Executive Summary

TIMSS 2003 is the third in a continuing cycle of international mathematics and science assessments conducted every four years. TIMSS assesses achievement in countries around the world and collects a rich array of information about the educational contexts for learning mathematics and science, with TIMSS 2003 involving more than 50 participants. This report contains the science results for 46 countries and four benchmarking participants at the eighth grade and for 25 countries and three benchmarking participants at the fourth grade. Trend data are provided at the eighth and fourth grades for those countries that also participated in 1995 and 1999 (please see the Introduction for more information about TIMSS 2003.)

Students' Science Achievement in 2003

- At the eighth grade, Singapore and Chinese Taipei were the top-performing countries having significantly higher average science achievement than the rest of the participating countries. The Republic of Korea also performed very well, with average achievement significantly higher than all of the other participating countries except Singapore, Chinese Taipei, and Hong Kong, SAR.
- At the fourth grade, Singapore was the top-performing country with higher average science achievement than all other participating countries. Chinese Taipei had significantly higher performance

than all countries except Singapore, and, in turn, Japan, Hong Kong SAR, and England outperformed the rest of countries except Singapore and Chinese Taipei.

Trends in Science Achievement

- At the eighth grade, several countries showed significantly higher average science achievement in 2003 compared to the previous assessments in 1995 and 1999. Korea, Hong Kong SAR, the United States, and Lithuania as well as the benchmarking Canadian province of Ontario, showed a pattern of improvement from assessment to assessment with significant change over the 8-year period from 1995 to 2003. Of the countries with results only from the 1999 and 2003 assessments, Malaysia, Israel, Jordan, Moldova, and the Philippines showed significant improvement.
- At the eighth grade, countries showing a decrease in average achievement in 2003 compared to previous assessments (1995, 1999, or both) included Hungary, Sweden, the Slovak Republic, Belgium (Flemish), the Russian Federation, Norway, Bulgaria, Iran, Cyprus, Indonesia, and Tunisia.
- At the fourth grade, many countries showed significant gains in average achievement between 1995 and 2003, including Singapore, Hong Kong SAR, England, Hungary, Latvia (LSS)[1], New Zealand, Slovenia, Cyprus, and Iran, as well as the benchmarking province of Ontario. The only significant declines were found in Japan, Scotland, Norway, and Quebec province.

Gender Differences in Science Achievement

- In the majority of participants at the eighth grade (33 out of 49), boys outperformed girls in science, often by a substantial margin. This was attributable mainly to higher performance by boys in

physics and earth science, although girls had, on average, higher achievement in life science. In eleven countries, including Egypt, Iran, Chinese Taipei, Botswana, South Africa, Lebanon, Singapore, Estonia, Cyprus, the Philippines, and New Zealand, the gender difference was not significant. In a further seven countries – Macedonia, Moldova, Armenia, the Palestinian National Authority, Saudi Arabia, Jordan, and Bahrain – the gender difference favored girls.

- The trend results at the eighth grade show that girls had greater improvement, on average, since 1999 than boys. Fifteen participants showed significant improvements for girls, and just eight for boys. Both girls and boys improved over previous assessments in nine countries and Ontario province. Reflecting declines in achievement across assessments, both genders had lower achievement in TIMSS 2003 in seven countries. In Indonesia, Macedonia, and the Russian Federation, the boys but not the girls had a significant decrease.
- At the fourth grade, the average gender difference in science achievement was negligible, although girls had significantly higher average achievement in Armenia, Moldova, the Philippines, and Iran, and boys had higher average achievement in the United States, Chinese Taipei, Cyprus, the Netherlands, and Scotland.
- The fourth-grade trend results show that average science achievement improved for both boys and girls since 1995. Both boys and girls improved in eight countries and Ontario province; in England only girls improved; and in Japan, Norway, and Quebec, both boys and girls showed a decline. Boys but not girls showed a decline in the Netherlands and the United States.

differences across countries in the percentages of students reaching the various benchmarks.

At the eighth grade, students reaching the **advanced benchmark** demonstrated a grasp of some complex and abstract science concepts. At the other end of the performance continuum, those reaching the **low benchmark** recognized some basic facts from the life and physical sciences.

- The highest performing countries –Singapore and Chinese Taipei – had one-third to one-fourth of their students reaching the advanced

benchmark and all except five countries had at least three-fourths of their students reaching this level. In the Philippines, Tunisia, and Morocco, less than half the students reached the low benchmark.

Students' Home Context for Learning Science

- At the eighth grade, students were asked about the level of their parents' schooling and their own expectations. Higher levels of parents' education were associated with higher student achievement in science in almost all countries. Also, students expecting to finish university had substantially greater average science achievement than those without university expectations.
- At both the eighth and fourth grades, in general, students from homes where the language of the test was always or almost always spoken had higher average science achievement than those who spoke it less frequently.
- At both the eighth and fourth grades, across countries on average, there was a clear-cut relationship between number of books in the home and science achievement.
- Science achievement was positively related to computer usage, particularly at eighth grade, with average achievement highest among students reporting using computers at home and at school. Next highest was achievement among students using computers at home but not school, followed by students using computers at school but not home, and then those using computers at other places or not using them at all. At both grades, the percentages of students report-

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The Science Curriculum

or investigation (64%). At the fourth grade, most students reported that they watch the teacher do a science experiment, and write or give an explanation for something they are studying in science, once or twice a month or more (69% of students for each activity).

- At both eighth and fourth grades, the textbook was often the foundation of science instruction. On average, more than half of students at both grades (56%) had teachers who reported using a textbook as the primary basis for their lessons, and many more as a supplementary resource (39% at eighth grade and 26% at fourth grade).
- On average, the three most common instructional activities in science classes (totaling 57% of class time) were teacher lecture (24% of class time), teacher-guided student practice (19%), and students working on problems on their own (14%).

School Contexts for Learning and Instruction

- At the eighth grade, average science achievement was 51 points higher for students in schools with few students from economically disadvantaged homes than for students attending schools with more than half their students from disadvantaged homes. At fourth grade, the difference was 43 points.
- At both eighth and fourth grades, there was a strong positive relationship between the principals' perception of school climate (based on seven questions about behaviors of teachers, parents, and students) and average science achievement. Asked the same seven questions, teachers had a somewhat more gloomy view of school climate than principals, but the relationship with achievement still was positive.
- Teachers were asked about the safety of their schools' neighborhoods, how safe they felt in their schools, and the sufficiency of security policies and practices. On average, 70 percent of eighth-grade students and 76 percent of fourth-grade students attended school characterized as safe by their teachers. At both grades, there was a positive relationship between school safety and science achievement.