PISA 2006: Science Competencies for Tomorrow's World

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Briefing note for Mexico

The OECD's Programme for International Student Assessment, PISA, examines how well individual national education systems are doing in equipping their young people for the world of tomorrow. In the highly competitive globalised economy of today, quality education is one of the most valuable assets that a society and an individual can have. Skills are key factors for productivity, economic growth and better living standards. Effective and innovative education policies open enormous opportunities for individuals just as faulty educational systems result in declining standards, exclusion and unemployment. They also underpin healthy and vibrant economies. That is why education plays a central role in OECD's agenda.

Dramatic changes in the global talent pool over recent decades oblige countries to assess the educational progress of their young people in a global context. Today, countries like China or India are delivering high skills at moderate cost and at an ever increasing pace. Other countries – including the developed countries that are members of OECD -- cannot ignore these competitive pressures, on pain of harming their own future well-being.

For this latest PISA assessment, no less than 57 countries participated, up from 41 in 2003 and 28 in 2000, covering close to 90% of the world economy. Therefore, PISA shows countries where they stand in terms of the science knowledge and skills of their 15-year-olds. But PISA also highlights where education systems *can be*, by showing what the best performing education systems achieve in terms of quality, equity, and efficiency. The results also identify some of the policy levers for raising quality and improving equity.

PISA 2006 focuses on the science performance of 15-year-olds. And it shows that among the best performing OECD countries, Finland, Canada, Japan, Australia and Korea achieve not only high performance but also offer an equitable access to learning opportunities. Students from all socio-economic spheres are given an opportunity to realise their potential, and they take these opportunities up. These results are a wake-up call for other countries that are doing less well in this respect. But OECD countries also need to look outside the OECD area, where we find three of the 5 top performers in PISA 2006 (Hong Kong-China, Chinese Taipei and Estonia).

But PISA is much more than just a ranking. It also tells countries about their strengths and weaknesses compared to their peers. Mexico is a case in point: Mexican students performed relatively better on science questions where they were asked to identify scientific issues. They found it relatively easier to figure out the key features of a scientific investigation. But they struggled to use scientific evidence and, in short they had difficulties to analyse data and experiments.

This is an important finding. Students who learn just to memorise and reproduce scientific knowledge and skills may find themselves ill-prepared for tomorrow's job market. Successful countries in the area of student use of scientific evidence, such as Finland, New Zealand, Australia and Canada, may provide useful points of reference and offer best practices.

We have devoted most of the attention in PISA 2006 to science, but PISA looks at other competency areas too. In mathematics, which had been the focus area in 2003, Mexico improved its achievement level from 385 to 406 score points. In 2003, girls had scored 10 points behind boys. However, in 2006, girls did considerably better and performed at the same level as boys. Mexican girls also performed better in reading, compared to PISA 2003, but boys did not improve significantly. This means that overall, with a score of 410 points, Mexican students had a similar performance in reading compared to PISA 2003.

But looking at averages only is not enough. How skills are distributed also matters. High-level skills are particularly important for countries to further technological development. On average across OECD countries, 9% of 15-year-olds reach Levels 5 and 6, the top levels of the PISA 2006 science scale. In Mexico only 3% of students achieved these levels and very few students reached the top level demonstrating that they could consistently identify, explain and apply scientific knowledge in a variety of complex life situations. In New Zealand and Finland the share of Level 6 performers is at least 3.9%, three times the OECD average; these countries also do better in the percentage of students reaching the next best level. This is a very important finding because, even if PISA cannot establish the causal nature of the relationship, the proportion of Level 5 and 6 performers at age 15 is a good predictor for a country's research intensity; it explains 70% of the OECD cross-country variation in the share of researchers in total employment.

But science education should also give citizens the ability to participate fully in society and in the labour market. This requires baseline scientific competency at least at PISA Level 2, which requires competencies such as recalling single scientific concepts and using results of a scientific experiment represented in a data table as they support a personal decision. Many countries have a serious problem with low performers; across the OECD, on average 19.2% of students perform below the PISA baseline Level 2. This is one of Mexico's biggest challenges, with 1 in 2 15-year-olds not reaching Level 2 – the only other OECD country with such a challenge is Turkey. Our experience in many countries has been that it is extremely difficult to reverse patterns of poor performance, and as skill demands in labour-markets increase, the social costs of poor educational levels are high and increasing. Therefore, the proportion of low performers in Mexico will deserve continued attention.

In PISA 2006 we also looked at students' attitudes towards science. Why is this important? Competing successfully in a globalised world increasingly depends on countries' ability to innovate. This in turn will require major investments in scientific infrastructure and the ability

to attract qualified individuals into science-related professions. Governments have to secure broad public support for scientific endeavour. Science and technology have enabled remarkable achievement over the past 100 years, but addressing these challenges successfully will require countries to make major investments in scientific infrastructure and to attract qualified individuals into science-related professions, as well as to secure broad public support for scientific endeavour and the capacity of all citizens to use science in relation to their lives. Peoples' attitudes to science thus play a key role. In general, Mexican 15-year-olds report a strong level of appreciation of science, one of the strongest, indeed, among the OECD countries. They report a higher personal value of science than their peers in other OECD countries. Thirty-five percent of Mexican students said that they expect a science-related career at age 30 (OECD average 25%), one of the highest proportions in the OECD. Last but not least, Mexican 15-year-olds were among the most confident in their science abilities among OECD countries.

Nevertheless, when it comes to science and the environment, Mexican 15-year-olds report a below-average level of awareness of environmental issues, that is, they were not as familiar with these issues and were less confident that they could explain the general issue. At the same time, many young Mexicans report being concerned about the environmental challenges that we face and do not believe that these will improve over the next 20 years. The less they know about science, the more optimistic they report to be that the environmental challenges will be successfully addressed.

Another very important dimension of all our work at the OECD is gender differences. Here, the PISA 2006 results are very encouraging: In 22 out of 30 OECD countries, boys and girls perform equally well in science. But will this result in gender parity later on in life, in career choices, in jobs, in salaries? Of course, we do not know what study choices Mexican 15-year-olds will actually make when they are older. PISA shows that Mexican girls and boys report similar attitudes towards science and are equally likely to expect to work in a science-

related career at age 30. Both girls and boys report to participate in science activities at a much higher extent than the OECD average, but girls report participating less in science-related activities, even though Mexican girls' performance in academic tests does not differ greatly from that of males. This is an important policy concern.

Knowing how things are is important. But how can we make things better? The results from the OECD PISA Assessment leave us with the question what schools and school policy-makers can do to raise performance and to moderate the impact that socio-economic background has on student performance.

Some people say that strong educational performance is all to do with money. And indeed, the results from PISA show a positive cross-country relationship with expenditure per student. But the relationship is far from straightforward: Finland, New Zealand, Korea, Japan, Australia and the Netherlands do well with moderate expenditure, while top spenders like the United States and Norway perform below the OECD average. The PISA results also show that, across the OECD area, student performance has generally remained flat between 2000 and 2006 while expenditure on education in OECD countries has risen by 39% in real terms during this period.

So money is important but not sufficient to raise educational performance. It matters at least equally how educational resources are invested. An adequate supply of teachers and quality of educational resources at school are associated with better learning outcomes. But more importantly, there are a number of school policies and practices that are crucial for performance without being necessarily tied to resources. Let me just highlight three of them – institutional differentiation, autonomy, and accountability, because they feature so prominently in national education policy debates.

Differentiation at an early age damages equity without improving quality. In systems that separate children early in secondary school, students' performance by the age of 15

depends more than average on their socio-economic background. And there is no systematic benefit in terms of the average performance. This is an important policy lesson, for Mexico as well as many of Europe's education systems. While the OECD average for the age of first selection is 14 years, in Mexico this is earlier at 12 years.

Private schooling is another form of institutional differentiation. Looking only at performance, students in private schools outperformed those in public schools in 20 countries. Only in three countries, public schools showed better results than private ones. But once you take account of the socio-economic background of students and schools the picture changes. Public schools then have an advantage of 12 score points over private schools. Private schools do of course offer an attractive alternative for parents looking to maximise the benefits for their children, including those benefits that come from the socio-economic level of schools' intake, but more private schooling is not automatically associated with better overall outcomes. In Mexico, there are large performance differences between public and private schools, with students in private schools scoring 53 points higher. This is above the OECD average performance difference of 25 score points. However, once the socio-economic background of students and schools are taken into account, students in public schools have a performance advantage of 21 score points.

On the second point: autonomy. Another feature that the best performers in PISA share is that they have devolved responsibility to the frontline. PISA suggests that countries giving more responsibility to schools tend to perform better. Giving schools more autonomy in formulating the budget, and letting them decide on allocations within the school tends to go hand in hand with better performance. This remains true even after accounting for socio-economic background and as other school and system level factors. School principals in Mexico report that the involvement of regional or national education authorities in decision making is similar to the OECD average, but for example in budgeting matters the school's

governing board has much less influence in Mexico than on average, but parents have much more influence than on average in the OECD.

The third point is accountability, and improved accountability is a fundamental counterpart to greater school autonomy. Accountability has to do, among other factors, with how education systems use results from assessments. In many countries, this is controversially debated. Some see assessment results primarily as tools to reveal best practices and identify shared problems in order to encourage teachers and schools to improve learning environments. Others extend their purpose to use the results to support contestability of public services or foster market-mechanisms in the allocation of resources. And it is widely debated to what extent information on student performance should be made available to parents and the public at large. PISA shows that schools posting results publicly tend to perform better (even after accounting for all other school and socio-economic factors). This effect is strong across many countries. This suggests that external monitoring of standards, rather than relying mostly on schools and teachers to uphold them, can make a real difference to results.

PISA itself has encouraged countries not to take internally assessed education standards for granted. We can already see that the discipline provided by subjecting schools to external assessment with publicly visible results produces strong effects. Of course, such issues are very sensitive and need to be carefully addressed. However, the long-term perspective of improved transparency in schooling outcomes is important.

School systems continue to face the challenge of how to improve equity without threatening quality. Given that resources are finite, the answer is not straightforward. Will reducing resources for socio-economically advantaged students and schools harm students' performance more than improving resources for socio-economically disadvantaged students and schools would improve results? Even if this were not to lower the average score, it is

possible that it would reduce the number of high-performing students, which in itself is undesirable.

PISA tells us that the most important factors for success are not the ones most closely associated with finite material resources, such as the distribution of good teachers. Rather, what matters is how schools and the school system are run – for example, the amount of time that students spend in class and the extent to which schools are accountable for their results. Delivering such advantages to one student is not obviously at the expense of another. This, in itself, is an important conclusion from PISA. It underlines once more that quality, equity and coherence in educational standards are indeed achievable policy goals.

By way of conclusion, educational policies should provide the basis for children to succeed. Successful learning experiences involve enabling environments at school, at home, everywhere. To get it right requires a deep understanding of how the system works. PISA is one of the tools at hand to improve performance, not only for policy-makers but for all of us striving to give our children the best education we can. But getting it right also requires courage to take the right measures and to reform when needed. The OECD stands ready to help – both with the analysis and the often difficult aspects of making reform happen.