International benchmarking for school improvement
THE OECD TEST FOR SCHOOLS (BASED ON PISA)

An introduction to the assessment
International Benchmarking for School Improvement

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U.S. version

An introduction to the assessment
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Parents, teachers, principals and administrators who are engaged in the running of schools and education systems need reliable information to assess how well their schools prepare students for life. Most monitor students’ learning in order to make this assessment. But in a global economy, the measurement of educational success can no longer be based on standards and local expectations alone. Comparisons also need to be made with the best performing schools and education systems internationally. International benchmarking and cross-country comparisons can help to better understand whether the younger generation is well-equipped with the skills needed in today’s globalised world. They can also offer guidance for governments, administrations and schools on the policies required to catch-up with the best performers.

Since 1997, the OECD Programme for International Student Assessment (PISA) has evaluated the quality, equity and efficiency of school systems in over 70 countries that, together, make up nine-tenths of the world economy. PISA represents a commitment to monitor the outcomes of education systems regularly within an internationally agreed framework and to provide a basis for global collaboration in defining and implementing educational policies.

Results from PISA reveal wide differences in the educational outcomes of countries. Those education systems that have been able to secure strong and equitable learning outcomes, and to mobilise rapid improvements, show others what can be achieved. Some of the strongest examples pertain to those countries that have seen rapid improvements over recent years.

For example, Korea’s average performance was already high in 2000, yet the Government was concerned that only a small elite achieved levels of excellence in the PISA reading assessment. Within less than a decade, Korea was able to double the share of students demonstrating excellence in this area. In Poland a major overhaul of the school system helped to dramatically reduce performance variability among schools, turn around the lowest-performing schools and raise overall performance by more than half a school year.

The remarkable success of Shanghai in China, which obtained some of the highest scores in PISA 2009, also shows the outcomes that can be achieved with moderate economic resources and in a diverse social context. In mathematics, more than a quarter of Shanghai-China’s 15-year-olds can conceptualise, generalise, and creatively use information based on their own investigations and modelling of complex problems. They can apply insight and understanding and develop new approaches and strategies when addressing novel situations. In the OECD area, just 3% of 15-year-old students reach that level of performance.

While knowing where a nation’s education system stands internationally is important, many schools and local school administrations want to go further and understand how their own individual schools perform compared with the world’s leading school systems and other schools operating within a similar social context. In collaboration with partners in different countries such as America Achieves in the United States, the OECD has developed an innovative tool to provide answers to these questions.

Similar to the international PISA assessment, the OECD Test for Schools measures 15-year-old students’ applied knowledge and competencies in reading, mathematics and science as well as their attitudes to learning and school. The reports that each school receives present over 40 figures that are unique to each school. Along with performance results, the reports attempt to show that the learning climate at school,
as well as students’ engagement towards learning, are important factors in trying to understand the overall performance of a school. School reports also provide examples of strategies, policies and practices from education systems around the world to support critical reflection and encourage school staff and local educators to look beyond their classrooms in search of national and global excellence.

This brochure, produced with support from Bloomberg Philanthropies, describes the new assessment tool and provides information to help local educators better understand how the assessment and the information it provides may support their improvement efforts. The OECD will continue to support all those involved in delivering “better policies for better schools and better lives.”
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INTRODUCTION TO THE OECD TEST FOR SCHOOLS (BASED ON PISA)

The OECD Test for Schools (based on PISA) is a student assessment that is linked to the knowledge base of the OECD’s internationally recognised Programme for International Student Assessment (PISA), an overview of which is presented in this brochure. While the international PISA assessment is intended to provide aggregate national results for international comparisons and to inform policy discussions, the OECD Test for Schools is designed to provide school-level results for benchmarking and school-improvement purposes. It allows schools to assess and benchmark their students’ proficiency in reading, mathematics, and science and to benchmark their performance against that of their peers in their country as well as in some of the world’s top-performing schools.

The OECD Test for Schools aims to support research, benchmarking and school improvement efforts by providing descriptive information and analyses on the skills and creative application of knowledge of 15-year-old students in reading, mathematics, and science that are comparable to existing PISA scales, when administered under appropriate conditions. Based on the contextual questionnaires that are an important part of the assessment, results also show how different factors within and outside the school are associated with student performance, including students’ socio-economic background, students’ attitudes and interests towards reading, science and mathematics, and the learning environment at school.

Box A. An introduction to PISA and the OECD

The Programme for International Student Assessment (PISA) is an international study that was launched in 1997 by the Organisation for Economic Co-operation and Development (OECD). PISA measures the skills and knowledge of 15-year-old students. The study is organised by the OECD every three years and aims to provide internationally comparable evidence on student learning outcomes. In PISA 2009, over 70 countries and economies participated from around the world, representing 90% of the world’s GDP.

The OECD is an international organisation that seeks to improve the economic and social well-being of people around the world. The Organisation assists countries by providing empirical evidence and policy insights to support dialogues and reform processes. In the field of education, the OECD helps member countries improve the quality, equity, efficiency and effectiveness of their education systems. The Organisation, headquartered in Paris, France, was founded in 1961 by 20 countries including Canada, the United Kingdom and the United States. In 2012, it consists of 34 member countries.

Since 2000, the OECD and national partners in participating countries implement PISA through an assessment of a randomly selected group of 15-year-old students. The students and participating school authorities (e.g. principals, directors) also fill in background questionnaires to provide information on the students’ family background and the way their schools are run. PISA has also implemented a parent questionnaire that countries can choose to administer. It seeks information on the household environment and parental involvement in their children’s learning.
For each cycle of PISA, one subject is the main area of assessment. In 2000, the focus of the assessment was reading, in 2003 mathematics, in 2006 science and in 2009 reading once again. The results for PISA 2009 are presented in several volumes:

- **Volume I**, *What Student Know and Can Do: Student Performance in Reading, Mathematics and Science*, summarises the student performance in the countries that participated in PISA 2009.
- **Volume II**, *Overcoming Social Background: Equity in Learning Opportunities and Outcomes*, examines how factors such as socio-economic background and immigrant status affect student and school performance, and looks at the role that education policy can play in moderating the impact of these factors.
- **Volume III**, *Learning to Learn: Student Engagement, Strategies and Practices*, explores the information gathered on students’ levels of engagement in reading activities and attitudes towards reading and learning.
- **Volume VI**, *Students On Line: Digital Technologies and Performance*, explores students’ use of information technologies to learn.

The figures and tables presented in the PISA reports include StatLinks© which allows the reader of the e-books to click and download the data in Excel™ files. In addition to the main PISA initial reports, there is a monthly series called “PISA in Focus” which describes a policy-oriented PISA topic in a concise, user-friendly way. The following are some recent editions of the PISA in Focus series:

- PISA in Focus 13: *Does money buy strong performance in PISA?*
- PISA in Focus 14: *What kinds of careers do boys and girls expect for themselves?*
- PISA in Focus 15: *How “green” are today’s 15-year-olds?*
- PISA in Focus 16: *Does performance-based pay improve teaching?*

The PISA 2012 cycle is currently taking place. The 2012 data collection focuses on mathematics and includes an optional computer-based assessment of mathematics and reading involving some 30 countries. It also includes an optional area of assessment: financial literacy, which 18 countries have decided to implement. Detailed results of PISA 2012 will be published in December 2013.

PISA not only seeks to assess whether students can reproduce knowledge, but also to examine how well they can extrapolate from what they have learned and apply it in unfamiliar settings, both in and outside of school.

To find out more about PISA and the OECD, go to:

- PISA – Measuring student success around the world
- PISA 2009 Key Findings
- PISA Take the Test: Sample Questions from OECD’s PISA Assessments
- PISA in Focus Series
- About the OECD
DESCRIPTION OF THE ASSESSMENT

The OECD Test for Schools is developed following the internationally agreed assessment frameworks used in the main international PISA studies. The frameworks were developed by international experts and are updated continuously to reflect subject matter developments and progress in assessment methods. The frameworks are based on the concepts of competencies and skills which consider students’ capacity to extrapolate from what they have learned and apply their knowledge and skills in real-life settings, as well as their capacity to analyse, reason and communicate effectively as they pose, interpret and solve problems in a variety of situations.

The OECD Test for Schools is developed around units that each contains two or more individual questions. A unit consists of stimulus material, including texts, diagrams, tables and/or graphs, followed by questions on various aspects of the text, diagram, table or graph, with the questions constructed so tasks that students have to undertake are as close as possible to those they might come across in the real world. The OECD Test for Schools contains 47 questions in reading, 40 in mathematics and 54 in science. Examples of the types of questions developed for the test are included in Annex A, and you can see all of the publicly available PISA questions in the publication PISA Take the Test: Sample Questions from OECD’s PISA Assessments.

The test questions vary in format. Around half require students to construct their own responses. Some require a brief answer, whereas others allow for different individual responses and, sometimes, an assessment of students’ justification of their viewpoints. The other half are multiple-choice questions in which students make either one choice among four or five alternatives or chose one of two possible responses (“yes”/”no” or “agree”/”disagree”) to a series of propositions or statements.

A typical student is estimated to take approximately 92 minutes to answer the questions in each of the three subject domains, without breaks! As this is clearly not possible, the test questions were organised into clusters of questions that were then organised into booklets, for a total of seven different test booklets. Each student, however, was expected to respond to only one test booklet, which the test administrators gave them. Each booklet covers a selection of questions, so that students answer overlapping groups of questions. Thus, the students are tested in a wide range of topics while limiting the test time for each individual student. With this design, each booklet takes 120 minutes to complete, to match the PISA main studies and provide students a similar test experience. It is important to note that the current assessment instruments cover all three domains of reading, mathematics and science equally.

Student and school questionnaires included in the assessment

In addition to the test questions on reading, mathematics and science, the assessment includes two contextual questionnaires. One is completed by the principal or designate and covers such elements as the structure and organisation of the school, student and teacher demographics and the school’s resources, policies and practices. Another questionnaire is completed by every student who participates in the assessment and includes questions about the student’s family and home possessions, the classroom and school climate and the students’ strategies, attitudes and dispositions towards learning in reading, mathematics and science. The student questionnaires are an important part of the assessment and are used to appropriately calculate performance results as well as to report on factors associated with learning outcomes.

Administration of the assessment in schools

Schools that decide to implement the assessment will need to work with the service providers to make sure that quality standards and procedures are followed in preparation for administering the test and on the day of testing. The minimum target number of students tested at each school is 75, but this will vary depending on the specific characteristics of the school. Smaller schools with less than 75 students in the 15-year-old age group may also participate if 100% of their eligible students can be tested, as long as at least 50 students participate the day of testing.
For the assessment, students respond to approximately two hours of test questions in reading, mathematics and science and answer a 30-minute student questionnaire that is an important part of the assessment. Overall, the testing experience for a student lasts approximately three to three-and-a-half hours, including instructions and break periods. In addition, school authorities (e.g. principals, directors, school masters) of participating schools will be asked to provide information on their school by filling out a questionnaire.

Schools that decide to implement the assessment will be expected to

- Assign a staff member to be the School Coordinator to work with the test administration contractors accredited by the OECD for the assessment in the United States and to facilitate the local test-administration process.
- **Ensure the proper test-taking conditions for a 3-hour and 30-minute (approximate) paper-and-pencil test that includes a 30-minute Student Questionnaire on the agreed-upon test day(s).** In addition, the principal or school director will also be expected to complete a separate 30-minute School Questionnaire as part of the assessment.

The **School Coordinator at each school** will be responsible to act as the liaison between the school and the test administrators to prepare and facilitate the assessment. The key activities of the School Coordinator are presented in the following table:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
</tr>
</thead>
</table>
| I. Preparation | 1. Determine date for the assessment with test administrators assigned by contractors  
2. Prepare the List of Eligible Students and submit it to the test administrator(s) |
| II. Before the assessment | 3. Receive Student Tracking Form showing students to be tested from test administrator(s)  
4. Organize and confirm logistical plans with school staff and with the test administrator(s)  
5. Notify teachers, students, and parents of the assessment and give School Questionnaire to appropriate person at your school  
6. Review and update the Student Tracking Form with S.E.N. codes and return to test administrator(s) |
| III. During the assessment | 7. Provide test administrator(s) with Student Tracking Form and completed School Questionnaire  
8. Be present throughout the assessment to assist the test administrator(s), if possible |
| IV. After the assessment | 9. Complete Post Assessment Survey |

The link between the school assessment and the international PISA studies

The value of the tool is its link to PISA and the international results published periodically by the OECD. At the same time, the **OECD Test for Schools** is not PISA and participation in one assessment should not be confused with the other. The tool differs from the main OECD PISA assessment in that it provides school-level results that are comparable to existing PISA scales, *when administered under appropriate conditions*. The main PISA studies provide aggregate national or specific results for some states in the case of the United States.
The OECD Test for Schools provides findings to schools on student performance and some of the school and student-level factors that are associated with performance. The assessment is based on the same PISA assessment frameworks as the main PISA studies, but the assessments are different and the priority is the national PISA study.

The OECD Test for Schools is intended to be complementary to the main PISA studies by making PISA-based results more accessible to a wider audience and empowering local educators to participate in and contribute to policy debates in their countries.

The Pilot Trial of the OECD Test for Schools

The international pilot trial of the OECD Test for Schools was conducted in 2012 with 126 schools across Canada, the United Kingdom and the United States. The purpose of the pilot was to confirm the administrative conditions and procedures of the assessment, to explore the reporting format of the results and gain feedback from the participating schools and districts before the instruments are made publicly available. Given the need to identify the most appropriate conditions under which the assessment needs to be administered to provide scores comparable to the PISA scales, the pilot was a valuable learning experience and provided empirical evidence.

The development of the assessment and the implementation of the pilot trial were carried out with support from America Achieves, Bloomberg Philanthropies, the Carnegie Corporation of New York, the Kern Family Foundation, the National Public Education Support Fund, and the William and Flora Hewlett Foundation. Additionally, EdLeader21 and its members provided very useful feedback during the development of the school report.

The pilot trial also sought to explore peer-to-peer learning opportunities and the sharing of effective practices between educators for local, national and international benchmarking. For this purpose, the OECD worked with partners in the United States, led by America Achieves, to organise a seminar with participating schools on 3 April 2013. Proceedings, presentations and videos related to participants can be found at www.americaachieves.org/.

WHAT THE ASSESSMENT REPORTS TO SCHOOLS AND DISTRICTS

School reports in the form of electronic books (e-books) were provided starting in November 2012 to participating schools that successfully tested. The school reports were primarily delivered through a secure file-transfer-protocol so that only authorised and registered persons were able to download the reports. An important consideration with regards to individual school’s results is the confidentiality kept during the pilot. The OECD did not publicly share results among participating schools or with third parties unless specifically requested to do so or granted permission by the participating schools and districts. Some schools that participated in the pilot have done so based on their own choice or on the decision of the district authorities.

Sample school reports are available for viewing here: www.oecd.org/pisa/pisa-basedtestforschools/.

The school reports and district notes provided to local educators as part of the assessment are geared towards principals, teachers, aides and staff and local education communities. One of the challenges in developing the content of the school reports was to not only make them statistically sound and technically robust, but to also make them accessible and relevant for the school audience. In addition, school reports steer away from presenting unsubstantiated causal inferences and prescriptive recommendations or “recipes” for student success. Instead, examples of strategies, policies and practices from education systems around the world have been included to support critical reflexion and to stimulate the interest of school staff and local educators beyond their classrooms in search of excellence.
Because of the nature of the assessment and the opportunities for benchmarking locally, nationally and internationally that it offers, the following are some of the principles that guide the reporting of school and district-level results:

- **Performance needs to be considered not in absolute terms, but in terms of equity and relative effectiveness of schools.**

  Many schools are successful in providing their students with skills and knowledge that enable them to compete with peers from the best education systems worldwide, and some are even able to do so with students from disadvantaged backgrounds. It is also clear, however, that there is room for improvement – for the high performing schools as well as those that may be underachieving below the country mean scores in PISA. Schools with performance results that place them at the very top in comparison with schools in the United States and in other countries should not see in the tool a means to “validate” their excellence for publicity – they should see it as a means to strive for even higher levels of performance for all students. At the same time, school staff and students in under-performing schools should be motivated and encouraged that improvement is not only possible, but within their reach.

- **International benchmarking supported by the school assessment and reports should be seen as a process.**

  The information presented in the school reports on students’ achievement, their engagement, and the teaching and learning environment at participating schools should stimulate further reflection and discussion among school staff and local educational authorities. Peer-to-peer learning opportunities and the sharing of effective practices are the logical next step in the process of international benchmarking for improvement. Throughout e-books provided to schools, therefore, the wealth of PISA results and related OECD research and resources (reports, videos and publications) are easily accessible through active hyperlinks. Users of the OECD Test for Schools assessment and reader of the results are thus invited to explore these and other resources in the search for excellence and best practices.

- **Although schools and districts are invited to openly share and discuss their results with the local education community of stakeholders (school staff, students and parents), they are in no way obligated to do so by choosing to use the assessment.**

  The assessment should be considered a tool for school improvement, not a tool for developing ranking or league tables. The tool measures cumulative student learning to inform, not penalise, schools and to support improvement locally where teaching and learning take place.

- **Performance should also be considered in light of the information the assessment provides in terms of the learning environment at schools.**

  The school-level estimates on the PISA scales that the assessment provides in reading, mathematics and science are only one part of the picture. Schools and local educators are invited to also consider the information provided in the school reports with regards to teacher-student relations, disciplinary climate, and students’ attitudes and engagement towards learning. Effective teaching for enhanced student outcomes, both cognitive and non-cognitive, is not uni-dimensional or captured by a single data point. Users of the assessment are thus invited to consider the multiple facets of performance included in the school reports.

- **In the future, the OECD Test for Schools can provide important peer-to-peer learning opportunities – locally, nationally and internationally – as well as the opportunity to share good practices to help identify “what works” to improve and make useful change.**
Availability of the assessment in the United States
The OECD will accredit a service provider in the United States that will be responsible for providing the services related to the test administration, data management, analysis and reporting for schools and districts. The OECD will supervise and work closely with the service provider to ensure that the service provider begins to communicate directly with interested schools and districts for testing to begin as early as Fall 2013.

Schools and districts that would like to begin planning for the assessment can visit the OECD Website www.oecd.org/pisa/pisa-basedtestforschools/ and they can also write to the OECD at: OECDTestforSchoolsSignUp@oecd.org

Costing parameters
Based on the experience of the pilot trial and of the associated costs, service providers will be expected to maintain their fees to interested schools and districts somewhere between 40 to 60 Euros (52 to 85 USD) per student for larger schools and at a fixed per-school-fee for smaller schools. This may vary depending on the specific characteristics of the school, district and the number of students and schools participating in the same school and/or district.

INTRODUCTION TO THE PISA SCALES AND PROFICIENCY LEVELS
To provide a better understanding of the type of tasks included in the test to assess students’ competencies in reading, mathematics and science, this section describes a key element of the OECD Test for Schools: the PISA scales and PISA proficiency levels.

Reading
The reading part of the OECD Test for Schools focuses on students’ ability to use written information in situations that they encounter in life. Like in the main PISA study, reading literacy in the OECD Test for Schools is defined as

understanding, using, reflecting on and engaging with written texts, in order to achieve one’s goals, to develop one’s knowledge and potential, and to participate in society.

This definition goes beyond the traditional notion of the decoding of information and literal interpretation of what is written, towards more applied tasks. To provide a better understanding of the type of tasks used to assess student competencies in the OECD Test for Schools, Figure A describes the PISA proficiency levels in reading and the types of tasks that students performing at different levels can be expected to successfully accomplish. Depending on the tasks that students are able to successfully respond to, students can be grouped into levels of reading proficiency. The relationship between the proficiency levels and the PISA scale scores (i.e. performance estimates) is also shown in the figure.

Figure A shows the lowest score limit on the PISA reading scale for each proficiency level. Students with a score between 480 and 552, for example, are proficient at Level 3. Students with a score above 698 are proficient at Level 6, while students with a score below 335 do not reach Level 1. Students below Level 1 are not necessarily considered illiterate, but based on the test used in the pilot, there is insufficient information on which to base a description of these students’ reading proficiency. Level 2 is considered the baseline level of reading proficiency. At this level students begin to demonstrate reading competencies that will enable them to participate effectively and productively in life.
## The six levels of reading proficiency in PISA

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit on PISA scale</th>
<th>What students can do at this level of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>698</td>
<td>Students at Proficiency Level 6 are highly skilled readers. They can conduct fine-grained analyses of texts, which require detailed comprehension of both explicit information and unstated implications, and they can reflect on and evaluate what they read at a more general level. Students at this level have successfully completed most of the tasks presented to them in the reading assessment, demonstrating that they are capable of dealing with many different types of reading material. Hence, they are diversified readers who can assimilate information from unfamiliar content areas presented in atypical formats, as well as being able to engage with more familiar content with typical structures and text features. Another characteristic of the most highly developed readers is that they can overcome preconceptions in the face of new information, even when that information is contrary to expectations. Students at this level are capable of recognising what is provided in a text, both conspicuous and more subtle information, while being able to apply a critical perspective to it, drawing on sophisticated understanding beyond the text.</td>
</tr>
<tr>
<td>5</td>
<td>626</td>
<td>Students at Proficiency Level 5 can handle texts that are unfamiliar in either form or content. They can find information in such texts, demonstrate detailed understanding, and infer which information is relevant to the task. They are also able to critically evaluate such texts and build hypotheses about them, drawing on specialised knowledge and accommodating concepts that might be contrary to expectations. An inspection of the kinds of tasks students at Level 5 are capable of suggests that those who get to this level and Level 6 can be regarded as potential “world class” knowledge workers of tomorrow.</td>
</tr>
<tr>
<td>4</td>
<td>553</td>
<td>Students at Proficiency Level 4 are capable of difficult reading tasks such as locating embedded information, construing meaning from linguistic nuances and critically evaluating a text. Tasks at this level that involve retrieving information require the reader to locate and organise several pieces of embedded information. Some tasks at this level require interpreting the meaning of nuances in a section of text by taking into account the text as a whole. Other interpretative tasks require understanding and applying categories in an unfamiliar context. Reflective tasks at this level require readers to use formal or public knowledge to hypothesise about or critically evaluate a text. Readers must demonstrate an accurate understanding of long or complex texts whose content or form might be unfamiliar.</td>
</tr>
<tr>
<td>3</td>
<td>480</td>
<td>Students at Proficiency Level 3 are capable of reading tasks of moderate complexity, such as locating multiple pieces of information, making links between different parts of a text, and relating it to familiar everyday knowledge. Tasks at this level require the reader to locate, and in some cases recognise the relationship between, several pieces of information that must meet multiple conditions. Interpretative tasks at this level require the reader to integrate several parts of a text in order to identify a main idea, understand a relationship, or construe the meaning of a word or phrase. They need to take into account many features in comparing, contrasting or categorising. The required information might not be prominent or there may be too much competing information, or there might be other obstacles in the text, such as ideas that are contrary to expectation or that are negatively worded. Reflective tasks at this level might require connections, comparisons, and explanations, or they might require the reader to evaluate a feature of the text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to everyday knowledge. Other tasks do not require detailed text comprehension but require the reader to draw upon less common knowledge.</td>
</tr>
<tr>
<td>2</td>
<td>407</td>
<td>Students at Proficiency Level 2 are capable of tasks that require the reader to locate one or more pieces of information, which might need to be inferred and might need to meet several conditions. Other tasks at this level require recognising the main idea in a text, understanding relationships, or construing meaning within a limited part of the text when the information is not prominent and the reader must make low-level inferences. Tasks at this level may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks require readers to make a comparison or several connections between the text and outside knowledge, by drawing on personal experience and attitudes. PISA considers Level 2 a baseline level of proficiency at which students begin to demonstrate the reading skills and competencies that will allow them to participate effectively and productively in life as they continue their studies, and as they enter into the labour force and become members of society.</td>
</tr>
<tr>
<td>1</td>
<td>335</td>
<td>Students at Proficiency Level 1 are capable of locating pieces of explicitly stated information that are rather prominent in the text, recognising a main idea in a text about a familiar topic, and recognising the connection between information in such a text and their everyday experience. Typically the required information in texts at this level is prominent and there is little, if any, competing information. The reader is explicitly directed to consider relevant factors in the task and in the text.</td>
</tr>
</tbody>
</table>
Mathematics
The OECD Test for Schools measures mathematics in terms of students’ capacity to formulate, employ and interpret mathematics in a variety of contexts. This includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena.

The test consists of tasks that allow the students to demonstrate their ability to analyse and reason as they solve and interpret mathematical problems that involve quantitative, spatial, probabilistic or other mathematical concepts. Depending on the tasks that students are able to respond to successfully, students can be grouped into different levels of mathematics proficiency. Figure B presents short descriptions of what students are expected to know and be able to do at each level of mathematics proficiency.

Figure B • The six levels of mathematics proficiency in PISA

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit on PISA scale</th>
<th>What students can do at this level of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>669</td>
<td>Students at Proficiency Level 6 can conceptualise, generalise and utilise information based on their investigations and modelling of complex problems. They can link different information sources and representations and flexibly translate between them. Students at this level are capable of advanced mathematical thinking and reasoning. They can apply this insight and understanding along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situations.</td>
</tr>
<tr>
<td>5</td>
<td>607</td>
<td>Students at Proficiency Level 5 can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare, and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriately linked representations, symbolic and formal characterisations, and insight pertaining to these situations. They can reflect on their actions and communicate their interpretations and reasoning.</td>
</tr>
<tr>
<td>4</td>
<td>545</td>
<td>Students at Proficiency Level 4 can work effectively with explicit models for complex, concrete situations that might involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic ones, linking them directly to aspects of real-world situations. Students at this level can use well-developed skills and reason flexibly, with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments and actions.</td>
</tr>
<tr>
<td>3</td>
<td>482</td>
<td>Students at Proficiency Level 3 can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They can develop short communications reporting their interpretations, results and reasoning.</td>
</tr>
<tr>
<td>2</td>
<td>420</td>
<td>Students at Proficiency Level 2 can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures, or conventions. They are capable of direct reasoning and literal interpretations of the results. PISA considers Level 2 a baseline level of mathematics proficiency at which students begin to demonstrate the kind of skills that enable them to use mathematics in ways that are considered fundamental for their future development.</td>
</tr>
<tr>
<td>1</td>
<td>358</td>
<td>Students at Proficiency Level 1 can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.</td>
</tr>
</tbody>
</table>
The lowest score limit on the PISA scale is presented for each level. Level 2 represents a baseline level of mathematics proficiency at which students begin to demonstrate the kinds of skills that enable them to use mathematics in ways that are considered fundamental for their future development. Students with a score between 482 and 545 are proficient at Level 3. Students with a score above 669 are proficient at Level 6, while students with a score below 358 do not reach Level 1. Students below Level 1 usually do not succeed at the most basic mathematical tasks that PISA and the OECD Test for Schools measure. Their pattern of answers is such that they would be expected to solve fewer than half of the tasks in a test made up of questions drawn solely from Level 1.

**Science**

Unlike many traditional assessments of student performance in science, the OECD Test for Schools is not limited to measuring students' mastery of specific science content. Rather, it attempts to measure the capacity of students to identify scientific issues, explain phenomena scientifically and use scientific evidence as the students encounter, interpret, solve and make decisions in life situations involving science and technology. As with reading and mathematics, depending on the science tasks that students are able to respond to successfully, students can be grouped into different levels of science proficiency.

<table>
<thead>
<tr>
<th>Level</th>
<th>Lower score limit on PISA scale</th>
<th>What students can do at this level of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>708</td>
<td>At Level 6, students can consistently identify, explain and apply scientific knowledge and knowledge about science in a variety of complex life situations. They can link different information sources and explanations and use evidence from those sources to justify decisions. They clearly and consistently demonstrate advanced scientific thinking and reasoning, and they demonstrate willingness to use their scientific understanding in support of solutions to unfamiliar scientific and technological situations. Students at this level can use scientific knowledge and develop arguments in support of recommendations and decisions that centre on personal, social or global situations.</td>
</tr>
<tr>
<td>5</td>
<td>633</td>
<td>At Level 5, students can identify the scientific components of many complex life situations; apply both scientific concepts and knowledge about science to these situations; and can compare, select and evaluate appropriate scientific evidence for responding to life situations. Students at this level can use well-developed inquiry abilities, link knowledge appropriately and bring critical insights to situations. They can construct explanations based on evidence and arguments based on their critical analysis.</td>
</tr>
<tr>
<td>4</td>
<td>559</td>
<td>At Level 4, students can work effectively with situations and issues that might involve explicit phenomena requiring them to make inferences about the role of science or technology. They can select and integrate explanations from different disciplines of science or technology and link them directly to aspects of life situations. Students at this level can reflect on their actions and can communicate decisions using scientific knowledge and evidence.</td>
</tr>
<tr>
<td>3</td>
<td>484</td>
<td>At Level 3, students can identify clearly described scientific issues in a range of contexts. They can select facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level can interpret and use scientific concepts from different disciplines and apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge.</td>
</tr>
<tr>
<td>2</td>
<td>409</td>
<td>At Level 2, students have adequate scientific knowledge to provide possible explanations in familiar contexts or draw conclusions based on simple investigations. They are capable of direct reasoning and making literal interpretations of the results of scientific inquiry or technological problem solving. PISA considers Level 2 a baseline level of proficiency at which students begin to demonstrate the science competencies that will enable them to participate actively in life situations related to science and technology.</td>
</tr>
<tr>
<td>1</td>
<td>335</td>
<td>At Level 1, students have such a limited scientific knowledge that it can only be applied to a few, familiar situations. They can present scientific explanations that are obvious and follow explicitly from given evidence.</td>
</tr>
</tbody>
</table>
Figure C presents short descriptions of what students are expected to know and be able to do at each level of science proficiency. The lowest score limit on the PISA scale is presented for each level. Level 2 has been established as the baseline level of science proficiency. It defines the level of achievement at which students begin to demonstrate the science competencies that will enable them to participate actively in life situations related to science and technology. Students with a score between 484 and 559 are proficient at Level 3. Students with a score above 708 are proficient at Level 6, while students with a score below 335 do not reach Level 1. Students below Level 1 usually do not succeed at the most basic levels of science that PISA and the OECD Test for Schools measure. Their pattern of answers is such that they would be expected to solve fewer than half of the tasks in a test made up of questions drawn solely from Level 1.

**EXAMPLES OF FIGURES FROM SCHOOL REPORTS**

Over the years, PISA results have shown that a strong learning environment and confident, engaged and motivated students are factors that consistently contribute to better learning outcomes. Based on students’ responses to a contextual questionnaire that is a key part of the assessment, the school and district reports provide information on the learning environment at schools in the context of other schools in the same country. The following are examples of figures that are included in the reporting to schools from the OECD Test for Schools. The example figures are based on actual results presented to schools in relation to disciplinary climate in English and mathematics lessons, teacher-student relations and students’ attitudes and engagement towards science.

**Disciplinary climate – reading**

The following Sample Figure 1 shows how students at an “Example School” responded to five questions on the disciplinary climate in English classes compared with high- and low-performing students in the same country that participated in PISA 2009. The figure shows the percentage of students who reported occasional or next-to-never interruptions in reading classes at the “Example School”, and among the 10% of highest- and lowest-performing students in the country – the United States for these examples – in PISA 2009. The occurrences include how often students don’t listen to what the teacher says, there is noise and disorder, the teacher has to wait a long time for students to quieten down, students cannot work well or students don’t start working for a long time after the lesson begins.

When comparing the disciplinary climate at a particular school with the disciplinary climate that top- and low-performing students experience, as shown in Sample Figure 1, it is useful to note that the darkness of the triangular markers indicates whether the responses for students at the school are on average statistically different from those of the highest- or lowest-performing students in the comparison country. In short, darker-toned markers indicate statistical significance so the results for a school can be considered to be significantly different. If for example the marker for low performing students in the United States is in a darker tone, but the marker for high performing students is not, then students at the particular school have answered the question to a degree that is statistically different from the lowest-performing students, but not statistically different from the highest performing students in the United States.

To place this example figure in context, the majority of students in the United States enjoy orderly classrooms in their English lessons. Around 8 out of 10 report that they never or only in some lessons think that students don’t start working for a long time after the lesson begins or that noise never or only in some lessons affects learning. As the example figure shows, however, not all students experience the same level of order in the classrooms. In general, high-performing students have a more positive view of the disciplinary climate than low-performing students.
While 9 out of 10 top-performing students report that the teachers rarely have to wait a long time for the students to quieten down, only 7 out of 10 low-performing students have a similarly positive experience in their English classes. PISA results over the years have found that this relationship between disciplinary climate and performance goes beyond the impact of students’ social background. While schools with disciplined classrooms tend to have more students from advantaged socio-economic backgrounds who also generally perform better, part of the correlation between disciplinary climate and performance is unrelated to socio-economic background.

To put these findings in context, in Canada and the United Kingdom, student reports of the learning environment are slightly less positive than in the United States. The most positive reports on the learning environment are found in Japan and Korea.

**Disciplinary climate – mathematics lessons**

Having looked at the disciplinary climate in English lessons in the previous example figure, the following example figure exemplifies the kind of information provided by the assessment with regards to the disciplinary climate in mathematics lessons. The same questions have been asked of students concerning the disciplinary climate in both subjects, so comparisons can be reasonably made between the learning environments in the two subjects at the example school.

Sample Figure 2 shows how students at this example school responded to five questions on the disciplinary climate in mathematics compared with high- and low-performing students in the comparison country that participated in PISA 2003. Similarly to the figure on disciplinary climate in English lessons, this figure shows...
the percentage of students who reported occasional or next-to-never interruptions in mathematics class at your school, and among the 10% highest- and lowest-performing students in the United States (comparison country). The occurrences include how often there are times students don’t listen to what the teacher says, there is noise and disorder, the teacher has to wait a long time for students to quieten down, students cannot work well or students don’t start working for a long time after the lesson begins.

Because PISA focused on mathematics in the 2003 cycle, results on the disciplinary climate in mathematics for other students in the United States that participated in PISA are drawn from the 2003 cycle, whereas for reading they are drawn from PISA 2009 when reading was the main subject of assessment.

Sample Figure 2 – Disciplinary climate in mathematics lessons at your school and among the top- and lowest-performing students in the United States in PISA 2003

As with English lessons, the majority of students in the United States enjoy orderly classrooms in their mathematics lessons. Around 7 out of 10 students who participated in PISA 2003 reported that they never or only in some lessons think that students don’t start working for a long time after the lesson begins or that noise never or only in some lessons affects learning. As Sample Figure 2 shows, however, not all students show the same learning environment in the classrooms. In general, high-performing students have a more positive view of the disciplinary climate than low-performing students. While around 9 out of 10 top-performing students report that the teachers rarely have to wait a long time for the students to quieten down, only 5 out of 10 low-performing students have a similarly positive experience in their mathematics lessons.

Because PISA focused on mathematics in the 2003 cycle, results on the disciplinary climate in mathematics for other students in the United States that participated in PISA are drawn from the 2003 cycle, whereas for reading they are drawn from PISA 2009 when reading was the main subject of assessment.
As with English lessons, the majority of students in the United States enjoy orderly classrooms in their mathematics lessons. Around 7 out of 10 students who participated in PISA 2003 reported that they never or only in some lessons think that students don’t start working for a long time after the lesson begins or that noise never or only in some lessons affects learning. As Sample Figure 2 shows, however, not all students show the same learning environment in the classrooms. In general, high-performing students have a more positive view of the disciplinary climate than low-performing students. While around 9 out of 10 top-performing students report that the teachers rarely have to wait a long time for the students to quieten down, only 5 out of 10 low-performing students have a similarly positive experience in their mathematics lessons.

**Teacher-student relations**

Along with the disciplinary climate, teacher-student relations in schools are a key element of the learning environment that is positively associated with student performance. The following Sample Figure 3 shows to what extent students at a particular school agree with several statements regarding the relationship with teachers. These statements reflect whether they get along well with most of their teachers, whether they feel that their teachers are interested in their well-being, whether the teachers listen to what the students have to say, whether the teachers provide extra help when needed, and whether the students feel that teachers treat them fairly.

To place the results for an individual school in context, the figure also shows how the highest- and lowest-performing students in the United States (comparison country) responded to the same questions in PISA 2009. As with similar figures, when comparing the teacher-student relations at a particular school to those of students in other schools, the darkness of the triangular markers indicates whether the responses for students at the school are statistically different from the highest- or lowest-performing students in the United States that participated in PISA.

**Sample Figure 3**  -  **Teacher-student relations at your school and among the top- and lowest-performing students in the United States in PISA 2009**

<table>
<thead>
<tr>
<th></th>
<th>Your School</th>
<th>Average percentage of the 10% highest performing students in reading (darker tone when statistically different from Your School)</th>
<th>Average percentage of the 10% lowest performing students in reading (darker tone when statistically different from Your School)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I get along well with most of my teachers</td>
<td>▼</td>
<td>▲</td>
<td>▲</td>
</tr>
<tr>
<td>Most of my teachers are interested in my well-being</td>
<td>▼</td>
<td>▲</td>
<td>▲</td>
</tr>
<tr>
<td>Most of my teachers really listen to what I have to say</td>
<td>▼</td>
<td>▲</td>
<td>▲</td>
</tr>
<tr>
<td>If I need extra help, I will receive it from my teachers</td>
<td>▼</td>
<td>▲</td>
<td>▲</td>
</tr>
<tr>
<td>Most of my teachers treat me fairly</td>
<td>▼</td>
<td>▲</td>
<td>▲</td>
</tr>
</tbody>
</table>

Source: OECD.
In PISA 2009 students from more than 70 countries and economies were asked the same questions on their teacher-student relations. The results from OECD countries suggest that students are generally satisfied with their relations with teachers. On average across OECD countries, 85% of students reported that they agree or strongly agree that they get along well with most of their teachers. In the United States the figures are even higher with 90% of students agreeing that they get along well with most of their teachers. In the United Kingdom and Canada, students report similarly positive teacher-student relations with 86% and 89% of students, respectively, agreeing with the statement. The overall teacher-student relations in the United States, United Kingdom and Canada are more positive than the OECD average. The results from the pilot trial of the OECD Test for Schools in these countries, however, has shown that some schools have been surprised to see how their students’ perceive the teacher-student relations.

**Students’ self-belief and interest in science and the relationship with performance**

In the last set of example figures, the focus turns to students’ motivation and self-efficacy in science. Although their engagement with science may be particularly relevant for schools with a specific focus on science and technology, the information in these figures may be helpful for other schools as well given the close association between motivation, self-efficacy and student performance in science.

**Sample Figure 4**

*Students’ instrumental motivation in science at your school and in the United States in PISA 2006*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Your School</th>
<th>United States (darker tone when statistically different from your school)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I study school science because I know it is useful for me</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Making an effort in my school science subject(s) is worth it because this will help me in the work I want to do later on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studying my school science subject(s) is worthwhile for me because what I learn will improve my career prospects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I will learn many things in my school science subject(s) that will help me get a job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What I learn in my school science subject(s) is important for me because I need this for what I want to study later on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: OECD.

**Instrumental motivation in science**

Sample Figure 4 shows how students at an example school responded to five questions regarding their motivation to learn science. The questions focus on students’ instrumental motivation in the sense of how important they see science for their own life as they move on to further studies and the labour market.

The responses provided by students at the example school are compared with responses from a representative sample of students in the United States (comparison country) who participated in PISA 2006 when science was the main focus of the assessment. Across the United States, 77% of students agree or strongly agree with the
statement “I study school science because I know it is useful for me”; 78% agree or strongly agree that “making an effort in my school science subject(s) is worth it because this will help me in the work I want to do later”; 70% agree or strongly agree that “studying my school science subject(s) is worthwhile for me because what I learn will improve my career prospects”; 70% agree or strongly agree with “I will learn many things in my school science subject(s) that will help get a job”; and 68% agree or strongly agree with “What I learn in my school science subject(s) is important for me because I need this for what I want to study later on.”

**Students’ self-efficacy in science**

Students who lack confidence in their ability to solve science tasks often tend to show weaker performance results than those with a high level of self-efficacy. Although improvements in confidence to some extent seem to mirror the students’ performance levels, improvements in performance and in self-confidence often need to go hand-in-hand: students with higher academic abilities are more confident, and in turn, students with higher confidence have the drive to make the efforts that improve their abilities.

Sample Figure 5 shows how students at an example school respond to eight questions regarding their self-efficacy in science. The responses show how confident students feel about having to do each of the science tasks mentioned in the figure. The values reported by the figure represent the percentage of students who responded they can perform the tasks “easily” or “with a bit of effort”.

---

**Sample Figure 5**

- **Students’ self-efficacy in science at your school and in the United States in PISA 2006**

<table>
<thead>
<tr>
<th>Task</th>
<th>Your School</th>
<th>United States (darker tone when statistically different from your school)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain why earthquakes occur more frequently in some areas than in others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognize the science question that underlies a newspaper report on a health issue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpret the scientific information provided on the labeling of food items</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predict how changes to an environment will affect the survival of certain species</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify the science question associated with the disposal of garbage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe the role of antibiotics in the treatment of disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify the better of two explanations for the formation of acid rain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discuss how new evidence can lead you to change your understanding about the possibility of life on Mars</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: OECD.
The example figure also shows how confident students in the United States (comparison country) on average feel about having to do the tasks, as measured by PISA 2006. The task that most students in the United States feel that they can do “easily” or “with a bit of effort” is “Recognise the science question that underlies a newspaper report on a health issue”. Eight out of ten students in the United States respond that they feel capable of the task. At the other end, the task that students feel less confident about is “Identify the better of two explanations for the formation of acid rain”. Six out of ten students in the United States feel that they can solve that task easily or with a bit of effort.

Sample Figure 6 shows an example school’s average performance results in reading along with the results of other schools in the United States that participated in PISA 2009. The red bubble (at the centre of the bands) represents the example school. The hollow bubbles represent schools that participated in PISA 2009. It is important to remember that students in the PISA 2009 schools are a representative sample of students in the United States.

Sample Figure 6 • **How your school’s results in reading compare with schools in the United States in PISA 2009**

- Your School
- Schools in the United States that participated in PISA 2009

*Note: Size of bubbles is proportional to the number of students enrolled at the school.*

*Source: OECD.*
The scale on the bottom (the x-axis) refers to the socio-economic status of students as measured by the PISA index of economic, social and cultural status (ESCS). The scale shows average index values of -3.0 to +3.0. The scale is calibrated so that a value of 1 equals a difference of 1 standard deviation from the OECD average of 0.0. The important element to keep in mind when reviewing these figures is that as values increase (from left to right), the average socio-economic status of students increases: they are more advantaged in terms of their socioeconomic background. Thus, schools that are plotted towards the lower end of the scale (-2.0 for example) will appear on the left side of the figure meaning that students on average in these schools come from disadvantaged backgrounds. Schools plotted with higher ESCS values such as +1.0 or higher (towards the right side of the x-axis) serve students primarily from advantaged backgrounds.

Schools with a similar socio-economic background to the example school are indicated by the vertical blue band. The schools that appear in this blue band are serving students from similar socio-economic backgrounds. These schools have an index value on the index of economic, social and cultural status (ESCS) that is within the range of 0.25 of a standard deviation from the example school’s value. Schools in the blue band, therefore, serve students that are on average from similar socio-economic backgrounds. With this information in mind, it is useful to see whether other schools that fall within the vertical blue band are performing above or below the example school’s level. Schools within the band that are well above the example school show a higher student performance with a student intake similar to that of the example school. Similarly, the schools within the band that are well below the example school show a lower student performance with a student intake similar to that of the example school.

EXAMPLES OF INSIGHTS FROM PISA AND INTERNATIONAL POLICIES AND PRACTICES INCLUDED IN THE REPORTS

Throughout the reports provided to schools, international case stories and insights on successful school improvement efforts gleaned from PISA and other OECD research on education are presented. The reports include several text boxes that describe how some schools and educators from around the world have succeeded in implementing reforms and how they have tackled low performance and cultivated talented students. The reports include links to additional resources, such as a video series that showcases local educators and policy makers from around the world telling their own stories about how they succeeded in improving student outcomes. These case studies will be updated based on ongoing OECD research and on findings from PISA 2012 the results of which will be published on 3 December 2013.

The following pages show a few examples of the relevant insights, policies and practices included as text boxes in the school reports in order to facilitate a better engagement with and use of the reports received as part of the OECD Test for Schools.
Box B. What makes a school successful? Some lessons from PISA

Success in terms of performance and equity: According to PISA, successful school systems are defined as those that perform above the OECD average in reading (493 points in 2009) and in which students’ socio-economic background has a smaller impact on reading performance than in a typical OECD country. On average across OECD countries, 14% of the variation in reading scores is explained by socio-economic background.¹

What characterises school systems that perform above average and in which students’ socio-economic background has a smaller impact on reading performance than in a typical OECD country?

PISA 2009 results identify several features of school systems that relate to student performance and equity in education. Factors such as how students are selected for entry into schools and classrooms; the extent to which individual schools are granted autonomy to make decisions on curricula and assessments; and whether schools are allowed to compete for student enrolment, as well as other factors such as accountability and where spending on education is directed, all play an important role in the success of school systems across OECD countries.

The most impressive outcome of world-class education systems is perhaps that they deliver high-quality learning consistently across the entire education system, so that every student benefits from excellent learning opportunities. To achieve this, education systems such as those in Japan, Canada and Korea invest educational resources where they can make the greatest difference, they attract the most talented teachers into the most challenging classrooms, and they establish effective spending choices that prioritise the quality of teachers (OECD, 2010). The following approaches highlighted in PISA 2009 results are utilised by educators and policy makers for successful schools.

- **Successful systems have low levels of student differentiation.** In other words, school systems where all students, regardless of their background, are offered similar opportunities to learn; socio-economically advantaged and disadvantaged students attend the same schools; and students rarely repeat grades or are transferred out of schools because of behavioural problems, low academic achievement or special learning needs are more likely to perform above the OECD average.

- Results from PISA also show that giving parents and students the ability to choose among schools does not relate positively to equity in education if their choice is constrained by financial or logistical considerations, such as additional tuition fees or transportation to and from schools. Thus, for local education systems considering policies with regards to school choice, it is important to consider the different aspects involved with school choice and competition.

- **School systems that grant schools more authority over the curriculum and allocation of resources tend to have higher results.** Schools that are able to make decisions about curricula and assessments, while limiting school competition for students, are also more likely to perform above the OECD average and to show below-average socio-economic inequalities. School systems that grant schools greater discretion in deciding student-assessment policies, the courses offered, the content of those courses, and the textbooks used are also those systems with higher reading scores overall.

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In addition, school systems in which school heads have more control over how resources are used, staff are deployed, work is organised and the work gets done are closely related to good school performance when combined with effective accountability systems.

- **Accountability goes hand in hand with school autonomy.** PISA results show that in school systems where most schools post achievement data publicly, average student performance is marginally higher in schools that also have autonomy over resource allocation.

Successful school systems provide an environment where they hold themselves accountable and where teachers work together to frame what they believe to be good practice, conduct field-based research to evaluate approaches they develop, and then assess their colleagues and their students by the degree to which they use practices that have proved effective in their classrooms.

Placing a high value on education is very important for success but can only get a country so far if the teachers, parents and citizens of a country believe that only a segment of the nation’s children can or need to meet high standards. Systems that show high performance and an equitable distribution of learning outcomes tend to be comprehensive and have a more positive outlook on every student’s ability to succeed, requiring teachers and schools to embrace diverse student populations through personalised educational pathways.

**Equity in schools in Finland**

Finland provides an excellent example of a thriving school system that embraces equity and diversity. Equality in educational opportunities lies at the heart of Finland’s education policy. Education policies emphasise equity and well-being in schools and rely upon the principle of inclusive education. The aim is for all children to find their neighbourhood school sufficient and appropriate to their needs and to their parents’ expectations. However, parents still have freedom to choose any school in their own municipality. While assessment practice is grounded in the national curriculum, education policy in Finland gives a high priority to individualised education and creativity as an important part of how schools operate. Thus, each student is judged more against his or her individual progress and abilities than against statistical indicators (OECD, 2012).

To find out more about what makes schools successful, go to:

- **Strong Performers and Successful reformers in Education: Maintaining a strongly supportive school system in which teachers and students share responsibility for results**
- **PISA in Focus 9: School autonomy and accountability: Are they related to student performance?**


Box C. Learning – and teaching – in the 21st century: Implications for educators

What is different today?

Across many education systems, there is increasing awareness of the need to allow students to acquire the knowledge and develop the skills and competencies they will need as adult citizens in globally competitive knowledge-based economies. Innovation in curricular content has not kept pace with other dramatic changes in many educational systems. Some education systems have reviewed and modified their curricula, sometimes considerably, but the most recent PISA results show that school systems are not always successful in preparing students for the kinds of competencies and skills that are the foundation for success as continuing students, as skilled workers and as citizens (OECD, 2008).

Education systems in many countries, including Canada, the United Kingdom and the United States for example, were established for a workforce that may no longer play the same roles in today’s economies. The following figure shows how the demand for skills has dramatically changed in the United States in the past 50 years and how routine manual tasks have given way to non-routine analytical and interactive tasks:

Figure D. Changes in the types of task input demanded in the labour market in the United States economy since 1960

The links between 21st century skills, competencies and Deeper Learning

In the context of education reform efforts in many countries, one designation for these types of 21st century competencies and skills is “Deeper Learning” that has been defined in a recent report by the National Research Council (NRC) in the United States as “the process through which a person becomes capable of taking what was learned in one situation and applying it to new situations – in other words, learning for ‘transfer’” (NRC, 2012).

There are also other examples and applications of the same general approach internationally, such as the Canadian Education Association’s focus on students’ intellectual engagement as part of “deep conceptual learning” (Dunleavy and Milton, 2010) and the focus of the Specialist Schools and Academies Trust in the United Kingdom on “assessment for learning, student voice, and learning to learn” to achieve “high meta-cognitive control and generic skills of learning” (Sims, 2006).
Another approach, advocated by the Partnership for 21st Century Skills (P21) and EdLeader21, focuses on “the 4 Cs”: Critical thinking, Communication, Collaboration and Creativity as required competencies for success in college, career and citizenship today (Greenhill and Kay, 2013). In most of these frameworks, non-cognitive competencies such as resilience, conscientiousness, metacognition and self-direction are also emphasised as critical for positive adult outcomes in life and career.

**Implications for educators today**

Not only must knowledge and information that are shared in schools, and skills that are developed, provide students with a foundational base, but schools must also help prepare students for the challenges they will face in the future as university students, as workers and as citizens. Schools and local educators must increasingly shift from a model that required routine practices to one that prepares students today to compete for jobs tomorrow that require a work ethic, collaboration, good communication, listening skills, social responsibility, critical thinking and problem solving (Greenhill and Kay, 2013). Curricular content therefore needs to be re-examined in order to see what changes are necessary to provide children with the knowledge, skills, and character traits they need to succeed in the 21st century.

The NRC report sets out three broad domains of competence: cognitive, intrapersonal and interpersonal and notes that available empirical evidence suggests that these can be taught and learned. For educators, the report also notes that emerging empirical evidence suggests the following teaching methods:

- Employing multiple and varied representations of concepts and tasks (representations, simulations, diagrams and teacher support)
- Encouraging questioning, explanation and elaboration by students
- Engaging students in challenging tasks and providing guidance in their own learning processes
- Employing relevant examples and clear cases that students can model
- Fostering student motivation by linking learning to interests and real-world applications of knowledge and skills, and
- Employing formative assessments that can inform teachers and students to adjust teaching and learning strategies.

In short, schools and educators today need to not only help students successfully enter the workforce of the 21st century, they must also help students become effective lifelong learners.

To find out more about 21st-century learning and teaching, go to:

- Preparing teachers and developing school leaders for the 21st century: Lessons from Around the World – Background Report for the International Summit on the Teaching Profession
- The National Research Council Report, Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century
- EdLeader21
- Partnership for 21st Century Skills
Box D. What PISA shows regarding student achievement in mathematics

Many educators rightly point out that many factors contribute to or hinder success in student learning outcomes. Results from PISA have shown that numerous learning and teaching strategies are associated with higher student performance in mathematics. Among the factors associated with performance are school- and classroom-level factors such as the disciplinary climate that exists in a classroom, the attitudes students have towards teachers and fellow classmates, the interest they have in the subject and their confidence in their ability to perform. School leaders and local educators are increasingly looking at how effective strategies can be fostered within schools and classrooms to enhance the learning environment and improve learning outcomes, even for students from disadvantaged backgrounds (OECD, 2009). The following are some of the findings from previous PISA cycles with regards to students’ achievement in mathematics:

- PISA has found that **disciplinary climate is the main teaching-related variable that shows a strong and consistent association with better performance**.

The PISA 2003 cycle focused on mathematics competencies and the factors associated with higher performance. PISA collects information on disciplinary climate from student responses to items in the questionnaire about disruptions in the classroom and student behaviours towards the teacher. PISA results from 2003 suggest that disciplinary climate produces positive results both at the individual and school levels, even after adjusting for other factors such as socio-economic status. In PISA 2003, differences in the disciplinary climate showed positive effects on mathematics results ranging from 40 score points or more in Turkey, Japan and the partner economy Hong Kong-China to less than 10 score points in Poland and Finland (OECD, 2009). Not only is a strong disciplinary climate consistently and strongly associated with better performance in mathematics across most countries, but policies targeted to improve disciplinary climate at the school level also yield positive effects.

...
PISA results show that the correlation between disciplinary climate and achievement is much higher at the school than at the student level. While the school-level disciplinary climate may relate to such factors as the socio-economic composition of the school, PISA results indicate that improving the disciplinary climate seems to be a universally effective strategy to improve achievement. Looked at another way, lost learning time in school is strongly associated with lower mathematics performance.

- PISA results have also shown that student attitudes such as motivation and confidence are strongly associated with higher performance, while student anxiety is associated with lower performance. Students’ motivation, which is measured in PISA 2003 by students’ interest in and enjoyment of mathematics, has a positive effect on performance in most countries. Moreover, students’ instrumental motivation – a term that refers to students’ perception of the importance of mathematics to future education or to careers – not only has a strong positive relationship with performance, but continues to show significant positive effects in 13 OECD countries even after weighting for all other factors such as socio-economic status and student-teacher relations. It is also noteworthy that PISA shows that in a few countries such as Poland, the United States, Canada and the Russian Federation, the effect of students’ interest in and enjoyment of mathematics is negative while the effect of students’ instrumental motivation is positive (OECD, 2009).

- PISA results indicate that a student’s strong sense of his or her own ability to learn mathematics is strongly associated with performance. In 2003, PISA measured self-efficacy, specifically in relation to mathematics, by students’ responses to their confidence level in their ability to solve a variety of mathematics problems. Students’ self-efficacy both in mathematics and science yields strong positive effects in all OECD countries when this factor is not overridden by students’ socio-economic background, perceptions of school, motivation to learn or other factors. The examples of Mexico (the OECD country with the lowest performance) and Brazil (OECD partner country) indicate that a high anxiety tends to correspond with low mathematics performance. Although PISA results cannot determine whether student attitudes lead to higher performance or if it is high performance that leads to more confidence, PISA results do suggest that building confidence needs to go hand in hand with enabling students to develop strategies for effective learning. Perhaps not surprisingly, students who are anxious about learning mathematics tend to perform worse. School leaders and local educators can use this information to implement teaching strategies in order to reduce anxiety, especially among students and in environments where it is highest.

- PISA also measures the effectiveness of learning outside the classroom (e.g. tutoring, extra classes and homework). The proportion of students tutored in mathematics ranges from 10% to 20% in most countries, to less than 10% in high-achieving countries such as Finland and Japan. In some low-achieving countries, particularly Greece, Mexico and Turkey, nearly one in three students (30%) is tutored outside the classroom. The popularity of tutoring and extra lessons in low-achieving contexts suggests that more efforts are being made by many students and by their parents to overcome low achievement, but that the effectiveness of these efforts should be closely looked at and monitored.

- PISA results have also suggested that extra mathematics homework appears to be targeted to students who need it most. Yet within countries that participated in PISA, the relationship between extra mathematics homework and performance tends to be negative, which suggests that extra efforts in terms of mathematics homework used to compensate for limitations of schooling or to substitute for instruction by teachers has only a limited positive effect. It is also likely that in many high-achieving countries, the mathematics teaching provided in school is sufficient to allow students to function well...
• without extra homework; however, when adjusting for other variables, total homework time does show significant positive effects on achievement for almost all countries. This shows that the time students invest in study in addition to their lessons is valuable and can help performance after all; however, educators should be mindful of the fact that mathematics learning is mainly school-based (OECD, 2009).

Additional factors might also contribute to higher mathematics performance. PISA results have also shown that in many education systems, there is a positive correlation between total instruction time and mean performance in mathematics. The total instruction time in the year varies greatly across and within countries. High-performing countries such as Korea have one of the highest yearly instruction times, at more than 30 hours per week, the most among OECD countries. Mexico is at the other extreme, with an estimated mean of 24 hours per week, and below 24 weeks of instruction per year, well below the OECD average of 36 weeks (OECD, 2010).

The approaches that students use to address a learning task are also important. Strategies such as memorisation/rehearsal, elaboration strategies and control strategies produce different results. Memorisation tends to be less used than either elaboration – thinking of new ways to get the answer – or control strategies, where the student starts by working out exactly what s/he needs to learn. What could be relevant for school leaders and teachers is that memorisation strategies are used more by students in relatively low-performing countries, with students in Mexico, Brazil, Thailand and Tunisia saying they use memorisation the most, and as a result produce a very high negative correlation between their use of memorisation and their performance on PISA.

Last but not least, teachers’ knowledge, skills and approaches to mathematics (and science) should continuously be updated so that concepts taught in the classroom remain relevant. Exchanging information, resources and expertise among educators and others such as researchers and universities may help keep curricula current. Local educators and school leaders should foster effective teaching and learning strategies that address issues such as disciplinary problems, additional instruction time in school and ways to boost students’ confidence in their abilities to solve math problems.

The importance of these factors with regard to students’ mathematics performance is the reason that the results for your school in the pilot trial include information on disciplinary climate, teacher-student relations, and students’ attitudes towards learning (e.g. instrumental motivation in mathematics and science).

To find out more about effective teaching and learning strategies in the classroom go to:

• **PISA in Focus 4: Has discipline in schools deteriorated?**
• **PISA in Focus 3: Does investing in after-school classes pay off?**
• **Mathematics Teaching and Learning Strategies in PISA**
• **Creating Effective Teaching and Learning Environments: First Results from TALIS**

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**Sources:** Organisation for Economic Cooperation and Development (OECD) (2009), *Creating Effective Teaching and Learning Environments: First Results from TALIS*, OECD Publishing.

Box E. What PISA shows regarding student achievement in science

Educators across OECD countries are mindful of today’s challenges of meeting a growing demand for science-related qualifications among young adults entering the workforce. In 2006, PISA focused on science by assessing students’ skills and knowledge of and about science; by looking at their attitudes and engagement with science; by looking at their general appreciation of science and personal beliefs as science learners; and by evaluating whether the students thought science would be valuable for their future. While 15-year-olds in OECD countries generally reported a positive disposition towards science, only one in three students on average across OECD countries (37%) reported that they would like to work in a career involving science and only one in five (21%) reported that they would aspire to a career in advanced science. One challenge facing educators, therefore, is to ensure that students are motivated and well-prepared to achieve scientific excellence in the future (OECD, 2007). How can schools foster and strengthen engagement in science-related areas and ensure that young adults leave school with the motivation and capacity to continue learning throughout life? The following are some of the insights from previous PISA cycles regarding factors surrounding student interest and achievement in science:

• **Overall, there is a strong and direct relationship between science performance and frequency of participation in student-initiated science activities in each of the OECD countries.**

  Exposure to science and engaging in science-related activities outside of school are two possible explanations for differences in student outcomes. When compared with the lowest performers in science, the OECD countries, top performers in science – students who reach at least Level 5 and can consistently demonstrate use of their scientific understanding in support of solutions to unfamiliar scientific situations – receive about two extra hours per week of instruction in science. PISA 2006 also asked students how often they pursued activities related to science outside of school, such as watching TV programmes about science or obtaining books on scientific topics. It was found that top performers in science engage in science-related activities more often than any other performance group. As science activities mostly take place outside of school, they are more likely to be associated with students’ socio-economic background. PISA thus also looked at what happened to student performance in science after accounting for students’ socio-economic background. *PISA results show that in all countries, student-initiated science activities maintain a strong statistical relationship with performance.* Educators and schools can explore ways of encouraging all students to engage in science-related activities outside of school with the aim of helping strong performers to excel and become top performers, in turn improving science performance overall.

• **Student experiences and dedication are important drivers of performance in science, as are student attitudes and motivations.**

  Interest in a subject can influence the intensity with which a student engages in learning. To measure students’ general interest in science and their interest in specific science topics, PISA 2006 asked students to provide information on their level of interest in subjects ranging from human biology to physics and on their general interest in the ways scientists design experiments. At least 50% of top performers on average across OECD countries reported being interested in all science topics they were asked about. Interest in and enjoyment of particular subjects – what PISA calls *intrinsic motivation* – affect both the degree and continuity of engagement in learning and students’ depth of understanding. Furthermore, future science motivation may be an important indicator of the proportion of students likely to pursue further science studies and/or careers. Results from PISA 2006 show that students generally enjoy learning science, with an average of 80% of top performers ...
reporting that they were both interested in learning about science and had fun doing so. PISA results suggest that educators should set a high priority on exploring and designing strategies to enable students to enjoy science.

- Students’ belief in their own ability to effectively handle tasks – what PISA calls self-efficacy – is often considered an important outcome of schooling. In 49 of 57 countries (including all OECD countries) a one-unit increase in the index of self-efficacy in science represents an increase of at least 20 score points on average. Confidence in their abilities in various subjects can bolster students’ motivation, learning behaviours and general expectations for their future. Self-efficacy centres on the kind of confidence needed for students to successfully master specific learning tasks, and thus is not simply a reflection of a student’s abilities and performance. The relationship between students’ self-efficacy and student performance may be reciprocal; students with higher academic ability can be more confident and greater confidence, in turn, can improve their academic ability. A strong sense of self-efficacy can also affect students’ willingness to take on challenging tasks and persist in tackling them: it can thus have a key impact on motivation.

- Overall, the majority of students in participating countries reported that they valued science in general; however, students also indicated that they do not necessarily relate science to their own lives or behaviour. For example, while 75% of students on average reported that science helped them to understand things around them, fewer reported they thought they would use science as adults (64% on average) and only 57% of students on average agreed that science was very relevant to them. In contrast, 80% of top performers reported that they would use science in many ways as adults.

An implication of this evidence is that the pool of talent for future science workers might be increased by seeking to raise top and strong performers’ motivation to learn science. In addition, by showing students that learning science is useful for further study and that opportunities exist for rewarding careers in science may also help incite students to see the benefits of learning science.

- PISA 2006 results also show that female students are much less likely to choose scientific study and science careers than males. It is therefore instructive to look at future-oriented science aspirations according to gender. Of the 28 OECD countries included in this comparison, 12 showed that male top performers in science had significantly higher aspirations to use science in the future. Yet, the overall aspiration pattern among science top and strong performers is the same for both sexes. So, the goal of increasing the numbers of adults engaged in the study and pursuit of scientific activities by fostering aspirations is valid for both.

- Educators and schools also would like to know how well they prepare students for future science-related careers. While at least 80% reported that their schools had prepared them well for science-related careers, only 34% of top performers in science reported being informed about employers or companies that hire people to work in science-related careers. In short, top performers perceived themselves to be well prepared by their schools for a science-related career, but not as informed about the careers available. This is an area where schools can develop ways to give students information about future job prospects.

Fostering interest and motivation in science is an important policy goal. Efforts to this end may relate to improved instructional techniques and a more engaging learning environment at school, but they can also extend to students’ lives outside school, such as making more and better content on the Internet more accessible or encouraging students to read more science-fiction novels, adventure stories or mysteries based on scientific and technical knowledge, ingenuity and solutions with characters (OECD, 2009).
By and large, educational excellence goes hand in hand with promoting student engagement in and enjoyment of science learning, both inside and outside the school. The payoff is quite significant: a large and diverse talent pool ready to take up the challenge of a career in science. In today’s global economy, it is the opportunity to compete on innovation and technology.

To find out more about what PISA shows regarding top performing students in science:

- **PISA 2006: Science Competencies for Tomorrow’s World, Vol. 1**
- **Top of the Class – High Performers in Science in PISA 2006**

Questions?

For more information, please visit the OECD Website:

www.oecd.org/pisa/pisa-basedtestsforSchools/

You can also download frequently asked Questions and Answers on the assessment here:

www.oecd.org/pisa/pisa-basedtestsforSchools/oecdtestsforSchoolsintheus.htm

Or write to:

OECDTestforSchools@oecd.org
The OECD is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation’s statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.
International benchmarking for school improvement
OECD TEST FOR SCHOOLS (BASED ON PISA)

How prepared are 15-year-old students at your school to continue as lifelong learners, to find and fill jobs of the 21st century and compete and collaborate as citizens in a globalised economy?

The OECD Programme for International Student Assessment (PISA) has evaluated and compared education systems world wide for more than ten years now, highlighting education systems that have either repeatedly outperformed others or have shown considerable improvement – sometimes within a relatively short period of time.

Increasingly, however, local educators and school staff are just as interested in international benchmarking and improvement as policy makers. The OECD Test for Schools (based on PISA) and the school results that participants receive allow local educators to do just that. School reports present performance results in reading, mathematics and science along with contextual information collected from students and school staff.

Because benchmarking is one step towards school improvement, school reports from the assessment also present examples of relevant school policies and practices from around the world to stimulate reflection and discussions among local educators. To make the school reports more accessible, active links are included throughout the electronic versions of the school reports that allow the reader one-click access to relevant OECD research, reports and resources.

Schools and districts in the United States that are interested in finding out more about the assessment and in signing up should visit: www.oecd.org/pisa/pisa-basedtestforschools/

And they can also write to:
OECDTestforSchoolsSignUp@oecd.org