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THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY (TIMSS)

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(EMBARGOED FOR RELEASE: 11 A.M. TUESDAY, DEC. 5, 2000)

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PAYING THE PRICE OF “NO CHANGE”

After the 1995 Third International Mathematics and Science Study (TIMSS), there have been vigorous debates about the middle school curriculum in the U.S. but no resulting widespread substantive change. Now the 1999 results are available and we find evidence of “no change, no gain”.

The 1995 TIMSS report found U.S. eighth grade students were above the international average in science but below it in mathematics. Other data revealed that the middle school curriculum in both mathematics and science covered elementary topics such as arithmetic, descriptive biology and earth science to the exclusion of the more advanced topics covered internationally such as algebra, geometry, chemistry and physics.

The 1999 report (dubbed TIMSS-R, for repeat) reveals the same patterns. Considering only the 23 countries that were in both the 1995 TIMSS and 1999 TIMSS-R (meeting the sampling guidelines in both), the 1999 results indicate the U.S. to be below the international average in mathematics but not different from it in science. Even when estimating the missing country means from the 1995 study, these conclusions do not change. So in many ways we still are where we were in 1995.

In terms of the mathematics curriculum, the 1999 results show that 28 percent of U.S. students are in classrooms that mostly emphasize number (arithmetic). This is more than three times the international average for the 23 countries. Also, 83 per cent of U.S. eighth-grade students attended classes whose teachers reported that they taught more than five periods of fractions and other arithmetic topics, which is over one and one-half (1.5) times the international average.

For science a large percentage of U.S. students (28 per cent) attend classes that mostly emphasize earth science (descriptive features of the earth) which is more than twice the international average of the 23 countries participating in both studies. On the other hand, only five percent of U.S. students are in classes whose teachers report that physics or chemistry is the most emphasized topic in their grade eight science class. The average of the 23 countries is almost five times larger. This implies that internationally one-quarter of the students in a

typical country attend a class in which chemistry or physics is the main subject matter for their eighth grade science class.

In 1995 some suggested the hope that the above average performance of U.S. fourth graders might foreshadow improvement as they progressed to eighth grade. The scenario followed the argument that these students had benefited from the reform that had taken place in the early grades and that this would follow them into the middle grades. The above data show the middle school curriculum has changed little. Perhaps related to this, the 1995 cohort of fourth grade students, now as eighth graders in 1999, have similarly fallen in the international rankings. Thus, they resemble the 1995 cohort of eighth graders more than the hoped-for new cohort of high-performing students. This confirms the point made relative to the 1995 results that our students don't start out behind those of other countries but fall behind during the middle school years.

Sometimes in the past, national efforts to address the needed curricular changes have failed. However, new efforts to bring about substantive and widespread change at the national level in mathematics for the middle grades are under way by ACHIEVE – a non-profit organization of governors and CEO's.

One final caution, the set of countries involved in 1999 TIMSS-R is different from those that participated in the original 1995 study. Some 10 new countries are involved but they are, for the most part, lower performing countries (seven out of 10 for both mathematics and science). This makes the interpretation of statements about the international mean perilous if such statements are based only on the 1999 results. Not only are there new countries involved but also 16 of the original TIMSS countries in 1995 did not participate in 1999. This is why we focus on the 23 countries who participated in both studies.

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Comparisons of eighth-grade science achievement, by Nation*: 1995 and 1999

1995 (Rescaled)

Scores Significantly Higher Than the USA's	
Nation	Average
Singapore	580
Czech Republic	555
Japan	554
Korea	546
Bulgaria	545
Netherlands	541
Slovenia	541
Hungary	537

1999

Scores Significantly Higher Than the USA's	
Nation	Average
Singapore	568
Hungary	552
Japan	550
Korea, Republic of	549
Netherlands	545
Australia	540
Czech Republic	539
England	538
Belgium-Flemish	535
Slovak Republic	535
Canada	533
Slovenia	533

Scores Not Significantly Different from the USA's	
Nation	Average
Belgium-Flemish	533
England	533
Slovak Republic	532
Australia	527
Russian Federation	523
International Mean	518
Canada	514
United States	513
New Zealand	511
Hong Kong SAR	510
Italy	497

Scores Not Significantly Different from the USA's	
Nation	Average
Hong Kong SAR	530
Russian Federation	529
International Mean	521
Bulgaria	518
United States	515
New Zealand	510
Latvia-LSS	503
Italy	498

Scores Significantly Lower Than the USA's	
Nation	Average
Latvia-LSS	476
Romania	471
Lithuania	464
Iran, Islamic Rep. of	463
Cyprus	452

Scores Significantly Lower Than the USA's	
Nation	Average
Lithuania	488
Romania	472
Cyprus	460
Iran, Islamic Rep. of	448

*23 Nations participated in TIMSS and TIMSS-R at eighth-grade level that met sampling guidelines in both 1995 and 1999.

SOURCE: Gonzales et al (2000). U.S. Department of Education. National Center for Education Statistics. Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999, NCES 2001-028, Table A3.10. Washington, DC: U.S. Government Printing Office.

Comparisons of eighth-grade mathematics achievement, by Nation*: 1995 and 1999

1995 (Rescaled)

1999

Scores Significantly Higher Than the USA's	
Nation	Average
Singapore	609
Japan	581
Korea, Republic of	581
Hong Kong SAR	569
Belgium-Flemish	550
Czech Republic	546
Slovak Republic	534
Slovenia	531
Netherlands	529
Bulgaria	527
Hungary	527
Russian Federation	524
Canada	521
Australia	519
International Mean	519

Scores Significantly Higher Than the USA's	
Nation	Average
Singapore	604
Korea, Republic of	587
Hong Kong SAR	582
Japan	579
Belgium-Flemish	558
Netherlands	540
Slovak Republic	534
Hungary	532
Canada	531
Slovenia	530
Russian Federation	526
Australia	525
International Mean	521
Czech Republic	520

Scores Not Significantly Different from the USA's	
Nation	Average
New Zealand	501
England	498
United States	492
Italy	491
Latvia-LSS	488
Romania	474

Scores Not Significantly Different from the USA's	
Nation	Average
Bulgaria	511
Latvia-LSS	505
United States	502
England	496
New Zealand	491
Italy	485

Scores Significantly Lower Than the USA's	
Nation	Average
Lithuania	472
Cyprus	468
Iran, Islamic Rep. of	418

Scores Significantly Lower Than the USA's	
Nation	Average
Lithuania	482
Cyprus	476
Romania	472
Iran, Islamic Rep. of	422

*23 Nations participated in TIMSS and TIMSS-R at eighth-grade level that met sampling guidelines in both 1995 and 1999.

SOURCE: Gonzales et al (2000). U.S. Department of Education. National Center for Education Statistics. Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999, NCES 2001-028, Table A3.11. Washington, DC: U.S. Government Printing Office.