each variable type 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 major consequences for analyses.

[4] Scoring guides for the released items are provided in the *Released Items* document, available for download at *http://timssandpirls.bc.edu/timss2011/international-database.html*.

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.

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 received only one of the 14 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, all variables 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 deleted or mistranslated—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."

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 2011 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 the scaling section in *Methods and Procedures in TIMSS and PIRLS 2011*).

TIMSS Achievement Scores

Achievement scales were produced for mathematics and science and their content and cognitive domains at both grades, 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 2011 scaling approach and how these achievement scales were created is available in the scaling section of *Methods and Procedures in TIMSS and PIRLS 2011*. For each achievement scale, the TIMSS 2011 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.

Exhibit 4.4: TIMSS 2011 Achievement Scales at Fourth and Eighth Grades

TIMSS 2011 Achievement Scales					
Fourth Grade	Overall	MAT	Mathematics	SCI	Science
	Content Domains	NUM	Number	LIF	Life Science
		GEO	Geometric Shapes and Measurement	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

The plausible values for any given scale are the best available measures of student achievement on that scale in the TIMSS 2011 International Database, and should be used as the outcome measure in any study of student achievement. Plausible values can be readily analyzed using the IEA International Database (IDB) Analyzer and the SAS programs described in this User Guide.

The achievement score variable names are based on an eight-character alphanumeric code (e.g., ASMKNO01), which adheres to the following rules:

- The first character is either "A," for a fourth grade score, 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 or a content domain 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, ASMKNO01 is the first plausible value on the fourth grade mathematics knowing cognitive domain achievement scale.

TIMSS International Benchmarks of Achievement

To help users of the TIMSS 2011 achievement results 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.[5] The *TIMSS 2011 International Reports* present the results of this scale anchoring, and report the percentage of students in each country reaching each of the TIMSS International Benchmarks.

Exhibit 4.5: TIMSS 2011 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

To assist analysts in using the TIMSS International Benchmarks in secondary analyses, the TIMSS 2011 International Database contains a set of variables indicating which International Benchmark the students reached. There is a benchmark variable for each plausible value of the overall mathematics and overall science scales at both grades. 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, 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 used for all the benchmark variables are described in Exhibit 4.6.

[5] The scale anchoring procedure is described in the scale anchoring section of *Methods and Procedures in TIMSS and PIRLS 2011*.

Exhibit 4.6: TIMSS 2011 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

4.4.2 TIMSS 2011 Within-country Scoring Reliability Data Files (ASR/BSR)

The TIMSS 2011 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 Operations and Quality Assurance in *Methods and Procedures in TIMSS and PIRLS 2011*). For each constructed response item in the 2011 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 the *TIMSS 2011 International Reports*.

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 above. 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, in accordance with the achievement item naming convention (e.g., M051064A);
- The Second Score variable has the letter "R" as the second character (e.g., MR51064A); and
- The Score Agreement variable has the letter "I" as the second character (e.g., MI51064A).

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 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 2011 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)

In general, the data in the Original Score variables are identical to those contained in the student achievement data files. In some cases, however, the response scores for specific items were recoded after a review of the international item statistics revealed inconsistencies in the original scoring guides, or showed that the original scores were not functioning as desired. The recoded score values were used in computing the achievement scores reflected in the International Reports and are present in the student achievement data files. In contrast, the Original Score variables in the scoring reliability data files contain the original unrecoded response scores. This was done so that the scoring reliability measures indicated in the Score Agreement variables were based on the original scoring guides used during the constructed response scoring sessions conducted in each country.

4.4.3 TIMSS 2011 Background Questionnaire Data Files

There are five usual types of TIMSS 2011 background questionnaire data files: four data files (student, teacher, school, and curriculum) correspond to the four types of background questionnaires administered in TIMSS 2011, and the fifth links the student and teacher background data. The first four types of data files contain the responses to the questions asked in their respective background questionnaires.

At the fourth grade, there is an additional file type that contains the responses from parents to the Learning to Read survey administered as part of the PIRLS 2011 assessment. This questionnaire was used in countries that administered the TIMSS and PIRLS 2011 assessments to the same sample of students; consequently, these countries have an additional TIMSS 2011 background questionnaire data file to hold these data.

TIMSS 2011 Student Background Data Files (ASG/BSG)

Students who participated in TIMSS 2011 were administered a background questionnaire with questions related to their home background, school experiences, and attitudes to 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 toward 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 the international reports. These variables are described later in this chapter.

PIRLS 2011 Home Background Data Files (ASH)

Countries that administered the TIMSS and PIRLS 2011 fourth grade assessments to the same sample of students also administered a "Learning to Read Survey," which was completed by the students' parents or guardians. This survey usually is called the Home Questionnaire. It asked questions about preparations for primary schooling, including attendance in preschool and literacy-centered activities in the home before the child began school, such as reading books, singing songs, or writing letters or words. Parents answered questions about home resources in addition to information about their highest level of education and employment situations.

TIMSS 2011 Teacher Background Data Files (ATG/BTM/BTS)

The mathematics and science teachers of the students that were sampled for TIMSS 2011 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.

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. Variable names for questions asked in both questionnaires are the same. 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 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.

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. Chapters 2 and 3 of this User Guide describe student-level analyses combining the teacher data and the student–teacher linkage data files with the IEA IDB Analyzer software, as well as with SAS programs.

TIMSS 2011 School Background Data Files (ACG/BCG)

The school background data files contain school principals' responses to the questions in the TIMSS 2011 school background 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, or SAS programs, are described in Chapters 2 and 3 of this User Guide, respectively.

TIMSS 2011 Student–Teacher Linkage Data Files (AST/BST)

The TIMSS 2011 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 to perform appropriate student-level analyses where teacher characteristics are considered as attributes of the students.

TIMSS 2011 Curriculum Data Files

The TIMSS 2011 curriculum questionnaire data files contain the responses provided by the National Research Coordinators of the participating countries to the TIMSS 2011 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 2011 International Database.

Background Variable Naming Convention

The background variable naming convention 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" is used to identify data from the school principals, the letter "T" is used for teacher data, 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 associated with questions in the background questionnaires and for the Rasch scores to contextual scales constructed from these data. The letter "D" is used for all

variables derived from responses in the background questionnairesand for the index variables constructed from these background Rasch scores.[6]

- The fourth character is used to indicate the subject or topic to which a background question refers. The following letters are used: [7]

  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 questionnaire variables represent the sequential numbering of the questions as presented in their respective questionnaires.[8]

The curriculum questionnaires use a different variable naming convention. The first three characters are "GEN" for general questions, "MA4" and "MA8" for fourth grade and eighth grade mathematics questions, respectively, and "SC4" and SC8" for fourth grade and eighth grade sciecne questions, respectively. The remaining characters indicate the sequential order of the questions in the curriculum questionnaires.

Background Variable Location Convention

Although the background variable naming convention was modified in 2011 to show explicitly the ordering of questions in the background questionnaires, each question also 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 now found in the question's variable name. For example, if the location variable is given as SQG-06, it refers to general question 6 in the student background questionnaire. This convention is followed in the data almanacs and in the description of the variables included in Supplements 1 and 2 to this User Guide.

---

6 The contextual scales are described in the context questionnaire scales section of *Methods and Procedures in TIMSS and PIRLS 2011*.

7 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.

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

Exhibit 4.8: Background 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 "the number of students in a 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.

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 small number of cases, data received from a country in an invalid or inconsistent manner also were coded as "Omitted."

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 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 removed—Variables corresponding to questions in the student, home, teacher, or school background questionnaires that were considered not applicable in some countries were not included in the national versions of the questionnaires. These questions 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."

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

"Not Applicable" response codes were used for the background 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.

Contextual Scales and Derived Variables

In the TIMSS 2011 questionnaires, often several questions were asked about various aspects of a single contextual 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 contextual construct of interest than the individual variables could on their own. These Rasch scores also were categorized, usually into three groups, to create an index. The Rasch scores and their indices are included in the International Database and described in the contextual questionnaire scaling section of *Methods and Procedures in TIMSS and PIRLS 2011*.

Additional variables were derived from responses to multiple questions to provide more pertinent information for reporting. Parents' education is an example where responses from both parents were combined into a single variable in order to report a single educational level. Generally, records (whether students, parents, teachers, or schools) were included in the calculation only if data were available for at least two-thirds of the variables involved. For example, if a derived variable was

based on six component variables, records that were missing responses to more than two of these were counted as missing on the derived variable. Supplement 3 to the User Guide provides a description of the derived variables included in the International Database.

Sampling and Weighting Variables

Several sampling and weighting variables are included in the TIMSS 2011 data files. They are listed and described in Exhibit 4.9 and 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.

Exhibit 4.9: TIMSS 2011 Sampling and Weighting Variables

Variable Name	Description
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
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
SCHWGT	School weight
TCHWGT	Overall teacher weight
MATWGT	Mathematics teacher weight
SCIWGT	Science teacher weight
WGTFAC1	School weighting factor
WGTADJ1	School weighting adjustment
WGTFAC2	Class weighting factor
WGTADJ2	Class weighting adjustment
WGTFAC3	Student weighting factor
WGTADJ3	Student weighting adjustment

Although TOTWGT has desirable properties, it also has 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 compute significance tests will 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.

Exhibit 4.10: Location of Sampling and Weighting Variables in the TIMSS 2011 Data Files

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

The weight variables TOTWGT, SENWGT, and HOUWGT are designed for use in student-level analyses from all student, home, and school background data files. The weight variable SCHWGT is designed for use in school-level analyses where the schools are the units of analysis.

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 properly weighted 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. All weighting variables beginning with the letters "WGT" are included to provide insight into the multi-stage sampling and weighting methodology applied to the TIMSS data. All weighting variables are described in the sampling section of *Methods and Procedures in TIMSS and PIRLS 2011*.

Structure and Design Variables

Besides the variables used to store responses to the background questionnaires and achievement booklets, the TIMSS 2011 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.

IDCNTRY

IDCNTRY is a five-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.

IDPOP

IDPOP identifies the target grade and is set to "1" for the fourth grade and "2" for the eighth grade.

IDGRADE

IDGRADE identifies the target grade of the participating students. In TIMSS 2011, the usual values are "4" and "8" for most countries.

IDSCHOOL

IDSCHOOL is a four-digit identification code that uniquely identifies the participating schools within each country. The school codes are not unique across countries. Schools across countries can be uniquely identified only with the IDCNTRY and IDSCHOOL combination of linking variables.

IDCLASS

IDCLASS is a six-digit identification code that uniquely identifies the sampled classrooms within a country. The variable IDCLASS has a hierarchical structure and is formed by concatenating the IDSCHOOL variable and a two-digit sequential number identifying the sampled classrooms within a

school. Classrooms can be uniquely identified in the database by the combination of IDCNTRY and IDCLASS as linking variables.

IDSTUD

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

IDBOOK

IDBOOK identifies the specific assessment booklet that was administered to each student. The booklets are given a numerical value from "1" through "14."

IDSTRATE & IDSTRATI

IDSTRATE and IDSTRATI are identification variables generated by the school sampling process. IDSTRATE identifies the explicit strata and IDSTRATI the implicit strata from which the participating schools were sampled. The codes assigned to these two variables vary from country to country and are documented in Supplement 4 to the User Guide.

IDTEACH

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

IDLINK

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

Exhibit 4.11 shows in which data files the various identification variables are located. It also highlights the combinations of variables used to uniquely identify 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. Because 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 uniquely identify 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 2011 Data Files

Identification Variable	Data File Type					
	ASA BSA	ASG BSG	AST BST	ATG BTM/BTS	ACG BCG	ASH
IDCNTRY	●	●	●	●	●	●
IDGRADE	●	●	●	●	●	●
IDPOP	●	●	●	●	●	●
IDSCHOOL	●	●	●	●	●	●
IDCLASS	●	●	●	●		●
IDSTUD	●	●	●			●
IDBOOK	●	●				
IDSTRATE	●	●				
IDSTRATI	●	●				
IDTEACH			●	●		
IDLINK			●	●		

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.

ITDATEM and ITDATEY

Month and year of testing for each student.

ITLANG

Language of testing for each student. It is set to "1" for all countries that tested in a single language. For countries that administered the test in more than one language, additional numerical codes are used that correspond to the order of the testing languages as shown in Supplement 2 to the User Guide.

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

4.5 TIMSS 2011 Codebook Files

All information related to the structure of the TIMSS 2011 data files, as well as the source, format, descriptive labels, and response option codes for all variables, is contained in codebook files. Each data file type in the International Database is accompanied by a codebook file, with the exception of the curriculum data files. The naming convention for codebook files is as follows:

- The first three characters of the filename are in every respect identical to those in the file names shown in Exhibit 4.2;
- The next three characters identify the files as TIMSS codebooks and are always "TMS";
- The seventh and eighth characters are always "M5" to indicate the TIMSS 2011 study cycle; and
- The three-character file extension is either .XLS for the Excel format, or .PDF for the printable format.

Codebook files can be read using Excel, or printed directly from PDF format using Acrobat Reader. They describe the contents and structure of the TIMSS data files. Important codebook fields include FIELD_LABL, which contains extended textual information for all variables, QUEST_LOC, which provides the location of questions and achievement items within their respective survey instruments, and FIELD_CODE, which lists all acceptable responses allowed in the database.

4.6 TIMSS 2011 Data Almanac Files

Data almanacs provide weighted summary statistics for all variables in the TIMSS 2011 data files. There are two basic types of data almanacs: achievement data almanacs for the achievement items, 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 2011 assessment. There are separate achievement data almanacs for fourth and eighth grades and for the two subjects, mathematics and science. 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 2007 and 2011 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 out-of-grade countries and benchmark participants, listed below the international averages, are not included in the calculation of international averages.

Exhibit 4.12: TIMSS 2011 Achievement Data Almanacs

Achievement Data Almanac	Contents
T11_G4_MAT_ItemAlmanac	Almanac for fourth grade mathematics items
T11_G4_SCI_ItemAlmanac	Almanac for fourth grade science items
T11_G4_MAT_TrendItemAlmanac	Trend almanac for fourth grade mathematics items
T11_G4_SCI_TrendItemAlmanac	Trend almanac for fourth grade science items
T11_G8_MAT_ItemAlmanac	Almanac for eighth grade mathematics items
T11_G8_SCI_ItemAlmanac	Almanac for eighth grade science items
T11_G8_MAT_TrendItemAlmanac	Trend almanac for eighth grade mathematics items
T11_G8_SCI_TrendItemAlmanac	Trend almanac for eighth grade science 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., 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, or did not 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).
- 1.GIRL %RIGHT and 2.BOY %RIGHT—The percent of girls and boys that either got a multiple choice item correct, 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 background questionnaires, including the contextual scales and their indices and the derived variables based on these background variables.[10] 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 TIMSS 2011 International Database are listed in Exhibit 4.13.

[10] The Home Questionnaire almanac lists only the countries that administered the TIMSS and PIRLS 2011 fourth grade assessments to the same sample of students.

Exhibit 4.13: TIMSS 2011 Background Data Almanacs

Background Data Almanac	Contents
T11_G4_MAT_StudentAlmanac	Fourth grade student background almanac with mathematics achievement
T11_G4_SCI_StudentAlmanac	Fourth grade student background almanac with science achievement
T11_G4_MAT_HomeAlmanac	Fourth grade home background almanac with mathematics achievement
T11_G4_SCI_HomeAlmanac	Fourth grade home background almanac with science achievement
T11_G4_MAT_TeacherAlmanac	Fourth grade teacher background almanac with mathematics achievement
T11_G4_SCI_TeacherAlmanac	Fourth grade teacher background almanac with science achievement
T11_G4_MAT_SchoolAlmanac	Fourth grade school background almanac with mathematics achievement
T11_G4_SCI_SchoolAlmanac	Fourth grade school background almanac with science achievement
T11_G8_MAT_StudentAlmanac	Eighth grade student background almanac with mathematics achievement
T11_G8_SCI_StudentAlmanac	Eighth grade student background almanac with science achievement
T11_G8_MAT_TeacherAlmanac	Eighth grade teacher background almanac with mathematics achievement
T11_G8_SCI_TeacherAlmanac	Eighth grade teacher background almanac with science achievement
T11_G8_MAT_SchoolAlmanac	Eighth grade school background almanac with mathematics achievement
T11_G8_SCI_SchoolAlmanac	Eighth grade school background almanac with science achievement

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

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 only on the students with valid data, as well as "Not Applicable" codes when used); 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 percentages and distributional statistics of continuous variables reported in the background data almanacs 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 were analyzed as student attributes.

4.7 TIMSS 2011 Test-Curriculum Matching Analysis Data Files

The Test-Curriculum Matching Analysis (TCMA) was conducted to investigate the appropriateness of the TIMSS 2011 mathematics and science assessments for the fourth and eighth grade students in the participating countries. To that end, participating countries were asked to indicate which items on the TIMSS 2011 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 curriculum in other countries. The analytical method used and the results of the TCMA are presented in Appendix F of the *TIMSS 2011 International Reports*.

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.

4.8 TIMSS 2011 Program Files

The TIMSS 2011 International Database includes a number of SAS programs and macros designed to facilitate the manipulation of the TIMSS 2011 data files and conduct proper statistical analyses taking into account the jackknife algorithm and the presence of plausible values. These programs are described in Chapter 3 of this User Guide.

The International Database contains two SPSS syntax files—ASASCRM5.SPS and BSASRCM5.SPS—which will recode the responses to individual items from the TIMSS 2011 achievement data files to their appropriate score levels. The files function much the same way as their SAS counterparts described in Chapter 3 of this User Guide (see Section 3.4). The International Database also includes a third SPSS syntax file to perform a variable recode required for the proper execution of the third example in Chapter 2 of this User Guide (see Section 2.5).

References

IBM Corporation. (2012). *IBM SPSS statistics* (version 20.0). Somers, NY: Author.

International Association for the Evaluation of Educational Achievement. (2012). *International database analyzer* (version 3.0). Hamburg, Germany: IEA Data Processing and Research Center.

Martin, M.O. & Mullis, I.V.S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). *TIMSS 2011 international results in science.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Mullis, I.V.S., Martin, M. O., Ruddock, G. J., O'Sullivan, C.Y., & Preuschoff, C. (Eds.). (2009). *TIMSS 2011 assessment frameworks.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

SAS Institute. (2011). *SAS system for Windows* (version 9.3). Cary, NC: Author.

Appendix

Organizations and Individuals Responsible for TIMSS 2011

TIMSS 2011 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 2011 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 2011 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 the fourth grade.

The TIMSS & PIRLS International Study Center at Boston College has responsibility for the overall direction and management of the TIMSS and PIRLS projects. 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. The IEA Data Processing and Research Center in Hamburg was responsible for processing and verifying the data submitted by the participants; 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 2011 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.

Funding

Funding for TIMSS 2011 was provided primarily by the participating countries. The National Center for Education Statistics of the US Department of Education was a major funding partner, providing funding under contract number ED08C00117. The content of this publication does not necessarily reflect the views or policies of the US Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the US Government.

The financial support from Boston College is gratefully acknowledged, as well as that from the UK's National Foundation for Educational Research.

IEA Secretariat

Seamus Hegarty, *IEA Chair*
Hans Wagemaker, *Executive Director*
Barbara Malak, *Manager, Member Relations*
Juriaan Hartenberg, *Financial Manager*
Paulína Koršňáková, *Senior Professional Researcher*
Isabelle Braun-Gémin, *Financial Manager Assistant*
David Ebbs, *Management Assistant*
Alana Yu, *Management Assistant*

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*
Alka Arora, *Assistant Research Director, TIMSS Mathematics*
Gabrielle M. Stanco, *Assistant Research Director, TIMSS Science*
Kathleen T. Drucker, *Assistant Research Director, PIRLS Reading*
Ieva Johansone, *Assistant Research Director, Operations and Quality Control*
Marcie Bligh, *Manager of Office Administration*
Bradley Brossman, *Psychometrician (through 2012)*
Courtney E. Castle, *Graduate Assistant*
Victoria A.S. Centurino, *Graduate Assistant*
Susan Farrell, *Senior Data Graphics Specialist*
Joseph Galia, *Senior Statistician/Programmer*
Christine Hoage, *Manager of Finance*
Lee R. Jones, *Chief Science Consultant*
Chad A. Minnich, *Writer/Editor*
Jennifer Moher Sepulveda, *Data Graphics Specialist*
Mario A. Pita, *Senior Data Graphics Specialist*
Jyothsna Pothana, *Statistician/Programmer*
Betty Poulos, *Administrative Coordinator*
Corinna Preuschoff, *Senior Research Specialist (through 2011)*
Moira A. Ragan, *Graduate Assistant*
Ruthanne Ryan, *Data Graphics Specialist*
Steven A. Simpson, *Data Graphics Specialist*

IEA Data Processing and Research Center

Dirk Hastedt, *Co-Director*
Juliane Hencke, *Project Co-Manager, TIMSS and PIRLS data processing*
Oliver Neuschmidt, *Project Co-Manager, TIMSS and PIRLS data processing*
Yasin Afana, *Deputy Project Manager, TIMSS and PIRLS data processing*
Milena Taneva, *Deputy Project Manager, TIMSS and PIRLS data processing*
Alena Becker, *Research Analyst*
Christine Busch, *Research Analyst*
Ralph Carstens, *Senior Research Analyst*
Mark Cockle, *Research Analyst*
Tim Daniel, *Research Analyst*
Limiao Duan, *Research Analyst*
Eugenio Gonzales, *Unit Head, Research and Analysis*
Pamela Inostroza, *Research Analyst*
Michael Jung, *Research Analyst*
Maike Junod, *Programmer*
Alexander Konn, *Programmer*
Marta Kostek-Drosihn, *Unit Coordinator*
Sabine Meinck, *Research Analyst, Sampling*
Sebastian Meyer, *Research Analyst*
Dirk Oehler, *Research Analyst*
Moritz Otto, *Programmer*
Devi Potham Rajendra Prasath, *Programmer*
Daniel Radtke, *Research Analyst*
Anke Sielemann, *Research Analyst*
Harpreet Singh Choudry, *Unit Head, Software*
Sabine Tieck, *Research Analyst*
Caroline Vandenplas, *Research Analyst*
Sabine Weber, *Research Analyst*
Bettina Wietzorek, *Meeting and Seminar Coordinator*
Meng Xue, *Programmer*
Olaf Zuehlke, *Research Analyst, Sampling*

Statistics Canada

Marc Joncas, *Senior Methodologist*
Sylvie LaRoche, *Senior Methodologist*

Educational Testing Service

Matthias Von Davier, *Research Director*
Edward Kulick, *Research Director*
Meng Wu, *Associate Psychometrician*
Jonathan Weeks, *Associate Research Scientist*
Scott Davis, *Data Analysis and Computational Research Specialist*
Yuxin (Christina) Tang, *Principal Research Data Analyst*
Zhumei Guo, *Senior Research Data Analyst*

Sampling Referee

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

TIMSS 2011 SCIENCE AND MATHEMATICS ITEM REVIEW COMMITTEE

Mathematics

Kiril Bankov
University of Sofia
Bulgaria

Karen Manriquez
Ministry of Education
Chile

Fou-Lai Lin
National Taiwan Normal University
Chinese Taipei

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

Christoph Selter
Mathematics Department
TU Dortmund University
Germany

Robert Garden
New Zealand

Liv Sissel Grønmo
Department of Teacher Education and School Research
ILS, University of Oslo
Norway

Mary Lindquist
United States

Hung-Hsi Wu
University of California, Berkeley
United States

Science

Martina Kekule
Charles University in Prague
Czech Republic

Jouni Viiri
University of Jyväskylä
Finland

Saulė Vingelienė
Educational Development Centre
Lithuania

Berenice Michels
National Institute for Curriculum Development
The Netherlands

Mariam Mohammad Ahmed
Evaluation Institute, Supreme Education Council
Qatar

Gabriela Noveanu
Institute for Educational Sciences
Curriculum Department
Romania

Galina Kovaleva
Institute of Content and Methods of Education
Center for Evaluating the Quality of General Education
Russian Academy of Education
Russian Federation

Maria Pilar Jimenez Aleixandre
Universidade de Santiago de Compostela
Spain

Wolfgang Dietrich
National Agency for Education
Sweden

Gerald T. Wheeler
National Science Teachers' Association
United States

TIMSS 2011 ITEM DEVELOPMENT TASK FORCES

Mathematics

Alka Arora, *Assistant Research Director, TIMSS Mathematics*
Graham Ruddock, *TIMSS Mathematics Coordinator (NFER)*
Ina V.S. Mullis, *TIMSS & PIRLS International Study Center Executive Director*
Mary Lindquist, *SMIRC Representative*
Robert Garden, *SMIRC Representative*
Berinderjeet Kaur, *Mathematics Consultant, National Institute of Education, Singapore*

Science

Gabrielle M. Stanco, *Assistant Research Director, TIMSS Science*
Christine O'Sullivan, *TIMSS Science Coordinator (K–12 Consulting)*
Helen Lye, *TIMSS Science Consultant (ACER)*
Gerald T. Wheeler, *SMIRC Representative*

Questionnaire Item Review Committee

Sue Thomson
Australian Council for Educational Research
Australia

Josef Basl
Czech School Inspectorate
Czech Republic

Naima Hassan
National Center of Examinations and Educational Evaluation
Egypt

Linda Sturman
National Foundation for Educational Research
England

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

Clara Rosaline Anumel
Inspectorate Division
Ghana Education Service
Ghana

Frederick Leung
Faculty of Education
The University of Hong Kong
Hong Kong SAR

Martina Meelissen
Department of Educational Organization and Management
Faculty of Behavioral Sciences
University of Twente
Netherlands

Barbara Japelj Pavešić
Educational Research Institute
Slovenia

Peter Nyström
Umeå University
Sweden

Patrick Gonzales
National Center for Education Statistics
U.S. Department of Education
United States

TIMSS 2011 NATIONAL RESEARCH COORDINATORS

Armenia
Arsen Baghdasaryan
Assessment and Testing Center of Armenia

Australia
Sue Thomson
Australian Council for Educational Research

Austria
Birgit Suchań
Bundesinstitut fuer Bildungsforschung, Innovation und Entwicklung des Oesterreichischen Schulwesens (BIFIE)

Azerbaijan
Emin Meherremov
Ulviya Mikailova *(through 2010)*
Department of Monitoring and Assessment
Ministry of Education

Bahrain
Huda Al-Awadi
Ministry of Education

Belgium (Flemish)
Jan Van Damme
Barbara Belfi
Centrum voor Onderwijseffectiviteit en evaluatie
Katholieke Universiteit Leuven

Botswana
Monamodi Kesamang
Botswana Examinations Council

Chile
Johanna Gubler Santander
Ministerio de Educacion

Chinese Taipei
Chen-Yung Lin
Graduate Institute of Science Education
National Taiwan Normal University

Croatia
Jasminka Buljan Culej
National Center for External Evaluation in Education

Czech Republic
Vladislav Tomášek
Czech School Inspectorate

Denmark
Peter Allerup
Department of Education
Aarhus University

England
Linda Sturman
National Foundation for Educational Research

Finland
Pekka Kupari
Finnish Institute for Educational Research
University of Jyväskylä

Georgia
Mamuka Jibladze
Dito Pataraia *(through 2011)*
National Assessment and Examinations Center

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

Ghana
Clara Rosaline Anumel
Inspectorate Division
Ghana Education Service

Honduras
Renán Rapálo Castellanos
Secretaria de Educacion
Instituto de Investigación
Universidad Pedagógica Nacional

Hong Kong SAR
Frederick Leung
Faculty of Education
The University of Hong Kong

Hungary
Ildikó Szepesi
Educational Authority
Department of Educational Assessment and Evaluation

Indonesia
Hari Setiadi
Nugaan Yulia Wardani *(through 2010)*
Center for Educational Assessment
Ministry of National Education

Iran, Islamic Republic of
Abdol'azim Karimi
Research Institute for Education (RIE)
Ministry of Education

Ireland
Eemer Eivers
Educational Research Centre
St. Patrick's College, Dublin

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

Italy
Elisa Caponera
Instituto Nazionale per la Valutazione del Sistema Educativo di Instruzione e di Formazione (INVALSI)

Japan
Fumi Ginshima
Kenji Matsubara
Yasushi Ogura *(through 2011)*
Keiichi Nishimura *(through 2011)*
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
Zhanat Bazarbekova
Tynyshkul Moldashevna Amreeva *(through 2011)*
National Centre for Education Quality Assessment

Korea, Republic of
Soojin Kim
Kyunghee Kim *(through 2010)*
Korea Institute for Curriculum & Evaluation

Kuwait
Marzouq Al-Ghonaim
Ministry of Education

Lebanon
Leila Maliha Fayad
Educational Center for Research and Development
Ministry of Education

Lithuania
Olga Kostina
Aistė Elijio *(through 2011)*
National Examination Centre
Ministry of Education and Science

Macedonia
Beti Lameva
National Examination Center

Malaysia
Faridah Abu Hassan
Dewani Goloi
Muhammad Zaini Mohd Zain
Educational Planning & Research Division
Ministry of Education

Malta
Raymond Camilleri
Directorate for Quality & Standards in Education
Ministry of Education

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

Netherlands
Marjolein Drent
Martina Meelissen
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
Patricia Wyers
Statistics and Research Branch
Department of Education

Norway
Liv Sissel Grønmo
Department of Teacher Education and School Research
ILS, University of Oslo

Oman
Zuwaina Saleh Al-Maskari
Ministry of Education

Palestinian National Authority
Mohammed O. Matar Mustafa
Assessment and Evaluation Deparment
Ministry of Education and Higher Education

Poland
Krzysztof Konarzewski
Polish Academy of Sciences

Dominik Mytkowski *(through 2010)*
Centralna Komisja Egzaminacyjna

Portugal
Ana Ferreira
Education Statistics and Planning Office
Ministry of Education

Qatar
Abdulsattar Mohammed Nagi
Office of Student Assessment
Evaluation Institute, Supreme Education Council

Romania

Gabriela Noveanu

Institute for Educational Sciences

Curriculum Department

Russian Federation

Galina Kovaleva

Institute of Content and Methods of Education

Center for Evaluating the Quality of General Education

Russian Academy of Education

Saudi Arabia

Saleh Alshaya

International Studies & Testing Center (ISTC)

Ministry of Education

Serbia

Slobodanka Gasic-Pavisica

Institute for Educational Research

Singapore

Pik Yen Lim

Chew Leng Poon

Elaine Chua Ka-Yi *(through 2011)*

Research and Evaluation Section/ Planning Division

Ministry of Education

Slovak Republic

Andrea Galádová

National Institute for Certified Educational Measurements

Slovenia

Barbara Japelj Pavešić

Educational Research Institute

South Africa

Vijay Reddy

Human Sciences Research Council (HSRC)

Spain

David Cervera Olivares

Jesús Domínguez Castillo *(through 2012)*

National Institute of Educational Evaluation

Ministry of Education, Culture and Sports

Sweden

Eva Lundgren

Swedish National Agency for Education

Syrian Arab Republic

Omar Abou Awn

Ministry of Education

Thailand

Precharn Dechsri

The Institute for the Promotion of Teaching Science and Technology

Tunisia

Kameleddine Gaha

National Centre for Pedagogical Innovation and Research in Education

Turkey

Nurcan Ateşok Deveci

General Directorate of Innovation and Educational Technologies

Murat Yalcin *(through 2011)*

Halil Rahman Acar *(through 2010)*

Educational Research & Development Directorate

Ministry of National Education

Ukraine

Larisa Dvoretska

Ukranian Center of Evaluation of Educational Quality

Nataliia Prokopenko *(through 2011)*

Ministry of Education and Science of Ukraine

United Arab Emirates
Nada Abu Baker Husain Ruban
Assessment Department
Ministry of Education

United States
Stephen Provasnik
Patrick Gonzalez *(through 2011)*
National Center for Education Statistics
U.S. Department of Education

Yemen
Tawfiq Ahmad Al-Mekhlafy
Educational Research and Development Center
Ministry of Education

BENCHMARKING PARTICIPANTS

Alberta, Canada
Ping Yang
Learner Assessment Branch
Alberta Education

Ontario, Canada
Michael Kozlow
Education Quality and Accountability Office

Quebec, Canada
Robert Marcotte
Direction de la sanction des etudes

Abu Dhabi, United Arab Emirates
Shaikha Ali Al Zaabi
Abu Dhabi Education Council

Dubai, United Arab Emirates
Mariam Al Ali
Knowledge and Human Development Authority

Alabama, United States
California, United States
Colorado, United States
Connecticut, United States
Florida, United States
Indiana, United States
Massachusetts, United States
Minnesota, United States
North Carolina, United States
Patrick Gonzalez
National Center for Education Statistics
U.S. Department of Education

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

BOSTON
COLLEGE

ISBN: 978-1-889938-13-4

timss.bc.edu