International Education Tests: An Overview, 2005

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International Assessments

Beginning in the 1960s, the United States and some European countries began discussing an effort to compare the performance of students on a common assessment given to a sample of students in each participating country. This report briefly summarizes the results of the more recent, and most widely respected, international assessments of student performance that were the result of the early discussions among nations.

PISA

The Programme for International Student Assessment (PISA) is an internationally standardized assessment that was jointly developed by participating countries and administered to15-year-olds in schools. The survey was implemented in 43 countries in the first assessment in 2000, in 41 countries in the second assessment in 2003 and at least 58 countries will participate in the third assessment in 2006. Tests are typically administered to between 4,500 and 10,000 students in each country.

The domains of reading, mathematical and science literacy are assessed. The main focus of PISA 2000 was on reading literacy. "Reading literacy is understanding, using, and reflecting on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society." In PISA 2003, the emphasis is on mathematical literacy and an additional domain on problem solving has been introduced. Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen. For the PISA 2006 cycle, the focus will be on scientific literacy.

TIMMS

The Trends in International Mathematics and Science Study measures trends in students' mathematics and science achievement. Offered in 1995, 1999, and 2003, TIMSS measures students' progress in mathematics and science achievement. In 1995 grades 4, 8, and the final year of secondary school were studied in 42 countries. In 1999, grade 8 was studied in 38 countries. In 2003, grades 4 and 8 were studied in 46 countries.

Each participating country is required to draw from a random sample of schools. In the United States, a national probability sample is drawn for each study that has resulted in over 500 schools and approximately 33,000 students participating in 1995, 221 schools and 9,000 students participating in 1999, and 480 schools and almost 19,000 students in 2003.

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PIRLS
The Progress in International Reading Literacy Study (PIRLS) was developed in 1959 by the International Association for the Evaluation of Educational Achievement (IEA) to assess students' reading achievement at fourth grade. Thirty-five countries participated in PIRLS 2001. PIRLS assessed a range of reading comprehension strategies for two major reading purposes – literary and informational. More than half of the questions were in the constructed-response format, requiring students to generate and write their answers.

The Differences Among International Tests
The results of PISA 2000 and TIMMS 1995, 1999 and 2003 do differ. One reason is that the two studies differ in their approach and methodology. TIMMS assessment materials were constructed on the basis of an analysis of the intended curriculum in each participating country in order to cover the core curriculum common in the majority of countries. PISA assessment materials cover the range of skills and competencies that were considered to be crucial to an individual's capacity to fully participate in and contribute meaningfully to a successful modern society. Also, the age-based PISA targets populations of 15-year-olds. TIMMS targets grade-based populations (grades 3-4, 7-8 and the final year of secondary school for 1995, grade 8 in 1999 and grades 4 and 8 in 2003).

Analysis of International Assessment Results
In 2005, NCEE staff analyzed the results of the PISA, TIMMS and PIRLS international student assessments in reading, math and science covering the years 1995-2003. Only tests given to students in grades eight and beyond were used for this analysis. While exams were administered to students in grade four in many countries, staff determined that the student performance close to the end of compulsory school was most applicable in this effort. For reading, staff used the results from PISA 2000 and 2003. For mathematics and science, PISA 2000 and 2003, and TIMMS 1995, 1999 and 2003 were applied. For each year analyzed, the top ten countries were ranked and rankings were then totaled for the years with the top three results. The conclusions from this analysis are:

- Korea
- Hong Kong
- Finland
- Japan
- The Netherlands
- Canada
- Australia

scored in the top ten countries on all three subjects: reading, mathematics and science. The Netherlands, while participating in both reading tests, only produced a sample size large enough to analyze one of the two tests, but still scored high.

- Singapore
- Taipei (Taiwan)
- Belgium/Flemish-Belgium

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scored in the top ten in two subjects. Singapore and Taipei did not participate in the reading exams and, therefore, we cannot rank them in this arena. It is worth noting that Singapore ranked number one in math and number two in science among the countries that were analyzed for this study, while Taipei (Taiwan) ranked fourth in math and first in science.

Ranking of Countries Participating in International Education Assessments, Grade 8 and Above, 1995-2003

Ranking 1995-2003	Top Readers	Top Mathematicians	Top Scientists
1	Finland	Singapore	Taipei (2 tests)
2	Canada	Hong Kong	Singapore
3	Australia	Korea	Japan
4	Korea (tie)	Taipei (2 tests)	Korea
5	New Zealand (tie)	Japan	Hong Kong
6	Ireland	Flemish Belgium	Finland
7	Hong Kong	Netherlands	Hungary (tie)
8	Sweden	Finland	Czech Republic (tie)
9	Japan	Canada	Netherlands
10	Netherlands (1test)	Switzerland	England
11	Liechtenstein	Slovak Republic	Australia
12	Belgium	Australia	Canada

Results from PISA 2003

In June 2004, the Organization for Economic Co-operation and Development released findings from the 2003 PISA study. The OECD reported that "Finland once again came out top in the OECD's latest PISA study of learning skills among 15-year-olds, with high performances in mathematics and science matching those of top-ranking Asian school systems in Hong Kong-China, Japan and Korea. But some low-performing countries showed only small improvements or actually did less well, widening the gap between the best and poorest performers.

More than 250,000 students in 41 countries took part in PISA 2003, the second three-yearly survey of its kind. The main focus in PISA 2003 was on mathematics, but the survey also looked at student performance in problem-solving, science and reading and at students' approaches to learning and attitudes to school.

Finland already led in the PISA 2000 reading assessment, and in PISA 2003 it maintained its high level of reading literacy while further improving its performance in mathematics and science. In mathematics, where the PISA 2003 tests sought to establish how well students can develop and apply mathematical models to deal with real-life tasks and interpret, validate and communicate the results, top-performing OECD countries also include the Netherlands.

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Most other countries' relative positions in the PISA 2003 survey remained broadly similar to those in PISA 2000, but some showed notable changes. Poland's overall performance rose thanks to big improvements among lower-performing students in the wake of a major reform of the education system in 1999. Smaller but still noteworthy improvements in at least two assessment areas also occurred in Belgium, the Czech Republic and Germany.

Overall, wealthier countries tend to do better in educational terms than poor nations, but there are exceptions: Korea's national income, for example, is 30 percent below the OECD average but its students are among the best performers in OECD countries. Nor is high expenditure necessarily a key to success: a number of countries do well in terms of "value for money" in their education systems, including Australia, Belgium, Canada, the Czech Republic, Finland, Japan, Korea and the Netherlands, while some of the "big spenders" perform below the OECD average. (Data for the United Kingdom are not included, due to insufficient response rates of students and schools. In PISA 2000, data for the Netherlands were excluded for the same reason).

The results of PISA 2003 suggest that both students and schools perform best in a climate characterized by high expectations that are supported through strong teacher-student relations, students who are ready to invest effort and who show interest and lower levels of anxiety with mathematics, and a positive disciplinary climate. In most of the countries that performed well, local authorities and schools also have substantial responsibility for educational content and/or the use of resources, and many set out to teach heterogeneous groups of learners.

PISA also benchmarks educational quality against other important dimensions:

- Students whose parents have better-paid jobs, are better educated and have more "cultural" possessions in their homes perform on average significantly better in all countries than those without such advantages. However, the degree of difference varies. Australia, Canada, Finland and Japan stand out for high standards of both quality and equity, with above-average mathematics performance and below-average impact of socio-economic background on student performance. In contrast, results for Belgium, Germany, Hungary and the Slovak Republic reveal large socio-economic inequalities in the distribution of educational opportunities.

- In Canada, Denmark, Finland, Iceland, Ireland, Norway, Poland and Sweden, parents can rely on high and consistent standards across schools. By contrast, variations in student performance in Austria, Belgium, Germany, Hungary, Italy, Japan, the Netherlands and Turkey are largely accounted for by performance differences between schools. In Poland, the differences between individual schools' performances have shrunk since PISA 2000, possibly reflecting the introduction of a more integrated school system in 1999.

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- Since some countries allocate students to schools according to their prior educational performance, some differences in average school performance are there by design. However, it is worrying to find large differences between schools, particularly in the countries with highly stratified and early selective systems, that are linked to socio-economic inequalities in learning opportunities. Peer-group influences may be one factor helping to raise the performance of pupils attending schools with higher socio-economic status. But better school resources and a more positive school climate also seem likely to play a part.

- While girls outperform boys in reading in all countries, gender differences in mathematics tend to be small. Most countries have more boys among top performers, resulting in a slight overall advantage for boys over girls in average terms. But boys and girls tend to be equally represented among the low-performers.

- Gender differences are larger within schools than they are overall. Girls attend the higher performing, academically oriented tracks and schools at a higher rate than boys but, within schools, girls often perform significantly below boys. Of more concern, girls consistently report lower interest in and enjoyment of mathematics, lower levels of self-confidence and higher levels of anxiety with mathematics, all of which continues to be reflected in subsequent study and occupational patterns. If girls are to be encouraged to go on to study mathematics and related subjects at a higher level, schools will need to do more to build their interest and confidence in mathematics from an early age.

- Student interest in mathematics is far lower, across countries, than in reading. Among OECD countries, about half of the students report being interested in the things they learn in mathematics, but only 38 per cent report that they do mathematics because they enjoy it. On the other hand, the great majority of students believe that studying mathematics will help them in their future.

- At the upper end of the scale, in Belgium, Japan and Korea between 8 and 9 per cent of students - more than double the OECD average - were able to perform the highly complex tasks required to reach Level 6, the top performance level, in mathematics. At the other end of the scale, over a quarter of students are not proficient beyond Level 1 in Italy, Portugal and the United States, over a third in Greece and over half in Mexico and Turkey."

PISA Problem Solving Study 2003

The collection of data concerning students' problem-solving skills as part of PISA 2003 was undertaken because the OECD countries attach great importance to how far students' capabilities in reading, mathematics and science are matched by an overall capability to solve problems in real-life situations beyond the specific context of school subject areas. To address this, the OECD countries

established a framework and assessment instruments to evaluate students' capacities to:
• identify problems in cross-curricular settings;
• identify relevant information or constraints;
• represent possible alternatives or solution paths;
• select solution strategies;
• solve problems;
• check or reflect on the solutions; and
• communicate the results.

Given the amount of time available for the assessment, the decision was made to focus on students' problem-solving capabilities in three types of situation:
• making decisions under constraints;
• evaluating and designing systems for a particular situation; and
• trouble-shooting a malfunctioning device or system based on a set of symptoms.

Working with these types of problems, a large set of tasks was developed and field-tested in participating countries. The results were 19 tasks that required problem-solving skills, most of which are set in units consisting of two or three related items dealing with the same contextual situation.

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