Changing Populations in TIMSS Cycles – An Alternative Approach to Reporting Trends

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Abstract

The IEA Trends in Mathematics and Science Studies (TIMSS) have taken place every four years beginning in 1995. Currently, data is available from 1995, 1999, 2004, and 2007. One of the intentions of TIMSS is to investigate the development over time of mathematics and science achievement in the participating countries. In the international reports, the mean achievement of countries is compared between cycles. The data allows this kind of comparison because it is based on representative samples. A critical point, however, is that these direct comparisons neglect changes in the targeted populations between the cycles. For example, the total and type of enrolment of students in the education systems changed in several countries to a considerable extent from one cycle to the next. One reason for these changes is often the goal to provide "education for all", in keeping with commitments to the respective demand formulated by UNESCO (2009). Consequently, more children now enter the education systems in these countries, many from population groups that were not enrolled in school in the past. Usually, these students come from disadvantaged backgrounds. For these education systems, no change in observed mean achievement among students between two cycles, or even a small drop, might in fact point to an increase in mean achievement of the total age cohort.

This paper reviews trend results from TIMSS, examining changes in the populations of specific participating education systems. Alternative reporting strategies are suggested that consider such changes.

Key words: TIMSS, trends, changes in populations, percentages of students in school systems

Introduction

The IEA Trends in Mathematics and Science Studies (TIMSS) bases its results – including trend results – on representative samples of students from the participating countries. In TIMSS 1995, 1999, 2003 and 2007 eighth-grade students were targeted; in TIMSS 1995, 2003 and 2007 fourth-grade and students were tested also. In terms of these studies' scope "…all students in the grade that represents four [or, alternatively, eight] years of formal schooling [were] enrolled, counting from the first year of ISCED Level 1…" (Olson et al., 2008). Consequently, all children that were not enrolled in the school system were beyond the scope of the study and their achievement was not observed. This approach is appropriate when comparing the outcome of education systems. It does not account, however, for changes in the composition of the school enrolment within education systems. Although TIMSS monitors many structural features, such as the years of formal schooling, average ages of students, percentages of excluded students, and participation rates as indicators for the quality of the samples (Martin et al., 2008), to assure fair comparisons changes in the composition of the population are not considered in the comparisons. However, the enrolment rates and the composition of the students enrolled in the school system changed in some countries quite significantly within four years. This paper focuses on the school enrolment rates. For example, the TIMSS score for science achievement of eighth-grade students in Egypt decreased significantly from 421 in 2003 to 408 in 2007 (Martin et al., 2008). On the other hand, the percentage of students enrolled in eighth grade in Egypt increased from 78% to 83% between these two cycles (see http://stats.uis.unesco.org). On the basis of these figures, did the Egyptian education system perform better in 2003 or in 2007? Or to put it another way, is it fair to say that the education system performed worse in 2007 than in 2003 because the average TIMSS science achievement score decreased?

The first aim of this paper is to make researchers and policymakers aware of this perspective by tabulating the achievement trends together with enrolment figures.

Following this, an adjustment of the mean achievement will be presented.

The UNSECO ‘education for all’ (EFA) initiative (UNESCO, 2009) has created awareness in many countries about including students from disadvantaged backgrounds in the education system. Students from disadvantaged backgrounds perform lower in all countries that participated in TIMSS (see chapter 4 in Mullis et al., 1998). This general correlation between achievement and family background is also described in other research papers – for example Prenzel et al. (2004) or White (1982).

The simplest model is to assume that all additional students belong in the lowest-performing category. Consequently, a model comparable to the one introduced by Mullis et al. (1998) can be applied. Mullis at al. calculated the average mathematics achievement of the top 25 percent of advanced mathematics students and the average physics achievement of the top five percent and top 10 percent of the advanced physics students adjusted for an index called TIMSS Coverage Index, which specified the percentage of the students in the final year of secondary school covered in the sample. For details of this method, please refer to Martin and Kelly (1998). Following a similar approach, we calculated the average achievement of the top 70 percent of students adjusted for the percentage of the population of children that were not in the school system. Then these averages are compared for each country between the cycles.

Applying this method to the above example of Egypt, where the enrolment rates were 78% in 2003 and 83% in 2007, the top 70 percent populations compared were as follows. For 2003 we get a value of (1-70/78)*100=10.3 and for 2007 (1-70/83)*100=15.7. This means that following the TIMSS model we compare the average achievement of the students who performed above the 10.3 percentile in 2003 in Egypt with the average achievement of the students who performed above the 15.7 percentile in 2007 in Egypt.

The main aim of this approach is to evaluate trends within countries and not to introduce a new comparison across countries.

The underlying assumption of this approach is that students who are newly introduced to the system will tend to be the poorest performers. This is probably not always true. It can be assumed however that newly introduced students, from a disadvantaged learning background, will have an achievement distribution that is below the distribution of the student cohort that was already part of the education system in an earlier cycle of the assessment.

Methodology

This paper is based on the approach used in the TIMSS 1995 final year of secondary school report (Mullis et. al., 1998). The challenge in TIMSS 1995 was that the international definition of students specialists in mathematics or physics led to fractions of the total student population that varied significantly between countries. For example, the percentage of physics specialists in the population ranged from 3.2% in the Russian Federation to 43.9% in Slovenia. To get meaningful comparisons, the approach used in the international report was to compare the mean achievement of the students who performed above the 75th percentile in each country (see table 1.2 in Mullis et al., 1998). The 75th percentile was adjusted based on the TIMSS coverage index. If, for example, only 63.1% of the population is covered in a sample (as was the case for the USA in that study), the 75th percentile became (1-25/63.1)*100=60.4. Thus, in the case of the USA, the average of the top 25% in the population was calculated as the mean of the students in the sample who performed above the 60.4th percentile. For details, please refer to chapter 8.4 in Martin and Kelly (1998).

But also when we look at trends in the TIMSS surveys, there are changes in the population. One of the changes is the difference in the percentage of students who are enrolled in school. Although the trends reported in the international report reflect the performance difference of the students in school, another perspective on the trends in the school system is to include also the changes in school enrolment when comparing achievement differences between cycles. As discussed above, this perspective benefits countries that follow the ‘education for all’ initiative – countries that otherwise fare badly when comparing only the non-adjusted country means.

The first step was to collect the information about the percentage of students who are enrolled in school in the different cycles of TIMSS. The data for student enrolment was found in the Social Indicators of Development publication from the World Bank and the UNESCO website. It was difficult to find comparable data regarding school enrolment for the TIMSS cycles of 1995 and 1999. Consequently, this paper focuses on the most recent TIMSS cycles of 2003 and 2007. Moreover, to limit its scope, this paper focuses on the data for eighth grade. Interestingly, some countries showed huge differences of school enrolment between cycles. The school enrolment varied between 31% in Morocco in TIMSS 2003 for Grade 8 and 100% in Scotland in TIMSS 2007. Most countries achieved an enrolment rate of over 70% in both cycles. The detailed results are presented and discussed in the next chapter.

For the further analysis, the focus was on countries where enrolment data for both cycles was available and changes of the school enrolment were found. England and Japan were dropped from the further analysis because there was no change in school enrolment. Countries that were dropped because no enrolment data was available for at least one of the cycles were Iran, Latvia, Lebanon, New Zealand, Oman, Russian Federation, Serbia, Singapore, Slovak Republic and Tunisia. To produce meaningful comparisons it was necessary to reduce the percentage of students that would be eliminated from the analysis due to the adjustment procedure described above. When we compare only the achievement of the students above the adjusted 90th percentile, this comparison is highly influenced by the achievement distribution of the students enrolled in the schools. This is not the intention of this paper. But since only countries could be included that have an out of school rate lower than the percentile chosen to have all student data available, the percentile must be set high. It was decided to compare the adjusted top 70 percent of the students or in other words the achievement of students who perform above the 30th percentile since most of the countries who participated in both TIMSS cycles met this threshold. Botswana, Ghana, Indonesia, Malaysia, Morocco, Saudi Arabia, Syria and Yemen were excluded because their enrolment rate was below the 70 percent cut-off point. The result was that 21 countries could be used in the further analysis.

For these 21 countries, the percentile that was calculated is comparable to the 70th percentile for both cycles when considering the in-school population. The percentiles corresponding to these percentages were then calculated. The results of these calculations can be found in Table 1 of the Appendix. The IEA IDB Analyzer was used to calculate the mean achievement of students above these percentiles for each country and each cycle. The results of these calculations are presented below and contrasted to the trends found in the international TIMSS 2007 reports (Mullis et. al. 2008 and Martin et.al. 2008).

Findings and Discussion

The first important findings of this paper are the differences in the percentage of students that are enrolled in the school systems in the different countries. Table 1 shows the percentage of students that are enrolled at secondary schools for each country that participated in at least one of the surveys – TIMSS 2003 or TIMSS 2007. Countries that did not participate in a cycle are marked by "NA". Countries for which no data is available are marked by 'missing'. For all countries that participated in both surveys, the mathematics and science achievement results as well as the differences in mathematics and science achievement between the two cycles are listed. All statistically significant changes are marked in yellow.

[Insert Table 1 about here]

As can be seen in Table 1, the percentages of students enrolled in the school system vary considerably, and in nearly all countries the percentages vary between the two cycles. In most countries, the percentage of students in the school system increased between 2003 and 2007. A decline was observed in only a few countries – namely in Australia, Jordan, The Netherlands, and Slovenia. In some countries, the percentage increased dramatically. There was an increase of 24 percent in Syria, of 14 percent in the Palestinian Authority, and of 10 percent in Indonesia. There were increases of between five and ten percent in Bahrain, Botswana, Cyprus, Egypt, Ghana, Hong Kong, Saudi Arabia, and Scotland. Such increases are, of course, very positive for the country but also create a challenge for the education system. Providing education to a significant increased number of students – sometimes with disadvantaged backgrounds or from remote areas – without compromising quality creates challenges in terms of school resources, number of teachers and others.

When comparing the achievement results of the countries between cycles, one should always interpret the results with the changes in mind. The Palestinian Authority, for example, showed a decline in mathematics and science achievement between 2003 and 2007. On the other hand, its school system was able to cope with about 25,000 more students (enrolment in 2003: 69,000; in 2007: 94,000). In addition to the other problems that this area faces at the moment, this creates an enormous additional challenge to the school system. From this perspective, can a decline from 31 to 23 score points be regarded as a failure of the system?

Table 2 compares the mathematics achievement trends in TIMSS 2003 and TIMSS 2007 based on the international report, with the trends for the top 70 percent of the population adjusted, as described in the methodology chapter above, to consider the percentages of students in schools. Columns 4–9 show the international trend results with the significant changes indicated in Column 10. Columns 11–16 show the adjusted means for TIMSS 2003 and 2007, their standard errors and the differences from the standard error. The significant changes are indicated in the final Column 17.

[Insert Table 2 about here]

It can be seen that the trends change significantly in several countries. Due to the reduced percentage of students in the schools, the decline in Australia became statistically significant. The increase of nine percent of the students in schools in Bahrain resulted in a reversed trend; instead of a statistically non-significant decline, the mathematics achievement of Bahrain increased significantly by more than 8 score points. In the case of Cyprus, the mathematics achievement gain between the two cycles increased from about six score points to more than 17. The declines of mathematics achievement for Egypt and Hong Kong became non-significant. For Korea, the increase in mathematics achievement is nearly twice as high as listed in the international report. The achievement increase in Lithuania became 7.5 score points and consequently statistically significant. The decline in Palestine and Scotland became statistically non-significant.

The trends in science achievement are very similar to those for mathematics achievement. Table 3 shows the trends as reported in the international TIMSS 2007 report and the trends based on the data adjusted for the in-school population.

[Insert Table 3 about here]

As can be seen in the Table 3, the increase in Bahrain grows from about 29 score points (in the international report) to more than 43 score points when adjusted for the nine-percent increase in the percentage of students who were enrolled in school. The decreases in science achievement observed for Chinese Taipei, Hong Kong, Korea, Norway, and Palestine all became statistically non-significant. The decreases in science achievement for other countries with increased percentages of students enrolled in schools were also reduced by 4–11 score points. For Slovenia the increase diminished when taking into account the five-percent decrease in school enrolment.

Conclusion and Implications

This paper illustrates that it is important to include information about changes in populations when evaluating and interpreting trends. Several countries reported the positive development of a higher percentage of students enrolled in the school system. However, sometimes this development is related to a decrease in mean achievement. The international TIMSS 2007 report shows declines in mathematics and science achievement in several countries – and some of these decreases were unexpectedly large. The analysis presented here shows that when considering the increased percentages of students in the education system, the declines are less severe than they were at first glance. Perhaps the education policymakers did a better job than first thought!

Of course future research in this area is highly desirable. By applying better population models and getting more information about the additional students introduced to the school systems we would gain a better understanding of the changes in achievement.

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Appendix

Table 1 of the Appendix shows in Columns 4 and 5 the percentages for each country that correspond to the 30 percentile of the population corrected for the percentage of students in schools for each cycle. These percentages were calculated as follows:

(1-70/n)*100 where n corresponds to the percentage of students enrolled in school, who are listed in Columns 2 and 3. Column 6 presents the percentile for mathematics achievement in 2003 for the percentage listed in Column 4. Columns 7, 8 and 9 present the percentiles for science achievement and for 2007.

[Insert Appendix Table 1 about here]

Table 1: Within School Population in TIMSS 2003 and TIMSS 2007

Secondary schools	% in school		Means and trends and their standard errors											
Country	TIMSS 03	TIMSS 07	T03 MAT	SE	T07 MAT	SE	difference	SE	T03 SCI	SE	T07 SCI	SE	difference	SE
Argentina	81	NA												
Algeria	NA	66												
Armenia	85	86	478	(3.0)	499	(3.5)	21	(4.6)	461	(3.5)	488	(5.8)	27	(6.7)
Australia	88	86	504.8	(4.6)	496.2	(3.9)	-8.57	(6.1)	527	(3.8)	515	(3.7)	-12	(5.3)
Bahrain	81	90	401	(1.7)	398	(1.6)	-3	(2.3)	438	(1.8)	468	(1.7)	29	(2.5)
Botswana	55	61												
Bulgaria	87	89	476	(4.3)	464	(5.0)	-12	(6.6)	479	(5.1)	470	(5.9)	-9	(7.8)
Chile	75	NA												
Chinese Taipei	93	95	585	(4.6)	598	(4.5)	13	(6.4)	571	(3.4)	561	(3.7)	-10	(5.0)
Colombia	NA	65												
Cyprus	88	94	459	(1.7)	466	(1.7)	6	(2.3)	442	(2.0)	452	(2.0)	10	(2.9)
Czech Republic	NA	missing												
Egypt	78	83	406	(3.5)	391	(3.6)	-16	(5.0)	421	(3.9)	408	(3.6)	-13	(5.3)
El Salvador	NA	missing												
England	95	95												
Estonia	92	NA												
Georgia	NA	79												
Germany	NA	missing												
Ghana	30	38												
Hong Kong	72	78	586.1	(3.3)	572.6	(5.8)	-14	(6.6)	556	(3.0)	530	(4.9)	-26	(5.8)
Hungary	87	90	529	(3.2)	517	(3.5)	-12	(4.7)	543	(2.8)	539	(2.9)	-4	(4.0)
Indonesia	47	57												
Iran	missing	77												
Israel	88	89	495.7	(3.4)	463.3	(3.9)	-32	(5.2)	488	(3.1)	468	(4.3)	-20	(5.3)
Italy	88	92	484	(3.2)	480	(3.0)	-4	(4.4)	491	(3.0)	495	(2.8)	4	(4.1)
Japan	100	100												
Jordan	80	79	424	(4.1)	427	(4.1)	2	(5.8)	475	(3.8)	482	(3.9)	7	(5.5)
Kazakhstan	NA	86												
Korea	91	94	589	(2.2)	597	(2.7)	8	(3.5)	558	(1.6)	553	(2.0)	-5	(2.6)
Kuwait	NA	missing												
Latvia	89	missing												
Lebanon		73												
Lithuania	92	94	502	(2.5)	506	(2.3)	4	(3.4)	520	(2.1)	519	(2.5)	-1	(3.3)
Macedonia, Rep. Of	82	NA												
Malaysia	69	72												
Malta	NA	84												
Mongolia	NA	82												
Moldova, Rep. Of	68	NA												
Morocco	31	35												
Netherlands	90	87												
New Zealand	92	NA												
Norway	95	96	461.5	(2.5)	469.3	(2.0)	8	(3.2)	494	(2.2)	487	(2.2)	-7	(3.1)
Oman	missing	missing												
Palestinian Nat'l Auth.	81	95	390.5	(3.1)	367.2	(3.5)	-23	(4.7)	435	(3.2)	404	(3.5)	-31	(4.8)
Phlippines	56	NA												
Quatar	NA	90												
Romania	80	81	475	(4.8)	461	(4.1)	-14	(6.3)	470	(4.9)	462	(3.8)	-8	(6.2)
Russian Federation	missing	missing												
Saudi Arabia	53	60												
Scotland	95	100	497.8	(3.7)	487.5	(3.7)	-10	(5.2)	512	(3.4)	496	(3.4)	-16	(4.8)
Slovak Republic	75	missing												
Slovenia	96	91	493	(2.2)	501.5	(2.1)	9	(3.0)	521	(1.8)	538	(2.2)	17	(2.8)
South Africa	62	NA												
Sweden	96	99	499.1	(2.6)	491.3	(2.3)	-8	(3.5)	524	(2.7)	511	(2.6)	-14	(3.7)
Syrian Arab. Rep.	39	63												
Thailand	NA	71												
Tunisia	68	missing												
Turkey	NA	66												
Ukraine	NA	84												
United States	87	88	504.4	(3.3)	508.5	(2.8)	4.09	(4.4)	527	(3.1)	520	(2.9)	-7.3	(4.2)
Yemen	35	37												

NA: country did not participate, missing: no data available

Table 2: Trends in Mathematics achievement

	% in school		Trends on international mathematics means							Trends on adjusted international math means						
Country	TIMSS 03	TIMSS 07	T03 Mat	SE	T07 MAT	SE	difference	SE		T03 Mat	SE	T07 MAT	SE	difference	SE	
Armenia	85	86	478	(3.0)	499	(3.5)	20.6	(4.6)	↑	503.42	(2.8)	524.70	(3.3)	21.28	(4.3)	↑
Australia	88	86	505	(4.6)	496	(3.9)	-8.6	(6.1)	◊	531.54	(3.7)	520.77	(3.3)	-10.77	(5.0)	↓
Bahrain	81	90	401	(1.7)	398	(1.6)	-3.1	(2.3)	◊	417.05	(2.8)	425.70	(3.3)	8.65	(4.3)	↑
Bulgaria	87	89	476	(4.3)	464	(5.0)	-12.5	(6.6)	◊	503.18	(3.7)	500.12	(3.2)	-3.06	(4.9)	◊
Chinese Taipei	93	95	585	(4.6)	598	(4.5)	13.1	(6.4)	↑	629.12	(2.7)	647.09	(2.4)	17.97	(3.6)	↑
Cyprus	88	94	459	(1.7)	466	(1.7)	6.1	(2.3)	↑	485.31	(2.3)	503.02	(2.0)	17.71	(3.1)	↑
Egypt	78	83	406	(3.5)	391	(3.6)	-15.6	(5.0)	↓	420.03	(3.7)	414.82	(4.2)	-5.21	(5.6)	◊
Hong Kong	72	78	586	(3.3)	573	(5.8)	-13.5	(6.6)	↓	591.89	(2.6)	592.52	(3.7)	0.63	(4.6)	◊
Hungary	87	90	529	(3.2)	517	(3.5)	-12.4	(4.7)	↓	555.71	(2.1)	548.08	(2.5)	-7.63	(3.2)	↓
Israel	88	89	496	(3.4)	463	(3.9)	-32.4	(5.2)	↓	523.66	(2.7)	498.22	(3.1)	-25.44	(4.1)	↓
Italy	88	92	484	(3.2)	480	(3.0)	-4.0	(4.4)	◊	508.56	(2.6)	508.44	(2.3)	-0.12	(3.5)	◊
Jordan	80	79	424	(4.1)	427	(4.1)	2.5	(5.8)	◊	442.52	(3.7)	446.52	(3.5)	4.00	(5.1)	◊
Korea	91	94	589	(2.2)	597	(2.7)	8.2	(3.5)	↑	622.24	(1.5)	637.32	(1.6)	15.08	(2.2)	↑
Lithuania	92	94	502	(2.5)	506	(2.3)	4.2	(3.4)	◊	531.24	(2.2)	538.74	(1.6)	7.50	(2.7)	↑
Norway	95	96	462	(2.5)	469	(2.0)	7.8	(3.2)	↑	490.15	(2.5)	496.99	(1.7)	6.84	(3.0)	↑
Palestinian Nat'l	81	95	391	(3.1)	367	(3.5)	-23.3	(4.7)	↓	409.61	(3.7)	407.02	(4.7)	-2.59	(6.0)	◊
Romania	80	81	475	(4.8)	461	(4.1)	-14.0	(6.3)	↓	495.48	(3.5)	486.07	(3.3)	-9.41	(4.8)	↓
Scotland	95	100	498	(3.7)	487	(3.7)	-10.3	(5.2)	↓	529.27	(3.2)	525.07	(2.8)	-4.20	(4.2)	◊
Slovenia	96	91	493	(2.2)	502	(2.1)	8.5	(3.0)	↑	521.77	(2.3)	527.46	(1.7)	5.69	(2.9)	↑
Sweden	96	99	499	(2.6)	491	(2.3)	-7.7	(3.5)	↓	529.64	(1.9)	522.59	(1.9)	-7.05	(2.7)	↓
United States	87	88	504	(3.3)	508	(2.8)	4.1	(4.4)	◊	530.67	(2.5)	534.69	(2.1)	4.02	(3.2)	◊

Table 3: Trends in Science achievement

	% in school		Trends on international science means							Trends on adjusted international science means						
Country	TIMSS 03	TIMSS 07	T03 SCI	SE	T07 SCI	SE	difference	SE		T03 SCI	SE	T07 SCI	SE	difference	SE	
Armenia	85	86	461	(3.5)	488	(5.8)	26.7	(6.7)	↑	483.63	(3.6)	516.49	(5.7)	32.9	(6.8)	↑
Australia	88	86	527	(3.8)	515	(3.7)	-12.2	(5.3)	↓	552.06	(2.7)	539.63	(3.2)	-12.4	(4.2)	↓
Bahrain	81	90	438	(1.8)	468	(1.7)	29.2	(2.5)	↑	454.63	(2.5)	498.15	(2.5)	43.5	(3.5)	↑
Bulgaria	87	89	479	(5.1)	470	(5.9)	-8.6	(7.8)	◊	510.22	(3.7)	506.03	(4.1)	-4.2	(5.5)	◊
Chinese Taipei	93	95	571	(3.4)	561	(3.7)	-10.1	(5.0)	↓	604.07	(2.3)	599.94	(2.6)	-4.1	(3.5)	◊
Cyprus	88	94	442	(2.0)	452	(2.0)	10.1	(2.9)	↑	466.10	(2.9)	486.07	(3.3)	20.0	(4.4)	↑
Egypt	78	83	421	(3.9)	408	(3.6)	-12.8	(5.3)	↓	438.53	(3.3)	433.33	(3.5)	-5.2	(4.8)	◊
Hong Kong	72	78	556	(3.0)	530	(4.9)	-25.9	(5.8)	↓	561.23	(2.3)	546.94	(3.5)	-14.3	(4.2)	↓
Hungary	87	90	543	(2.8)	539	(2.9)	-3.7	(4.0)	◊	566.95	(2.2)	566.36	(2.3)	-0.6	(3.2)	◊
Israel	88	89	488	(3.1)	468	(4.3)	-20.3	(5.3)	↓	515.28	(2.9)	504.04	(3.3)	-11.2	(4.3)	↓
Italy	88	92	491	(3.0)	495	(2.8)	4.2	(4.1)	◊	515.92	(2.8)	523.58	(3.1)	7.7	(4.2)	◊
Jordan	80	79	475	(3.8)	482	(3.9)	6.9	(5.5)	◊	495.35	(2.7)	501.78	(3.2)	6.4	(4.2)	◊
Korea	91	94	558	(1.6)	553	(2.0)	-5.3	(2.6)	↓	584.40	(1.8)	584.69	(2.2)	0.3	(2.8)	◊
Lithuania	92	94	520	(2.1)	519	(2.5)	-0.9	(3.3)	◊	544.99	(2.5)	550.72	(2.8)	5.7	(3.7)	◊
Norway	95	96	494	(2.2)	487	(2.2)	-7.2	(3.1)	↓	521.63	(2.3)	517.64	(2.4)	-4.0	(3.3)	◊
Palestinian Nat'l /	81	95	435	(3.2)	404	(3.5)	-31.3	(4.8)	↓	456.79	(3.2)	449.67	(4.0)	-7.1	(5.1)	◊
Romania	80	81	470	(4.9)	462	(3.8)	-7.7	(6.2)	◊	489.85	(4.0)	482.96	(3.6)	-6.9	(5.3)	◊
Scotland	95	100	512	(3.4)	496	(3.4)	-15.9	(4.8)	↓	542.66	(2.9)	533.26	(3.3)	-9.4	(4.4)	↓
Slovenia	96	91	521	(1.8)	538	(2.2)	17.0	(2.8)	↑	564.72	(2.4)	564.42	(1.9)	-0.3	(3.1)	◊
Sweden	96	99	524	(2.7)	511	(2.6)	-13.6	(3.7)	↓	555.28	(2.4)	545.97	(2.2)	-9.3	(3.2)	↓
United States	87	88	527	(3.1)	520	(2.9)	-7.3	(4.2)	◊	554.53	(2.4)	548.56	(2.4)	-6.0	(3.4)	◊

Appendix table 1: adjusted percentages and corresponding percentiles

Secondary schools	% in school		adjusted to 70.00		math percentile		science percentile	
Country	TIMSS 03	TIMSS 07	TIMSS 03	TIMSS 07	TIMSS 03	TIMSS 07	TIMSS 03	TIMSS 07
Armenia	85	86	18	19	402	430	386	404
Australia	88	86	20	19	438	428	465	442
Bahrain	81	90	14	22	316	332	354	401
Bulgaria	87	89	20	21	406	385	399	386
Chinese Taipei	93	95	25	26	518	541	521	508
Cyprus	88	94	20	26	393	413	375	400
Egypt	78	83	10	16	290	288	280	303
Hong Kong	72	78	3	10	432	440	412	420
Hungary	87	90	20	22	462	449	481	478
Israel	88	89	20	21	424	385	418	387
Italy	88	92	20	24	417	426	424	442
Jordan	80	79	13	11	323	296	368	356
Korea	91	94	23	26	529	540	507	506
Lithuania	92	94	24	26	446	455	470	470
Norway	95	96	26	27	416	431	452	444
Palestinian Nat'l Auth.	81	95	14	26	291	303	329	330
Romania	80	81	13	14	367	355	364	366
Scotland	95	100	26	30	454	444	466	453
Slovenia	96	91	27	23	450	448	480	485
Sweden	96	99	27	29	458	455	480	469
United States	87	88	20	20	437	447	458	453