

## **Curriculum coverage and scale correlation on TIMSS 2003**

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TIMSS examines the effectiveness of curriculum and instruction in relation to student achievement, which makes the issue of assessment-curriculum alignment important for test developers and policymakers alike. While TIMSS assessments were developed to represent an agreed-upon framework and were intended to have as much in common across countries as possible, it was inevitable that the match between test and curriculum would not be identical in all countries. This article looks at issues of curriculum coverage and how non-coverage affects scale scores. Using not-covered items identified by the IEA Test–Curriculum Matching Analysis (Mullis, Martin, Gonzalez, & Chrostowski, 2004), the research team removed from all countries the items listed as not covered for a particular country. The team then rescaled the data using item response theory (IRT) scaling methods, and correlated the resulting scale scores with the reported scale scores. This procedure was repeated using each country’s list of not-covered items. The analysis showed that the scale scores for all items correlated very highly with the curriculum-covered items for the country assessed. The results indicate that even if countries did select the items covered in their intended curricula, no statistically significant effects could be found in any country’s international standings.

## INTRODUCTION

International assessments such as the Trends in International Mathematics and Science Study (TIMSS) provide a reliable means for better understanding the state of education systems in a number of diverse countries. Designed to improve teaching and learning in mathematics and science, TIMSS examines the effectiveness of the intended curriculum and instruction in relation to student achievement and provides opportunity to compare student achievement across countries.

The curricular focus of TIMSS presents a subtle but important difference relative to the focus of other assessments, such as the Programme for International Student Assessment (PISA), which considers workforce knowledge. For TIMSS, the focus on the intended curriculum of many of the participating countries raises a unique range of issues. In particular, test–curriculum alignment is a central consideration for TIMSS validity and for cross-national comparisons. In this article, we seek to gain a deeper understanding of the effect of test–curriculum alignment in a large-scale assessment context.

To ensure that comparisons of student achievement across countries are as fair and equitable as possible, TIMSS developed extensive assessment frameworks and specifications that addressed the important aspects of mathematics and science in countries' curricula and instructional programs. The study also went to great lengths to develop assessment items closely representing those specifications (Mullis, Martin, Gonzalez, & Chrostowski, 2004).

Using as their referent the frameworks and specifications (Mullis et al., 2003), the TIMSS research consortium proposed a distribution of content and cognitive domains to education system representatives. The consortium used feedback from experts from the participating countries to further refine the assessment framework, and from there to develop assessment specifications. The participating education system representatives then referred to the revised framework and specifications in order to contribute a pool of items, which the consortium subsequently reviewed and field tested prior to conducting the main survey.

During each step of the TIMSS development process, feedback and participation were solicited from representatives of the participating countries, experts in mathematics and science, and testing specialists. Every effort was made to ensure that the tests represented the curricula of the participating countries and that the items showed no bias toward or against a specific country. The final assessments were endorsed by the representatives of the participating countries.

Although the TIMSS assessment is carefully designed to maximize content and cognitive domain coverage as well as curriculum coverage, the nature of working with dozens of diverse countries introduces challenges. As we noted above, TIMSS was developed using an agreed-upon framework; however, some discrepancies between the test and a given education system's intended curriculum persist. Explanations for these discrepancies are offered in the TIMSS 2003 reports. For example, the *TIMSS 2003 International Mathematics Report* (Mullis et al., 2004, p. 397) states:

To restrict test items to just those topics included in the curricula of all participating countries and covered in the same sequence would severely limit test coverage and restrict the research questions that the study is designed to address. The tests, therefore, inevitably have some items measuring topics unfamiliar to some students in some countries.

To understand the degree to which TIMSS 2003 departed from any given curriculum, IEA conducted the Test–Curriculum Matching Analysis (TCMA), based on Beaton’s (1998) approach. For each education system, responses were elicited from an individual designated as familiar with that system’s curriculum. In particular, respondents indicated whether each TIMSS item was appropriate for more than 50% of students in the assessed grades. Country by country, those items designated as *not covered* were removed from the item set. Simple proportions of items correct were then calculated for all countries based on covered items for a particular country.

Initial findings from the TCMA, which used proportions of items correct, indicate that the noted departures from test–curriculum alignment generally did not affect the relative performance of the education systems (Mullis et al., 2004). Furthermore, removing items considered not covered within one education system consistently increased the proportion of items correct for that system. These results left the overall rankings of countries essentially unchanged, regardless of the items selected for analysis.

Despite findings that indicate trivial effects resulting from various item choices for the TCMA, our experience is that policymakers and researchers continue to voice concern about the possible effects that departures from their respective curricula may have. In response to concerns from TIMSS study participants, we used item response theory (IRT) scaling methods to uncover what, if any, effects test–curriculum mismatch may have on TIMSS achievement. Through use of IRT, we intend to contribute an alternative approach to understanding how item selection affects education system performance on the TIMSS 2003 mathematics assessment. While many of the countries participating in TIMSS have perfect or nearly perfect alignment between their curriculum and the TIMSS assessment, several countries indicated that 85% or fewer TIMSS items were covered in their curriculum. This project draws from and expands on the methods used by Beaton (1998) to understand the extent to which test–curriculum departures affect scale scores for participating countries.

A secondary purpose of this article is to examine the characteristics of not-covered items in terms of item type, content domain, and cognitive domain. This sort of exploratory analysis will allow for a better understanding of the types of items not covered in country curriculums. Additionally, it will allow identification of commonalities across countries in terms of curriculum coverage and item types.

## RESEARCH METHODS

### Data

TIMSS 2003 was the third in a continuing cycle of curriculum-based international assessments in mathematics and science. The target population of TIMSS 2003 was all students at the end of Grades 4 and 8 in the participating countries. In addition to assessing mathematics and science achievement of fourth and eighth graders internationally, the TIMSS program of studies collects a wealth of background data from students, teachers, and principals or headmasters/mistresses of participating schools. According to the TIMSS assessment framework, the Grade 4 sample is defined as the upper of the two adjacent grades with the most nine-year-olds. The Grade 8 sample includes children aged 13 and 14, and is defined as the upper of the two adjacent grades with the most 13-year-olds (Mullis et al., 2003).

In this study, we used Grade 8 mathematics achievement data along with the TCMA results that indicated whether or not items were covered within the curriculum of each education system. In 2003, 46 education systems and four benchmarking education systems were assessed at the Grade 8 level. To ensure readability of figures and tables, we use country abbreviations throughout this article. Table 1 includes the full country name for each of the abbreviations used.

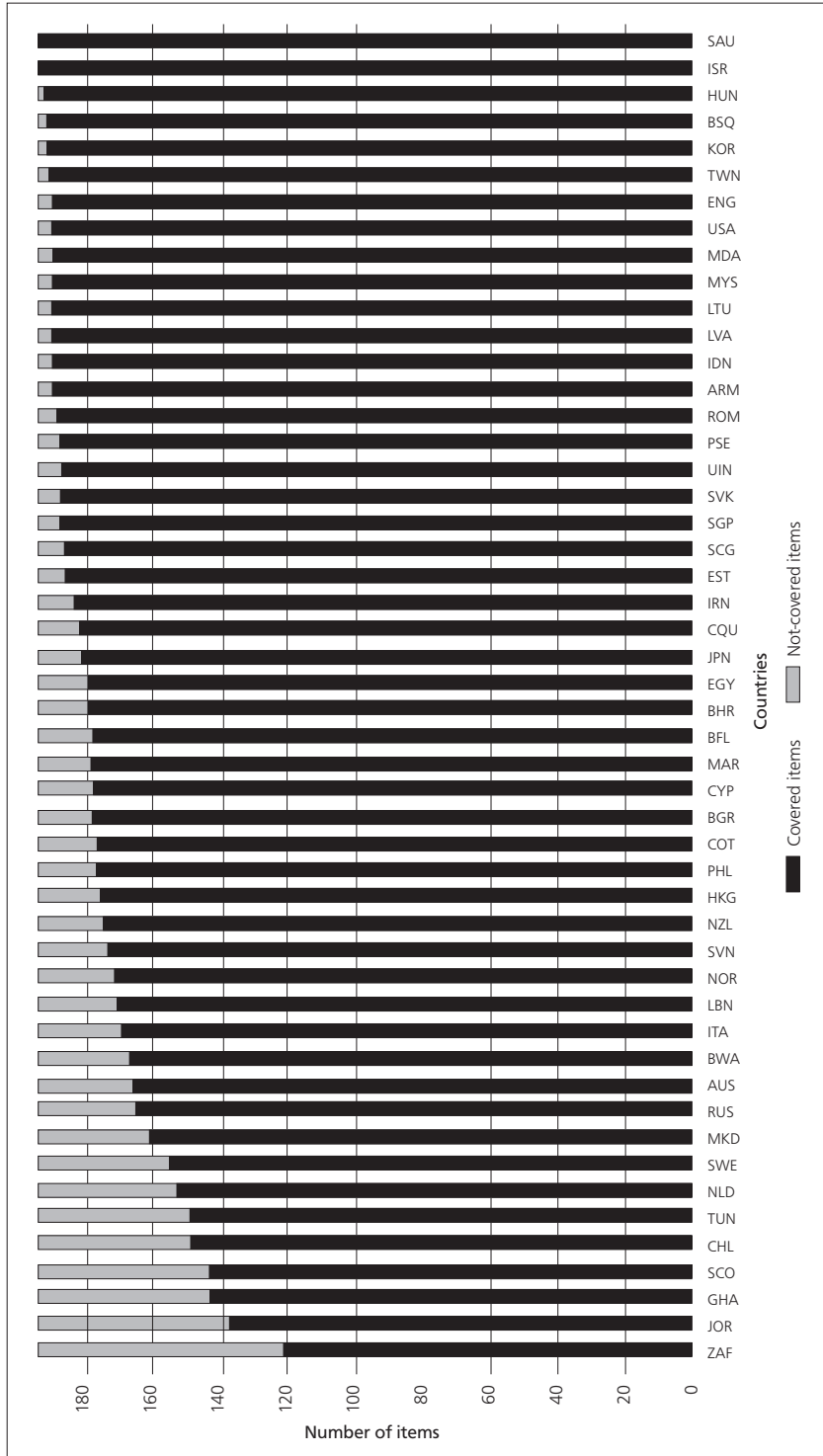
**Table 1: Country abbreviations**

| Country name    | Country abbreviation |
|-----------------|----------------------|
| ARMENIA         | ARM                  |
| AUSTRALIA       | AUS                  |
| BELGIUM FLEMISH | BFL                  |
| BULGARIA        | BGR                  |
| BAHRAIN         | BHR                  |
| BOTSWANA        | BWA                  |
| CHILE           | CHL                  |
| CYPRUS          | CYP                  |
| EGYPT           | EGY                  |
| ENGLAND         | ENG                  |
| ESTONIA         | EST                  |
| GHANA           | GHA                  |
| HONG KONG       | HKG                  |
| HUNGARY         | HUN                  |
| INDONESIA       | IDN                  |
| IRAN            | IRN                  |
| ISRAEL          | ISR                  |
| ITALY           | ITA                  |
| JORDAN          | JOR                  |
| JAPAN           | JPN                  |
| KOREA           | KOR                  |

| Country name       | Country abbreviation |
|--------------------|----------------------|
| LEBANON            | LBN                  |
| LITUANIA           | LTU                  |
| LATVIA             | LVA                  |
| MOROCCO            | MAR                  |
| MOLDOVA            | MDA                  |
| MACEDONIA          | MKD                  |
| MALAYSIA           | MYS                  |
| NETHERLANDS        | NLD                  |
| NORWAY             | NOR                  |
| NEW ZEALAND        | NZL                  |
| PHILIPPINES        | PHL                  |
| PALESTINE          | PSE                  |
| ROMANIA            | ROM                  |
| RUSSIAN FEDERATION | RUS                  |
| SAUDI ARABIA       | SAU                  |
| SERBIA             | SCG                  |
| SCOTLAND           | SCO                  |
| SINGAPORE          | SGP                  |
| SLOVAK REPUBLIC    | SVK                  |
| SLOVENIA           | SVN                  |
| SWEDEN             | SWE                  |
| TUNISIA            | TUN                  |
| CHINESE TAIPEI     | TWN                  |
| UNITED STATES      | USA                  |
| SOUTH AFRICA       | ZAF                  |

In the TIMSS 2003 data, the proportion of items reported as covered by a given curriculum varies. In the Grade 8 mathematics assessment, 15 education systems reported that 97% of TIMSS mathematics items were covered in their curricula. In fact, Saudi Arabia and Israel indicated that all items were covered in their curriculum. At the other end of the spectrum, nine countries reported that 85% or fewer of the TIMSS items were covered. Education systems with the lowest coverage included South Africa (62%), Jordan (71%), Scotland (74%), and Ghana (74%). The average proportion of items covered by a given curriculum in this dataset was about 90%. Figure 1 illustrates the distribution of the number of covered and not-covered items across the countries. The black bars indicate the number of covered items for a particular country; the grey bars show the number of not-covered items. The countries are sorted from lowest to highest number of covered items.

Figure 1: Number of covered and not-covered items per country



## Analysis

To answer the research question regarding the possible effects of item selection on education system performance, we completed a number of steps. We first reviewed the TCMA to identify those items indicated as not covered for each country. To gain a further understanding of the types of not-covered items (with respect to content and cognitive domains), we conducted an exploratory analysis of not-covered items. In particular, we compared item difficulties for covered versus not-covered items for each country. We also compared the proportion of covered and not-covered items by content and cognitive domain for each country.

Next, we removed from the entire mathematics achievement database items indicated as not covered in each country to create 46 separate datasets for analysis. Thus, if Country A identified Items 16, 19, and 23 as not covered by their curriculum, we removed those items for all countries, thereby creating the dataset, *Not covered for Country A*. We repeated this process for all countries. The resulting datasets were subsequently scaled with a three-parameter IRT model using PARSCALE (version 4.1), with parameters of the response model estimated by marginal maximum likelihood (MML).

We chose a three-parameter model that would be as consistent as possible with the original scaling of the TIMSS 2003 data. As an initial step in the scaling process, we first calibrated all items with a random selection of one half of the students in the sample. In alignment with the TIMSS 2003 scaling methods and procedures (Martin et al., 2004), we removed student answers coded as not reached during item calibration; however, for scale score estimation, we included these items as incorrect responses. Each scaling analysis resulted in a new set of item parameters for all of the remaining items; the resulting mathematics scores were expected a priori (EAP) estimates.

We standardized the resulting scores to a mean of 500 and a standard deviation of 100, practice consistent with TIMSS 2003 procedures. However, because of slight differences in scaling procedures, our scale scores exhibited trivial differences from those scores included in the international report (Mullis et al., 2004). We expected these differences because we did not use student background information to estimate student achievement distributions (called conditioning) and therefore did not draw plausible values. Because the new scale scores were based on items identified as covered in a specific country, we refer to them as *covered* scale scores.

For all countries, we correlated the 46 sets of new parameters with the item parameters based on all items included in the calibration. We then correlated the new scale scores, standardized to a mean of 500 and a standard deviation of 100, with the scale scores that included all items. We reasoned that, given the problems of explicitly ranking countries, correlating the original scale scores with the *covered* scale scores was a more reasonable approach. High correlations suggest that the original and the *covered* scales are essentially measuring the same thing. Low correlations suggest that the two scales may be measuring two different things, and that this may affect a country's overall performance on the assessment.

## RESULTS

This section details results from the exploratory analysis conducted in order to provide information regarding the types of items not covered across countries.

### Items by Item Types

We first consider curriculum coverage rates by item type (multiple-choice versus constructed-response). In the TIMSS 2003 assessment, 66% of the administered mathematics items were multiple-choice, while the remaining 33% of the items were constructed-response. Figures 2 and 3 illustrate the rate of coverage for constructed-response and multiple-choice items. The black bars indicate the proportion of covered items for a particular country; the grey bars show the proportion of not-covered items. The dark, heavy line indicates the 85% mark. Black bars above this line indicate that more than 85% of items were covered by the given country's curriculum.

The majority of countries covered 85% or more of the constructed-response items in their respective curricula. However, 10 countries covered less than 85% of the constructed-response items. At the extreme, South Africa covered only half of the constructed-response items. On the other hand, seven countries indicated that all constructed-response items were covered in their curriculum. On average, countries covered about 90% of the constructed-response items.

When the multiple-choice items were compared with the constructed-response items, it was apparent that about the same number of countries reported coverage of 85% or more of the multiple-choice items; however, fewer countries reported coverage of all multiple-choice items. Nine countries reported that fewer than 85% of the multiple-choice mathematics items were covered in their curricula. On average, countries covered about 91% of the multiple-choice items. Scotland and South Africa had the most not-covered multiple-choice items: both countries indicated that about 35% of these items were not covered in their respective curricula. However, it has to be noted that the number of multiple-choice items administered in the TIMSS 2003 assessment was larger than the number of constructed-response items administered.

### Items by Difficulty

Here, we examine the difficulty of an item as a specific attribute of that item. We reasoned that items not covered in a country's curriculum would be relatively more difficult than covered items.

To investigate whether not-covered items were generally more difficult than covered items, we compared the average difficulty of covered versus not-covered items in each country. We conducted this analysis using the percentage correct per item in each country as the basis. We took the average percent correct values for each item and country from the data almanacs that are published along with the *TIMSS 2003 User Guide for the International Database* (Martin, 2005). We calculated the percent correct for an item in a country on the basis of the percentage of students answering the item correctly, excluding students who did not reach the item. For multiple-choice items, the percent correct matches the percentage of students choosing the correct



Figure 2: Coverage rates of constructed-response items

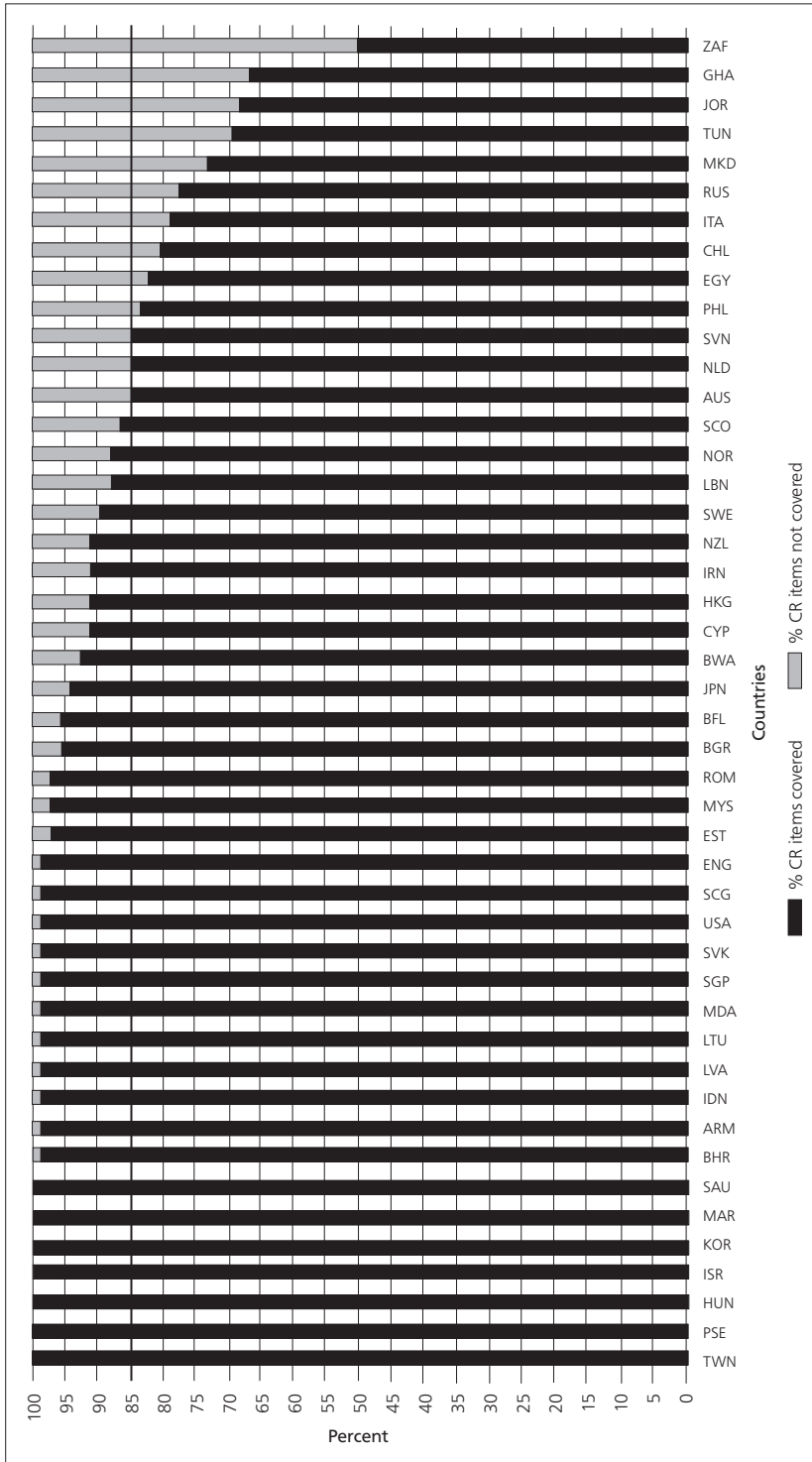
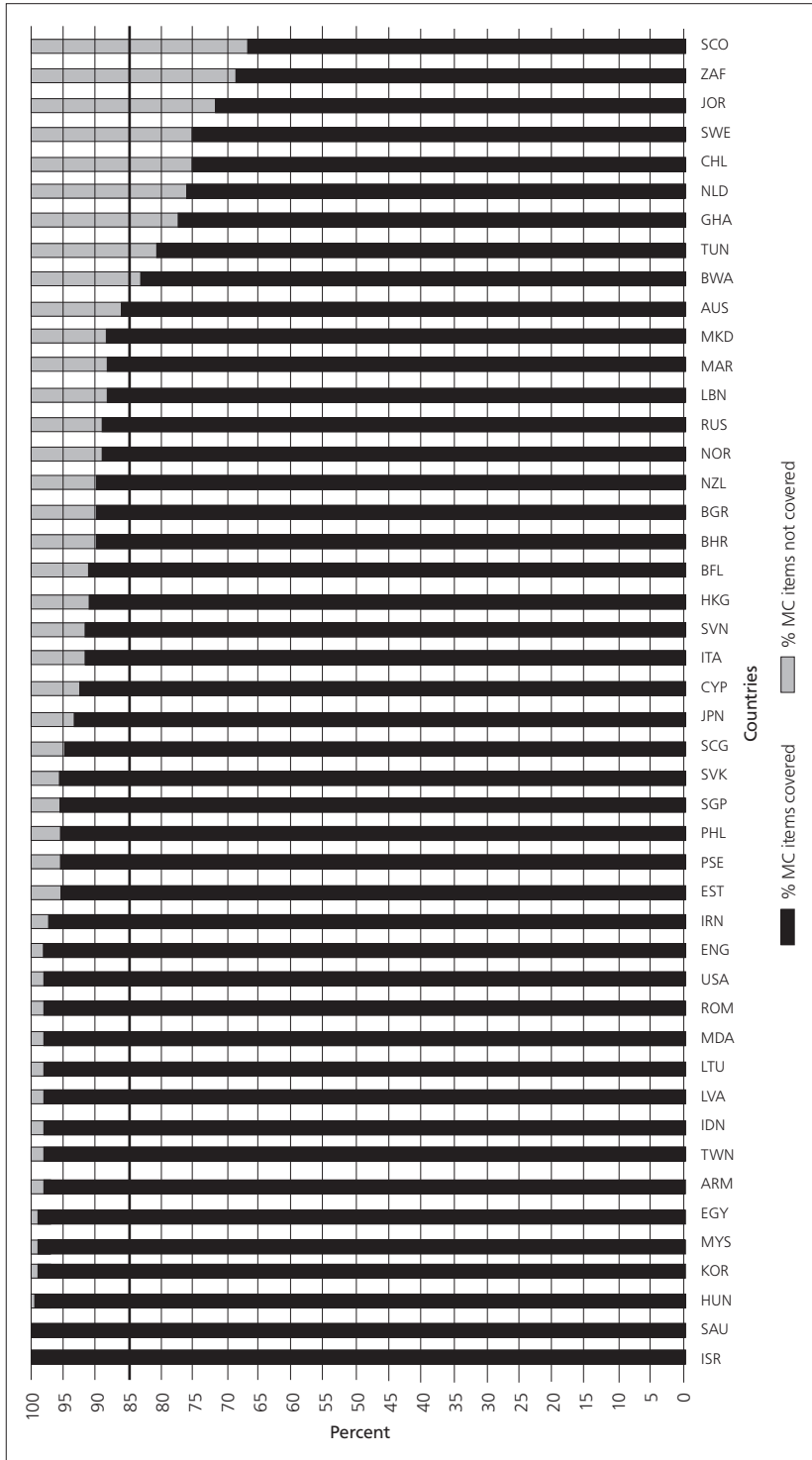


Figure 3: Coverage rates for multiple-choice items



answer category. For constructed-response items worth one score point, the percent correct matches the percentage of students receiving one score point. For constructed-response items worth two score points, we applied a partial credit model. Here, the percent correct is the sum of the percentage of students receiving two score points plus half of the percentage of students receiving one score point.

In order to adjust the difficulty of an item in a country relative to other countries and other items, we calculated the item residuals for each item-by-country according to the following formula based on an ANOVA type model (Beaton & Gonzalez, 1997):

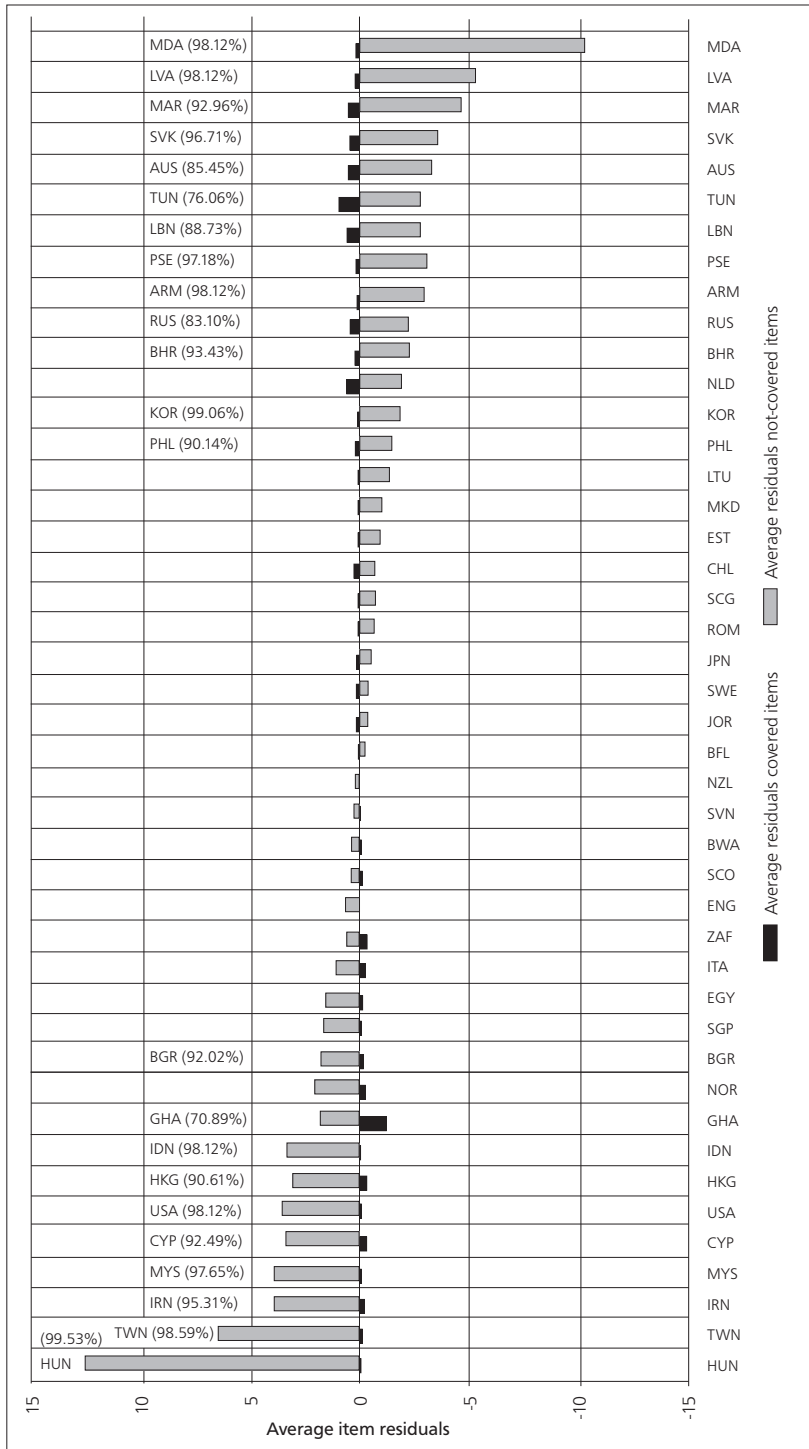
$$\varphi_{res(i,c)} = \varphi_{ic} - \bar{\varphi} - (\bar{\varphi}_c - \bar{\varphi}) - (\bar{\varphi}_i - \bar{\varphi}),$$

where  $\bar{\varphi}$  = the mean over all countries and all items;  $\varphi_{ic}$  = the overall difficulty for country  $c$  on item  $i$ ;  $\bar{\varphi}_c$  = the overall average item difficulty for country  $c$  over all items; and  $\bar{\varphi}_i$  = the overall item difficulty for item  $i$  over all countries. This residual indicates how much better or worse a country performed on an item than would be expected given overall item difficulties, for a particular country, for a particular item in the given country and internationally. We then averaged these residuals for both covered and not-covered items in each country.

Figure 4 shows the item residual average for each country calculated separately for covered and not-covered items. Because Saudi Arabia and Israel had no not-covered items, we did not include them in this analysis. The results are sorted by the differences between the residuals for covered items and those for not-covered items. For countries on the left side of the figure through New Zealand (NZL), the not-covered items were generally less difficult than the covered items. This is illustrated by the positive average residuals for not-covered items (displayed as grey bars), and the negative average residuals for covered items (displayed as black bars). Significant differences in favor of either covered or not-covered items are noted with a country abbreviation placed above the item residual bars. Additionally, the item coverage rates appear in brackets after the country abbreviation to indicate coverage rates in countries where we found significant differences in the covered versus not-covered item difficulties.

While, for the majority of countries, item residuals were not significantly different, 10 countries did significantly better than we would have expected on not-covered items than on covered items. However, for 13 countries, not-covered item performance was significantly worse than we would have expected relative to covered items.

Figure 4: Average item residuals for covered items versus not-covered items



### Percentage of Not-Covered Items by Content Domain

We next examined curriculum coverage of the administered items by content domain. Here, content domain refers to the specific mathematics subject matter covered in the TIMSS assessment. Five content domains were used in TIMSS 2003: number, algebra, geometry, measurement, and data. Number was the domain with the most items administered ( $N = 57$ ), while data was the one with the fewest items assessed ( $N = 28$ ). The percentages calculated and displayed in Table 2 are based on the number of items not covered in relation to the number of items per reporting category. Results are sorted in each column from lowest to highest percentage of not-covered items.

In the content domain number, 23 out of 46 countries indicated that all number items were covered in their curriculum. Jordan (JOR), with 37%, and Scotland (SCO), with 32%, were the countries with the highest proportion of number items not covered in their respective curriculums.

For the algebra content domain, the highest percentages of not-covered items were found in Chile (CHL), with 47%, followed by Ghana (GHA) and South Africa (ZAF), each with 43%. Eight countries reported that all algebra items were covered in their curriculums.

In the geometry content domain, South Africa (ZAF) and the Netherlands (NLD) had the highest percentage of not-covered geometry items, with 71% and 55%, respectively; nine countries had all geometry items covered. When compared to the other reporting categories, geometry, with 15% not-covered items on average, emerged as the reporting category with the second-highest non-coverage rate.

While the majority of the countries had all measurement items covered (27 out of 46 countries), Jordan (JOR) reported that 32% of the measurement items were not covered in their curriculum. Measurement, compared to the other reporting categories, emerged as the reporting category with the lowest percentage of non-coverage (on average, 3%).

Macedonia (MKD) was the country with the highest percentage of data items not covered (93%), followed by South Africa (ZAF; 86%) and Slovenia (SVN; 54%). However, in 15 countries, all of the data items were covered in the curriculum. On average, 19% of the items in this content domain were reported as not covered. Relative to the other reporting categories, data emerged as the reporting category with the highest, on average, non-coverage rate.

### Percentage of Not-Covered Items by Cognitive Domain

We next considered item-curriculum alignment by cognitive domain. The cognitive domains defined the set of behaviors expected of students as they engaged with the mathematics content. The items administered in TIMSS covered four cognitive domains: knowing facts and procedures, using concepts, solving routine problems, and reasoning (Mullis et al., 2003). However, due to some overlap across the four domains, experts felt comfortable in combining the domains into the following three: knowing facts, procedures, and concepts; applying knowledge and understanding; and reasoning (Mullis, Martin, & Foy, 2005).

Table 2: Percentage of items not covered, by content domain

|    | Country | Number<br>(N=57) | Algebra<br>(N=47) | Geometry<br>(N=31) | Measurement<br>(N=31) | Data<br>(N=28) |
|----|---------|------------------|-------------------|--------------------|-----------------------|----------------|
| 1  | ARM     | 0                | 2                 | 10                 | 0                     | 0              |
| 2  | AUS     | 11               | 26                | 26                 | 3                     | 4              |
| 3  | BFL     | 0                | 11                | 19                 | 6                     | 7              |
| 4  | BGR     | 0                | 4                 | 13                 | 0                     | 36             |
| 5  | BHR     | 0                | 9                 | 16                 | 0                     | 18             |
| 6  | BWA     | 12               | 15                | 26                 | 3                     | 14             |
| 7  | CHL     | 2                | 47                | 32                 | 13                    | 29             |
| 8  | CYP     | 0                | 6                 | 13                 | 0                     | 32             |
| 9  | EGY     | 4                | 0                 | 0                  | 13                    | 29             |
| 10 | ENG     | 4                | 4                 | 0                  | 0                     | 0              |
| 11 | EST     | 2                | 2                 | 16                 | 3                     | 0              |
| 12 | GHA     | 12               | 43                | 29                 | 10                    | 43             |
| 13 | HKG     | 0                | 6                 | 16                 | 0                     | 36             |
| 14 | HUN     | 0                | 2                 | 0                  | 0                     | 0              |
| 15 | IDN     | 0                | 2                 | 10                 | 0                     | 0              |
| 16 | IRN     | 0                | 9                 | 0                  | 0                     | 21             |
| 17 | ISR     | 0                | 0                 | 0                  | 0                     | 0              |
| 18 | ITA     | 9                | 17                | 19                 | 10                    | 11             |
| 19 | JOR     | 37               | 19                | 19                 | 32                    | 39             |
| 20 | JPN     | 2                | 9                 | 13                 | 10                    | 4              |
| 21 | KOR     | 2                | 0                 | 3                  | 0                     | 0              |
| 22 | LBN     | 4                | 13                | 13                 | 6                     | 32             |
| 23 | LTU     | 0                | 2                 | 10                 | 0                     | 0              |
| 24 | LVA     | 0                | 2                 | 10                 | 0                     | 0              |
| 25 | MAR     | 2                | 0                 | 26                 | 0                     | 21             |
| 26 | MDA     | 0                | 2                 | 10                 | 0                     | 0              |
| 27 | MKD     | 0                | 13                | 3                  | 0                     | 93             |
| 28 | MYS     | 0                | 2                 | 3                  | 0                     | 7              |
| 29 | NLD     | 12               | 34                | 55                 | 3                     | 0              |
| 30 | NOR     | 4                | 23                | 23                 | 0                     | 7              |
| 31 | NZL     | 11               | 19                | 10                 | 0                     | 4              |
| 32 | PHL     | 2                | 2                 | 19                 | 3                     | 29             |
| 33 | PSE     | 0                | 2                 | 16                 | 0                     | 0              |
| 34 | ROM     | 0                | 2                 | 13                 | 0                     | 0              |
| 35 | RUS     | 0                | 23                | 29                 | 3                     | 29             |
| 36 | SAU     | 0                | 0                 | 0                  | 0                     | 0              |
| 37 | SCG     | 2                | 0                 | 0                  | 0                     | 25             |
| 38 | SCO     | 32               | 28                | 35                 | 3                     | 29             |
| 39 | SGP     | 0                | 2                 | 0                  | 0                     | 21             |
| 40 | SVK     | 0                | 0                 | 0                  | 0                     | 25             |
| 41 | SVN     | 4                | 4                 | 3                  | 3                     | 54             |
| 42 | SWE     | 7                | 36                | 35                 | 3                     | 21             |
| 43 | TUN     | 7                | 32                | 32                 | 6                     | 50             |
| 44 | TWN     | 0                | 0                 | 3                  | 0                     | 7              |
| 45 | USA     | 0                | 2                 | 10                 | 0                     | 0              |
| 46 | ZAF     | 5                | 43                | 71                 | 13                    | 86             |

Table 3 shows that the highest number of items were those assessing the applying cognitive domain ( $N = 93$ ). Knowing comprised 65 items; reasoning comprised 36 items. The results in each column of the table are sorted from the lowest to the highest percentage of not-covered items.

For knowing, Scotland (SCO) reported the highest proportion (42%) of not-covered knowing items in its curriculum. Ten countries reported that all items in this cognitive domain were covered. With 33% of applying items reported as not covered in its curriculum, South Africa (ZAF) had the highest percentage of not-covered items in the applying cognitive domain. At the other extreme, five countries reported that all applying items were covered by their curriculum. South Africa (ZAF) was again the fore in reporting the highest proportion of not-covered reasoning items at 69%. This was the highest proportion of not-covered items listed by any country on any of the cognitive domains. However, 14 countries reported that their respective curriculums covered all items on this domain.

### **Correlations between Countries' Mean Scores and Correlations between Countries' Item Parameters**

After removing not-covered mathematics items for each country as indicated by the country curriculum experts and re-scaling the data, we correlated the newly calculated scores with the scores based on all items included. Table 4 displays the results of this analysis. All Pearson correlations were very high (above 0.990), with more than half of the countries (27) showing correlations of 1. The lowest correlations belonged to Jordan (0.992), South Africa (0.992), and Macedonia (0.995), all countries that reported fewer than 85% of items covered by their curriculums.

We also considered the correlation between item parameters (item discrimination, item difficulty, and guessing parameter) based on the original scaling and the modified scaling that included only curriculum-covered items. Rounding the correlations to three decimal places gave correlations that were all 1.000.

### **Differences between Mean Scores**

Because all but two of the selected countries (Israel and Saudi Arabia) indicated that some items were not covered in their intended Grade 8 curriculum, we analyzed the data to determine whether the inclusion of these items had any effect on the international performance comparisons.

The second row of Table 5 represents the maximum number of available score points for the covered items selected by each country. All together, the TIMSS 2003 assessment contained 194 mathematics items. As some of the (constructed-response) items were assigned more than one score point, the number of score points for the entire test was 213. The median number of score points covered across all countries was 199 or 93% of the test. The row shows that the countries varied substantially in their judgments of the number of items that were covered in the Grade 8 curriculum, from Israel and Saudi Arabia having full item coverage to South Africa having 60% of the items included in their intended curriculums.

Table 3: Percentage of items not covered, by cognitive domain

|    | Country | Knowing<br>(N=65) | Applying<br>(N=93) | Reasoning<br>(N=36) |
|----|---------|-------------------|--------------------|---------------------|
| 1  | ARM     | 0                 | 4                  | 0                   |
| 2  | AUS     | 14                | 16                 | 11                  |
| 3  | BFL     | 2                 | 11                 | 11                  |
| 4  | BGR     | 5                 | 8                  | 17                  |
| 5  | BHR     | 11                | 6                  | 3                   |
| 6  | BWA     | 9                 | 18                 | 11                  |
| 7  | CHL     | 17                | 14                 | 14                  |
| 8  | CYP     | 5                 | 11                 | 8                   |
| 9  | EGY     | 2                 | 6                  | 19                  |
| 10 | ENG     | 6                 | 0                  | 0                   |
| 11 | EST     | 5                 | 3                  | 6                   |
| 12 | GHA     | 32                | 18                 | 36                  |
| 13 | HKG     | 11                | 6                  | 14                  |
| 14 | HUN     | 0                 | 1                  | 0                   |
| 15 | IDN     | 0                 | 4                  | 0                   |
| 16 | IRN     | 6                 | 6                  | 0                   |
| 17 | ISR     | 0                 | 0                  | 0                   |
| 18 | ITA     | 9                 | 10                 | 28                  |
| 19 | JOR     | 29                | 32                 | 22                  |
| 20 | JPN     | 8                 | 4                  | 11                  |
| 21 | KOR     | 2                 | 0                  | 3                   |
| 22 | LBN     | 12                | 11                 | 14                  |
| 23 | LTU     | 0                 | 4                  | 0                   |
| 24 | LVA     | 0                 | 4                  | 0                   |
| 25 | MAR     | 11                | 6                  | 6                   |
| 26 | MDA     | 0                 | 4                  | 0                   |
| 27 | MKD     | 9                 | 19                 | 25                  |
| 28 | MYS     | 3                 | 1                  | 3                   |
| 29 | NLD     | 26                | 16                 | 25                  |
| 30 | NOR     | 5                 | 14                 | 17                  |
| 31 | NZL     | 9                 | 10                 | 11                  |
| 32 | PHL     | 8                 | 5                  | 19                  |
| 33 | PSE     | 5                 | 1                  | 6                   |
| 34 | ROM     | 5                 | 0                  | 6                   |
| 35 | RUS     | 9                 | 11                 | 36                  |
| 36 | SAU     | 0                 | 0                  | 0                   |
| 37 | SCG     | 6                 | 4                  | 0                   |
| 38 | SCO     | 42                | 18                 | 19                  |
| 39 | SGP     | 5                 | 4                  | 0                   |
| 40 | SVK     | 3                 | 5                  | 0                   |
| 41 | SVN     | 6                 | 11                 | 19                  |
| 42 | SWE     | 29                | 17                 | 11                  |
| 43 | TUN     | 20                | 20                 | 36                  |
| 44 | TWN     | 0                 | 2                  | 3                   |
| 45 | USA     | 0                 | 4                  | 0                   |
| 46 | ZAF     | 26                | 33                 | 69                  |



Table 4: Correlation between scores based on all items included and scores based on each country's not-covered items removed (sorted by correlations)

|    | Coverage pattern | Pearson correlations* |
|----|------------------|-----------------------|
| 1  | JOR              | 0.992                 |
| 2  | ZAF              | 0.992                 |
| 3  | MKD              | 0.995                 |
| 4  | NLD              | 0.998                 |
| 5  | TUN              | 0.998                 |
| 6  | SWE              | 0.998                 |
| 7  | SCO              | 0.998                 |
| 8  | EGY              | 0.999                 |
| 9  | PHL              | 0.999                 |
| 10 | CHL              | 0.999                 |
| 11 | HKG              | 0.999                 |
| 12 | SVN              | 0.999                 |
| 13 | CYP              | 0.999                 |
| 14 | NZL              | 0.999                 |
| 15 | NOR              | 0.999                 |
| 16 | AUS              | 0.999                 |
| 17 | BWA              | 0.999                 |
| 18 | IRN              | 0.999                 |
| 19 | GHA              | 0.999                 |
| 20 | LBN              | 1                     |
| 21 | RUS              | 1                     |
| 22 | BGR              | 1                     |
| 23 | ITA              | 1                     |
| 24 | MAR              | 1                     |
| 25 | ENG              | 1                     |
| 26 | JPN              | 1                     |
| 27 | BFL              | 1                     |
| 28 | SCG              | 1                     |
| 29 | BHR              | 1                     |
| 30 | SVK              | 1                     |
| 31 | SGP              | 1                     |
| 32 | PSE              | 1                     |
| 33 | EST              | 1                     |
| 34 | ROM              | 1                     |
| 35 | ARM              | 1                     |
| 36 | IDN              | 1                     |
| 37 | LTU              | 1                     |
| 38 | LVA              | 1                     |
| 39 | MDA              | 1                     |
| 40 | USA              | 1                     |
| 41 | MYS              | 1                     |
| 42 | TWN              | 1                     |
| 43 | KOR              | 1                     |
| 44 | HUN              | 1                     |
| 45 | ISR**            | 1                     |
| 46 | SAU**            | 1                     |

**Note:** \* Pearson correlations rounded to three decimal places; \*\*country reported that all items are covered in the curriculum.

Table 5: Average scale score based on subset of items identified by each country as addressing its curriculum

|  | Average | (se)   | SGP    | KOR    | HKG    | TWN    | JPN    | BFL    | NLD    | HUN    | EST    | RUS    | LVA    | AUS    | SVK    | USA    |
|--|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <i>(Number of score points included)</i> |         |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Countries                                | 213     |        | 206    | 193    | 211    | 210    | 199    | 198    | 169    | 212    | 204    | 177    | 209    | 206    | 182    | 208    |
| SGP                                      | 620.64  | (3.47) | 621.40 | 620.50 | 620.21 | 620.51 | 619.96 | 620.08 | 620.09 | 620.64 | 619.97 | 621.46 | 621.01 | 618.19 | 621.03 | 621.01 |
| KOR                                      | 603.91  | (1.71) | 603.27 | 604.31 | 603.43 | 603.36 | 603.64 | 602.39 | 597.28 | 603.85 | 603.38 | 601.44 | 603.67 | 600.52 | 602.98 | 603.67 |
| HKG                                      | 603.70  | (3.16) | 603.92 | 603.41 | 603.64 | 603.44 | 602.80 | 602.17 | 599.92 | 603.71 | 602.78 | 603.60 | 603.74 | 601.72 | 603.62 | 603.74 |
| TWN                                      | 597.78  | (4.07) | 597.47 | 597.64 | 596.87 | 597.48 | 596.81 | 596.55 | 593.12 | 597.73 | 597.43 | 596.47 | 597.77 | 595.39 | 597.34 | 597.77 |
| JPN                                      | 589.22  | (1.95) | 589.11 | 589.77 | 586.41 | 589.14 | 591.49 | 589.02 | 586.10 | 589.21 | 588.71 | 586.04 | 588.99 | 587.46 | 588.95 | 588.99 |
| BFL                                      | 561.79  | (2.54) | 561.16 | 562.19 | 558.86 | 561.51 | 562.80 | 562.91 | 564.15 | 561.79 | 562.25 | 560.95 | 562.00 | 564.02 | 560.87 | 562.00 |
| NLD                                      | 559.63  | (3.78) | 558.38 | 559.61 | 554.06 | 559.29 | 560.41 | 560.57 | 570.43 | 559.71 | 559.75 | 557.65 | 560.07 | 564.92 | 557.81 | 560.07 |
| HUN                                      | 556.00  | (3.10) | 556.58 | 555.86 | 555.95 | 556.12 | 555.41 | 555.87 | 555.01 | 556.02 | 555.66 | 555.67 | 556.17 | 555.82 | 556.80 | 556.17 |
| EST                                      | 554.59  | (2.94) | 554.61 | 554.92 | 554.71 | 554.76 | 554.73 | 555.24 | 554.38 | 554.59 | 555.63 | 554.70 | 554.09 | 556.70 | 554.51 | 554.09 |
| RUS                                      | 536.47  | (3.28) | 536.90 | 536.24 | 538.97 | 536.48 | 535.17 | 535.68 | 532.05 | 536.49 | 536.36 | 538.14 | 536.05 | 533.79 | 537.10 | 536.05 |
| LVA                                      | 533.34  | (3.00) | 533.23 | 533.28 | 532.46 | 533.32 | 533.38 | 534.18 | 532.21 | 533.32 | 533.34 | 534.12 | 533.21 | 531.66 | 533.25 | 533.21 |
| AUS                                      | 531.55  | (4.27) | 530.70 | 531.66 | 527.30 | 531.56 | 532.41 | 532.09 | 537.04 | 531.59 | 531.24 | 528.93 | 531.95 | 533.03 | 530.52 | 531.95 |
| SVK                                      | 530.16  | (3.23) | 530.46 | 530.10 | 531.91 | 530.57 | 530.26 | 531.22 | 529.15 | 530.17 | 530.38 | 531.02 | 529.79 | 531.45 | 530.55 | 529.79 |
| USA                                      | 529.30  | (3.06) | 528.43 | 529.33 | 525.05 | 529.20 | 529.28 | 529.34 | 534.39 | 529.29 | 529.42 | 528.70 | 529.71 | 528.99 | 528.36 | 529.71 |
| MYS                                      | 529.20  | (3.90) | 529.16 | 529.05 | 528.63 | 529.10 | 529.62 | 530.11 | 530.22 | 529.23 | 528.32 | 529.62 | 529.36 | 529.23 | 529.44 | 529.36 |
| SWE                                      | 527.30  | (2.48) | 525.98 | 527.74 | 521.28 | 527.06 | 528.07 | 528.14 | 535.92 | 527.35 | 527.67 | 524.62 | 527.74 | 532.40 | 525.62 | 527.74 |
| LTU                                      | 526.21  | (2.37) | 526.21 | 525.99 | 523.56 | 526.16 | 525.38 | 526.73 | 527.76 | 526.25 | 526.04 | 526.36 | 526.08 | 526.59 | 526.06 | 526.08 |
| SCO                                      | 524.97  | (3.61) | 524.12 | 525.08 | 520.12 | 525.29 | 526.35 | 525.82 | 530.91 | 524.92 | 524.97 | 522.30 | 525.36 | 526.54 | 523.93 | 525.36 |
| ENG                                      | 524.52  | (4.42) | 523.49 | 524.62 | 519.48 | 524.62 | 525.47 | 524.88 | 530.27 | 524.53 | 523.89 | 521.11 | 525.01 | 526.70 | 523.39 | 525.01 |
| ISR                                      | 522.16  | (3.09) | 521.53 | 522.31 | 522.16 | 522.46 | 523.35 | 522.57 | 521.21 | 522.16 | 522.90 | 522.57 | 522.06 | 520.57 | 521.90 | 522.06 |
| NZL                                      | 518.89  | (4.98) | 518.26 | 519.10 | 514.08 | 518.83 | 519.81 | 519.36 | 524.58 | 518.88 | 518.51 | 514.95 | 519.32 | 521.00 | 517.90 | 519.32 |
| SVN                                      | 513.27  | (2.19) | 513.55 | 513.45 | 512.08 | 513.57 | 514.11 | 514.02 | 516.03 | 513.32 | 513.71 | 512.91 | 513.40 | 515.69 | 513.37 | 513.40 |
| ITA                                      | 511.77  | (2.89) | 511.60 | 511.66 | 511.30 | 511.60 | 510.10 | 512.77 | 513.97 | 511.83 | 511.20 | 511.74 | 511.88 | 513.91 | 511.16 | 511.88 |
| ROM                                      | 502.99  | (4.39) | 503.17 | 502.68 | 506.41 | 503.30 | 501.37 | 502.30 | 499.36 | 502.96 | 503.18 | 504.57 | 502.63 | 501.25 | 503.37 | 502.63 |
| SCG                                      | 502.80  | (2.31) | 502.95 | 502.67 | 506.19 | 502.90 | 500.95 | 501.24 | 498.27 | 502.77 | 503.26 | 504.50 | 502.71 | 502.49 | 503.29 | 502.71 |
| BGR                                      | 500.68  | (3.61) | 500.67 | 500.88 | 502.26 | 500.98 | 500.46 | 501.15 | 496.92 | 500.67 | 501.20 | 501.68 | 500.32 | 499.89 | 500.69 | 500.32 |
| ARM                                      | 498.30  | (2.66) | 499.02 | 498.16 | 503.91 | 499.27 | 496.78 | 495.55 | 492.34 | 498.34 | 498.58 | 498.45 | 497.64 | 495.20 | 499.64 | 497.64 |
| NOR                                      | 488.44  | (2.35) | 487.32 | 488.66 | 484.16 | 488.44 | 489.44 | 488.73 | 494.09 | 488.46 | 488.65 | 486.37 | 488.52 | 491.46 | 487.13 | 488.52 |
| MDA                                      | 487.75  | (3.39) | 488.85 | 487.61 | 492.27 | 487.80 | 486.50 | 487.20 | 484.35 | 487.71 | 488.08 | 488.32 | 487.24 | 487.74 | 488.70 | 487.24 |
| CYP                                      | 487.38  | (1.41) | 486.57 | 487.24 | 487.74 | 487.44 | 486.98 | 487.67 | 487.44 | 487.40 | 487.37 | 487.40 | 487.12 | 488.29 | 486.65 | 487.12 |
| MKD                                      | 469.90  | (2.86) | 469.85 | 469.81 | 472.70 | 469.98 | 468.74 | 469.10 | 468.76 | 469.89 | 470.45 | 470.48 | 469.55 | 471.04 | 470.26 | 469.55 |
| LBN                                      | 463.08  | (2.75) | 464.14 | 462.74 | 467.95 | 462.83 | 461.04 | 463.05 | 456.40 | 463.05 | 463.42 | 465.13 | 462.12 | 460.85 | 464.49 | 462.12 |
| JOR                                      | 458.34  | (3.17) | 458.67 | 458.40 | 458.93 | 458.15 | 458.01 | 457.37 | 455.95 | 458.33 | 458.11 | 458.84 | 458.41 | 455.88 | 458.83 | 458.41 |
| IDN                                      | 453.15  | (3.20) | 453.22 | 453.08 | 454.16 | 453.14 | 453.34 | 453.15 | 452.81 | 453.15 | 452.44 | 453.03 | 453.06 | 454.21 | 453.19 | 453.06 |
| TUN                                      | 447.63  | (1.69) | 448.63 | 447.84 | 450.28 | 447.93 | 449.01 | 449.18 | 445.8  | 447.62 | 448.28 | 448.93 | 446.88 | 447.62 | 448.39 | 446.88 |
| IRN                                      | 447.12  | (1.78) | 447.35 | 447.09 | 447.50 | 446.67 | 447.24 | 446.65 | 445.17 | 447.12 | 446.32 | 446.82 | 446.99 | 445.92 | 447.19 | 446.99 |
| BHR                                      | 443.47  | (1.09) | 444.01 | 443.44 | 444.25 | 443.66 | 443.89 | 443.51 | 442.08 | 443.47 | 443.37 | 444.00 | 443.30 | 440.77 | 444.26 | 443.30 |
| CHL                                      | 442.88  | (2.24) | 443.04 | 442.98 | 439.27 | 442.96 | 443.92 | 444.21 | 448.23 | 442.88 | 443.08 | 441.22 | 443.21 | 445.12 | 442.42 | 443.21 |
| EGY                                      | 442.16  | (2.33) | 442.49 | 442.05 | 445.05 | 442.02 | 442.17 | 441.60 | 440.74 | 442.15 | 442.28 | 444.08 | 442.57 | 440.87 | 442.60 | 442.57 |
| PSE                                      | 433.18  | (2.09) | 433.34 | 432.96 | 434.93 | 433.05 | 432.76 | 432.44 | 431.19 | 433.18 | 432.75 | 433.57 | 433.04 | 433.18 | 433.56 | 433.04 |
| MAR                                      | 431.96  | (1.68) | 433.03 | 431.94 | 432.58 | 432.12 | 432.80 | 433.02 | 430.24 | 431.97 | 432.20 | 432.53 | 431.42 | 431.03 | 432.98 | 431.42 |
| PHL                                      | 427.99  | (3.65) | 428.03 | 428.01 | 428.44 | 427.67 | 427.90 | 428.11 | 428.86 | 427.98 | 427.94 | 428.66 | 428.66 | 427.88 | 428.41 | 428.66 |
| BWA                                      | 421.85  | (1.70) | 422.14 | 421.83 | 422.12 | 421.97 | 422.69 | 422.17 | 424.01 | 421.83 | 422.05 | 422.93 | 422.20 | 422.75 | 422.26 | 422.20 |
| SAU                                      | 399.18  | (1.99) | 399.84 | 399.24 | 401.70 | 399.54 | 399.61 | 399.60 | 398.03 | 399.17 | 399.84 | 400.78 | 398.46 | 399.13 | 399.77 | 398.46 |
| GHA                                      | 386.85  | (1.69) | 387.36 | 386.83 | 391.73 | 386.84 | 387.37 | 386.52 | 386.43 | 386.84 | 387.33 | 389.32 | 387.09 | 387.43 | 387.85 | 387.09 |
| ZAF                                      | 382.71  | (3.15) | 382.81 | 382.72 | 384.76 | 382.71 | 383.59 | 383.94 | 386.84 | 382.70 | 383.06 | 384.71 | 383.27 | 385.35 | 382.95 | 383.27 |

CURRICULUM COVERAGE AND SCALE CORRELATION ON TIMSS 2003

| MYS    | SWE    | LTU    | SCO    | ENG    | ISR    | NZL    | SVN    | ITA    | ROM    | SCG    | BGR    | ARM    | NOR    | MDA    | CYP    | MKD    | LBN    |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 209    | 172    | 209    | 158    | 208    | 213    | 191    | 187    | 178    | 207    | 205    | 196    | 209    | 209    | 197    | 188    | 174    | 189    |
| 620.86 | 619.38 | 621.01 | 618.89 | 620.08 | 620.64 | 619.25 | 620.61 | 618.19 | 620.87 | 621.16 | 621.65 | 621.01 | 619.29 | 621.01 | 620.47 | 622.84 | 621.47 |
| 603.42 | 598.04 | 603.67 | 597.12 | 603.02 | 603.91 | 600.89 | 604.41 | 604.69 | 603.77 | 603.29 | 603.12 | 603.67 | 600.36 | 603.67 | 604.05 | 604.62 | 602.05 |
| 603.67 | 599.76 | 603.74 | 600.91 | 603.38 | 603.70 | 601.40 | 603.95 | 603.00 | 603.10 | 603.69 | 603.66 | 603.74 | 601.77 | 603.74 | 603.44 | 606.38 | 602.71 |
| 597.86 | 592.66 | 597.77 | 593.26 | 597.23 | 597.78 | 594.63 | 597.83 | 597.29 | 597.76 | 597.41 | 597.30 | 597.77 | 595.33 | 597.77 | 597.00 | 598.84 | 596.02 |
| 588.63 | 587.30 | 588.99 | 587.84 | 588.57 | 589.22 | 588.46 | 587.48 | 586.46 | 588.34 | 588.89 | 588.96 | 588.99 | 587.29 | 588.99 | 587.49 | 584.78 | 586.92 |
| 561.72 | 562.73 | 562.00 | 562.77 | 561.65 | 561.79 | 564.22 | 559.79 | 561.82 | 561.32 | 560.98 | 560.70 | 562.00 | 563.66 | 562.00 | 559.50 | 557.31 | 560.75 |
| 559.46 | 566.99 | 560.07 | 565.76 | 562.06 | 559.63 | 564.64 | 556.11 | 556.19 | 559.13 | 557.92 | 556.88 | 560.07 | 563.90 | 560.07 | 554.98 | 549.66 | 556.32 |
| 556.23 | 554.87 | 556.17 | 554.27 | 555.11 | 556.00 | 556.01 | 555.36 | 555.17 | 555.45 | 556.62 | 556.19 | 556.17 | 556.94 | 556.17 | 554.23 | 554.66 | 555.55 |
| 554.01 | 555.20 | 554.09 | 554.25 | 554.89 | 554.59 | 555.79 | 553.12 | 554.70 | 554.33 | 554.46 | 554.37 | 554.09 | 556.46 | 554.09 | 554.20 | 553.12 | 554.36 |
| 536.30 | 532.68 | 536.05 | 532.06 | 536.08 | 536.47 | 534.02 | 539.67 | 537.59 | 536.68 | 537.01 | 536.29 | 536.05 | 534.16 | 536.05 | 537.71 | 541.65 | 537.28 |
| 533.00 | 531.38 | 533.21 | 529.63 | 532.30 | 533.34 | 533.44 | 533.54 | 533.97 | 533.39 | 533.14 | 532.80 | 533.21 | 533.16 | 533.21 | 532.68 | 532.37 | 533.68 |
| 531.44 | 535.93 | 531.95 | 535.14 | 533.47 | 531.55 | 534.18 | 528.21 | 529.48 | 531.03 | 530.45 | 530.05 | 531.95 | 533.75 | 531.95 | 527.64 | 522.68 | 529.07 |
| 529.65 | 531.47 | 529.79 | 527.07 | 529.39 | 530.16 | 530.16 | 531.31 | 531.27 | 530.17 | 530.38 | 530.31 | 529.79 | 531.44 | 529.79 | 532.48 | 532.48 | 530.74 |
| 529.30 | 531.45 | 529.71 | 530.67 | 530.12 | 529.30 | 530.87 | 525.68 | 527.98 | 529.19 | 528.33 | 527.73 | 529.71 | 531.16 | 529.71 | 525.79 | 521.16 | 527.75 |
| 529.86 | 528.85 | 529.36 | 528.71 | 528.77 | 529.20 | 529.79 | 529.43 | 529.72 | 528.85 | 529.44 | 528.37 | 529.36 | 529.06 | 529.36 | 528.12 | 528.29 | 530.02 |
| 527.15 | 536.02 | 527.74 | 534.99 | 529.76 | 527.30 | 532.50 | 520.22 | 525.53 | 526.68 | 525.74 | 525.59 | 527.74 | 532.54 | 527.74 | 523.30 | 515.54 | 523.52 |
| 526.17 | 526.49 | 526.08 | 525.94 | 526.28 | 526.21 | 526.90 | 528.28 | 525.21 | 526.12 | 526.02 | 525.74 | 526.08 | 527.45 | 526.08 | 524.97 | 524.71 | 527.22 |
| 525.03 | 530.61 | 525.36 | 531.07 | 527.24 | 524.97 | 528.37 | 519.85 | 524.47 | 524.52 | 523.83 | 523.40 | 525.36 | 527.32 | 525.36 | 520.37 | 514.57 | 521.90 |
| 524.33 | 528.60 | 525.01 | 529.88 | 526.85 | 524.52 | 527.76 | 519.23 | 522.44 | 523.61 | 523.16 | 522.45 | 525.01 | 527.03 | 525.01 | 519.67 | 513.75 | 520.94 |
| 522.11 | 520.69 | 522.06 | 520.02 | 521.80 | 522.16 | 520.63 | 520.64 | 521.42 | 522.38 | 521.58 | 522.37 | 522.06 | 521.68 | 522.06 | 521.85 | 521.49 | 521.82 |
| 518.76 | 523.63 | 519.32 | 523.77 | 521.10 | 518.89 | 522.12 | 515.52 | 516.96 | 517.86 | 517.92 | 517.44 | 519.32 | 521.95 | 519.32 | 514.41 | 509.27 | 515.65 |
| 512.91 | 514.63 | 513.40 | 514.40 | 513.08 | 513.27 | 514.30 | 514.30 | 513.27 | 512.96 | 513.20 | 512.70 | 513.40 | 515.16 | 513.40 | 512.48 | 511.19 | 513.16 |
| 511.69 | 513.06 | 511.88 | 511.64 | 511.56 | 511.77 | 513.75 | 510.39 | 512.05 | 511.70 | 511.42 | 510.16 | 511.88 | 513.04 | 511.88 | 512.15 | 509.18 | 511.65 |
| 502.47 | 498.38 | 502.63 | 498.48 | 502.09 | 502.99 | 499.40 | 505.90 | 504.36 | 503.52 | 503.22 | 503.59 | 502.63 | 500.66 | 502.63 | 506.06 | 509.39 | 504.36 |
| 502.90 | 498.06 | 502.71 | 497.94 | 501.78 | 502.80 | 500.12 | 504.61 | 504.58 | 503.43 | 503.25 | 503.43 | 502.71 | 501.27 | 502.71 | 505.68 | 509.57 | 502.90 |
| 500.62 | 497.71 | 500.32 | 498.21 | 499.76 | 500.68 | 499.45 | 501.60 | 502.08 | 500.91 | 500.66 | 501.14 | 500.32 | 499.87 | 500.32 | 503.16 | 505.52 | 502.26 |
| 498.16 | 495.15 | 497.64 | 493.98 | 497.55 | 498.30 | 494.09 | 502.81 | 498.19 | 499.31 | 499.43 | 501.16 | 497.64 | 493.73 | 497.64 | 504.39 | 510.49 | 500.14 |
| 488.26 | 494.71 | 488.52 | 494.02 | 490.33 | 488.44 | 491.46 | 483.73 | 486.76 | 488.06 | 486.92 | 486.05 | 488.52 | 491.53 | 488.52 | 485.06 | 478.88 | 485.32 |
| 487.62 | 485.63 | 487.24 | 487.23 | 487.45 | 487.75 | 485.49 | 491.40 | 489.16 | 488.00 | 488.88 | 489.48 | 487.24 | 486.48 | 487.24 | 490.48 | 494.81 | 488.33 |
| 487.54 | 487.21 | 487.12 | 486.20 | 486.90 | 487.38 | 486.73 | 488.00 | 488.07 | 487.75 | 486.51 | 485.83 | 487.12 | 487.14 | 487.12 | 489.91 | 489.62 | 488.59 |
| 469.75 | 469.96 | 469.55 | 469.19 | 470.44 | 469.90 | 469.33 | 470.07 | 471.13 | 470.47 | 470.14 | 470.37 | 469.55 | 469.74 | 469.55 | 472.81 | 474.16 | 470.18 |
| 462.93 | 456.52 | 462.12 | 457.27 | 461.11 | 463.08 | 460.13 | 467.03 | 465.28 | 463.80 | 464.53 | 465.67 | 462.12 | 459.28 | 462.12 | 464.83 | 470.62 | 466.15 |
| 458.48 | 455.82 | 458.41 | 457.93 | 457.36 | 458.34 | 456.87 | 457.41 | 457.73 | 458.23 | 458.98 | 458.73 | 458.41 | 456.29 | 458.41 | 459.06 | 457.45 | 458.42 |
| 453.39 | 452.06 | 453.06 | 452.74 | 452.85 | 453.15 | 453.77 | 453.42 | 452.92 | 452.88 | 453.38 | 453.08 | 453.06 | 452.90 | 453.06 | 452.97 | 453.34 | 453.10 |
| 447.53 | 448.96 | 446.88 | 449.50 | 447.14 | 447.63 | 447.36 | 450.56 | 449.42 | 448.19 | 448.69 | 449.14 | 446.88 | 447.81 | 446.88 | 450.65 | 452.99 | 450.48 |
| 446.67 | 444.67 | 446.99 | 447.91 | 446.88 | 447.12 | 447.29 | 448.75 | 447.82 | 447.10 | 447.30 | 446.57 | 446.99 | 445.73 | 446.99 | 448.15 | 449.92 | 448.03 |
| 443.60 | 442.82 | 443.30 | 445.74 | 443.44 | 443.47 | 442.45 | 444.27 | 443.56 | 443.28 | 444.18 | 443.71 | 443.30 | 441.57 | 443.30 | 442.96 | 441.95 | 443.85 |
| 442.86 | 448.42 | 443.21 | 445.70 | 443.73 | 442.88 | 444.98 | 440.30 | 443.23 | 442.94 | 442.57 | 442.12 | 443.21 | 445.77 | 443.21 | 440.87 | 436.57 | 442.31 |
| 442.12 | 439.54 | 442.57 | 440.41 | 441.30 | 442.16 | 440.84 | 444.23 | 442.73 | 442.36 | 442.61 | 443.46 | 442.57 | 440.17 | 442.57 | 443.75 | 446.68 | 443.22 |
| 433.52 | 432.84 | 433.04 | 432.70 | 432.95 | 433.18 | 432.58 | 434.66 | 433.33 | 433.37 | 433.55 | 433.57 | 433.04 | 432.50 | 433.04 | 435.28 | 436.08 | 434.00 |
| 432.20 | 432.28 | 431.42 | 432.99 | 431.88 | 431.96 | 431.21 | 433.36 | 433.11 | 432.25 | 433.04 | 433.16 | 431.42 | 430.89 | 431.42 | 432.96 | 434.64 | 433.34 |
| 428.26 | 429.43 | 428.66 | 429.91 | 427.81 | 427.99 | 429.33 | 429.51 | 428.13 | 428.25 | 428.39 | 428.79 | 428.66 | 429.07 | 428.66 | 427.87 | 428.41 | 428.94 |
| 422.57 | 424.79 | 422.20 | 424.58 | 422.09 | 421.85 | 423.66 | 423.38 | 423.20 | 421.96 | 422.26 | 422.36 | 422.20 | 423.75 | 422.20 | 420.57 | 422.02 | 422.59 |
| 398.99 | 400.40 | 398.46 | 402.87 | 399.72 | 399.18 | 398.86 | 400.59 | 399.53 | 399.41 | 399.74 | 400.18 | 398.46 | 398.57 | 398.46 | 400.38 | 402.34 | 400.00 |
| 387.34 | 387.41 | 387.09 | 389.32 | 386.66 | 386.85 | 386.61 | 388.56 | 387.72 | 387.19 | 387.83 | 389.43 | 387.09 | 386.30 | 387.09 | 390.70 | 394.47 | 389.99 |
| 383.38 | 386.40 | 383.27 | 387.66 | 383.14 | 382.71 | 384.33 | 383.65 | 383.40 | 382.91 | 382.96 | 384.38 | 383.27 | 384.87 | 383.27 | 384.56 | 385.8  | 384.28 |

Table 5: Average scale score based on subset of items identified by each country as addressing its curriculum (contd.)

|           | Average                                  | (se)   | JOR    | IDN    | TUN    | IRN    | BHR    | CHL    | EGY    | PSE    | MAR    | PHL    | BWA    | SAU    | GHA    | ZAF    |
|-----------|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|           | <i>(Number of score points included)</i> |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Countries |  |        | 152    | 209    | 162    | 203    | 199    | 192    | 164    | 207    | 198    | 192    | 184    | 213    | 151    | 128    |
| SGP       | 620.64                                   | (3.47) | 619.39 | 621.01 | 621.08 | 620.79 | 621.38 | 620.58 | 620.83 | 620.91 | 621.32 | 621.91 | 618.46 | 620.64 | 619.74 | 619.89 |
| KOR       | 603.91                                   | (1.71) | 604.52 | 603.67 | 602.70 | 604.33 | 601.87 | 598.72 | 608.21 | 603.71 | 602.59 | 604.62 | 599.69 | 603.91 | 602.47 | 599.28 |
| HKG       | 603.70                                   | (3.16) | 602.22 | 603.74 | 602.66 | 603.72 | 602.54 | 601.33 | 605.82 | 603.17 | 603.04 | 604.79 | 601.42 | 603.70 | 602.49 | 602.27 |
| TWN       | 597.78                                   | (4.07) | 596.69 | 597.77 | 595.39 | 597.26 | 596.28 | 594.08 | 600.85 | 597.55 | 596.62 | 598.92 | 593.81 | 597.78 | 595.60 | 594.12 |
| JPN       | 589.22                                   | (1.95) | 586.98 | 588.99 | 585.54 | 588.04 | 587.88 | 586.29 | 587.50 | 588.47 | 587.83 | 586.85 | 587.61 | 589.22 | 584.36 | 576.31 |
| BFL       | 561.79                                   | (2.54) | 553.53 | 562.00 | 560.10 | 559.98 | 561.38 | 564.46 | 558.82 | 561.25 | 560.65 | 558.35 | 563.90 | 561.79 | 559.48 | 554.23 |
| NLD       | 559.63                                   | (3.78) | 547.36 | 560.07 | 550.43 | 556.25 | 560.13 | 564.14 | 553.74 | 558.87 | 557.02 | 555.00 | 563.68 | 559.63 | 558.12 | 546.83 |
| HUN       | 556.00                                   | (3.10) | 550.54 | 556.17 | 552.91 | 554.71 | 556.06 | 555.73 | 552.47 | 555.50 | 555.72 | 553.09 | 557.76 | 556.00 | 552.76 | 550.99 |
| EST       | 554.59                                   | (2.94) | 552.53 | 554.09 | 554.13 | 554.63 | 554.84 | 553.11 | 551.11 | 554.30 | 554.01 | 552.64 | 555.86 | 554.59 | 553.25 | 549.81 |
| RUS       | 536.47                                   | (3.28) | 539.94 | 536.05 | 537.46 | 537.37 | 536.79 | 530.65 | 539.18 | 536.65 | 536.49 | 538.97 | 535.48 | 536.47 | 537.89 | 540.24 |
| LVA       | 533.34                                   | (3.00) | 531.67 | 533.21 | 533.08 | 532.97 | 533.93 | 530.46 | 532.39 | 533.34 | 532.60 | 532.21 | 532.8  | 533.34 | 532.50 | 530.74 |
| AUS       | 531.55                                   | (4.27) | 517.56 | 531.95 | 524.57 | 528.36 | 531.01 | 533.93 | 527.35 | 531.01 | 530.13 | 526.66 | 533.53 | 531.55 | 528.92 | 519.14 |
| SVK       | 530.16                                   | (3.23) | 527.28 | 529.79 | 532.79 | 531.93 | 531.30 | 532.43 | 529.91 | 530.21 | 531.28 | 530.45 | 530.73 | 530.16 | 532.76 | 533.84 |
| USA       | 529.30                                   | (3.06) | 521.57 | 529.71 | 523.40 | 525.77 | 528.75 | 528.99 | 524.29 | 529.18 | 528.17 | 525.43 | 531.63 | 529.30 | 524.66 | 518.98 |
| MYS       | 529.20                                   | (3.90) | 524.56 | 529.36 | 528.29 | 529.09 | 529.05 | 532.56 | 529.90 | 528.92 | 528.52 | 528.03 | 528.91 | 529.20 | 529.74 | 531.40 |
| SWE       | 527.30                                   | (2.48) | 509.84 | 527.74 | 519.11 | 523.29 | 526.91 | 531.93 | 518.49 | 526.79 | 525.48 | 519.75 | 531.61 | 527.30 | 526.61 | 513.13 |
| LTU       | 526.21                                   | (2.37) | 527.03 | 526.08 | 524.73 | 525.31 | 526.82 | 524.20 | 525.57 | 526.01 | 525.09 | 526.94 | 527.01 | 526.21 | 523.30 | 521.61 |
| SCO       | 524.97                                   | (3.61) | 510.20 | 525.36 | 517.65 | 521.44 | 524.73 | 527.29 | 518.64 | 524.42 | 523.66 | 518.12 | 527.14 | 524.97 | 523.82 | 509.89 |
| ENG       | 524.52                                   | (4.42) | 508.00 | 525.01 | 515.63 | 520.79 | 523.37 | 526.29 | 518.39 | 523.45 | 522.16 | 517.72 | 526.75 | 524.52 | 521.30 | 508.94 |
| ISR       | 522.16                                   | (3.09) | 520.33 | 522.06 | 521.86 | 521.83 | 521.73 | 520.28 | 520.86 | 522.40 | 522.03 | 521.73 | 522.39 | 522.16 | 521.25 | 519.79 |
| NZL       | 518.89                                   | (4.98) | 503.43 | 519.32 | 510.85 | 515.36 | 518.21 | 521.54 | 514.51 | 517.87 | 516.82 | 513.38 | 521.48 | 518.89 | 516.13 | 503.91 |
| SVN       | 513.27                                   | (2.19) | 508.13 | 513.40 | 511.97 | 512.72 | 513.40 | 515.40 | 512.68 | 512.99 | 512.60 | 513.17 | 515.14 | 513.27 | 511.57 | 512.18 |
| ITA       | 511.77                                   | (2.89) | 507.83 | 511.88 | 511.46 | 511.67 | 512.14 | 513.69 | 510.23 | 511.75 | 511.30 | 509.67 | 511.92 | 511.77 | 512.49 | 511.70 |
| ROM       | 502.99                                   | (4.39) | 506.60 | 502.63 | 507.04 | 505.58 | 503.12 | 500.38 | 507.46 | 503.55 | 503.98 | 506.82 | 501.47 | 502.99 | 504.74 | 511.59 |
| SCG       | 502.80                                   | (2.31) | 505.36 | 502.71 | 506.34 | 504.93 | 501.96 | 498.89 | 506.35 | 503.25 | 503.20 | 505.83 | 501.25 | 502.80 | 504.62 | 510.71 |
| BGR       | 500.68                                   | (3.61) | 503.11 | 500.32 | 505.11 | 502.90 | 500.82 | 498.37 | 502.53 | 500.94 | 500.83 | 501.45 | 499.37 | 500.68 | 501.68 | 505.14 |
| ARM       | 498.30                                   | (2.66) | 506.00 | 497.64 | 505.67 | 502.63 | 499.00 | 488.88 | 502.10 | 499.40 | 501.68 | 504.32 | 497.21 | 498.30 | 499.32 | 511.45 |
| NOR       | 488.44                                   | (2.35) | 473.89 | 488.52 | 481.32 | 485.73 | 487.36 | 492.37 | 482.49 | 487.91 | 486.52 | 483.35 | 491.28 | 488.44 | 489.49 | 476.11 |
| MDA       | 487.75                                   | (3.39) | 493.72 | 487.24 | 491.00 | 490.13 | 488.58 | 485.85 | 491.59 | 487.90 | 488.89 | 491.89 | 487.28 | 487.75 | 492.24 | 495.42 |
| CYP       | 487.38                                   | (1.41) | 484.82 | 487.12 | 490.68 | 489.47 | 486.77 | 487.58 | 489.75 | 487.71 | 487.46 | 488.06 | 486.89 | 487.38 | 489.45 | 491.70 |
| MKD       | 469.90                                   | (2.86) | 472.21 | 469.55 | 472.92 | 471.96 | 470.10 | 468.32 | 471.12 | 470.34 | 470.48 | 470.66 | 469.93 | 469.90 | 471.42 | 473.99 |
| LBN       | 463.08                                   | (2.75) | 475.11 | 462.12 | 467.05 | 464.40 | 464.40 | 459.02 | 466.35 | 463.89 | 464.76 | 467.75 | 460.68 | 463.08 | 460.05 | 474.51 |
| JOR       | 458.34                                   | (3.17) | 469.15 | 458.41 | 459.59 | 458.82 | 457.83 | 455.91 | 457.77 | 458.31 | 458.60 | 458.03 | 456.92 | 458.34 | 457.39 | 456.63 |
| IDN       | 453.15                                   | (3.20) | 455.80 | 453.06 | 452.50 | 453.38 | 453.40 | 453.74 | 453.66 | 452.88 | 452.80 | 452.99 | 452.96 | 453.15 | 452.63 | 455.50 |
| TUN       | 447.63                                   | (1.69) | 452.59 | 446.88 | 455.34 | 449.99 | 449.82 | 452.12 | 450.41 | 448.37 | 450.35 | 450.81 | 447.24 | 447.63 | 451.57 | 456.61 |
| IRN       | 447.12                                   | (1.78) | 451.29 | 446.99 | 448.60 | 448.13 | 446.65 | 447.36 | 449.56 | 447.19 | 446.01 | 448.40 | 444.49 | 447.12 | 449.70 | 450.24 |
| BHR       | 443.47                                   | (1.09) | 451.17 | 443.30 | 444.02 | 443.09 | 443.86 | 443.43 | 443.83 | 443.50 | 444.19 | 444.54 | 442.34 | 443.47 | 443.61 | 442.05 |
| CHL       | 442.88                                   | (2.24) | 434.23 | 443.21 | 440.18 | 441.27 | 443.32 | 447.57 | 439.88 | 442.74 | 442.81 | 438.70 | 444.84 | 442.88 | 445.68 | 438.66 |
| EGY       | 442.16                                   | (2.33) | 454.47 | 442.57 | 445.89 | 443.09 | 441.80 | 441.94 | 446.06 | 442.29 | 442.82 | 446.16 | 440.00 | 442.16 | 443.85 | 451.80 |
| PSE       | 433.18                                   | (2.09) | 442.97 | 433.04 | 435.91 | 434.81 | 433.10 | 433.22 | 434.28 | 433.19 | 433.91 | 434.78 | 432.78 | 433.18 | 435.14 | 436.33 |
| MAR       | 431.96                                   | (1.68) | 440.76 | 431.42 | 435.46 | 432.95 | 433.29 | 432.69 | 433.63 | 432.30 | 433.37 | 433.24 | 431.06 | 431.96 | 432.87 | 436.63 |
| PHL       | 427.99                                   | (3.65) | 432.59 | 428.66 | 428.31 | 427.81 | 428.27 | 429.74 | 429.96 | 428.30 | 428.60 | 430.18 | 428.87 | 427.99 | 427.84 | 434.90 |
| BWA       | 421.85                                   | (1.70) | 424.67 | 422.20 | 422.34 | 420.45 | 422.34 | 424.50 | 423.42 | 421.94 | 423.14 | 424.10 | 423.95 | 421.85 | 421.77 | 427.49 |
| SAU       | 399.18                                   | (1.99) | 409.01 | 398.46 | 403.17 | 400.76 | 400.15 | 401.61 | 401.38 | 399.19 | 399.59 | 404.60 | 398.61 | 399.18 | 402.42 | 405.98 |
| GHA       | 386.85                                   | (1.69) | 01.15  | 387.09 | 394.62 | 390.01 | 387.61 | 389.51 | 389.80 | 387.39 | 389.41 | 390.77 | 385.92 | 386.85 | 389.32 | 402.14 |
| ZAF       | 382.71                                   | (3.15) | 391.17 | 383.27 | 386.27 | 384.06 | 383.16 | 387.35 | 383.76 | 383.09 | 383.97 | 385.10 | 384.81 | 382.71 | 386.99 | 391.61 |

The first two grey-shaded columns in Table 5 show the average mathematics scores based on all test items included for each participant and their standard errors in parentheses. All numbers are rounded to two decimal places. The subsequent columns contain the performance of each country based on those items judged appropriate by the participant listed in the header of each column. The table is sorted by performance based on all items, from the highest to the lowest. Singapore received the highest average score (620.64); South Africa had the lowest score (382.71).

An answer to the question of whether or not the selection of items affected average student performance can be obtained by comparing the shaded diagonal cells in Table 5 with the performance of the students on the test as a whole, which is presented in the first shaded column. For example, Singapore reached a score of 621.40 on its own set of items, while it received a score of 620.50 for the items selected by Korea, and a score of 620.21 for the items selected by Hong Kong. The largest effect was found for the Netherlands and Jordan, with both countries gaining 11 score points on their own sets of items. On average, a country gained two score points if its set of not-covered items was removed from the scaling. Two countries, Israel and Saudi Arabia, showed no gain because they declared all items appropriate. Seven countries performed less well on their selected items. The median gain was one score point.

The rows in Table 5 indicate the effect of the different item selections on each country's student performance. The performance of students in Singapore was highest on the items judged as appropriate for Macedonia (622.84) and lowest on the items selected for Italy (618.19). However, the differences between the highest value and the smallest value were small for all countries, on average about 12 score points.

The columns in Table 5 show the relative positions of a country's performance when using the items selected for the other countries. In general, the relative positions of the countries changed very little as a result of the item selection. The high-performing countries consistently remained high-achieving for any item choice, while the low-performing countries consistently achieved at the low end of the distribution. Countries in the middle remained in the middle of the achievement distribution.

For reasons of completeness, Table 6 shows the standard errors associated with the average scale scores (Table 5) by country. The standard error for the score based on the test items included by each of the countries listed in the header row can be read across the row. The columns show the standard error for the score of the country down the left on the items included by the country list in the header row. The standard error for the score for each different country based on its own judgment about the test items included is displayed along the diagonal.

In order to illustrate the findings of Table 5 more clearly, Figure 5 shows the mean country scores calculated with all items included versus mean country scores for covered items only. The mean country scores for both all and covered items are represented by the grey-shaded column titled "Average" and the grey-shaded diagonal cells of Table 5, respectively. We used the jackknife method to estimate the standard errors of these average scores. The black rectangles in the scatterplot

Table 6: Standard errors for average scale scores by country

|           | Average                                  | (se)   | SGP  | KOR  | HKG  | TWN  | JPN  | BFL  | NLD  | HUN  | EST  | RUS  | LVA  | AUS  | SVK   | USA  |
|-----------|--|--------|------|------|------|------|------|------|------|------|------|------|------|------|-------|------|
| Countries | <i>(Number of score points included)</i> |        |      |      |      |      |      |      |      |      |      |      |      |      |       |      |
|           | 213                                      |        | 206  | 193  | 211  | 210  | 199  | 198  | 169  | 212  | 204  | 177  | 209  | 206  | 182   | 208  |
| SGP       | 620.64                                   | (3.47) | 3.50 | 3.46 | 3.49 | 3.47 | 3.44 | 3.41 | 3.44 | 3.47 | 3.45 | 3.50 | 3.49 | 3.43 | 3.50  | 3.49 |
| KOR       | 603.91                                   | (1.71) | 1.71 | 1.71 | 1.73 | 1.71 | 1.72 | 1.69 | 1.63 | 1.71 | 1.72 | 1.72 | 1.70 | 1.67 | 1.710 | 1.70 |
| HKG       | 603.70                                   | (3.16) | 3.13 | 3.15 | 3.12 | 3.16 | 3.13 | 3.12 | 3.03 | 3.15 | 3.14 | 3.14 | 3.15 | 3.06 | 3.14  | 3.15 |
| TWN       | 597.78                                   | (4.07) | 4.07 | 4.06 | 4.13 | 4.06 | 4.01 | 3.95 | 3.78 | 4.07 | 4.06 | 4.08 | 4.05 | 3.93 | 4.08  | 4.05 |
| JPN       | 589.22                                   | (1.95) | 1.94 | 1.95 | 1.94 | 1.95 | 1.96 | 1.97 | 1.92 | 1.94 | 1.95 | 1.95 | 1.94 | 1.98 | 1.94  | 1.94 |
| BFL       | 561.79                                   | (2.54) | 2.54 | 2.54 | 2.57 | 2.54 | 2.55 | 2.53 | 2.42 | 2.53 | 2.53 | 2.51 | 2.53 | 2.51 | 2.54  | 2.53 |
| NLD       | 559.63                                   | (3.78) | 3.78 | 3.78 | 3.76 | 3.77 | 3.76 | 3.75 | 3.84 | 3.78 | 3.78 | 3.74 | 3.77 | 3.87 | 3.78  | 3.77 |
| HUN       | 556.00                                   | (3.10) | 3.11 | 3.09 | 3.17 | 3.10 | 3.06 | 3.09 | 3.03 | 3.10 | 3.10 | 3.17 | 3.10 | 3.02 | 3.13  | 3.10 |
| EST       | 554.59                                   | (2.94) | 2.94 | 2.95 | 2.99 | 2.94 | 2.88 | 2.93 | 2.93 | 2.94 | 2.96 | 2.98 | 2.94 | 2.99 | 2.94  | 2.94 |
| RUS       | 536.47                                   | (3.28) | 3.32 | 3.26 | 3.50 | 3.28 | 3.20 | 3.22 | 3.04 | 3.29 | 3.26 | 3.36 | 3.27 | 3.14 | 3.33  | 3.27 |
| LVA       | 533.34                                   | (3.00) | 2.97 | 2.98 | 3.04 | 2.99 | 2.94 | 2.94 | 2.97 | 3.00 | 2.97 | 2.97 | 3.02 | 2.96 | 2.96  | 3.02 |
| AUS       | 531.55                                   | (4.27) | 4.28 | 4.26 | 4.28 | 4.25 | 4.21 | 4.24 | 4.19 | 4.28 | 4.21 | 4.25 | 4.28 | 4.25 | 4.28  | 4.28 |
| SVK       | 530.16                                   | (3.23) | 3.25 | 3.23 | 3.32 | 3.24 | 3.19 | 3.24 | 3.17 | 3.23 | 3.21 | 3.27 | 3.24 | 3.14 | 3.28  | 3.24 |
| USA       | 529.30                                   | (3.06) | 3.04 | 3.06 | 3.06 | 3.05 | 3.01 | 3.04 | 3.09 | 3.06 | 3.04 | 3.04 | 3.06 | 3.07 | 3.04  | 3.06 |
| MYS       | 529.20                                   | (3.90) | 3.92 | 3.89 | 3.99 | 3.89 | 3.84 | 3.86 | 3.78 | 3.90 | 3.88 | 3.94 | 3.87 | 3.85 | 3.90  | 3.87 |
| SWE       | 527.30                                   | (2.48) | 2.47 | 2.49 | 2.43 | 2.49 | 2.50 | 2.51 | 2.56 | 2.48 | 2.50 | 2.46 | 2.47 | 2.60 | 2.47  | 2.47 |
| LTU       | 526.21                                   | (2.37) | 2.38 | 2.37 | 2.43 | 2.39 | 2.35 | 2.38 | 2.36 | 2.38 | 2.37 | 2.41 | 2.38 | 2.44 | 2.38  | 2.38 |
| SCO       | 524.97                                   | (3.61) | 3.61 | 3.61 | 3.62 | 3.60 | 3.57 | 3.60 | 3.68 | 3.61 | 3.59 | 3.57 | 3.61 | 3.69 | 3.60  | 3.61 |
| ENG       | 524.52                                   | (4.42) | 4.41 | 4.41 | 4.45 | 4.39 | 4.36 | 4.36 | 4.44 | 4.43 | 4.37 | 4.4  | 4.42 | 4.48 | 4.40  | 4.42 |
| ISR       | 522.16                                   | (3.09) | 3.09 | 3.09 | 3.08 | 3.09 | 3.08 | 3.04 | 2.98 | 3.09 | 3.09 | 3.10 | 3.07 | 3.04 | 3.10  | 3.07 |
| NZL       | 518.89                                   | (4.98) | 4.96 | 4.99 | 5.00 | 4.99 | 4.95 | 5.03 | 4.93 | 4.98 | 5.03 | 4.94 | 4.95 | 5.05 | 4.94  | 4.95 |
| SVN       | 513.27                                   | (2.19) | 2.20 | 2.19 | 2.23 | 2.19 | 2.19 | 2.24 | 2.21 | 2.19 | 2.21 | 2.18 | 2.18 | 2.22 | 2.19  | 2.18 |
| ITA       | 511.77                                   | (2.89) | 2.93 | 2.88 | 2.96 | 2.87 | 2.86 | 2.86 | 2.75 | 2.89 | 2.89 | 2.92 | 2.88 | 2.84 | 2.93  | 2.88 |
| ROM       | 502.99                                   | (4.39) | 4.36 | 4.39 | 4.41 | 4.39 | 4.36 | 4.31 | 4.19 | 4.39 | 4.39 | 4.41 | 4.37 | 4.29 | 4.39  | 4.37 |
| SCG       | 502.80                                   | (2.31) | 2.32 | 2.31 | 2.37 | 2.31 | 2.26 | 2.26 | 2.22 | 2.31 | 2.33 | 2.37 | 2.30 | 2.29 | 2.32  | 2.30 |
| BGR       | 500.68                                   | (3.61) | 3.62 | 3.60 | 3.67 | 3.61 | 3.61 | 3.50 | 3.45 | 3.60 | 3.64 | 3.62 | 3.59 | 3.59 | 3.62  | 3.59 |
| ARM       | 498.30                                   | (2.66) | 2.65 | 2.65 | 2.72 | 2.66 | 2.68 | 2.62 | 2.53 | 2.66 | 2.65 | 2.76 | 2.65 | 2.64 | 2.66  | 2.65 |
| NOR       | 488.44                                   | (2.35) | 2.36 | 2.35 | 2.31 | 2.36 | 2.34 | 2.42 | 2.45 | 2.35 | 2.35 | 2.35 | 2.35 | 2.36 | 2.36  | 2.35 |
| MDA       | 487.75                                   | (3.39) | 3.42 | 3.39 | 3.48 | 3.38 | 3.31 | 3.31 | 3.09 | 3.39 | 3.39 | 3.40 | 3.37 | 3.31 | 3.45  | 3.37 |
| CYP       | 487.38                                   | (1.41) | 1.41 | 1.41 | 1.43 | 1.41 | 1.41 | 1.40 | 1.44 | 1.41 | 1.43 | 1.45 | 1.39 | 1.41 | 1.41  | 1.39 |
| MKD       | 469.90                                   | (2.86) | 2.85 | 2.85 | 2.87 | 2.84 | 2.79 | 2.82 | 2.82 | 2.86 | 2.85 | 2.85 | 2.87 | 2.77 | 2.85  | 2.87 |
| LBN       | 463.08                                   | (2.75) | 2.77 | 2.75 | 2.80 | 2.74 | 2.71 | 2.76 | 2.75 | 2.75 | 2.75 | 2.83 | 2.75 | 2.74 | 2.77  | 2.75 |
| JOR       | 458.34                                   | (3.17) | 3.13 | 3.17 | 3.12 | 3.15 | 3.12 | 3.10 | 3.13 | 3.17 | 3.15 | 3.07 | 3.16 | 3.11 | 3.13  | 3.16 |
| IDN       | 453.15                                   | (3.20) | 3.17 | 3.19 | 3.16 | 3.20 | 3.20 | 3.15 | 3.09 | 3.20 | 3.18 | 3.14 | 3.17 | 3.16 | 3.18  | 3.17 |
| TUN       | 447.63                                   | (1.69) | 1.69 | 1.69 | 1.65 | 1.68 | 1.68 | 1.66 | 1.62 | 1.69 | 1.70 | 1.71 | 1.67 | 1.59 | 1.69  | 1.67 |
| IRN       | 447.12                                   | (1.78) | 1.76 | 1.78 | 1.72 | 1.77 | 1.77 | 1.75 | 1.69 | 1.78 | 1.75 | 1.73 | 1.78 | 1.74 | 1.75  | 1.78 |
| BHR       | 443.47                                   | (1.09) | 1.08 | 1.10 | 1.10 | 1.09 | 1.08 | 1.12 | 1.11 | 1.09 | 1.09 | 1.12 | 1.10 | 1.09 | 1.09  | 1.10 |
| CHL       | 442.88                                   | (2.24) | 2.21 | 2.23 | 2.19 | 2.23 | 2.21 | 2.23 | 2.19 | 2.24 | 2.23 | 2.23 | 2.24 | 2.22 | 2.24  | 2.24 |
| EGY       | 442.16                                   | (2.33) | 2.31 | 2.32 | 2.31 | 2.34 | 2.29 | 2.26 | 2.18 | 2.33 | 2.33 | 2.26 | 2.31 | 2.26 | 2.31  | 2.31 |
| PSE       | 433.18                                   | (2.09) | 2.10 | 2.08 | 2.07 | 2.09 | 2.10 | 2.09 | 2.01 | 2.09 | 2.08 | 2.07 | 2.08 | 1.97 | 2.10  | 2.08 |
| MAR       | 431.96                                   | (1.68) | 1.69 | 1.67 | 1.65 | 1.69 | 1.68 | 1.67 | 1.70 | 1.68 | 1.70 | 1.68 | 1.67 | 1.58 | 1.72  | 1.67 |
| PHL       | 427.99                                   | (3.65) | 3.65 | 3.65 | 3.58 | 3.64 | 3.62 | 3.64 | 3.55 | 3.65 | 3.65 | 3.62 | 3.65 | 3.50 | 3.64  | 3.65 |
| BWA       | 421.85                                   | (1.70) | 1.68 | 1.70 | 1.61 | 1.70 | 1.71 | 1.72 | 1.70 | 1.70 | 1.73 | 1.68 | 1.68 | 1.68 | 1.67  | 1.68 |
| SAU       | 399.18                                   | (1.99) | 1.96 | 1.98 | 1.94 | 1.96 | 1.94 | 1.90 | 1.82 | 1.99 | 1.96 | 1.93 | 1.94 | 1.95 | 1.94  | 1.94 |
| GHA       | 386.85                                   | (1.69) | 1.68 | 1.70 | 1.64 | 1.68 | 1.67 | 1.63 | 1.62 | 1.69 | 1.67 | 1.60 | 1.70 | 1.63 | 1.68  | 1.70 |
| ZAF       | 382.71                                   | (3.15) | 3.13 | 3.15 | 3.00 | 3.14 | 3.12 | 3.12 | 3.13 | 3.15 | 3.15 | 3.08 | 3.13 | 3.09 | 3.13  | 3.13 |

CURRICULUM COVERAGE AND SCALE CORRELATION ON TIMSS 2003

| MYS  | SWE  | LTU  | SCO  | ENG  | ISR  | NZL  | SVN  | ITA  | ROM  | SCG  | BGR  | ARM  | NOR  | MDA  | CYP  | MKD  | LBN  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 209  | 172  | 209  | 158  | 208  | 213  | 191  | 187  | 178  | 207  | 205  | 196  | 209  | 209  | 197  | 188  | 174  | 189  |
| 3.49 | 3.42 | 3.49 | 3.45 | 3.47 | 3.47 | 3.39 | 3.43 | 3.39 | 3.46 | 3.49 | 3.50 | 3.49 | 3.45 | 3.49 | 3.48 | 3.51 | 3.48 |
| 1.71 | 1.64 | 1.70 | 1.62 | 1.71 | 1.71 | 1.66 | 1.69 | 1.72 | 1.72 | 1.71 | 1.72 | 1.70 | 1.68 | 1.70 | 1.74 | 1.75 | 1.72 |
| 3.14 | 3.05 | 3.15 | 3.06 | 3.14 | 3.16 | 3.05 | 3.07 | 3.05 | 3.16 | 3.14 | 3.14 | 3.15 | 3.08 | 3.15 | 3.21 | 3.12 | 3.18 |
| 4.07 | 3.86 | 4.05 | 3.89 | 4.04 | 4.07 | 3.86 | 4.10 | 4.00 | 4.08 | 4.08 | 4.09 | 4.05 | 3.94 | 4.05 | 4.13 | 4.21 | 4.09 |
| 1.95 | 1.98 | 1.94 | 1.95 | 1.94 | 1.95 | 1.97 | 1.91 | 1.84 | 1.95 | 1.94 | 1.97 | 1.94 | 1.94 | 1.94 | 1.99 | 1.93 | 1.97 |
| 2.53 | 2.42 | 2.53 | 2.50 | 2.53 | 2.54 | 2.50 | 2.59 | 2.56 | 2.51 | 2.53 | 2.56 | 2.53 | 2.51 | 2.53 | 2.54 | 2.64 | 2.57 |
| 3.77 | 3.81 | 3.77 | 3.95 | 3.80 | 3.78 | 3.81 | 3.76 | 3.57 | 3.76 | 3.78 | 3.84 | 3.77 | 3.77 | 3.77 | 3.79 | 3.76 | 3.78 |
| 3.11 | 3.10 | 3.10 | 3.08 | 3.10 | 3.10 | 3.04 | 3.16 | 3.05 | 3.10 | 3.13 | 3.16 | 3.10 | 3.08 | 3.10 | 3.10 | 3.23 | 3.18 |
| 2.95 | 2.89 | 2.94 | 2.93 | 2.94 | 2.94 | 2.91 | 2.88 | 2.94 | 2.93 | 2.94 | 2.95 | 2.94 | 2.97 | 2.94 | 3.00 | 3.00 | 2.95 |
| 3.30 | 3.11 | 3.27 | 3.22 | 3.26 | 3.28 | 3.13 | 3.34 | 3.35 | 3.30 | 3.32 | 3.31 | 3.27 | 3.15 | 3.27 | 3.39 | 3.52 | 3.36 |
| 3.00 | 2.86 | 3.02 | 2.87 | 2.99 | 3.00 | 2.95 | 2.89 | 2.96 | 2.99 | 2.96 | 2.94 | 3.02 | 2.94 | 3.02 | 3.02 | 2.97 | 3.00 |
| 4.27 | 4.15 | 4.28 | 4.19 | 4.28 | 4.27 | 4.33 | 4.41 | 4.16 | 4.25 | 4.28 | 4.24 | 4.28 | 4.25 | 4.28 | 4.27 | 4.45 | 4.31 |
| 3.24 | 3.20 | 3.24 | 3.17 | 3.24 | 3.23 | 3.19 | 3.42 | 3.31 | 3.23 | 3.26 | 3.27 | 3.24 | 3.17 | 3.24 | 3.23 | 3.46 | 3.30 |
| 3.05 | 3.01 | 3.06 | 3.03 | 3.05 | 3.06 | 3.04 | 3.04 | 2.98 | 3.05 | 3.05 | 3.04 | 3.06 | 3.04 | 3.06 | 3.07 | 3.05 | 3.02 |
| 3.90 | 3.75 | 3.87 | 3.78 | 3.88 | 3.90 | 3.84 | 3.96 | 3.94 | 3.89 | 3.91 | 3.93 | 3.87 | 3.84 | 3.87 | 3.99 | 4.13 | 3.95 |
| 2.48 | 2.56 | 2.47 | 2.60 | 2.49 | 2.48 | 2.53 | 2.36 | 2.34 | 2.47 | 2.47 | 2.51 | 2.47 | 2.53 | 2.47 | 2.50 | 2.39 | 2.43 |
| 2.36 | 2.36 | 2.38 | 2.35 | 2.36 | 2.37 | 2.38 | 2.45 | 2.36 | 2.38 | 2.38 | 2.42 | 2.38 | 2.38 | 2.38 | 2.44 | 2.52 | 2.43 |
| 3.61 | 3.68 | 3.61 | 3.68 | 3.64 | 3.61 | 3.69 | 3.60 | 3.47 | 3.60 | 3.61 | 3.62 | 3.61 | 3.62 | 3.61 | 3.69 | 3.63 | 3.61 |
| 4.44 | 4.40 | 4.42 | 4.62 | 4.45 | 4.42 | 4.50 | 4.30 | 4.35 | 4.41 | 4.42 | 4.40 | 4.42 | 4.43 | 4.42 | 4.45 | 4.38 | 4.38 |
| 3.09 | 3.00 | 3.07 | 3.01 | 3.12 | 3.09 | 3.04 | 3.13 | 3.06 | 3.09 | 3.09 | 3.10 | 3.07 | 3.08 | 3.07 | 3.02 | 3.10 | 3.05 |
| 4.95 | 5.02 | 4.95 | 5.09 | 5.01 | 4.98 | 5.07 | 4.98 | 4.94 | 4.98 | 4.96 | 5.02 | 4.95 | 5.00 | 4.95 | 5.07 | 5.04 | 4.98 |
| 2.19 | 2.21 | 2.18 | 2.14 | 2.18 | 2.19 | 2.20 | 2.25 | 2.18 | 2.19 | 2.20 | 2.20 | 2.18 | 2.16 | 2.18 | 2.22 | 2.19 | 2.20 |
| 2.91 | 2.76 | 2.88 | 2.81 | 2.87 | 2.89 | 2.82 | 2.92 | 2.94 | 2.91 | 2.94 | 2.93 | 2.88 | 2.79 | 2.88 | 2.92 | 2.99 | 2.89 |
| 4.39 | 4.25 | 4.37 | 4.26 | 4.40 | 4.39 | 4.32 | 4.42 | 4.36 | 4.41 | 4.38 | 4.36 | 4.37 | 4.33 | 4.37 | 4.38 | 4.43 | 4.36 |
| 2.31 | 2.25 | 2.30 | 2.17 | 2.32 | 2.31 | 2.23 | 2.39 | 2.37 | 2.33 | 2.33 | 2.32 | 2.30 | 2.26 | 2.30 | 2.34 | 2.42 | 2.33 |
| 3.61 | 3.54 | 3.59 | 3.50 | 3.61 | 3.61 | 3.55 | 3.70 | 3.65 | 3.64 | 3.62 | 3.63 | 3.59 | 3.60 | 3.59 | 3.67 | 3.76 | 3.62 |
| 2.67 | 2.56 | 2.65 | 2.53 | 2.63 | 2.66 | 2.61 | 2.71 | 2.65 | 2.66 | 2.66 | 2.63 | 2.65 | 2.64 | 2.65 | 2.69 | 2.78 | 2.69 |
| 2.36 | 2.43 | 2.35 | 2.55 | 2.37 | 2.35 | 2.43 | 2.21 | 2.30 | 2.34 | 2.36 | 2.35 | 2.35 | 2.37 | 2.35 | 2.29 | 2.18 | 2.31 |
| 3.40 | 3.18 | 3.37 | 3.24 | 3.38 | 3.39 | 3.27 | 3.56 | 3.48 | 3.40 | 3.44 | 3.40 | 3.37 | 3.29 | 3.37 | 3.42 | 3.60 | 3.44 |
| 1.42 | 1.50 | 1.39 | 1.46 | 1.42 | 1.41 | 1.44 | 1.37 | 1.45 | 1.44 | 1.42 | 1.41 | 1.39 | 1.44 | 1.39 | 1.41 | 1.32 | 1.41 |
| 2.85 | 2.80 | 2.87 | 2.84 | 2.85 | 2.86 | 2.82 | 2.72 | 2.83 | 2.86 | 2.86 | 2.82 | 2.87 | 2.80 | 2.87 | 2.86 | 2.76 | 2.88 |
| 2.76 | 2.71 | 2.75 | 2.71 | 2.74 | 2.75 | 2.72 | 2.77 | 2.84 | 2.75 | 2.77 | 2.70 | 2.75 | 2.78 | 2.75 | 2.74 | 2.71 | 2.80 |
| 3.14 | 3.02 | 3.16 | 3.02 | 3.14 | 3.17 | 3.11 | 3.19 | 3.13 | 3.18 | 3.14 | 3.11 | 3.16 | 3.11 | 3.16 | 3.18 | 3.17 | 3.11 |
| 3.20 | 3.06 | 3.17 | 3.02 | 3.17 | 3.20 | 3.14 | 3.20 | 3.20 | 3.20 | 3.17 | 3.13 | 3.17 | 3.13 | 3.17 | 3.13 | 3.13 | 3.15 |
| 1.68 | 1.58 | 1.67 | 1.61 | 1.64 | 1.69 | 1.61 | 1.74 | 1.69 | 1.70 | 1.69 | 1.67 | 1.67 | 1.65 | 1.67 | 1.65 | 1.69 | 1.69 |
| 1.76 | 1.66 | 1.78 | 1.74 | 1.76 | 1.78 | 1.75 | 1.76 | 1.80 | 1.77 | 1.75 | 1.73 | 1.78 | 1.74 | 1.78 | 1.76 | 1.78 | 1.76 |
| 1.08 | 1.10 | 1.10 | 1.09 | 1.11 | 1.09 | 1.11 | 1.08 | 1.11 | 1.10 | 1.08 | 1.09 | 1.10 | 1.10 | 1.10 | 1.08 | 1.08 | 1.11 |
| 2.23 | 2.21 | 2.24 | 2.14 | 2.24 | 2.24 | 2.24 | 2.21 | 2.22 | 2.24 | 2.23 | 2.16 | 2.24 | 2.23 | 2.24 | 2.23 | 2.16 | 2.26 |
| 2.32 | 2.19 | 2.31 | 2.20 | 2.31 | 2.33 | 2.26 | 2.37 | 2.32 | 2.33 | 2.31 | 2.31 | 2.31 | 2.20 | 2.31 | 2.30 | 2.32 | 2.26 |
| 2.08 | 1.98 | 2.08 | 1.98 | 2.07 | 2.09 | 2.04 | 2.17 | 2.10 | 2.11 | 2.09 | 2.09 | 2.08 | 2.01 | 2.08 | 2.06 | 2.10 | 2.07 |
| 1.69 | 1.63 | 1.67 | 1.56 | 1.64 | 1.68 | 1.65 | 1.73 | 1.75 | 1.71 | 1.71 | 1.68 | 1.67 | 1.60 | 1.67 | 1.68 | 1.71 | 1.72 |
| 3.63 | 3.50 | 3.65 | 3.48 | 3.60 | 3.65 | 3.58 | 3.68 | 3.62 | 3.66 | 3.65 | 3.58 | 3.65 | 3.53 | 3.65 | 3.58 | 3.52 | 3.58 |
| 1.69 | 1.70 | 1.68 | 1.67 | 1.71 | 1.70 | 1.68 | 1.65 | 1.72 | 1.72 | 1.67 | 1.67 | 1.68 | 1.69 | 1.68 | 1.66 | 1.53 | 1.67 |
| 1.95 | 1.95 | 1.94 | 1.83 | 1.98 | 1.99 | 2.00 | 1.98 | 2.04 | 1.99 | 1.96 | 1.86 | 1.94 | 1.95 | 1.94 | 1.98 | 1.96 | 2.00 |
| 1.70 | 1.66 | 1.70 | 1.60 | 1.70 | 1.69 | 1.69 | 1.66 | 1.62 | 1.69 | 1.69 | 1.61 | 1.70 | 1.66 | 1.70 | 1.62 | 1.52 | 1.64 |
| 3.13 | 3.13 | 3.13 | 3.10 | 3.14 | 3.15 | 3.16 | 3.08 | 3.11 | 3.15 | 3.13 | 3.06 | 3.13 | 3.14 | 3.13 | 3.03 | 2.86 | 3.09 |

Table 6: Standard errors for average scale scores by country (contd.)

|           | Average                                  | (se)   | JOR  | IDN  | TUN  | IRN  | BHR  | CHL  | EGY  | PSE  | MAR  | PHL  | BWA  | SAU   | GHA  | ZAF  |
|-----------|--|--------|------|------|------|------|------|------|------|------|------|------|------|-------|------|------|
| Countries | <i>(Number of score points included)</i> |        |      |      |      |      |      |      |      |      |      |      |      |       |      |      |
|           |  |        | 152  | 209  | 162  | 203  | 199  | 192  | 164  | 207  | 198  | 192  | 184  | 213   | 151  | 128  |
| SGP       | 620.64                                   | (3.47) | 3.73 | 3.49 | 3.45 | 3.49 | 3.48 | 3.42 | 3.43 | 3.46 | 3.47 | 3.51 | 3.49 | 3.47  | 3.49 | 3.27 |
| KOR       | 603.91                                   | (1.71) | 1.79 | 1.70 | 1.75 | 1.74 | 1.70 | 1.63 | 1.74 | 1.72 | 1.72 | 1.72 | 1.69 | 1.71  | 1.68 | 1.68 |
| HKG       | 603.70                                   | (3.16) | 3.31 | 3.15 | 3.20 | 3.19 | 3.14 | 3.02 | 3.10 | 3.16 | 3.15 | 3.16 | 3.07 | 3.16  | 3.03 | 2.96 |
| TWN       | 597.78                                   | (4.07) | 4.34 | 4.05 | 4.17 | 4.11 | 4.02 | 3.83 | 4.10 | 4.08 | 4.09 | 4.17 | 3.95 | 4.07  | 4.00 | 4.04 |
| JPN       | 589.22                                   | (1.95) | 2.07 | 1.94 | 2.02 | 2.01 | 1.96 | 2.00 | 1.85 | 1.96 | 1.97 | 1.95 | 1.96 | 1.95  | 1.82 | 1.92 |
| BFL       | 561.79                                   | (2.54) | 2.74 | 2.53 | 2.60 | 2.59 | 2.53 | 2.46 | 2.56 | 2.51 | 2.52 | 2.57 | 2.54 | 2.54  | 2.49 | 2.48 |
| NLD       | 559.63                                   | (3.78) | 4.13 | 3.77 | 3.69 | 3.83 | 3.81 | 3.83 | 3.60 | 3.76 | 3.77 | 3.75 | 3.85 | 3.78  | 3.68 | 3.60 |
| HUN       | 556.00                                   | (3.1)  | 3.24 | 3.10 | 3.15 | 3.12 | 3.14 | 3.12 | 3.12 | 3.11 | 3.13 | 3.17 | 3.07 | 3.10  | 3.14 | 3.15 |
| EST       | 554.59                                   | (2.94) | 2.98 | 2.94 | 3.05 | 2.99 | 2.90 | 2.95 | 2.92 | 2.94 | 2.94 | 2.88 | 2.94 | 2.94  | 2.89 | 2.90 |
| RUS       | 536.47                                   | (3.28) | 3.46 | 3.27 | 3.44 | 3.39 | 3.24 | 3.24 | 3.43 | 3.3  | 3.36 | 3.31 | 3.14 | 3.28  | 3.39 | 3.58 |
| LVA       | 533.34                                   | (3)    | 3.05 | 3.02 | 2.98 | 3.04 | 2.93 | 2.87 | 2.98 | 3.00 | 2.96 | 2.94 | 2.88 | 3.00  | 2.98 | 2.97 |
| AUS       | 531.55                                   | (4.27) | 4.46 | 4.28 | 4.26 | 4.29 | 4.25 | 4.24 | 4.40 | 4.26 | 4.24 | 4.40 | 4.18 | 4.27  | 4.07 | 4.27 |
| SVK       | 530.16                                   | (3.23) | 3.35 | 3.24 | 3.33 | 3.24 | 3.26 | 3.15 | 3.39 | 3.25 | 3.28 | 3.35 | 3.21 | 3.23  | 3.25 | 3.35 |
| USA       | 529.30                                   | (3.06) | 3.08 | 3.06 | 3.02 | 3.07 | 3.04 | 3.01 | 3.04 | 3.05 | 3.05 | 3.08 | 3.02 | 3.06  | 3.02 | 2.99 |
| MYS       | 529.20                                   | (3.9)  | 4.05 | 3.87 | 4.02 | 3.99 | 3.88 | 3.82 | 4.03 | 3.89 | 3.89 | 3.96 | 3.79 | 3.90  | 3.88 | 4.06 |
| SWE       | 527.30                                   | (2.48) | 2.62 | 2.47 | 2.47 | 2.52 | 2.49 | 2.56 | 2.27 | 2.48 | 2.48 | 2.39 | 2.57 | 2.48  | 2.37 | 2.25 |
| LTU       | 526.21                                   | (2.37) | 2.48 | 2.38 | 2.49 | 2.43 | 2.41 | 2.36 | 2.41 | 2.39 | 2.40 | 2.46 | 2.39 | 2.37  | 2.46 | 2.53 |
| SCO       | 524.97                                   | (3.61) | 3.82 | 3.61 | 3.63 | 3.70 | 3.62 | 3.60 | 3.52 | 3.60 | 3.61 | 3.63 | 3.60 | 3.61  | 3.44 | 3.57 |
| ENG       | 524.52                                   | (4.42) | 4.58 | 4.42 | 4.44 | 4.46 | 4.44 | 4.33 | 4.22 | 4.42 | 4.40 | 4.38 | 4.38 | 4.42  | 4.27 | 4.15 |
| ISR       | 522.16                                   | (3.09) | 3.21 | 3.07 | 3.01 | 3.04 | 3.08 | 3.05 | 3.08 | 3.09 | 3.10 | 3.10 | 3.07 | 3.09  | 3.06 | 2.86 |
| NZL       | 518.89                                   | (4.98) | 5.04 | 4.95 | 5.09 | 5.06 | 5.02 | 4.93 | 4.90 | 4.98 | 4.99 | 5.03 | 4.96 | 4.98  | 4.86 | 4.98 |
| SVN       | 513.27                                   | (2.19) | 2.34 | 2.18 | 2.21 | 2.21 | 2.24 | 2.26 | 2.26 | 2.20 | 2.23 | 2.22 | 2.15 | 2.19  | 2.17 | 2.22 |
| ITA       | 511.77                                   | (2.89) | 2.95 | 2.88 | 2.92 | 2.90 | 2.92 | 2.82 | 2.94 | 2.91 | 2.94 | 2.95 | 2.79 | 2.89  | 2.91 | 3.04 |
| ROM       | 502.99                                   | (4.39) | 4.47 | 4.37 | 4.35 | 4.39 | 4.33 | 4.28 | 4.50 | 4.40 | 4.39 | 4.53 | 4.32 | 4.39  | 4.27 | 4.37 |
| SCG       | 502.80                                   | (2.31) | 2.36 | 2.30 | 2.41 | 2.32 | 2.32 | 2.26 | 2.37 | 2.33 | 2.35 | 2.38 | 2.28 | 2.31  | 2.36 | 2.43 |
| BGR       | 500.68                                   | (3.61) | 3.70 | 3.59 | 3.72 | 3.65 | 3.63 | 3.53 | 3.64 | 3.64 | 3.65 | 3.72 | 3.61 | 3.61  | 3.69 | 3.56 |
| ARM       | 498.30                                   | (2.66) | 2.68 | 2.65 | 2.72 | 2.69 | 2.64 | 2.71 | 2.72 | 2.66 | 2.65 | 2.70 | 2.63 | 2.66  | 2.78 | 2.81 |
| NOR       | 488.44                                   | (2.35) | 2.29 | 2.35 | 2.31 | 2.31 | 2.39 | 2.47 | 2.16 | 2.34 | 2.35 | 2.20 | 2.37 | 2.35  | 2.30 | 2.16 |
| MDA       | 487.75                                   | (3.39) | 3.47 | 3.37 | 3.45 | 3.44 | 3.39 | 3.20 | 3.51 | 3.39 | 3.40 | 3.52 | 3.32 | 3.39  | 3.40 | 3.45 |
| CYP       | 487.38                                   | (1.41) | 1.38 | 1.39 | 1.42 | 1.40 | 1.44 | 1.47 | 1.37 | 1.43 | 1.45 | 1.41 | 1.44 | 1.41  | 1.43 | 1.43 |
| MKD       | 469.90                                   | (2.86) | 2.79 | 2.87 | 2.80 | 2.83 | 2.86 | 2.74 | 2.73 | 2.86 | 2.86 | 2.72 | 2.80 | 2.86  | 2.82 | 2.70 |
| LBN       | 463.08                                   | (2.75) | 2.57 | 2.75 | 2.80 | 2.73 | 2.74 | 2.79 | 2.77 | 2.75 | 2.75 | 2.68 | 2.78 | 2.75  | 2.79 | 2.83 |
| JOR       | 458.34                                   | (3.17) | 3.14 | 3.16 | 3.01 | 3.16 | 3.12 | 2.99 | 3.23 | 3.18 | 3.11 | 3.25 | 3.10 | 3.17  | 2.99 | 3.12 |
| IDN       | 453.15                                   | (3.2)  | 2.98 | 3.17 | 3.06 | 3.16 | 3.13 | 3.06 | 3.22 | 3.20 | 3.14 | 3.18 | 3.12 | 3.20  | 3.08 | 3.01 |
| TUN       | 447.63                                   | (1.69) | 1.67 | 1.67 | 1.68 | 1.65 | 1.68 | 1.65 | 1.78 | 1.69 | 1.68 | 1.78 | 1.66 | 1.69  | 1.67 | 1.69 |
| IRN       | 447.12                                   | (1.78) | 1.73 | 1.78 | 1.75 | 1.77 | 1.74 | 1.65 | 1.83 | 1.77 | 1.73 | 1.77 | 1.71 | 1.78  | 1.69 | 1.69 |
| BHR       | 443.47                                   | (1.09) | 1.12 | 1.10 | 1.09 | 1.09 | 1.07 | 1.08 | 1.08 | 1.09 | 1.06 | 1.07 | 1.09 | 1.09  | 1.10 | 1.18 |
| CHL       | 442.88                                   | (2.24) | 2.12 | 2.24 | 2.22 | 2.21 | 2.22 | 2.24 | 2.20 | 2.24 | 2.24 | 2.17 | 2.20 | 2.24  | 2.17 | 2.08 |
| EGY       | 442.16                                   | (2.33) | 2.29 | 2.31 | 2.23 | 2.32 | 2.28 | 2.19 | 2.41 | 2.33 | 2.29 | 2.36 | 2.29 | 2.33  | 2.21 | 2.16 |
| PSE       | 433.18                                   | (2.09) | 2.07 | 2.08 | 2.02 | 2.07 | 2.10 | 1.98 | 2.16 | 2.11 | 2.12 | 2.18 | 2.04 | 2.09  | 2.05 | 2.07 |
| MAR       | 431.96                                   | (1.68) | 1.74 | 1.67 | 1.83 | 1.69 | 1.73 | 1.66 | 1.67 | 1.70 | 1.77 | 1.67 | 1.61 | 1.68  | 1.68 | 1.75 |
| PHL       | 427.99                                   | (3.65) | 3.52 | 3.65 | 3.47 | 3.58 | 3.65 | 3.43 | 3.69 | 3.66 | 3.64 | 3.67 | 3.61 | 3.65  | 3.46 | 3.47 |
| BWA       | 421.85                                   | (1.7)  | 1.60 | 1.68 | 1.60 | 1.63 | 1.68 | 1.62 | 1.65 | 1.72 | 1.71 | 1.66 | 1.73 | 1.700 | 1.58 | 1.50 |
| SAU       | 399.18                                   | (1.99) | 1.74 | 1.94 | 1.90 | 1.96 | 1.98 | 1.86 | 2.02 | 1.99 | 1.92 | 2.01 | 1.92 | 1.99  | 1.95 | 2.02 |
| GHA       | 386.85                                   | (1.69) | 1.44 | 1.70 | 1.50 | 1.63 | 1.67 | 1.68 | 1.66 | 1.68 | 1.66 | 1.63 | 1.61 | 1.69  | 1.62 | 1.41 |
| ZAF       | 382.71                                   | (3.15) | 2.80 | 3.13 | 2.98 | 3.05 | 3.11 | 3.12 | 3.03 | 3.14 | 3.12 | 3.04 | 3.11 | 3.15  | 2.98 | 2.76 |



illustrate the mean country score when all items were included regardless of whether or not the country covered the item. The grey circles indicate the position of the mean country score when we removed those items not covered in a country during scaling. The confidence intervals show if the differences were significant or not. As in most countries, the mean country scores based on covered and not-covered items were about the same; the black rectangles in the scatter plot are often not visible.

Figure 5: Differences between score based on all items and score based on covered items

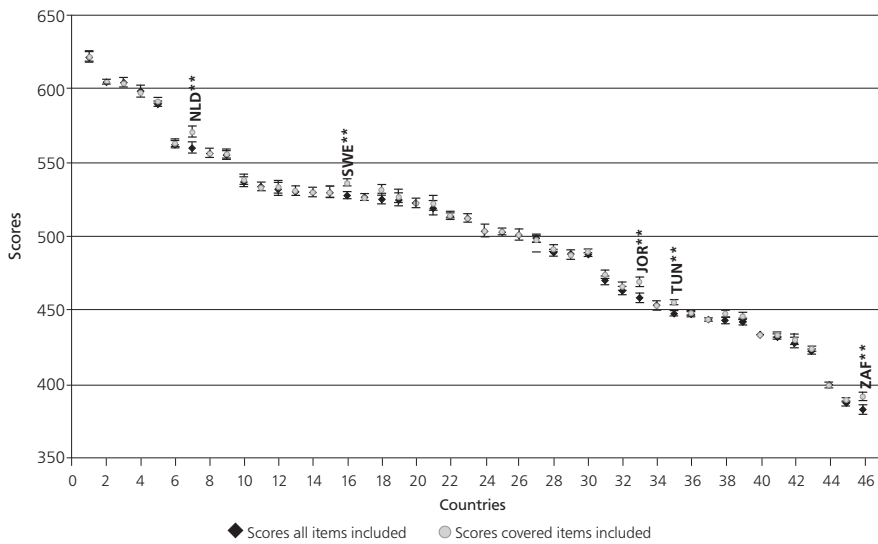


Figure 5 clearly shows that, for the great majority of the countries, no significant differences existed between mean country scores based on all items included and those based on covered items only. However, the mean country score was significantly higher in a few countries—Jordan, the Netherlands, South Africa, Sweden, and Tunisia— when not-covered items were removed before scaling. Each of these countries is highlighted in the figure via the appropriate country abbreviation and \*\* above its score. The largest differences evident in the figure are those for the Netherlands and Jordan, with both gaining 11 score points. Sweden and South Africa gained about nine score points, and Tunisia would have increased its score points by about eight if its covered items had been considered in the scaling. However, because we used EAP scores, the standard errors generated from this analysis were generally underestimated.

**Influence on Rank Positions**

We also considered the effect of curriculum coverage on country rankings. As was the case for most other countries, no rank changes were noted for Jordan and South Africa when not-covered items were removed from the scaling. The Netherlands would have increased its relative rank position by one position, and thereby exchanged its rank

position with Belgium Flemish, if its not-covered items had been removed. However, the difference between the score from the Netherlands and the score from Belgium Flemish was not statistically significant. Tunisia also would have increased its position by one, and thereby exchanged rank position with Indonesia. Again, the difference between the scores was not significant. The largest increase was that for Sweden, where we would have observed a rank increase of six positions from 16 to 10 if its not-covered items had been removed. However, if we look at the countries included on rank positions 10 to 16 and then look at their scores based on Sweden's curriculum, we can see that the differences between the scores of these countries are very small and not significant.

## DISCUSSION AND CONCLUSION

During the study described in this article, we used TIMSS 2003 Grade 8 mathematics data to examine the effect of curriculum coverage on scale scores. We also conducted an exploratory analysis to gain a better understanding of the types of items that given countries reported as not covered in their respective intended curriculums. We used an IRT scaling approach to understand the effect of curriculum coverage on scale scores and simple descriptive statistics for the exploratory analysis.

Our exploratory analysis uncovered a number of interesting findings. In terms of constructed-response versus multiple-choice items, we found a majority of the participating countries reported full coverage of constructed-response items but not of multiple-choice items. We also found that, for 13 countries, performance on the not-covered items compared to performance on the covered items was significantly worse than we had expected. Our expectation here was reasonable, because we would expect that students would be more likely to correctly answer covered items than not-covered items. However, our results also showed that, in 10 countries, students did significantly better than we had expected on not-covered items than on covered items. Interestingly, these countries were distributed throughout the achievement range and did not seem to exhibit any immediately obvious patterns.

When we considered items by content domain, the data domain had, on average, the highest rates of not-covered items. In fact, for 17 countries, 25% or more of the data items were not covered by their curriculums. Nonetheless, 15 countries reported that all data items were covered by their curriculum. It is interesting to note that while many of the countries reporting full coverage in the data domain were Eastern European (Armenia, Estonia, Hungary, Latvia, Lithuania, Moldova, and Romania), a number of geographically similar countries reported high rates of non-coverage (Bulgaria, Macedonia, Russia, Slovakia, and Slovenia). Finally, Ghana, Jordan, and South Africa consistently reported low rates of curriculum coverage across all content domains, which is in line with low rates of general coverage. Across the three cognitive domains assessed in the TIMSS 2003 mathematics items, we found a wide distribution of curriculum coverage. In general, the low rates of curriculum coverage in the cognitive

domains were consistent with the rates of coverage overall.

The findings from our analysis of the effect of item–curriculum coverage on scale scores for TIMSS 2003 suggested that scale scores for all items correlated very highly with curriculum-covered items for each country assessed. The same was true for correlations between the item parameters when those items were scaled with all items and only those items covered in a country.

The results of the differences in the mean scores and the countries' rank positions accord with Beaton's (1998) findings and the findings of the TCMA reported in the *TIMSS 2003 International Mathematics Report* (Mullis et al., 2004). Our results indicate that even if countries had selected the items covered in their intended curriculums, we would have found no statistically significant effects across the countries' international standings. Although there were small increases in some of the countries' performances on their own subsets of items, this situation did not substantially affect the overall picture. Similar to the findings of the TCMA (Mullis et al., 2004), countries with high or low performance on the full set of mathematics items exhibited relatively high or low performance regardless of the set of items used for comparison. Given that the TIMSS 2003 research consortium conducted an extensive process during test development to ensure that the study's assessment was as fair as possible, our results are not unexpected and support earlier findings. Because the majority of countries indicated that they covered most items in their intended curriculums, the calculated scale scores were based on a highly similar set of items.

### **Implications and Areas for Further Research**

Our findings suggest that a high degree of confidence can be placed in the estimated scale scores for all countries assessed during TIMSS 2003 regardless of item selection. Our results also should help validate earlier findings regarding assessment performance and departures from test–curriculum alignment.

Further studies designed to investigate the effect of curriculum coverage on science scores or conducted with the Grade 4 sample may be useful for validating the current findings. Additionally, scaling items reported as not covered may provide valuable information regarding the characteristics of items not covered by a particular country's curriculum.

### **References**

- Beaton, A. (1998). Comparing cross-national student performance on TIMSS using different test items. *International Journal of Educational Research*, 29(6), 529–542.
- Beaton, A., & Gonzalez, E. (1997). Reporting achievement in mathematics and science content areas. In M. Martin & D. Kelly (Eds.), *Third International Mathematics and Science Study technical report: Vol. II. Implementation and analysis* (pp. 175–185). Chestnut Hill, MA: Center for the Study of Testing, Evaluation, and Educational Policy, Boston College.
- Martin, M. (2005). *TIMSS 2003 user guide for the international database*. Chestnut

Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Martin, M., Mullis, I., & Chrostowski, S. (2004). *TIMSS 2003 technical report*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Mullis, I., Martin, M., & Foy, P. (2005). *IEA's TIMSS 2003 report on achievement in the mathematics cognitive domains*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Mullis, I., Martin, M., Gonzalez, E., & Chrostowski, S. (2004). *TIMSS 2003 international mathematics report*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Mullis, I., Martin, M., Smith, T., Garden, R., Gregory, K., Gonzalez, E., Chrostowski, S., & O'Connor, K. (2003). *TIMSS assessment frameworks and specification 2003* (2nd ed.). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.