# Foreword

Equipping citizens with the knowledge and skills necessary to achieve their full potential, contribute to an increasingly interconnected world, and ultimately convert better skills into better lives is a central preoccupation of policy makers around the world. Results from the OECD's Survey of Adult Skills show that highly skilled adults are not only twice as likely to be employed and almost three times more likely to earn an above-median salary than poorly skilled adults, they are also more likely to volunteer, to report that they are in good to excellent health, to see themselves as actors rather than as objects of political processes, and to trust others. Fairness, integrity and inclusiveness in public policy thus all hinge on the skills of citizens.

In working to achieve these goals, more and more countries are looking beyond their own borders for evidence of the most successful and efficient education policies and practices. Over the past decade, the OECD Programme for International Student Assessment, PISA, has become the world's premier yardstick for evaluating the quality, equity and efficiency of school systems. But the evidence base that PISA has produced goes well beyond statistical benchmarking. By identifying the characteristics of high-performing education systems, PISA allows governments and educators to identify effective policies that they can then adapt to their local contexts.

The latest PISA assessment in 2015 focused on science, a discipline that plays an increasing role in our economic and social lives. From taking a painkiller to determining what is a "balanced" meal, from drinking pasteurised milk to deciding whether or not to buy a hybrid car, science is pervasive. And science is not just test tubes and the periodic table; it is the basis of nearly every tool we use – from a simple can opener to the most advanced space explorer. More important, science is not only the domain of scientists. In the context of massive information flows and rapid change, everyone now needs to be able to "think like a scientist": to be able to weigh evidence and come to a conclusion; to understand that scientific "truth" may change over time, as new discoveries are made, and as humans develop a greater understanding of natural forces and of technology's capacities and limitations.

The last time science was the focus of PISA was in 2006. Since then, science and technology have advanced tremendously. The smartphone was invented and became ubiquitous. Social media, cloud-based services, robotics and machine learning have transformed our economic and social life. New possibilities of gene sequencing and genome editing, synthetic biology, bio-printing or regenerative medicine and brain interfaces are changing life itself. Against this backdrop, and the fact that expenditure per primary and secondary student rose by almost 20% across OECD countries over this period, it is disappointing that, for the majority of countries with comparable data, science performance in PISA remained virtually unchanged since 2006. In fact, only a dozen countries showed measurable improvement in the science performance of their 15-year-olds, including high-performing education systems, such as Singapore and Macao (China), and low-performing ones, such as Peru and Colombia.

It is also worrying to see how many young people fail to reach even the most essential learning outcomes. In September 2015, world leaders gathered in New York to set ambitious goals for the future of the global community. Goal 4 of the Sustainable Development Goals seeks to ensure "inclusive and equitable quality education and promote



lifelong learning opportunities for all". This includes that "all learners acquire the knowledge and skills needed to promote sustainable development" (Target 4.7). Only in Canada, Estonia, Finland, Hong Kong (China), Japan, Macao (China) and Singapore do at least four out of five 15-year-old students master the baseline level of proficiency in science, reading and mathematics. These countries show that there are countries on nearly every continent that could achieve the goal of universal basic skills by 2030. At the same time, the small group of countries that has moved close to securing at least basic skills for all shows how much remains to be done in most countries – including some of the wealthiest OECD countries – to attain the Sustainable Development Goals.

The data also show that the world is no longer divided between rich and well-educated nations and poor and badly educated ones: the 10% most disadvantaged students in Viet Nam compare favourably to the average student in the OECD area. Clearly, all countries and economies have excellent students, but few have enabled all students to excel. Achieving greater equity in education is not only a social justice imperative, it is also a way to use resources more effectively, increase the supply of skills that fuel economic growth, and promote social cohesion.

PISA also finds varying levels of engagement with science and expectations of science-related careers across students who are similarly capable and interested in science. In a majority of countries and economies, students from advantaged backgrounds are more likely to expect a career in science – even among students who perform similarly in science and who reported similar enjoyment of learning science.

Similarly, while it is encouraging that boys and girls now show similar levels of science performance in PISA, large gender differences remain in students' dispositions towards science-related careers, even among students who score similarly in science and who report similar levels of enjoyment in learning science. In Germany, Hungary and Sweden, for instance, top-performing boys are significantly more likely than top-performing girls to expect a career requiring further training in science. These findings have serious implications not only for higher education, where young women are already under-represented in the science, technology, engineering and mathematics fields of study, but also later on, when these young women enter the labour market.

Gender stereotypes about scientists and about work in science-related occupations can discourage some students from engaging further with science. Schools can counter these stereotypes, and help both boys and girls cultivate a wider perspective on science, including through better career information. Employers and educators in perceived "masculine" or "feminine" fields can also help eliminate existing stereotypes by underscoring the close inter-relationships among the numerous fields of science.

The subject of science itself suffers from a stereotyped image. Too often, school science is seen as the first segment of a (leaky) pipeline that will ultimately select those who will work as scientists and engineers. Not only does the "pipeline" metaphor discount the many pathways successful scientists have travelled to reach their career goals, it also conveys a negative image of those who do not end up as scientists and engineers. Because knowledge and understanding of science is useful well beyond the work of scientists and is, as PISA argues, necessary for full participation in a world shaped by science-based technology, school science should be promoted more positively – perhaps as a "springboard" to new sources of interest and enjoyment. Expanding students' awareness about the utility of science beyond teaching and research occupations can help build a more inclusive view of science, from which fewer students feel excluded.

PISA is not only an accurate indicator of students' abilities to participate fully in society after compulsory school, but also a powerful tool that countries and economies can use to fine-tune their education policies. There is no single combination of policies and practices that will work for everyone, everywhere. Every country has room for improvement, even the top performers. That's why the OECD produces this triennial report on the state of education across the globe: to share evidence of the best policies and practices and to offer our timely and targeted support to help countries provide the best education possible for all of their students. With high levels of youth unemployment, rising inequality, a significant gender gap, and an urgent need to boost inclusive growth in many countries, we have no time to lose. The OECD stands ready to support policy makers in this challenging and crucial endeavour.

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