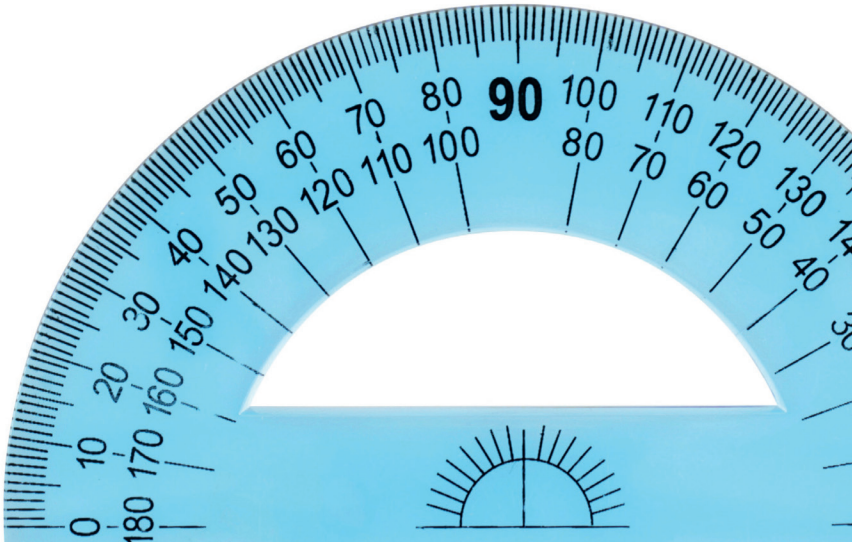
Slovak Republic: Skilling up the next generation

An analysis of Slovak Republic's performance in the Program for International Student Assessment

WORLD BANK GROUP
Education Global Practice
Europe and Central Asia Region



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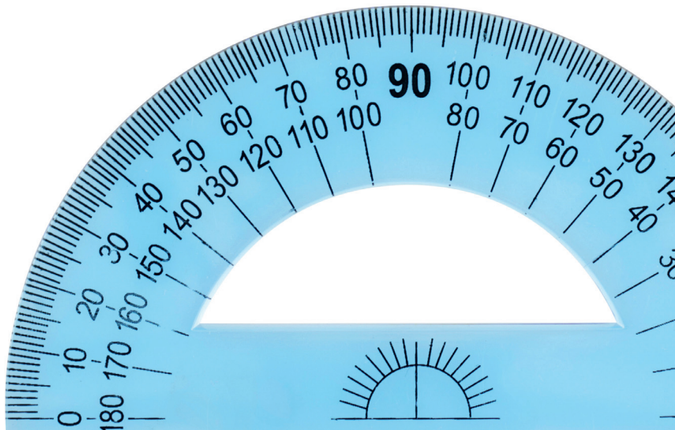
Abbreviations and Acronyms

ESCS	Economic, Social, and Cultural Status
ECA	Europe and Central Asia
ECE	Early Childhood Education
EU	European Union
GDP	Gross Domestic Product
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
RIF	Re-centered Influence Functions
TIMSS	Trends in International Mathematics and Science Study
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
VET	Vocational Education and Training

Executive Summary



Executive Summary

Facing the prospects of rapid aging and shrinking population over the coming decades, Slovakia needs a highly skilled workforce to help generate the productivity growth that it needs to fuel its continued convergence of living standards with its West European neighbors.

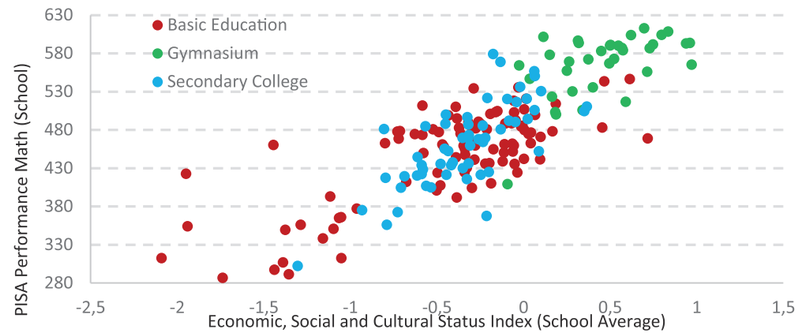
Skilling up the workforce starts with equipping youth with the right cognitive and socio-emotional foundation skills. International research has identified three dimensions of skills that matter for good employment outcomes and economic growth: cognitive skills, such as literacy, numeracy, creative and critical thinking or problem-solving; socio-emotional skills and behavioral traits, such as conscientiousness, grit or openness to experience; and job- or occupation-specific technical skills, such as the ability to work as an engineer. Cognitive and socio-emotional skills formation starts early in a person's life. Good cognitive and socio-emotional skills provide a necessary foundation for the subsequent acquisition of technical skills. Put differently, poor literacy and numeracy skills severely undermine a person's ability to benefit from further training and lifelong learning.

Slovakia can do significantly better in preparing its next generation with the right cognitive foundation skills. This report focuses on cognitive skills and examines results for Slovakia from the Program for International Student Assessment (PISA), which assesses the mathematics, reading, and science competencies of 15-year-olds. Its findings suggest that Slovakia can do significantly better in helping students develop cognitive foundation skills. Slovakia's aggregate mathematics, reading, science, and problem-solving scores have remained below OECD averages, while its 15-year-olds perform on par with peers of several neighboring countries, like Poland, in problem-solving.

- **Slovakia's education system is one of the most inequitable education systems in the European Union (EU).** This is the most worrying finding of this report. Performance in PISA varies significantly by the student's socioeconomic background. While it is not surprising to find disparities in countries between skills of students from rich and poor households, the gap between students from the top and bottom quintile in Slovakia is the equivalent to almost *four years* of schooling, significantly more than elsewhere in the EU. Performance also varies by type of school – between general secondary schools (gymnáziums) and vocational secondary schools. Slovakia's 15 year-olds from socioeconomically disadvantaged background are disproportionately represented in vocational schools, where aggregate performance is significantly behind that in the gymnáziums. While PISA data do not allow for a disaggregated analysis by ethnic background of students, Roma youth are likely to suffer disproportionately from the inequities in the education system stemming from socioeconomic disadvantages. Lastly, while repetition rates are small, they appear to be on the rise and are a major factor contributing to the decline of PISA mathematics scores between 2003 and 2012.

Students from different socioeconomic strata are highly segregated into different types of schools and achieve widely differing levels of cognitive skills. This is illustrated in Figure 1, which summarizes the gaps--representing the equivalent of multiple years of schooling-as measured by PISA mathematics scores. More than a quarter of Slovakian 15 year-olds perform at the bottom level in PISA's mathematics test and risk leaving school without the minimum literacy and numeracy skills needed to succeed in obtaining a productive job, in subsequent training, and in lifelong learning. In fact, the proportion of students who do not reach the basic proficiency in mathematics, reading, and science levels has increased since 2003.

Figure 1. PISA mathematics performance by school types and socioeconomic status, 2012



Source: World Bank Staff estimates using PISA 2012 data. 40 points is the equivalent to what an average students learns in a school year. OECD averages of ESCS index and PISA mathematics score are 0 and 500, respectively. The ESCS school average is calculated by computing the weighted average of student's ESCS at each school. Secondary college refers to secondary vocational schools.

The explanations for the significant variance in student achievement seem to lie in the significant social stratification of schools, which goes hand-in-hand with early ability-based selection into gymnáziums and vocational tracks; insufficient efforts to tackle inequity in learning conditions faced by Slovakian students, and an increase in repetition rates among 15-year-olds. Finally, recent evidence (OECD 2015) points to an increased effect from the selectivity practiced by schools may exacerbate the segregation of students by socioeconomic status.

Policy recommendations. Slovakia has the dual challenge of ensuring equality of opportunities and quality across its entire education system. Countries like Poland have shown that with the introduction of relevant education policies, both objectives can be achieved. Moreover, international evidence suggests that accomplishing both goals has a positive effect on economic growth. This note proposes several policy recommendations, based on an analysis of Slovakia's PISA data as well as international evidence, to make Slovakia's education system both stronger and more inclusive, including:

- **Delaying the age of selection of students into gymnáziums and vocational schools**. Delayed selection, as in the case of Poland and other countries, has been shown to have a positive effect on aggregate student achievement and on equity in learning outcomes.

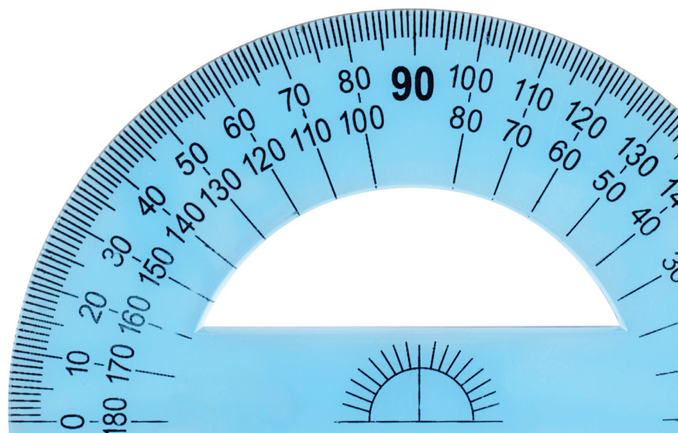
- **Improving the cognitive skills of students in vocational schools by introducing systemic measures that enhance learning**. Since most students in vocational schools come from less advantaged backgrounds, the purpose of this policy would be to try to offset the influence of peer effects through better-quality vocational schools and more general curriculum content.

- **Examining the causes of the rise of repetition rates and finding ways to reduce them**. Increasing repetition rates are an important factor that helps explain the decline in learning, particularly among students who belong to the bottom quintiles.

- **Promoting universal coverage of quality preschool education for children between ages three and five.** Inequalities can start early in life, and good quality preschool education can help students from all socioeconomic backgrounds lay a foundation to better develop cognitive and socio-emotional skills.

Chapter 1

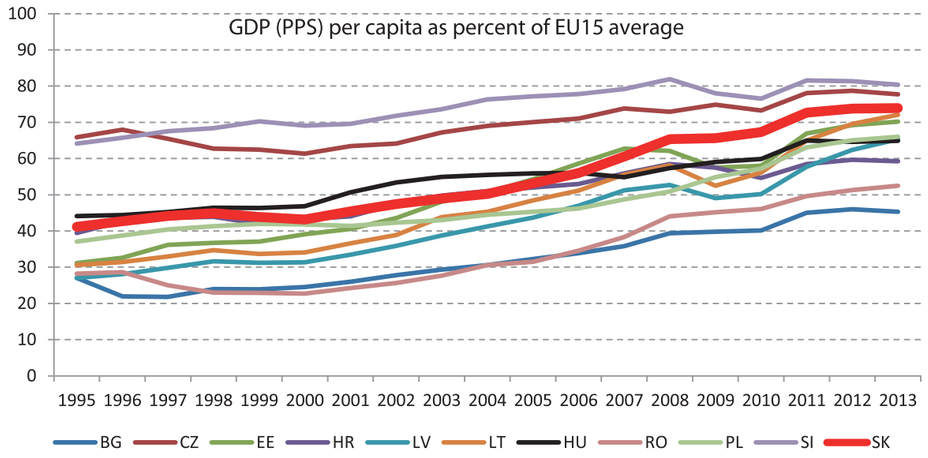
Why Skills Matter for Slovakia



Why skills matter for Slovakia

Slovakia, like many of its European peers, faces the dual demographic challenge of an aging and shrinking population. Slovakia has enjoyed the advantage of robust income growth during the past two decades. In 1995, Slovakia's GDP per capita was slightly more than 40 percent of the EU15 average. By 2013, its GDP per capita rose to 74 percent of that average (Figure 2), narrowing the gap between its living standards and those of the EU15, cementing its "Tatra Tiger" moniker in the process. However, looking ahead, its demographic challenge of an aging and shrinking population could prevent that convergence in living standards from continuing. Slovakia faces a population decline of almost 10 percent between 2010 and 2050 and median ages are expected to increase from 37.2 to 48.2 during the same years (Figure 3).

Figure 2. Slovakia's income convergence: GDP per capita, Slovakia and nearby countries, 1995 - 2013

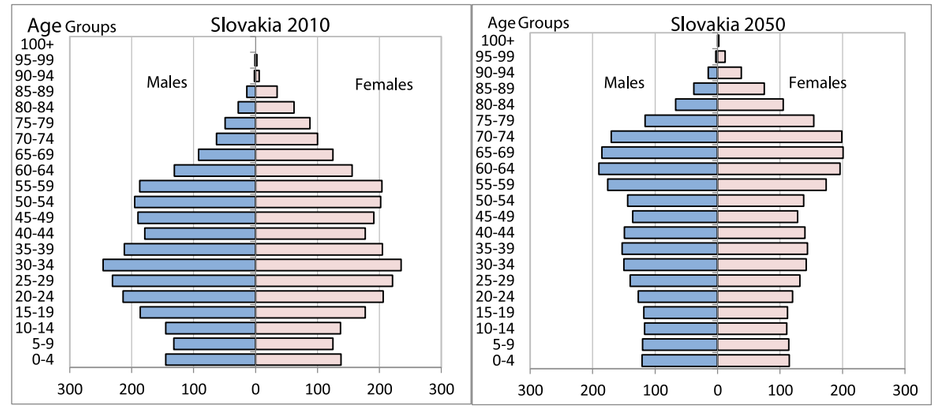


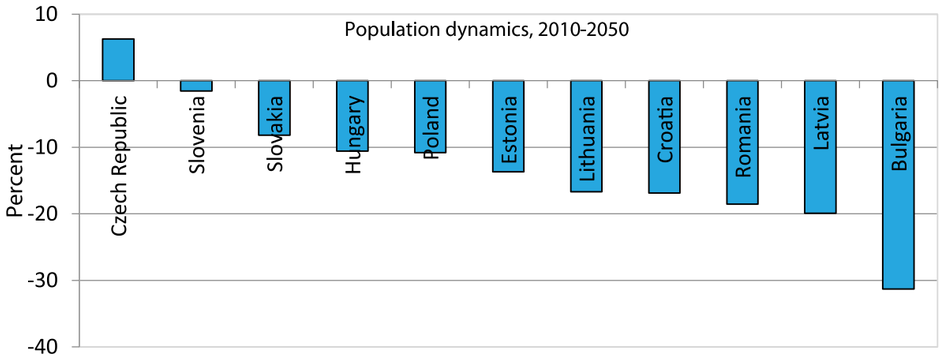
Source: World Bank Staff estimates using Eurostat data

Leveraging its human capital will be a key strategy if Slovakia is to sustain the gains made in its living standards. Overall, policymakers can mitigate the threats to economic growth due to population aging and decline. Recommended policies usually balance quantity and quality approaches. A quantity-focused approach centers on expanding the number of workers through traditional means such as increasing the employment rate and encouraging immigration. A quality approach requires, among other things, enhancing labor productivity by raising the skills of the current and future workforce. Slovakia has significant room for improving its employment rate (currently at 65 percent for the population ages 20–64, according to the 2013 Labor Force Survey). Moreover, young Slovaks experience a slow school-to-work transition. According to Eurostat, since 2011, just under 15 percent of 15- to 24-year-olds have remained idle and are not in employment, education, or training (NEET). In addition to the lost income, poor labor market outcomes at the beginning of the professional life may have a long-lasting, negative impact over long-term labor market outcomes, limiting the possibilities of young people (Schmillen and Umkehrer, 2013; Kahn, 2010; Gregg and Tominey, 2005). As such, skills development will play an important role in harnessing the labor potential of both the employed and the idle population. This report places the spotlight on Slovakia's next generation and explores

whether the education system is providing youth with the skills required to enhance their productivity and labor market integration.

Figure 3. Slovakia's population age distribution and projected population growth, 2010 - 2050





Source: World Bank staff estimates using UN Population Prospects. Medium variant.

The importance of cognitive skills

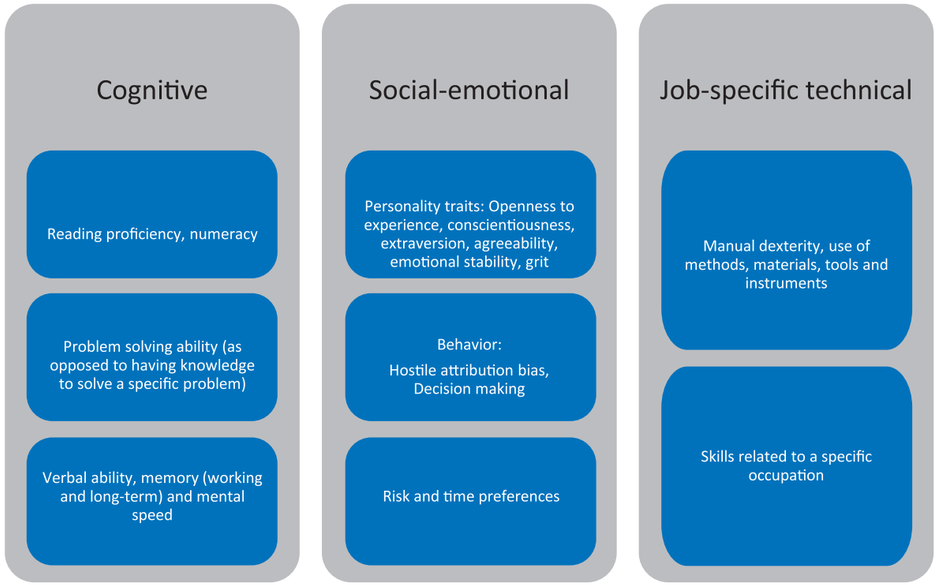
International evidence shows how much the skills of a country's workforce matter for economic growth and shared prosperity. International evidence suggests that quality of education is one of the most important determinants of long-term economic growth.[1] Research has explored student assessment surveys from 1960 onward (Hanushek and Woessmann, 2007 and 2012), estimating that a score improvement of 50 points in PISA would imply an increase of 1 percentage point in the annual growth rate of GDP per capita.[2]

Both the share of students achieving basic literacy and the share of top-performing students matter for growth (Hanushek and Woessmann, 2007; OECD, 2010). A recent OECD (2015) report presents economic returns *to universal basic skills,* defined as all students enrolled in secondary schooling and the performance of those young people currently not in school raised to achieving level 1 skills (420 points) in PISA by 2030. While low-income countries with lagging education systems stand to gain the most, advanced middle-income and high-income countries can expect a significant boost for long-run economic growth (until 2095) simply by making their education systems deliver better for the weakest students. The report finds that on average, high-income countries could gain a 3.5 percent higher discounted average GDP over the next 80 years if they were to ensure that all students achieved basic skills, defined as level 1 in PISA. As will be presented in this report, a significant and growing share of Slovak 15-year-olds currently perform below level 1 of PISA. Ensuring universal basic skills in Slovakia would add 5.4 percent to discounted future GDP.

Ensuring that all have basic cognitive skills also helps make growth inclusive. Beyond aggregate growth, education improves the living standards of individuals. Individuals who are more educated can acquire even more skills – and higher-order skills as well – making them more productive and employable. Through the acquisition of more higher-order skills, they can extend their labor market participation over their lifetimes, which in turn leads to higher earnings and better quality of life.3 Education is an engine of social mobility: Human capital is a key asset in income generation and hence critical to reducing poverty and increasing shared prosperity (Bussolo and Lopez-Calva, 2014).

[1] See Sala-i–Martin, Doppelhofer, and Miller (2004).
[2] See Hanushek and Woessmann (2007) and Hanushek (2010). Using these tests as measures of cognitive skills of the population, they show that countries that had better quality of education in the 1960s experienced faster economic growth during the years 1960-2000, controlling for other factors.
[3] See Hanushek (2013).

Figure 4. Three dimensions of skills



Source: Bodewig and Badiani-Magnusson (2014)

"Skills" can be differentiated into separate, mutually reinforcing dimensions along cognitive, socio-emotional, and technical skills. Figure 4 presents the differentiation across the different skills dimensions. *Cognitive* skills include literacy and numeracy, such as measured in PISA, but also competencies like critical thinking and problem-solving. *Socio-emotional* skills, also known as non-cognitive skills, capture one's ability to interact with others as well as determination and focus on getting a job done. *Technical (job-relevant) skills* in turn capture one's ability to perform technical tasks in any occupation, such as work as a plumber or engineer. Measuring the level of educational attainment does not automatically mean measuring actual skills. While many countries in Central and Eastern Europe have seen educational attainment (years of education, level of education completed) expand since the start of the economic transition, they have not necessarily seen improvements in their performance in international student assessments that measure cognitive skills, such as PISA (Sondergaard and Murthi, 2012).

Cognitive skills built in childhood and youth are a necessary foundation for successful acquisition of technical and job-specific skills later in life. The foundations of cognitive and behavioral skills are formed early and are the platform upon which later skills are built. The most sensitive periods for building a skill vary across the three dimensions of skills, and skill formation benefits from previous investments and is cumulative. Technical and job relevant skills – often acquired last, through technical and vocational education and training (TVET), higher education, and on-the-job learning – benefit from strong cognitive and behavioral skills acquired earlier in the education system. In other words, the cognitive skills acquired in childhood and youth, such as those measured by PISA, will help workers to continuously update their technical skills during their working lives. This is of particular

importance in aging economies such as Slovakia's where workers need to adapt to technological progress during their longer working lives.

This report focuses on cognitive skills and examines evidence from the performance of 15-year-old Slovakian students on the PISA assessment of mathematics, reading, science and problem-solving competencies. Introduced in 2000 by the Organization for Economic Co-operation and Development (OECD), PISA is a worldwide study of 15-year-old school students' performance in three different disciplines: mathematics, science, and reading. PISA 2012 also included a problem-solving assessment. PISA focuses on the competence of students and their ability to tackle real-life problems in these disciplines. The assessment emphasizes critical skills for personal and professional development. The objective of the PISA testing is to determine how well students are prepared to meet some of the challenges of their future lives. A sample question from mathematics illustrates the applied nature of the PISA tests: "Nick wants to pave the rectangular patio of his new house. The patio has length 5.25 meters and width 3.00 meters. He needs 81 bricks per square meter. Calculate how many bricks Nick needs for the whole patio".[1] In assessing the performance of 15 year-olds, it captures largely those Slovakian students who are in any one track in upper-secondary education and a small share of students who are still in lower-secondary. Since skills formation is cumulative, PISA reflects not just competencies acquired in those schools but competencies acquired even earlier in the education system as well. PISA's scoring system is standardized so that the mean score for each discipline among OECD countries in the year 2000 is 500 points, with a standard deviation of 100 points. According to OECD, 40 points in PISA is equivalent to what students learn in one year of schooling.[2] Slovakia has participated in PISA rounds since 2003.

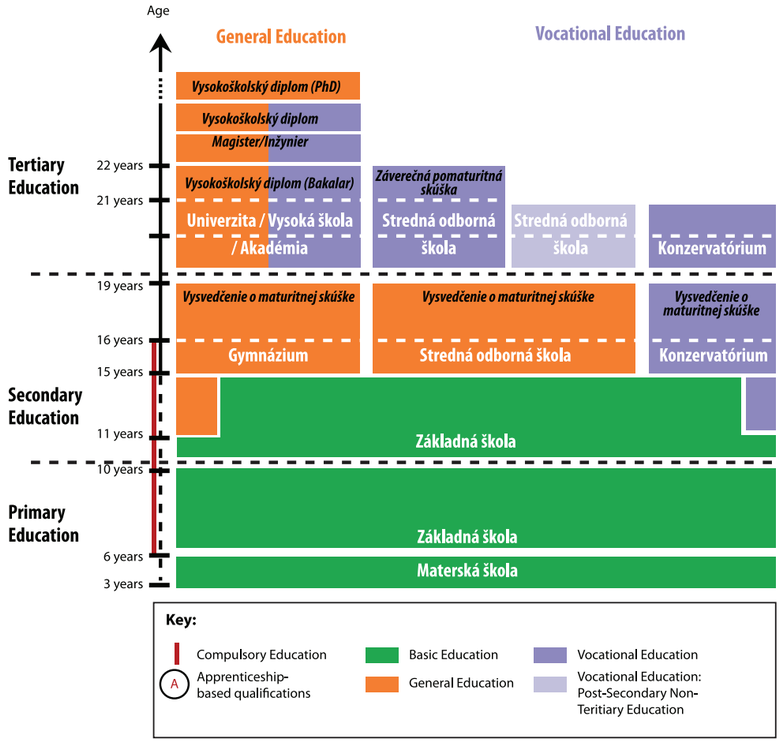
Slovakia's education system

Slovakia's education system is aligned with the skills formation process, starting with early childhood education, and focuses on cognitive skills-oriented learning content. Slovakia's compulsory education system begins with primary school, where students enter at age six (see Figure 5). While early childhood education (ECE) is not compulsory, the government is responsible for its provision from ages three to six (Materská škola). There is a substantial shortage of kindergarten places in Slovakia due in part to the increasing number of births between 2002 and 2011 (OECD, 2015). The population of children ages three to five increased from 154,000 in 2006 to 168,000 in 2012. Between 2007 and 2013 the number of rejected applications to kindergarten increased more than five-fold, and the number is expected to continue increasing (OECD, 2015). In 2015, the government pledged an additional ECE investment of €10 million to reduce this shortage (Eurypedia, European Encyclopedia on National Education Systems, Slovakia). Primary (ISCED 1) and lower-secondary education (ISCED 2) form a single structure and last for nine years. In this single structure, the first stage of primary school is organized as grades one to four, and the second stage as grades five to nine. In the final year of compulsory schooling (year 10), students attend the first year of upper secondary education.

[1] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

[2] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

Figure 5. The structure of Slovakia's education system



Source: ONISEP, 2015.

As in many other European countries, Slovakia's education system allows students to pursue different educational tracks at the start of upper secondary education. Upper secondary education (ISCED 3, typically for students ages 15 to 19) covers the equivalent of grades 10–12 and is provided in three parallel tracks: general secondary schools (Gymnáziums), vocational secondary schools (Stredná odborná škola), and conservatories (Konzervatórium[3]). General secondary schools provide general education and prepare students for the school leaving examination, the prerequisite for admission to higher education. Secondary vocational schools provide general and pre-vocational education, prepare students for the secondary school-leaving examination required for higher education, and offer vocational post-secondary programs. However, it is possible for students to enter general secondary schools or conservatories as early as age 11 for a period of eight years.

[3] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

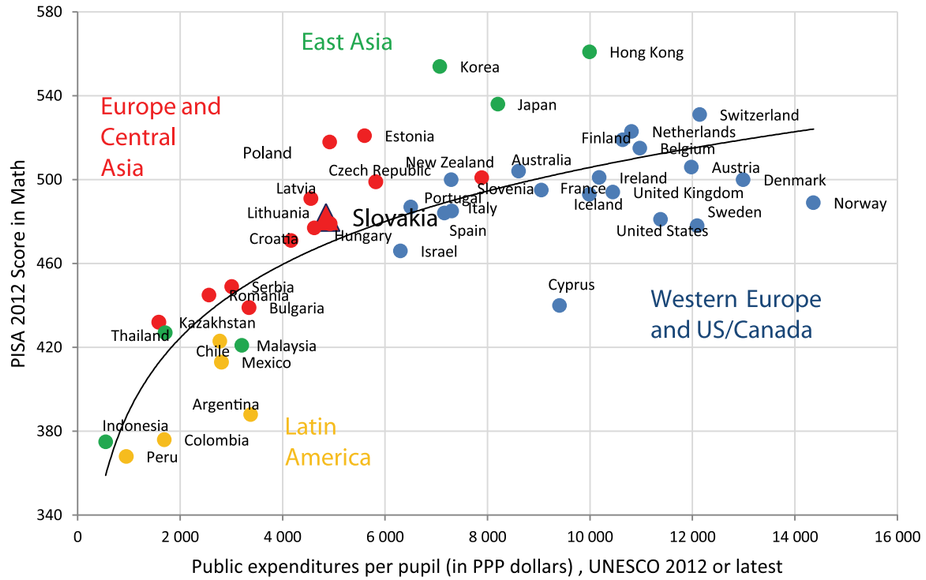
Slovakia's public spending on education is significantly below OECD averages. The OECD public spending on education averages 5.3 percent of GDP (and 6.1 percent total, public and private, spending). In contrast, Slovakia spent about 4.1 percent of GDP (and 10.4 percent of total government spending) on education in 2011. The proportion of Slovakia's public investment has remained at similar levels since 2004, although it was marginally lower between 2005 and 2008 (Figure 3). Slovakia's performance is marginally above what should be expected given its current level of public expenditure per student and similar to that of neighboring economies. Nonetheless, some countries with similar levels of investment, like Poland and Latvia, have much higher cognitive outcomes (Figure 3).

Table 1. Annual public expenditure on education in Slovakia, 2004–11

	2004	2005	2006	2007	2008	2009	2010	2011
Total expenditure								
As percent of GDP	**4.2**	**3.8**	**3.8**	**3.6**	**3.6**	**4.1**	**4.2**	**4.1**
As percent of total government expenditure	**11.1**	**10.1**	**10.4**	**10.6**	**10.3**	**9.8**	**10.6**	**10.4**
Expenditure per student (in PPP$)								
Primary education	1,737.7	2,371.1	2,817.8	3,261.8	3,629.2	4,260.3	5,301.3	5,010.4
Secondary education	2,472.6	2,475	2,732.6	3,079.1	3,503.8	4,175.8	4,655.3	4,627.1
Tertiary education	4,700.6	3,882.7	4,507.5	4,077.2	4,254.5	4,245	4,562.7	5,683

Source: UNESCO, 2015.

Figure 6. PISA mathematics scores and public expenditures per student, Slovak Republic and PISA countries wordlwide



Source: World Bank staff estimations using PISA 2012 data and UNESCO 2012 data. Note: The curve represents a logarithmic approximation of the scatter plots.

Box 1. Recent reforms in the education system of Slovakia

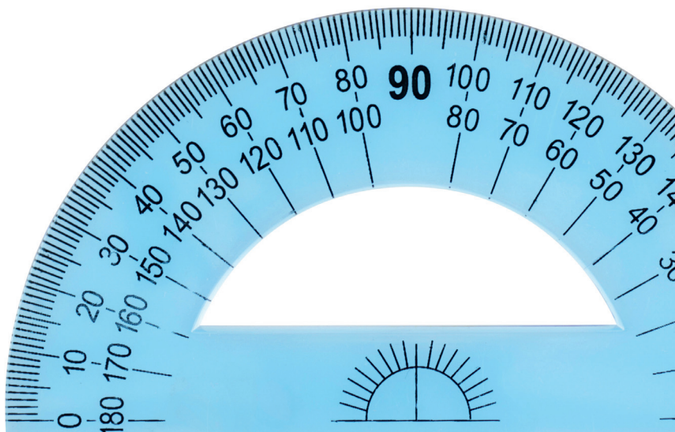
Slovakia has taken many steps during the last decade to improve its education system. In 2001 the government approved a National Program of Upbringing and Education, Millennium, which introduced some guiding principles for changes in the education system (Šiškovič & Toman, 2015). Subsequent reform measures have brought increased autonomy and accountability mechanisms, the introduction of per-capita financing (early in 2004), increased certification of teachers, and the introduction of monitoring and evaluation mechanisms.

Slovakia already had a decentralized education system by 2003, and this process continued during the last decade. For instance, in 2003 principals already had the authority to hire and fire teachers. They also had major decision-making responsibility regarding assessment and student admission policies. Between 2003 and 2012, decentralization was continued by giving schools more pedagogical autonomy. This can be seen in the increase in the number of principals that reported higher autonomy in the courses offered and in course content. The effect of school autonomy has varied across countries. Countries with strong institutions have benefited more, on average, than countries without them. Unless complemented by an improvement in school directors' managerial capacities, enhanced school autonomy risks resulting in more quality variation across schools. Recent empirical evidence suggests that the managerial capacities of school directors are an important determinant of the quality of education services (Bloom and others 2014). Empirical evidence also suggests that autonomy measures have better results when they are introduced alongside accountability mechanisms, which Slovakia introduced along with the curriculum autonomy. For instance, in 2006 only 28 percent of schools had achievement data posted publicly; but by 2012, the number of schools that had the data publicly posted increased to 77 percent.

The country has also seen an increase in teacher certification and in the introduction of monitoring and evaluation mechanisms. Teachers are one of the most important policy instruments that a government has to improve education quality, and they also are the most expensive education budget item. Since 2009 teachers have been free to choose their teaching techniques. Teacher salaries are pegged to qualifications and professional development activity, which increases teachers' incentives to achieve certification (Shewbridge et al., 2014). At the same time, while schools in the country are free to conduct their own self-assessments, quality evaluations based on standardized student assessments have only begun. In 2015, fifth grade students will be assessed with standardized test scores for the first time. This will provide a picture of the quality of the education system and provide important information at the school level. Up to now, students have only taken part in two high-stakes exams: one in ninth grade, before applying to secondary schools, and the Maturita examination at the end of upper-secondary and before higher education. Recent evidence from Pakistan and Mexico shows that using results from standardized tests as a diagnosis tool to design school improvement plans can be a cost-effective way of improving the quality of education services (Patrinos, Garcia-Moreno, & De Hoyos, 2015). And given that Slovakia is going to implement a standardized test, it would be only marginally more costly to use the results from the standardized tests as a diagnostic tool to improve school performance through the development of report cards.

Chapter 2

Cognitive skills of 15-year-old Slovak students

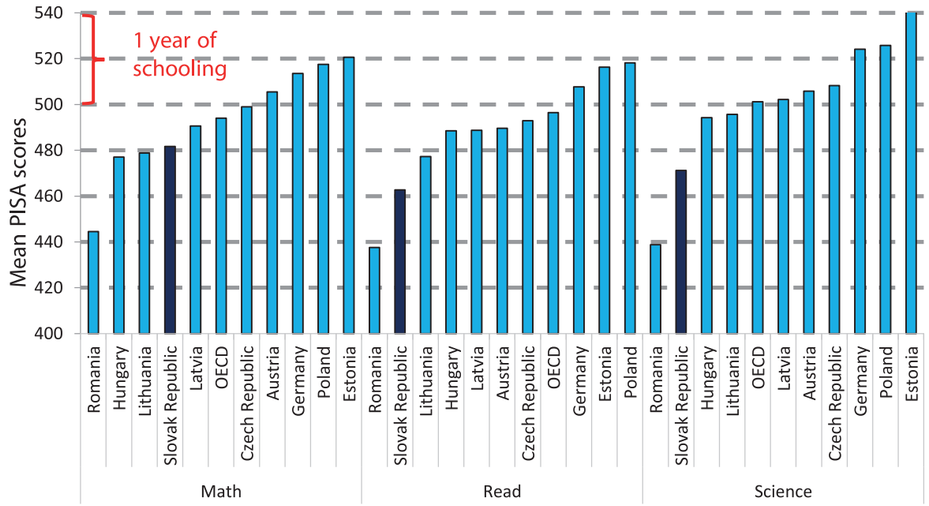


Cognitive skills of 15-year-old Slovak students

Snapshot of Slovakia's performance in PISA

Slovakia's 15-year-olds performed modestly in PISA 2012. In context, Slovakia's PISA 2012 scores lagged the OECD average in all subjects.[4] Of the 65 participating countries, Slovakia ranked 34th in math, 40th in science, and 43rd in reading. The difference between Slovakia and the OECD average is widest in reading and narrowest in math, with a differential of 33 points in reading and 13 points in math. Overall, its 15-year-olds performed worse in PISA 2012 than all peer countries in the Visegrad group and in the Baltic States (Figure 7), suggesting that the Slovak education community is failing to provide students with adequate skills for their future.

Figure 7. PISA scores, all subjects, Slovakia and neighboring countries, 2012



Source: World Bank staff estimates using PISA data.

Slovakia has experienced a decline in the three disciplines—math, reading and science—since its inaugural participation in PISA in 2003, if its 2009 performance is excluded.[5] The drop in test scores between 2003 and 2012 was greater in science (24 points) but was also large in mathematics (16 points) (Figure 8, panel A). Reading scores remained about the same, 469 in 2012 and 463 in 2003[6]. While performance declined across almost the entire distribution in mathematics and the bottom half in reading, low achievers lost more than others. Overall, Slovakia's high-achievers increased their performance in reading but decreased in mathematics and science (Figure 8, panels B and C).

[4] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

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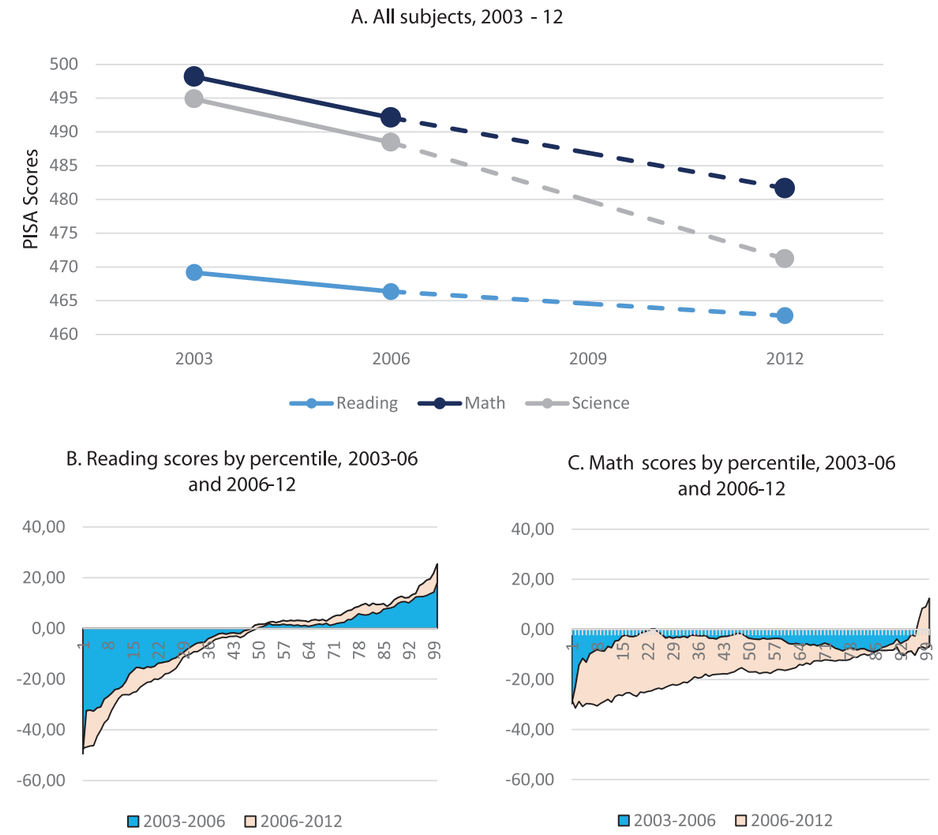
Figure 8. PISA performance over time, all subjects, Slovak Republic

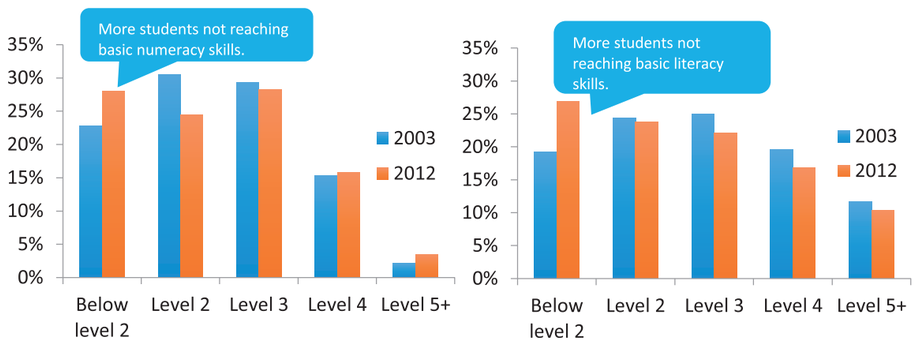


Source: World Bank staff estimates using PISA data. Linear interpolation was used to estimate the PISA 2009 scores given the declining performance since 2003 (Panel A).

Slovakia also saw an increase in the share of innumerate and illiterate students in the 2012 assessment. PISA categorizes scores in six levels of proficiency; students who score below level 2 in reading and mathematics tests are considered functionally illiterate and innumerate, respectively. These definitions imply that students below this level are unable to understand and solve simple problems, severely limiting their development and subsequent cognitive and technical skill acquisition process.

Figure 9 shows how almost 30 percent of 15-year-olds scored below level two in reading and more than one-quarter scored this low in math, leaving Slovakia far below the OECD average. In the performance distribution, between 2003 and 2012 more 15-year-olds shifted toward levels 1 and 2 than shifted toward levels 5 and 6. As such, the gains by high performers in math and science in 2006-12 were negated by the performance declines among low performers widening the performance gap.

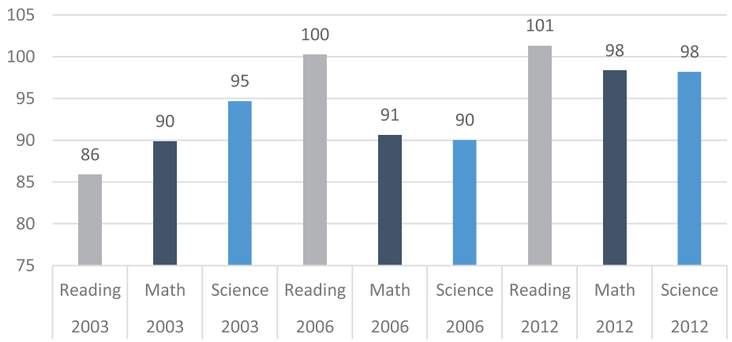
Figure 9. Distribution of students by proficiency level in mathematics and reading, 2003 and 2012



Source: PISA 2003 and 2012.

In addition to the decline in aggregate learning outcomes, Slovakia saw an increase in test score inequality. There has been an increased dispersion in the test score distribution for the three subjects, suggesting increasing inequalities in learning. For instance, while learning outcomes in reading did not decrease much, the dispersion in scores increased quite a bit. The standard deviation increased from 86 points in 2003 to 101 points in 2012. This makes the reading test score distribution quite unequal. The dispersion in test scores also increased for mathematics, although much less than it did for reading, from 90 to 98 points between 2003 and 2012. Inequality for science only marginally increased, remaining broadly at similar levels as in 2003 (the standard deviation was 95 points in 2003 and 98 points in 2012) (Figure 10).

Figure 10. Standard deviation of PISA scores by discipline, 2003, 2006, and 2012



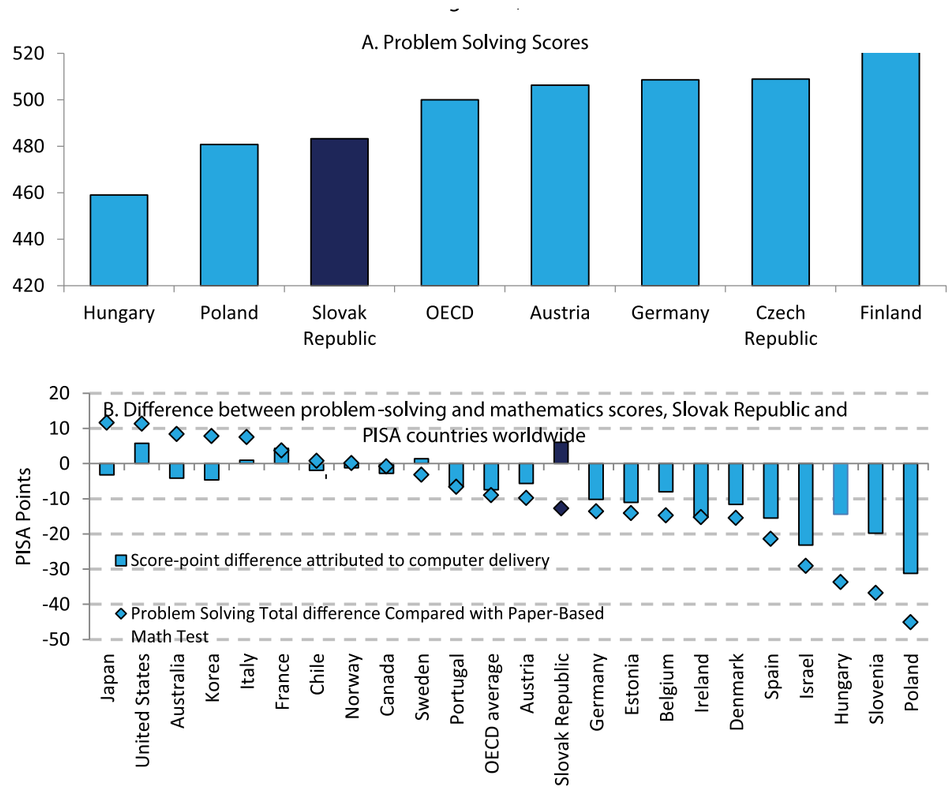
Source: PISA 2003, 2006, and 2012.

In the new PISA problem-solving assessment, the performance of 15-year-olds in Slovakia was above that of their peers in many neighboring countries, although it was below the OECD average. Conducted for the first time in 2012, the new PISA creative problem-solving assessment measures the capacity of students to respond to non-routine analytical problems in a digital environment.[7] Results in the creative problem-solving test place Slovakia

[7] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

above comparator countries like Poland and Hungary, but behind others such as Austria, Germany, and the Czech Republic (Figure 11). This new dimension allows one to analyze performance gaps in compared to the mathematics assessment and, given that the delivery mode of the test is computer-based, illustrates the influence of computer skills on relative performance in problem solving. Slovakia's small variation of 6 points in this test as compared to the paper-based math test can be attributed to other factors related to acquisition of cognitive skills and not to a lack of computer skills. In fact, the delivery mode (computer-based) of the problem-solving test had a slight positive effect on performance if it had any effect at all.

Figure 11. PISA problem-solving and mathematics scores, Slovak Republic and regional neighbors, 2012

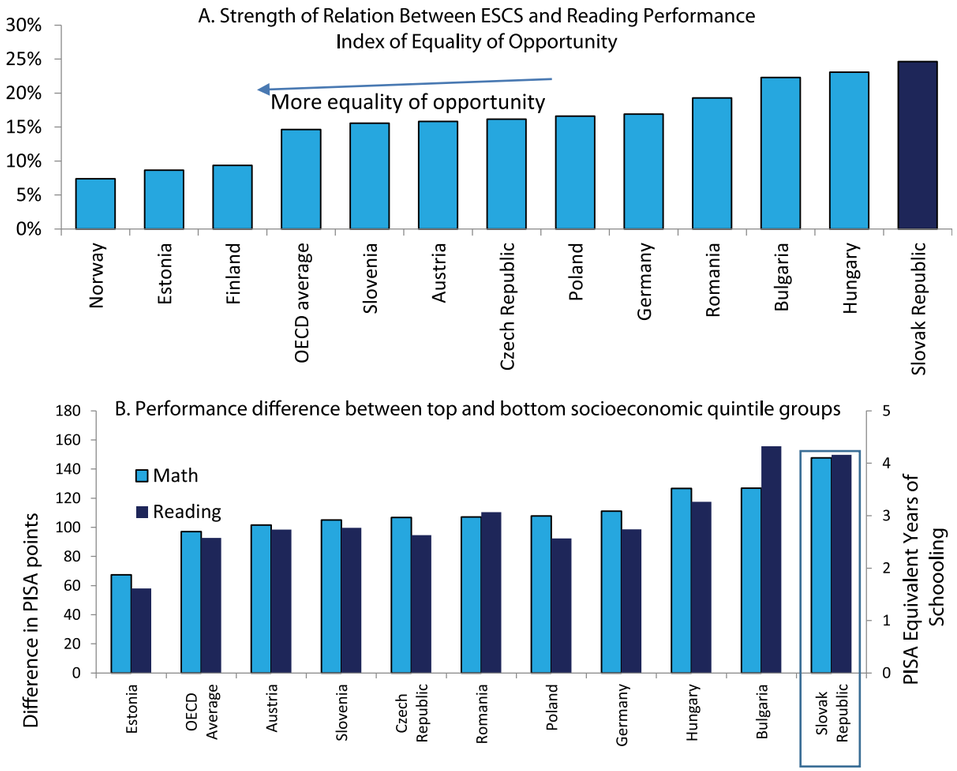


Source: World Bank staff estimations using PISA 2012 data.

Performance in PISA and student background

Substantial disparities in cognitive skills emerge between students from rich and poor households. PISA allows researchers to assess equity in education systems and its relation to socioeconomic status, because it collects information on performance and student background characteristics (Box 2). Two measures are used in this report to examine equity in education: (i) How much of the variation in outcomes can be explained by socioeconomic status and (ii) how much of the inequality in scores can be attributed to ESCS (measured as the PISA score gap between top and bottom ESCS quintiles).[8] Figure 12 summarizes the evidence from those two measures. Roughly speaking, one quarter of Slovakia's performance variance can be explained by the student ESCS Index, significantly more than for the performance of its regional neighbors (Figure 12, panel A). The difference in Slovakia's PISA scores in reading and math between its top and bottom ESCS quintiles is approximately 150 points – the equivalent of almost four years of schooling (Figure 12, panel B). This duration is also equivalent to the length of upper-secondary education in many countries. Both indicators suggest that a student's household characteristics disproportionately determine cognitive skill acquisition.

Figure 12. Equity performance: Slovak Republic, peer countries, and regional neighbors, 2012



Source: World Bank staff estimates using PISA 2012 data. Note: The Index of Equality of Opportunity is the percent of the variance in reading scores explained by the main predetermined socioeconomic characteristics in a linear regression (Ferreira and Gignoux 2011).

[8] While the skills percentages are lower for the Poland data compared to those observed in the original paper of Autor, Levy, and Murnane (for instance, the original article shows about 12 percentage points for non-routine cognitive skills analytical for the USA, compared with an increase of less than 2 percentage points in Poland), the original paper covered 40 years of data (between 1960 and 2000). The data used to construct the Poland analysis covers just eight years, between 2002 and 2010.

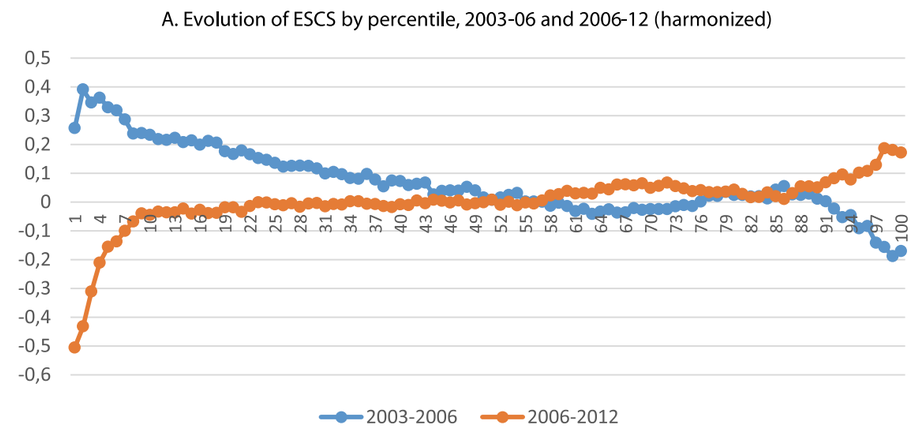
Box 2. PISA's Index of Economic, Social, and Cultural Status

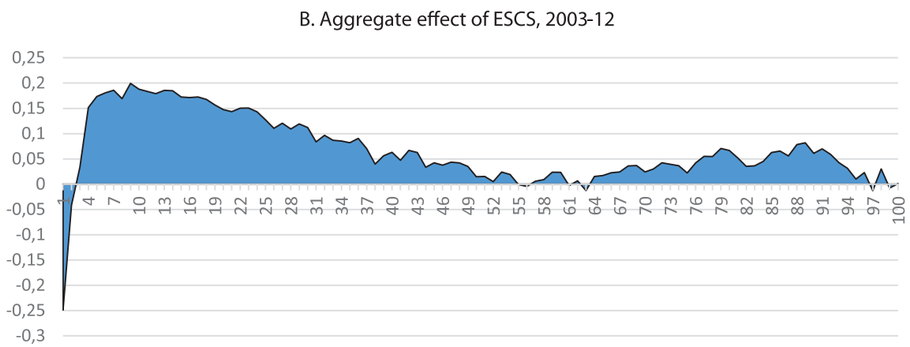
Created by OECD, PISA's Index of Economic, Social, and Cultural Status (ESCS) is a multidimensional measurement scale that takes into account information reported by students on their family's wealth, occupational, educational, and cultural background. It is derived from a combination of three other indexes: (i) an index of the highest occupational status of parents, indicating not only labor market status, but also the type of job held by parents; (ii) an index based on the highest level of parental education in years of schooling; and (iii) an index of family home possessions, which itself consists of a combination of the family's possessions (such as cars, bathrooms, and technological devices), its educational resources (such as desks, computers, textbooks, and the number of other books), and the type of its cultural possessions (such as the type and genre of books or works of art). The ESCS Index is the most important determinant of student achievement and is therefore crucial for analysis of the quality of education.

Source: OECD 2014a

Between 2003 and 2006, the socioeconomic conditions substantially improved for the bottom 40 percent of the student population, while the ESCS conditions remained mostly the same for the rest of the students. Between 2006 and 2012, ESCS conditions remained constant for most of the student population (Figure 13, panel A). The overall effect of changes in the ESCS conditions between 2003 and 2012 on the student population can be seen in Figure 13 (panel B). The improved conditions in socioeconomic status are consistent with the reduced income inequality that occurred in Slovakia during this period. In many countries, an improvement of the socioeconomic conditions of the household is associated with an increase in students test scores (OECD, 2012). This is because families with higher socioeconomic status are more able to devote more resources or are more motivated to support their children's learning. In fact, many countries work to break this strong link between socioeconomic conditions and student outcomes by building good education systems that compensate for different socioeconomic conditions.

Figure 13. ESCS conditions and aggregate effect, 2003-12

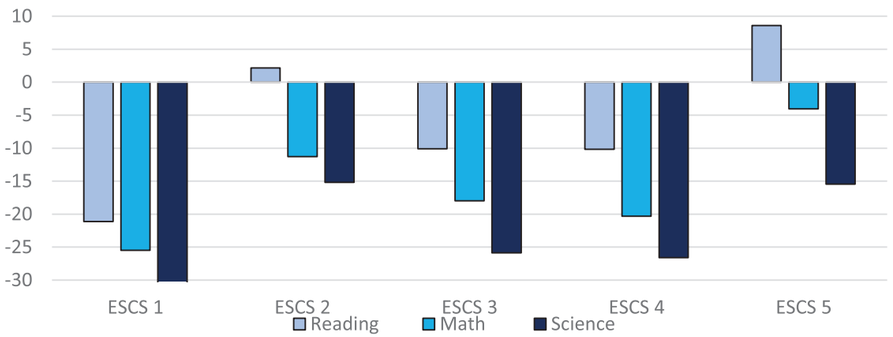




Source: World Bank staff estimates using PISA 2012 data.

Unfortunately, the socioeconomic improvements in Slovakia did not translate into achievement improvements in PISA scores.[9] In fact, between 2003 and 2012, students from the lowest socioeconomic quintile, as well as those from third and fourth quintiles experienced larger performance declines than their peers in other quintiles. The largest drop in scores was in science, followed by math (Figure 14). Students belonging to the bottom socioeconomic quintile experienced severe declines in scores—by 30 points in science, 20 points in math, and 15 points in reading. In contrast, reading performance showed more variation, as it did not decline for all students. For instance, students from the top socioeconomic quintile improved their reading scores by 9 points during the period, while performance in reading decreased for the lowest socioeconomic quintile by more than 20 points. Performance also decreased for students who spoke Romani at home, which, for the most part, characterized the more socioeconomically disadvantaged households.

Figure 14. Difference between 2012 and 2003 PISA performance, by ESCS and subject



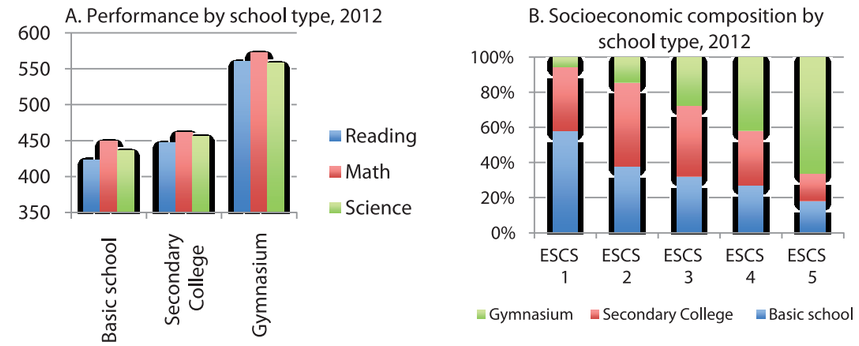
Source: World Bank staff estimates using PISA 2012 data.

[9] The parameter relating socioeconomic status with learning outcomes in the production function was zero, as it was statistically insignificant.

Students who are 15 years old are distributed among three types of school. Around 43 percent of students remain in basic school, 34 percent attend the secondary vocational stream (secondary college), and 23 percent attend gymnáziums, the general secondary academic stream. The fact that such a high percentage of the sample of students is still in basic school can (mostly) be explained by the school entrance criteria. The PISA sample is constructed for 15-year-olds, which for the 2012 assessment consisted of those born in 1996. In Slovakia, this group, as well as earlier and subsequent cohorts, is exogenously divided into two different grades, nine and 10, because school entrance depends on month of birth within the same year. For instance, more than 80 percent of students born before September are able to enroll in basic school, while those born from September onwards have to wait one more year to join basic school. Thus, students who were born before September join either gymnáziums or vocational schools by grade 10; while those who were born later remain in basic school. The sample of students in basic schools also includes students who repeated grades in addition to those who were born later in the year.

There are significant performance differences by school types. The difference in performance between students in gymnáziums and those in vocational schools (secondary college) is particularly striking, accounting for almost three years of schooling. Figure 15 (panel A) illustrates the differences in performance across the three streams. As seen in Figure 15 (panel B), social stratification plays an important role, with many students from the richer socioeconomic strata attending gymnáziums, while less affluent students go to vocational schools (secondary colleges). In addition, the difference between gymnáziums and basic schools performance is as great as the difference in performance between gymnáziums and vocational schools (secondary colleges).

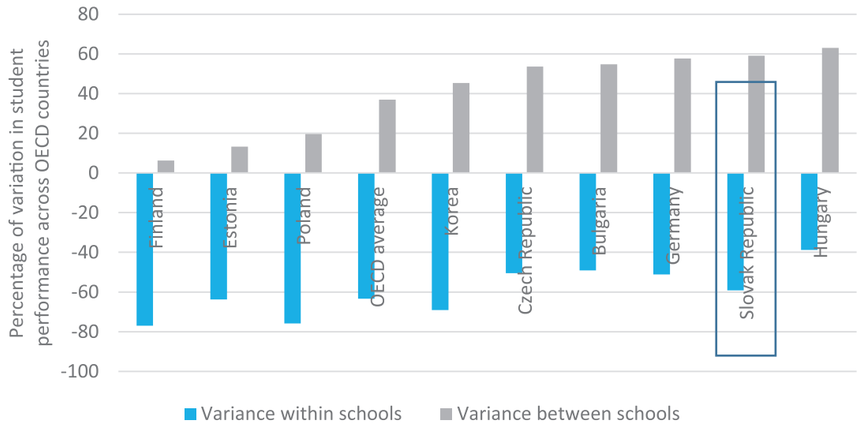
Figure 15. PISA performance and socioeconomic composition of school type, 2012



Source: World Bank staff estimates using PISA 2012 data.

Between-school variations in test results are much stronger than within-school differences, suggesting an inequitable school system. The variation in performance between schools is a measure of how big the "school effects" are, and they are closely related to how students are allocated or selected into schools. It can be argued that the lower the between-school variance, the more equitable the education system is. Between-school differences in mathematics performance in 2012 accounted for *close to 60 percent* of the variation in student performance in Slovakia. This is significantly above the OECD average (see Figure 16) and that of neighboring countries such as Czech Republic, Germany, and Bulgaria. This reinforces the point that the school that students attend predicts their learning outcomes (OECD, 2014b).

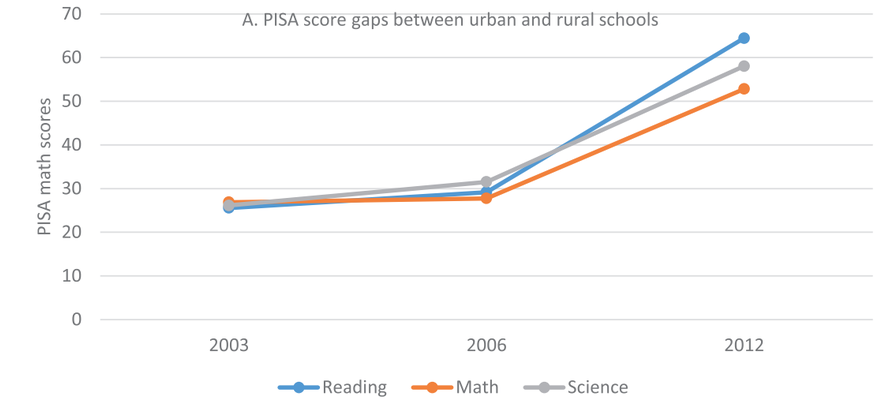
Figure 16. Variation in PISA student mathematucs performance between and within schools, Slovakia and regional neighbors, 2012

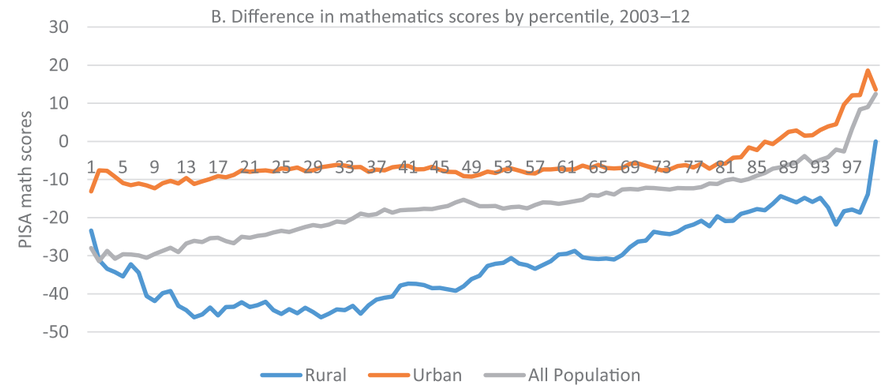


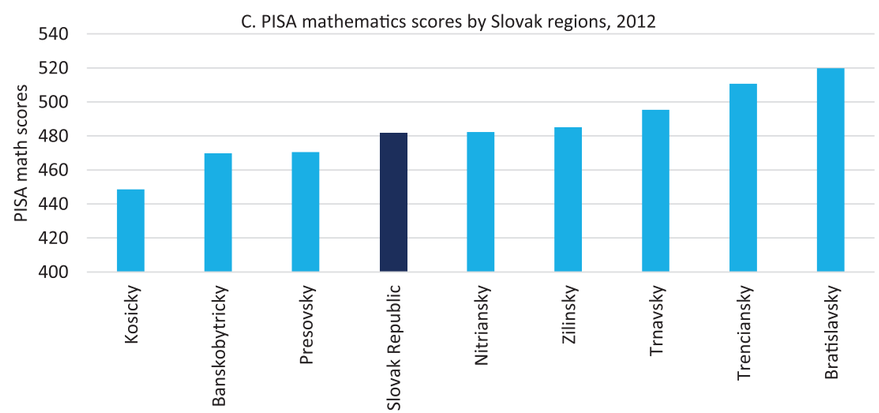
Source: OECD (2014b)

PISA performance also varies across urban and rural locations as well as by regions in Slovakia. First, there is a clear urban-rural gap in student achievement that has increased over the years (Figure 17, panel A). The urban-rural gap in Slovakia is among the largest in the region and larger than that in countries such as Slovenia, Latvia, Romania, and Poland. About 95 percent of students in the PISA 2012 sample who speak Romani at home live in rural areas; and over 80 percent belong to the bottom quintile (see also Box 3). Second, while in urban areas PISA mathematics performance decreased marginally (by less than 10 points) among low achievers and increased for the top achievers, in rural areas it dropped substantially for both middle and low achievers (Figure 17, panel B). Third, performance in 2012 varied significantly across Slovak regions (Figure 17, panel C).

Figure 17. Urban-rural performance gaps in PISA, 2003-12







Source: World Bank staff estimates using PISA 2003, 2006 and 2012 data.

Box 5: Roma Communities in Slovakia

The differences in living standards between Roma communities and the general Slovak population are stark and start early in life. Findings from a large scale UNDP/World Bank/EC regional Roma survey (2011) show that the vast majority of Roma in Slovakia (87 percent) live in poverty. The gaps between the marginalized Roma and the majority population start early. For example, only 28 percent of Slovak Roma children ages three to six attend preschool, compared with 58 percent of non-Roma children living nearby. Despite widely held perceptions to the contrary, 82 percent of Slovak Roma indicate the wish for their children to achieve at least upper-secondary or tertiary education, yet only 28 percent of their children actually reach–but do not necessarily complete–upper secondary education. This compares with 94 percent of the general population completing upper secondary.

The persistent gap in education outcomes throughout the early years is likely the driving force behind similarly large gaps in employment between the Roma and non-Roma: only 20 percent of working-age Roma men and 9 percent of Roma women have jobs, compared with 72.5 percent of working age men and 57.4 percent of working age women in the general Slovak population (Eurostat, 2011). These rates are low also for regional standards: they are less than half those found in Bulgaria, the Czech Republic, and Romania. Moreover, wage levels among the Roma who do have jobs are on average half those earned by the general population.

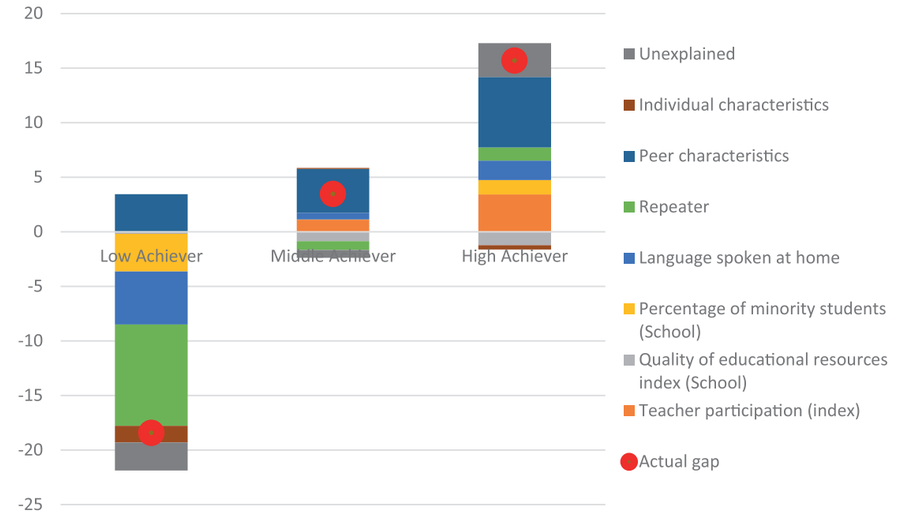
While the 2011 Census indicated a Roma population of 105,738, UNDP's 2013 "Atlas of Roma Communities" estimates a population size of approximately 400,000. The aforementioned survey found that 40 percent of the Slovak Roma population was under 15 years of age. A considerable share of new labor market entrants in Slovakia today are young, mostly unskilled Roma. By 2050, the Roma population is estimated to nearly double at current growth rates of approximately 1.7 percent per year, while Slovakia's population as a whole is expected to shrink (World Bank, 2012) – making Roma inclusion indispensable for Slovakia's long-term economic sustainability.

Understanding drivers of performance decline

Decomposing the aggregate performance change by student type allows one to examine changes in underlying factors.10 As shown in Figure 8 (panel B), PISA reading scores declined at the bottom of the performance distribution, while they increased at the top. Figure 18 depicts the actual performance gap between 2012 and 2003 as well as factors that contributed to the changes in reading test scores between those years by different performance groups (low, middle, and high achievers). The analysis shows that while socioeconomic peer effects (measured with the average ESCS at the school level) had a small and positive impact on scores between 2003 and 2012, the gains were offset by repetition, quality of educational resources, a higher proportion of minority students and students speaking a different language at home than Slovak. Low achievers (students in the 20th percentile of the reading distribution) are the most affected by these factors. In contrast, high achievers (those belonging to the 80th percentile) substantially benefited from peer effects, while the influence of repetition or other differentiation policies was minor. In mathematics and science these factors are also statistically significant but with much smaller impact, with most of the decline remaining unexplained.

[10] The analysis in this section is based on a two-fold Oaxaca–Blinder (OB) decomposition analysis based on a traditional education production function. The variables used in the analysis include age, gender, ESCS student, ESCS school (peer-effects), grade, quality of educational resources (index), % of minority students at school, Romani speaker (dummy), and repetition (dummy). Further, the Firpo, Fortin, and Lemieux (2009) methodology allows one to apply the OB decomposition to the 20th and 80th percentile observations, and not just to the means alone (see Annex 2).

Figure 18. Decomposition of changes in PISA reading scores between 2003 and 2012 into factors and by student achievement group



Source: World Bank staff calculations based on PISA 2003 and 2012 data.

Note: Results decomposition was done using an Oaxaca-Blinder method on RIF-regressions for each quintile of the distribution of performance (Firpo, Fortin, and Lemieux, 2009). Low, middle, and high achievers are students in the 20th, 50th, and 80th percentile, respectively.[11] The teacher participation index measures the degree of participation that teachers have in school decision-making (OECD, 2005). Note that when decomposing differences, one explanatory factor is often found to be negative or higher than the actual difference, meaning that other factors outweighed its impact. For more information, see Annex 2, Table A2.

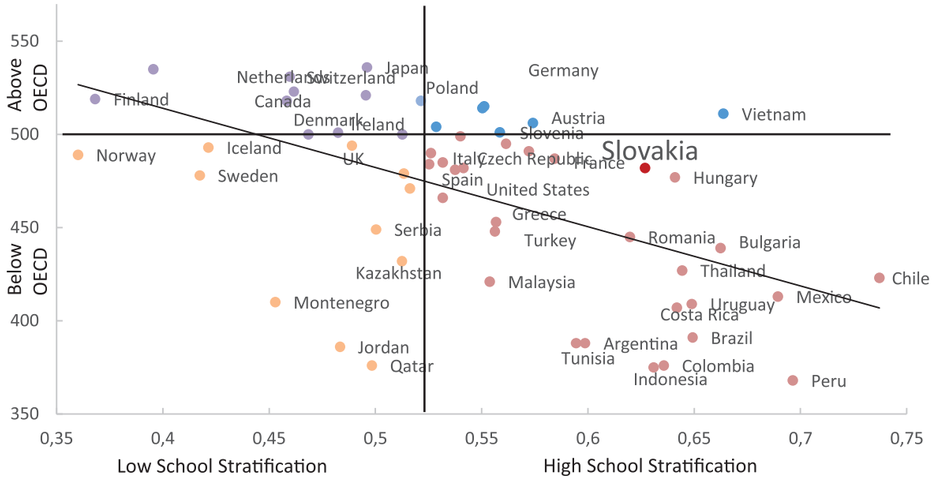
Repetition Rates

While grade repetition has not been common in Slovakia, it seems to be on the rise and is associated with student performance. There was a significant increase in the repetition rate reported by students in Slovakia between 2003 and 2012, from 2.5 percent to 7.6 percent (OECD, 2013c). Most affected are students who belong to the bottom ESCS quintile. In 2003, for example, 9 percent of students who belonged to the bottom quintile were repeaters, but by 2012 that number had increased to 25 percent. This contrasts with an overall drop in grade repetition among OECD countries during the same period. The gap between repeaters and non-repeaters is the largest in the OECD.

Social School Stratification

Slovakia has high levels of social school stratification. Social school stratification is measured with an index that represents the correlation between the PISA student's socioeconomic status and the school's average socioeconomic status. The index runs from zero to 1. Countries without any social stratification, where children from different socioeconomic backgrounds were studying together in all schools, would have a value of zero in the stratification index. In such a case, the schools would exactly reflect the diversity of the society. For the most part, countries that perform better in PISA have low levels of social school stratification (Figure 19). In fact, there are only a handful of countries, like Germany or Austria, which perform above the OECD average and also have high levels of social stratification. Social stratification in Slovakia has marginally increased from 0.58 in 2003 to 0.63 in 2012.

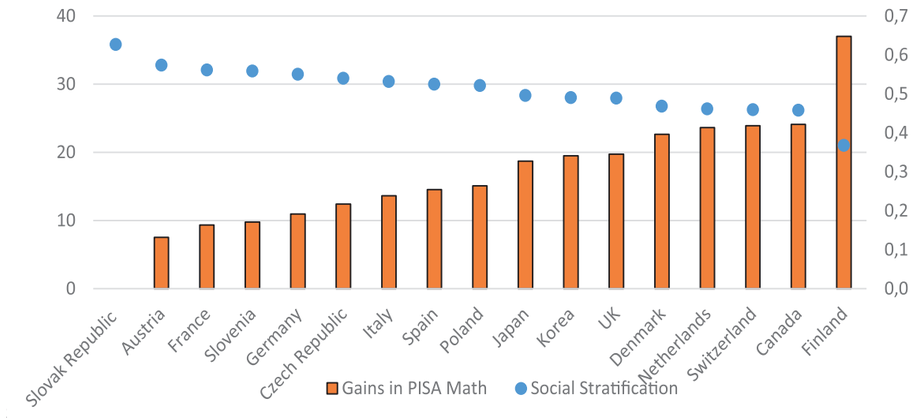
Figure 19. Social stratification: PISA math scores by degree of school stratification, Slovak Republic and PISA



Source: World Bank staff estimates using PISA 2012 data. Note: PISA mathematics scores on vertical axis. Index of School Social Stratification on horizontal axis. The index ranges from 0 to 1. A higher index indicates a higher correlation between students' and schools' socioeconomic status. OECD mathematics score average 500 points. OECD average Index of School Social Stratification is 0.525.

Reducing social stratification could raise performance. Social stratification heavily depends on parental decisions and on policies governing the selection of students into different education tracks. Simulations using the 2012 PISA data suggest that PISA scores could increase if the level of social segregation were reduced to match that of some comparator countries (Figure 20.) For instance, PISA mathematics scores in Slovakia would be almost 40 points higher – the equivalent of one year of schooling – if its school social stratification levels were like those in Finland.

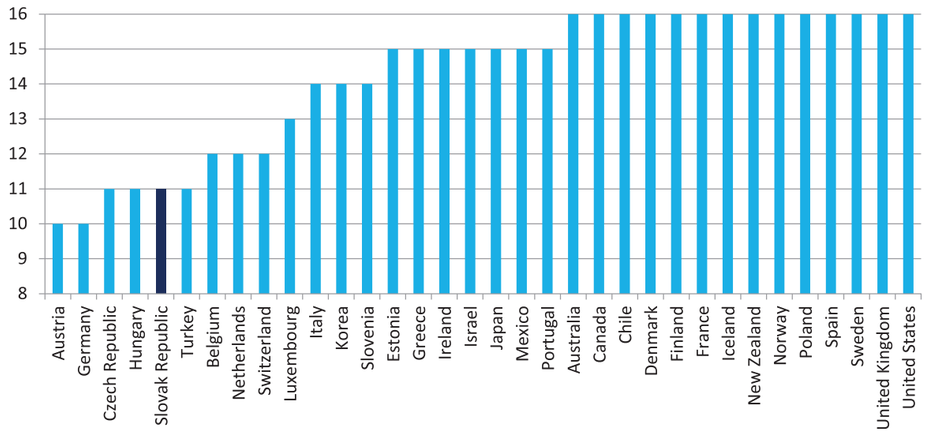
Figure 20. Simulated PISA mathematics gains (Slovakia) based on emulation of other nations' social stratification indices



Note: The simulated mathematics gains here represent the expected scores for Slovakia if its social stratification were reduced to the levels of each of the countries shown. Gains are based on a cross-country linear regression.

Slovakia's education system selects students between general and vocational tracks at a young age. While most students get selected into different types of school at age 15, the system also allows for an earlier selection of students, starting from age 11, into gymnasiums (Figure 21). International evidence suggests that such early tracking has a negative impact on equity and does not improve average performance. Hanushek and Woessman (2006) used previous PISA data to show how early tracking systems lead to a systematic increase in inequality of student performance without affecting average performance levels. At the national level, similar evidence has been found in Poland (see Jakubowski et al., 2010) and Germany (Piopiunik, 2013). The findings suggest that no efficiency is gained by streaming students early and that, in fact, delayed tracking can promote better performance among all students.

Figure 21. Age of first selection between general and vocational tracks, Slovakia and PISA countries worldwide

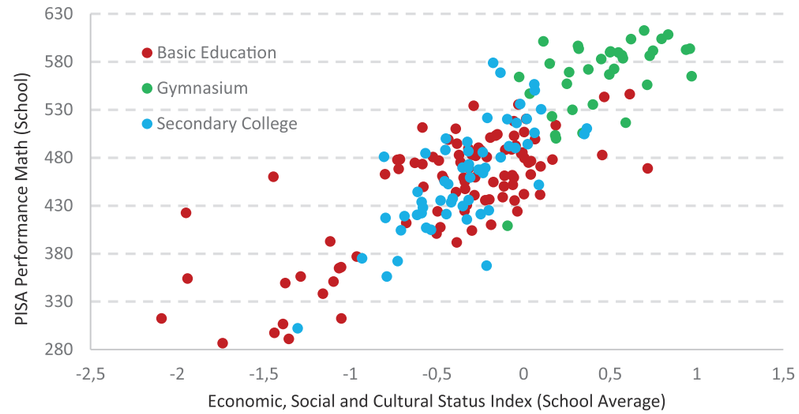


Source: OECD (2010a)

The overall message from the analysis is that education in Slovakia does not act as an engine of social mobility, but appears to further deepen socioeconomic disadvantage. There are three key messages that emerge from this analysis. First, performance in PISA varies significantly by the student's socioeconomic background. Second, performance varies by type of school. Third, 15-year-olds from socioeconomically disadvantaged backgrounds are disproportionately represented in vocational schools and vocational secondary schools (or indeed are still in basic schools, where aggregate performance is significantly lower than that in general secondary schools12). Figure 22 summarizes the above evidence in a single picture showing how students from different socioeconomic strata distribute into different educational tracks and achieve widely differing levels of cognitive skills as measured by PISA.

[12] In Slovakia, the 15-year-old group is divided into two different grades, 9 and 10, exogenously. This is because the school entrance depends on the month of birth. The majority of students who were born September onwards are still enrolled in basic schools (although students who are repeating grade enter in this group too), while those who were born on or before August have already selected between different types of schools. Tracking takes place between grades 9 and 10.

Figure 22. PISA mathematics scores by ESCS index and school type, 2012

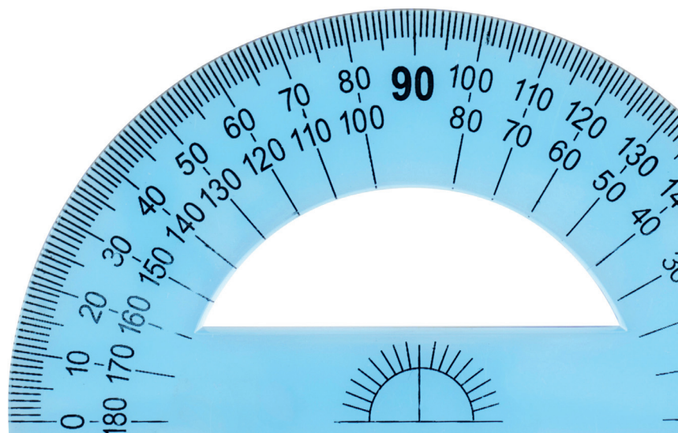


Source: World Bank Staff estimates using PISA 2012 data.

Note: 40 points is the equivalent to what an average students learns in a school year. OECD averages of ESCS index and PISA mathematics score are 0 and 500, respectively. The ESCS school average is calculated by computing the weighted average of student's ESCS at each school. Secondary college refers to vocational secondary school.

Chapter 3

Policy Implications



Policy Implications

Slovakia is facing the dual challenge of a fast aging and shrinking population and significant cognitive skill shortages among many youth. The principal response to ensure growth and convergence in times of demographic decline is to raise productivity. Doing this requires raising the skills base of the population. Yet Slovakia is not doing as well as it needs to in equipping all its youth for productive employment along longer working lives. It is already experiencing the negative consequences, evident in the relatively high share of its youth who are not in employment, education or training (NEET), a share that was measured in 2013 as 13.7 percent of its 15- to 24- year-olds (Eurostat data). A principal challenge in skilling up its next generation is to reduce the impact of socioeconomic disadvantage on access to quality education and on learning outcomes.

Addressing equity issues in education is crucial for reducing poverty, boosting shared prosperity, and fostering sustained economic growth and convergence in living standards. In the case of Slovakia, students' improved socioeconomic conditions of students, particularly among those at the bottom of the ESCS distribution, do not appear be associated with improved test scores. In fact, the data show a decline in student performance since 2003. While household socioeconomic conditions are important for student achievement, so are many other policies in the education system. It is important to note that since the PISA test is conducted at age 15, most students taking it are in their first year of secondary education, suggesting that not all of their varying performance can be attributed to the type of secondary school they attend. However, the analysis also points toward the fact that, for reasons not captured by the PISA data (and suggesting the need for more analysis of socioeconomic stratification of schools in basic education), students get selected into different tracks in such a way that enrolment and performance across secondary school types is stratified along socioeconomic background lines. This suggests that factors related to school segregation based on socioeconomic conditions, even during basic education, and repetition rates all play a role in aggregate performance and the inequity in outcomes. Moreover, recent evidence (Šiškovič & Toman, 2015) also suggest that the increase in schools' selectivity may be an important factor contributing to school segregation that would benefit from examination in more detail.

This report suggest recommendations to help Slovakia increase its quality of education and to make the system more equitable. The recommendations proposed below rely on the analytical findings of this note as well as international experience. Given that public spending on education in Slovakia is low relative to the OECD spending average, there appears to be some fiscal space to make investments in quality and equity-enhancing policies.

Promoting quality and equity in the education system

To ensure greater equity in Slovakia's education system, coordinated policies need to be introduced to promote inclusiveness and quality for the most vulnerable within the system. These measures should be coupled with adequate monitoring and accountability mechanisms that prevent local policies of any type from causing segregation at the school or classroom level to proliferate. Raising the quality of education for all can be achieved through three channels: (i) by delaying the selection of students between vocational and general education tracks, (ii) by raising the quality of education in vocational and vocational secondary schools, and (iii) by reconsidering policies related to repetition.

Delay the age of selection of students into vocational and general tracks. International evidence suggests that

delaying the age of selection of students into vocational and general tracks, for example until after the end of compulsory education, may promote quality and equity. The example of Poland is instructive: Poland delayed the selection into vocational and general tracks by one year until the age of 15 as part of its comprehensive education reform package in 2000, thereby extending all students' exposure to general curriculum content. Poland has seen significant improvements in both aggregate PISA scores and equity indicators since then (Jakubowski et al., 2010). Moreover, the incentives that schools are faced with in Slovakia need to be reviewed. For instance, given the high degree of decentralization in admission decision-making, schools appear to have incentives to select students based either on socioeconomic or ability characteristics, reinforcing peer effects and reducing school effort.

Raise the quality of education in vocational secondary schools. PISA scores in vocational schools significantly lag those in gymnasiums. While some of these differences may be expected, the gap in performance between students in gymnasiums and those in vocational and basic schools is unacceptably large, the equivalent of multiple years of schooling. It raises the question whether the curriculum in vocational schools devotes sufficient attention to general, cognitive content and whether teachers are equipped with the tools to impart those skills effectively to students who need additional support. If the vocational curriculum and teachers are not so equipped, there is a need to increase educational quality in these schools, even if, as recommended in this report, the age of selection between vocational and general secondary schools is raised.

Reconsider repetition as a differentiation policy. With an increased body of evidence showing the failure of retention, many OECD countries are either banning or reducing repetition in schools. However, this is not the case in Slovakia, where repetition by 15-year-olds has increased from 2 percent to 7 percent in the last decade. Moreover, repetition is disproportionately common among the most vulnerable students. This report shows that an increase in repetition is associated with a decline in performance, especially among low-achieving students. Thus, it is appropriate to explore in more detail the causes of the increasing repetition rates and measures that could help address those causes.

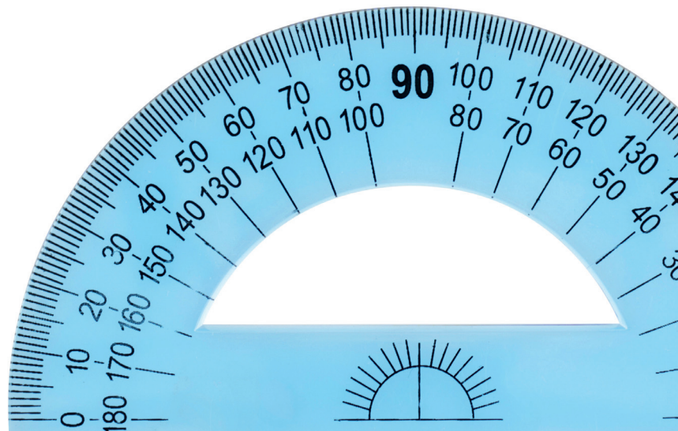
Promoting access to quality early childhood education

Expand access to quality preschool education. Expanding access to preschool can help improve the opportunities of children from disadvantaged backgrounds. Global evidence shows that providing quality preschool education is important for promoting children's social, emotional, physical, and cognitive development; it also increases school readiness, which helps learning (Heckman and LaFontaine 2010; Heckman 2008; Engle et al. 2011). Cognitive skills gaps start opening during early life, and inequalities in access to early childhood perpetuate learning gaps. Given that attendance in early childhood programs is correlated with higher educational attainment and higher socio-emotional skills, policies to improve access to and the quality of early childhood education in Slovakia would help improve the skills for new labor market entrants, translating into higher human capital and productivity and likely contributing to an overall reduction in learning inequality.

While general access to preschool education is relatively high in Slovakia--over 80 percent of the students in the PISA sample had more than one year of pre-primary education--inequalities in access remain. For instance, only 68 of students who belong to the bottom quantile attended more than one year of preschool education, compared

with 89 percent of those in the top quintile. About 14 percent of students belonging to the bottom quintile never attended preschool, compared with only 2 percent of students in the top quintile. An analysis of determinants of student achievement does not show preschool education as a statistically significant variable. This can have many causes, including the possible lack of quality of the preschool services offered when students attended these programs during the late 1990s and early 2000s. However, evidence does show that Roma children who completed ECD are less likely to be enrolled in special schools (by about 7 percent) and are more likely to complete secondary school and less likely to be on social assistance (World Bank, 2012). Universal preschool education for children aged 3–5 in Slovakia would provide a great opportunity to effectively narrow the skills gap from the early stages of children's lives.

References
Annex



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Annex 1: Education attainment across years

Table A1. Percent of population aged 15+ by highest level of schooling attained and average years of schooling in Slovak Republic, 1990-2010

Year	Highest level attained						Average Years of Schooling			
	Primary		Secondary		Tertiary		Total	Primary	Secondary	Tertiary
	Total	Completed	Total	Completed	Total	Completed				
1990	38.2	28.9	52.3	32.6	7.9	4.0	10.69	8.44	2.01	0.24
1995	28.4	22.2	59.5	38.4	10.3	5.0	11.24	8.56	2.37	0.31
2000	27.5	21.7	60.8	42.6	9.7	4.7	11.20	8.46	2.46	0.29
2005	9.4	7.5	74.3	55.7	15.2	7.3	12.22	8.27	3.50	0.45
2010	1.3	1.0	80.1	61.8	18.3	8.8	12.82	8.04	4.24	0.54

Source: Barro-Lee Dataset (2012).

Annex 2. Decomposition methodology

The analytical approach used in this report is based on the Firpo, Fortin, and Lemieux (2009) methodology. Typically, the literature on decomposition of student scores in PISA through groups (Amermueller, 2004) and years (Barrera et al., 2011) has focused on the mean differences, with little attention to what happens at the tails of the distribution. The Firpo, Fortin, and Lemieux (FFL) method allows one to decompose gaps in student performance not only for the mean but also for other statistics of the distribution. Traditionally, the problem with quantile regressions has been that the law of iterated expectations does not apply, thus making it impossible to interpret the unconditional marginal effect of each independent variable on a student's performance. However, recent econometric techniques, such as the one proposed by FFL, have solved this methodological difficulty. The FFL technique is based on the construction of re-centered influence functions (RIF) of a quantile of interest q_τ as a dependent variable in a regression:

$$RIF(I;q_\tau) = q_\tau + \frac{\tau - D(I \leq q_\tau))}{f_I(q_\tau)} \qquad (1)$$

where D is an indicator function and $f_I(\cdot)$ is the density of the marginal distribution of scores. A crucial characteristic of this technique is that it provides a simple way of interpreting the marginal impact of an additional unit of a certain factor on students' PISA scores. Once the unconditional quantile regression has been computed for different quantiles of the distribution, the results can be decomposed following the Oaxaca-Blinder approach.

Table 2A. Decomposition of reading score gaps between 2012 and 2003

by student achievement group

VARIABLES	Percentile 20 Low Achiever	Percentile 50 Middle Achiever	Percentile 80 High Achiever
Year 2012	378.4***	473.1***	551.7***
	-9.991	-4.817	-6.797
Year 2003	396.9***	469.6***	536.1***
	-4.149	-3.394	-4.316
Difference	-18.43*	3.461	15.67**
	-10.7	-5.837	-7.981
Explained	-16.18**	2.955	9.096
	-7.78	-4.767	-6.024
Unexplained	-2.245	0.506	6.571
	-7.279	-3.689	-5.558
Age	-0.214	-0.0647	-0.0382
	-0.945	-0.293	-0.187
Gender	0.00342	0.148	0.073
	-0.837	-0.492	-0.504
ESCS Index (student)	0.808	0.931	1.193
	-0.997	-0.844	-0.926
ESCS Index (school)	3.321	3.971	6.442
	-3.867	-3.604	-4.986
Romani Speaker	-4.857***	0.599*	1.733***
	-1.486	-0.331	-0.591
Repeater	-9.261***	-0.788***	1.230***
	-1.919	-0.276	-0.401
Grade	-2.400*	-1.079*	-1.793*
	-1.333	-0.606	-0.981
Quality of School Resources Index	-0.265	-0.879	-1.16
	-1.314	-0.702	-0.994
% of Minority Students (School)	-3.319*	0.116	1.418*
	-1.694	-0.402	-0.79
Constant	363.7	-112.7	-365.8**
	-257.8	-120.3	-181.1
Observations	11,753	11,594	11,696

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1