LEARNING ACHIEVEMENT IN THE CEE/CIS REGION

A COMPARATIVE ANALYSIS OF THE RESULTS FROM THE 2006 PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)
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<td>Central and Eastern Europe and the Commonwealth of Independent States</td>
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<td>ECE</td>
<td>Early childhood education</td>
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<tr>
<td>EFA</td>
<td>Education for All</td>
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<tr>
<td>EU8</td>
<td>The eight countries that acceded into the EU in 2004: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
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<td>OECD</td>
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EXECUTIVE SUMMARY

Why this report
The Millennium Development Goals (MDGs) and Education for All (EFA) strategies have focused increasing attention on the issue of educational quality. This is especially true in the transition states of Central and Eastern Europe and the Commonwealth of Independent States (CEE/CIS). These countries, which are making the transition from Soviet education systems to more modern and nationally relevant systems, are confronted with major obstacles to achieving good outcomes for school quality and learning.

Since the publication in 2007 of the study, *Education for Some More than Others*, which was commissioned by the UNICEF Regional Office for Central and Eastern Europe and the Commonwealth of Independent States, new data on educational outcomes in the region have become available. The most recent results of the Programme for International Student Assessment (PISA), a large-scale international assessment conducted by the Organization for Economic Co-Operation and Development (OECD), provide an excellent opportunity for a deeper analysis of the quality and relevance of basic education in this region. The last round of PISA was undertaken in 2006; it focused on science, but also provided performance results on reading and mathematics. Seventeen countries in the CEE/CIS region participated in this latest round of PISA, including seven countries that were participating for the first time.

Scope of the report
This paper utilizes data from PISA to achieve three objectives. First, the study presents the results of PISA’s evaluation of learning outcomes in reading, science and mathematics in the CEE/CIS region. Second, the paper attempts to identify trends over time and across countries with particular regard to quality and equity. Lastly, this paper makes policy recommendations in response to the evidence presented by PISA.

This study primarily focuses on nine participating countries with which UNICEF has a Programme of Cooperation in education (hereafter referred to as programme countries): Azerbaijan, Bulgaria, Croatia, Kyrgyz Republic, Montenegro, Romania, Russian Federation, Serbia and Turkey. For the purpose of comparison, results from the eight countries that acceded into the European Union (EU) in 2004 – the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia (EU8) – are also presented.

Main findings

**Overall Performance (Chapter 2)**

- In order to assess each country’s relative performance level, we examine *mean scores* in science, reading and mathematics in PISA 2006. Ranking the CEE/CIS countries on the basis of average score, we see that the EU8 countries all perform above the UNICEF programme countries. The CEE/CIS average is lower than the OECD average, while the EU8 countries are on a level with the OECD.

Some country highlights:
- The Kyrgyz Republic performs below all other PISA countries in all three literacy domains, followed by Azerbaijan.
- The Russian Federation and Croatia are the two UNICEF programme countries that consistently perform above the CEE/CIS average. Croatia is the only UNICEF programme country that is on a level with various EU8 countries in reading and science.
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- Estonia and Slovenia, together with the Czech Republic in science and mathematics and Poland in reading, are significantly above the OECD average and do markedly better than all other CEE/CIS countries.

➤ To estimate how many students may be at a disadvantage for fully participating in society in each country, we examine the number of students who do not reach the baseline level of achievement as defined by PISA (Literacy Level 2). In all three literacy domains (science, reading, mathematics), there are on average 31 per cent fewer students who reach this level in the UNICEF programme countries than in the EU8 countries.

➤ Since science literacy was the focus of PISA 2006, there is sufficient detail to make it possible to analyse the strengths and weaknesses of countries in relation to different scientific competencies:

- In general, students in the CEE/CIS region are better at explaining phenomena scientifically than they are at identifying scientific issues or using scientific evidence.
- One possible explanation of this could be that some countries in the region may still be using outdated teaching techniques, with a focus on delivery, accumulation and reproduction of facts. In such countries, a more flexible approach to learning is called for in order for students to be able to develop wider scientific and thinking skills.
- Students in Azerbaijan and Kyrgyz Republic (the lowest-performing countries) have the weakest level of competency in using scientific evidence.

➤ PISA, being an ongoing triennial survey, makes it possible to monitor changes in educational outcomes over time. For each subject, data is comparable only from the point when a first in-depth assessment took place:

- In reading, there was a statistically significant improvement in average performance between PISA 2000 and 2006 in Poland and Latvia, and a decline in the Russian Federation, Bulgaria and Romania. There was no statistically significant change in Turkey, Hungary, the Czech Republic, and Slovakia.
- In mathematics, for which trend data is available only since 2003, there was no significant change in average performance in the eight CEE/CIS countries.
- In science, the 2006 PISA test was not comparable with earlier years. Looking at the previous test, there was statistically significant progress between 2000 and 2003 in Poland, the Czech Republic, Latvia and the Russian Federation, but none in Hungary.
- Poland is a country that made the most progress since 2000. This is attributed to a 1999 reform providing more integrated educational structures, as it separated students into different school tracks one year later (that is, after the age of 15).

Equity (Chapter 3)

➤ Average performance levels mask significant variation in performance within countries. Large within-country differences in performance are a concern when education is seen in its function of furthering equality of opportunity and social cohesion. To give an overview of the extent of inequality in performance within countries, we look at the performance distribution in terms of the size of the gap between the top-achievers and lowest-achievers in a country, as measured by the difference between the 95th and 5th percentiles. This study finds:

- UNICEF programme countries generally have lower within-country disparities, except the Kyrgyz Republic and Bulgaria, while the EU8 countries mostly have larger disparities, except Estonia and Latvia.
• On average, CEE/CIS countries have smaller disparities in performance than OECD countries.
• Bulgaria is the only country in which disparities are larger than the OECD average in all three literacy domains, indicating that there are considerable inequalities in what students learn within Bulgaria’s educational system.
• In all countries, disparities are large.
• There is no trade-off between high achievement and low disparities: the two can go together.

➤ How much of the overall variation in performance is attributable to differences between schools? The higher the between-school variance, the more students are grouped in schools in which other students perform at levels similar to their own. We notice that:
• The three countries with the lowest between-school variance (Estonia, Latvia and Poland), also have high levels of performance. This indicates that providing similar learning opportunities across schools is compatible with high overall achievement.
• Countries with early institutional differentiation – i.e., Hungary, the Czech Republic, Slovakia, Turkey and Bulgaria, where students are separated into different school types at 11 years of age – have a relatively high proportion of between-school variance.

➤ One of the UN Millennium Development Goals is about reducing gender disparities in access to education. But once in school, are there any gender disparities in achievement? Looking at the gender gap in PISA:
• In reading, girls tend to do significantly better than boys in all countries, but the average gap in favour of girls is larger in the CEE/CIS than it is in the OECD.
• In mathematics, there are 6 out of 17 CEE/CIS countries in which boys do better than girls, but gender differences are generally small.
• In science, there are seven CEE/CIS countries in which girls do better than boys, but differences are small.
• On average, girls in CEE/CIS countries tend to do better than boys relative to OECD countries in all three literacy domains.

➤ Socio-economic status and family background are two of the most important factors influencing performance in all countries. Having a disadvantaged background does not always mean poor performance, and some countries manage to moderate the relationship more than others, mitigating rather than perpetuating or reinforcing existing inequalities:
• Bulgaria and the Czech Republic are the countries where two students of different socio-economic background have the largest overall difference in expected science scores, while Azerbaijan has the least differences.
• In all countries except Poland, the association of the school’s socio-economic intake with performance is much larger than that of an individual’s own background, and is particularly large in Slovenia and the Czech Republic.

➤ Estonia seems to be an example to follow in the region, achieving both high levels of quality and equity in learning outcomes.

School and system factors (Chapter 4)
➤ The relationship between country wealth and educational expenditure and educational performance is strong among the CEE/CIS countries, but does not hold among the richer OECD countries. Some countries in the CEE/CIS region may be too poor to be able to provide sufficient educational opportunities.
Spending alone is by no means all that counts in producing high performance. PISA collects information on various school and system factors that may be related to performance:

- Concerning **school location**, students in schools in smaller communities generally have lower mean performance than those in larger communities. But by taking socio-economic intake into account, the disadvantage of schools in smaller communities often disappears. It seems that the socio-economic disadvantage of smaller communities drives the lower performance results.

- Concerning **school selection and choice**:
  - In countries with a larger number of distinct programme types, and where students are placed into different types of schools or programmes at an early age, socio-economic background tends to have a significantly larger impact on student performance, with no benefit to overall performance.
  - Having **ability grouping for all subjects** within school is negatively associated with performance among PISA countries.

- Concerning **use of achievement data**:
  - Schools posting achievement data publicly seem to do better overall in PISA.

- Concerning **school autonomy**:
  - An average of 70 per cent of students in the CEE/CIS are in schools where principals report that their school has considerable decision-making responsibility.
  - Schools in UNICEF programme countries generally have less responsibility in decision making compared to EU8 countries.
  - Countries in which principals reported higher degrees of autonomy in various aspects of decision-making generally have higher average performance.
  - Students in educational systems that give more autonomy to schools to formulate the school budget tend to perform better, even controlling for other variables.

- Concerning **school resources**:
  - A lack of qualified teachers and a perceived inadequacy of a school’s educational resources are negatively related to science performance at the school level, but the overall relationship disappears when accounting for socio-economic background factors. It remains negative in a few CEE/CIS countries.
  - Pupil/teacher ratios and the number of computers per student are not related to performance even before accounting for background factors.
  - Three quarters or more of school principals expressed the concern that an inadequacy of educational resources hindered the capacity to provide instruction in the Russian Federation, Montenegro, Azerbaijan, and Kyrgyz Republic. In Azerbaijan, Kyrgyz Republic and Turkey, around 60 per cent of principals had the impression that a lack of qualified science teachers hindered instruction, while the CEE/CIS average was 10 per cent.
  - Even where there seems to be no direct relationship between the reported inadequacy of educational resources and school performance, there should be cause for concern for those countries where there is a diffuse sense of inadequacy of resources among school principals.
• Concerning **learning time:**
  ✔ The average students’ learning time for regular lessons in school and for self-study or homework are overall positively associated with performance. Participating in school activities such as science clubs, fairs, competitions and excursions is also positively related to performance.
  ✔ This does not mean that it is necessary to have long hours at school for high levels of performance. For example Finland, the top-performing country in PISA across the three domains, devotes less time to regular lessons in school than the OECD average.
  ✔ The Kyrgyz Republic is the PISA country with the largest percentage of students having less than 2 hours a week of regular school lessons, on average, in each of the three subjects.

**Policy recommendations (Chapter 5)**

*What policy factors can help explain why most UNICEF programme countries participating in PISA lag behind OECD and EU8 countries?*

➤ Most countries in the region have the same **legacy from Soviet times:** school curriculum and teacher training mandated by the government that promoted knowledge acquisition and neglected knowledge application.

• Reforms started in the mid-1980s, and went much faster after the break-up of the Soviet Union and socialist block in Eastern Europe in 1991.

• Not all countries were able to improve, primarily because of insufficient resources and other priorities. In some countries, such as Bulgaria, Romania, Azerbaijan, The Russian Federation and Kyrgyz Republic, student achievement actually became worse than during Soviet times.

• Other countries, such as Estonia, Poland and Croatia, found a way to succeed even in spite of economic limitations and shortages.

*How to improve quality with equity?*

➤ PISA assumes that the goal of each country’s curriculum is to provide a certain level of **functional literacy:** Students should learn to apply knowledge in real-life situations and communicate thoughts and ideas effectively.

➤ In Estonia, the top-performing country in the region, the biggest positive developments in the education sector are linked to its curriculum development efforts.

• A national curriculum framework, adopted by the Estonian Government in 1996, has given each school the right and obligation to develop its own curriculum.

• Students with special needs were included in regular schools rather than in special schools.

➤ A successful strategy adopted by the **Croatian** government was its collaborative approach to planning the curriculum.

• Croatia created the Council of National Curriculum that included scholars, teachers, Ministry of Education officials, researchers, leaders of the teachers’ union, philosophers and even theologians, which developed a clear and concise ‘Strategy for the Construction and Development of the National Curriculum’.

• The Council of National Curriculum also devoted attention to the preschool curriculum, the development of children with special needs, as well as opportunities for accelerated progress for gifted children.
➤ **Improve the status of the teaching profession:** In the UNICEF programme countries, teaching is considered to be among the least attractive and lowest paid jobs.

What lessons can be learned from top performers in PISA?

➤ The best performing education systems manage to attract the **best teachers**. Only top graduates get accepted to become teachers.

- Top scoring Finland and Singapore limit the supply of **teacher-training places** to meet demand.
- Teaching is a high-status profession and there are generous **funds for each trainee teacher**.
- Procedures ensure that the lowest-performing teachers can be removed from the classroom based on their performance.

➤ These countries also **avoid leaving any child behind**: they provide extra assistance to children with special educational needs and to children who lag behind their peers academically for any reason.

➤ **Slovenia**, which did well on PISA overall performance, uses an ‘assessment’ approach that emphasizes thorough scientific assessment of academic progress at all stages. Sound evaluations help Slovenian education officials identify educational problems and deal with them very early.

What are the strategies for improving equity without threatening quality?

Different CEE/CIS countries took different **approaches to educational improvement**:

➤ Estonia, Latvia, Lithuania and Poland took an incremental approach, reviewing educational legislation, funding and curricula with the goal of providing **quality education for all** students in all schools.

➤ The Russian Federation, Azerbaijan and Kyrgyz Republic concentrated on the best-performing students. Elite schools, schools offering specialized courses and schools for gifted students received additional resources, while most schools were left with minimal resources.

➤ **Poland** improved performance and reduced disparities between schools by focusing on **integration**, postponing differentiation of students into different school tracks by one year. It proved that with thoughtful strategies based on data, collaboration among stakeholders and well-focused resource allocation, rapid changes are possible.

➤ In CEE/CIS countries such as Estonia that performed well, **preschool education** is almost universal. This is not the case in countries that performed poorly, e.g. Azerbaijan, Montenegro and Kyrgyz Republic.
Recommendations

The following recommendations stem from the analysis in PISA 2006 of the educational systems of countries that performed poorly, as well as those countries that have shown significant improvements after reform:

1. **Align the curriculum** in the areas of reading, mathematics, science and information literacy with modern skill needs. Clearly define student learning outcomes that all students must attain for each educational level.

2. Develop high quality materials and textbooks.

3. **Make immediate effort to deal with teacher shortages** in Bulgaria, Kyrgyz Republic, Azerbaijan, Croatia, Montenegro, Romania and Serbia. This is especially important for rural schools. Monetary incentives and better selection and training are needed to attract and retain qualified teachers.

4. **Initiate a nationwide programme to improve teacher quality in each country.** This should include both pre-service and in-service training focusing on a high-level knowledge of the curriculum, mastery of teaching methods, assessment techniques, curriculum leadership and quality assurance.

5. **Improve preschool coverage and preschool education.** Students who start primary school without having attended pre-primary school may have difficulty catching up with their more advanced peers.

6. **Develop assessment capacity at each level, beginning with the classroom teacher and continuing up to the education minister.** Assessment strategies should include targets for student performance and rigorous testing at the end of each stage. The results should be regularly analysed and improvement plans developed. The reviews of student progress should be made public.

7. **Improve the leadership quality at each level.** The quality of school leadership is critical to raising the standards of teaching and learning. The most effective school leaders should be identified and encouraged to lead educational systems and networks with appropriate training and remuneration.

8. **Improve educational funding management.** Educational funding in most of the CEE/CIS countries is insufficient, and even those scarce funds are not managed well. School administrators should be trained in budget management or strategic planning.
CHAPTER 1

INTRODUCTION
CHAPTER 1: INTRODUCTION

The region of Central and Eastern Europe and the Commonwealth of Independent States (CEE/CIS) was long known for universal education with broad gender equality and relatively high learning achievements. But the economic, social and political upheaval in the period of transition placed enormous stress on education systems. While the situation in most areas has stabilized considerably, disparities in some social and economic outcomes are deepening across the region. The study, *Education for Some More than Others*, published by the UNICEF Regional Office for Central and Eastern Europe and the Commonwealth of Independent States in 2007, confirmed the trends identified since the early 1990s: a reversal and deterioration of education, notably in the areas of access and equity, learning and labour market outcomes, and financing and governance.

Overall enrolment rates remain quite high. But disparities in access and completion of basic education vary widely by country, and disturbing gaps are found for children from disadvantaged families, children of marginalized ethnic groups (especially the Roma), children with special educational needs, and girls.

Education systems in the region are also generating growing inequalities in learning outcomes. Countries that spend the least on education show the worst results, and disparities in learning outcomes are commonly stratified by socio-economic status. While education systems are being reformed, changes have not penetrated into the classrooms, especially in poor and rural areas; outdated curricula and teaching methods prepare students for memorization of facts rather than applying the skills that are needed in knowledge-based societies and economies.

Governance and public expenditure, in spite of increases in recent years, have reinforced educational inequality. Public expenditure remains insufficient in many countries and tends to benefit the richest; decentralization has resulted in funding burdens passed to localities to the detriment of equity; poor pay and low motivation of teachers contribute to decreasing quality and falling demand; and increasing reliance on private tutoring widens the gap in educational achievements.

Quality is increasingly at the centre of the international discourse on educational development and strategies for realizing the Millennium Development Goals (MDGs) and Education for All (EFA) goals. This is especially true in the transition states of CEE/CIS. These countries, facing the challenges of converting from archaic Soviet education systems, are confronted with major obstacles to achieving good school quality and learning outcomes.

The most recent results of the Programme for International Student Assessment (PISA), a large-scale international assessment conducted by the Organization for Economic Co-operation and Development (OECD), provide an opportunity to analyse the quality and relevance of basic education in this region. Seventeen countries that are geographically part of the CEE/CIS region participated in this latest round of PISA in 2006, with seven of them participating for the first time.

This paper uses data from PISA to achieve three objectives. First, the study presents the results of the PISA evaluation of learning outcomes in reading, science and mathematics in the CEE/CIS region. Second, the paper identifies trends over time and across countries, with particular regard to quality and equity. Lastly, this paper makes policy recommendations that grow out of the PISA data.

PISA is an ongoing triennial survey launched by the OECD in order to assess students’ ‘preparedness for adult life’ as they near the end of secondary education. PISA measures the performance of 15-year-old students in three core competencies: reading, mathematics and science. PISA has thus far been administered three times, in 2000, 2003 and 2006. In each year, PISA measured students’
overall performance in the three competencies and conducted an in-depth investigation of students’
skills in one of the three subjects. PISA 2000 focused on reading; PISA 2003 focused on mathematics
and PISA 2006 focused on science. (See Box 2 for a list of the specific abilities that PISA tracks.)

In 2006, nationally-representative samples were drawn from 57 countries, totalling around 400,000
students. These students were randomly selected to participate in PISA in order to represent 20
million 15-year-olds. Students spent two hours partly on tasks that required them to construct their
own answers, and partly on multiple choice questions. They also answered a half-hour questionnaire
about themselves, focusing on their personal background, learning habits and attitudes. Their
principals answered a questionnaire about their schools, including demographic characteristics and
the quality of the learning environment at school.

The number of countries participating in PISA has increased over time, from 32 in 2000, to 57 in 2006
(see Table 1 for a list of participating countries and for country groupings). PISA 2009, which will
again focus on reading, is set to include 67 countries and provinces. The number of countries from
the CEE/CIS region that participate in PISA has also increased over time. In 2000, only five countries
from the region participated; in 2006, 17 countries participated. In 2009, 20 CEE/CIS countries will
participate, with Albania, Kazakhstan and Moldova joining the group.

This study primarily focuses on the nine participating countries with which UNICEF has a Programme
of Cooperation in education: Azerbaijan, Bulgaria, Croatia, Kyrgyz Republic, Montenegro, Romania,
the Russian Federation, Serbia and Turkey. For the purpose of comparison, results of the eight EU
countries that acceded into the EU in 2004 – the Czech Republic, Estonia, Hungary, Latvia, Lithuania,
Poland, Slovakia and Slovenia – will also be presented. This study is based mainly on results as

Chapter 2 describes overall performance levels in the CEE/CIS countries in science, reading and
mathematics in PISA 2006. It looks at average literacy scores as well as at the percentage of students
that are below the baseline level of achievement identified by PISA, and illustrates trends in overall
performance since the first PISA assessment in 2000.

Chapter 3 investigates equity in performance. It looks first at the extent of overall within-country
disparities in achievement levels across the 15-year-old student population, and at how these have
changed over time. It also looks at the extent to which variability of the performance results is
concentrated between or within schools. Finally, it examines inequality in performance by gender,
mother’s educational attainment, and the socio-economic background of the family and school.

1 OECD 2007. For more information on the PISA survey, as well as for examples of questions asked, please refer to this
publication or to http://www.pisa.oecd.org/.
**Box 2 Concepts of literacy in PISA 2006**

Measurements of performance in reading, mathematics and science in PISA are based on a concept of literacy, which is the capacity of students to extrapolate from what they have learned, to apply their knowledge in novel settings, and to analyse, reason and communicate effectively as they pose, solve and interpret problems in a variety of situations.

PISA measures the skills that determine one’s competitiveness in the new global economy – i.e., the ability to:

- Integrate formal and informal learning, declarative knowledge (‘knowing that’) and procedural knowledge (‘knowing how’);
- Access, select and evaluate knowledge in an information-rich world;
- Develop and apply diverse forms of intelligence;
- Learn and work effectively in teams;
- Create and transpose knowledge;
- Cope with ambiguous situations, unpredictable problems and unforeseen circumstances;
- Deal with multiple careers – i.e., learning how to ‘reinvent’ oneself, locate oneself in a job market, and choose and fashion the relevant education and training.*

*Reading literacy* focuses on the ability of students to use written information in situations that they encounter in their lives, and on the knowledge and skills required to apply reading to learning, rather than on the technical skills acquired in learning to read. Reading literacy is defined as understanding, using and reflecting on written texts in order to achieve one’s goals, to develop one’s knowledge and potential and to participate in society. PISA intends to measure the extent to which individuals are able to construct, expand and reflect on the meaning of what they have read in a wide range of texts common both within and beyond school.

The concept of *mathematical literacy* used by PISA is concerned with the capacity of students to analyse, reason and communicate effectively as they pose, solve and interpret mathematical problems in a variety of situations involving quantitative, spatial, probabilistic or other mathematical concepts. PISA defines mathematical literacy as ‘an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual’s life as a constructive, concerned and reflective citizen’.

PISA 2006 defines *scientific literacy* in terms of an individual’s:

- Scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues;
- Understanding of the characteristic features of science as a form of human knowledge and enquiry;
- Awareness of how science and technology shape our material, intellectual and cultural environments; and
- Willingness to engage with science-related issues, and with the ideas of science, as a reflective citizen.


Chapter 4 looks at school and system-level factors affecting performance. It presents the context by looking at the level of country wealth available for educational expenditure and its relationship to performance. It then goes on to examine various school factors that seem to affect performance outcomes even when keeping constant family socio-economic background, the major predictor of performance. The factors described relate mainly to school selection and choice, ability grouping, public posting of student results, school autonomy, school resources and learning time.

Chapter 5 looks at the policy factors that underlie why most UNICEF programme countries participating in PISA lag behind OECD and EU8 countries. It examines the legacy from Soviet times, looks at differences in preschool education attendance, curriculum development, and analyses model educational policies in Poland, Estonia, Slovenia and Croatia. It also presents examples of teacher selection and training policies from top-performing OECD countries. Drawing from these analyses, it proposes a series of recommendations.

### Table 1 Countries in PISA 2006, and whether they participated in previous years

<table>
<thead>
<tr>
<th>OECD Countries</th>
<th>Also participated in:</th>
<th>Other countries</th>
<th>Also participated in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>X</td>
<td>X</td>
<td>Argentina</td>
</tr>
<tr>
<td>Austria</td>
<td>X</td>
<td>X</td>
<td>Azerbaijian</td>
</tr>
<tr>
<td>Belgium</td>
<td>X</td>
<td>X</td>
<td>Brazil</td>
</tr>
<tr>
<td>Canada</td>
<td>X</td>
<td>X</td>
<td>Bulgaria</td>
</tr>
<tr>
<td><strong>Czech Republic</strong></td>
<td>X</td>
<td>X</td>
<td>Chile</td>
</tr>
<tr>
<td>Denmark</td>
<td>X</td>
<td>X</td>
<td>Chinese Taipei</td>
</tr>
<tr>
<td>Finland</td>
<td>X</td>
<td>X</td>
<td>Colombia</td>
</tr>
<tr>
<td>France</td>
<td>X</td>
<td>X</td>
<td>Croatia</td>
</tr>
<tr>
<td>Germany</td>
<td>X</td>
<td>X</td>
<td>Estonia</td>
</tr>
<tr>
<td>Greece</td>
<td>X</td>
<td>X</td>
<td>Hong Kong-China</td>
</tr>
<tr>
<td><strong>Hungary</strong></td>
<td>X</td>
<td>X</td>
<td>Indonesia</td>
</tr>
<tr>
<td>Iceland</td>
<td>X</td>
<td>X</td>
<td>Israel</td>
</tr>
<tr>
<td>Ireland</td>
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<td>X</td>
<td>Jordan</td>
</tr>
<tr>
<td>Italy</td>
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<td>X</td>
<td>Kyrgyz Republic</td>
</tr>
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<td>X</td>
<td>Latvia</td>
</tr>
<tr>
<td>Korea</td>
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<td>Liechtenstein</td>
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<tr>
<td>Luxembourg</td>
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<td>X</td>
<td>Lithuania</td>
</tr>
<tr>
<td>Mexico</td>
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<td>X</td>
<td>Macao-China</td>
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<tr>
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</tr>
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<td>New Zealand</td>
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<td>X</td>
<td>Qatar</td>
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<tr>
<td>Norway</td>
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<td>X</td>
<td>Romania</td>
</tr>
<tr>
<td><strong>Poland</strong></td>
<td>X</td>
<td>X</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Portugal</td>
<td>X</td>
<td>X</td>
<td>Serbia</td>
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<tr>
<td><strong>Slovakia</strong></td>
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<td>Slovenia</td>
</tr>
<tr>
<td>Spain</td>
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<td>Thailand</td>
</tr>
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<td>Turkey</td>
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<td>X</td>
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</tr>
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<td>United Kingdom</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>


UNICEF programme countries are shown in red; EU8 countries are shown in green italic (here and in subsequent tables and figures).
CHAPTER 2

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2a. Overview of Performance ................................................................. 24
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CHAPTER 2: OVERALL PERFORMANCE

2a. Overview of Performance

Table 2 shows average scores in science, reading and mathematics for the CEE/CIS countries that participated in PISA 2006. As can be seen from the table, there is a clear separation in the ranking of the three literacy domains between the EU8 countries (in italics at the top of the table) and the UNICEF programme countries. The CEE/CIS average of reading, mathematics and science performance is 46 points lower than the OECD average. Within the CEE/CIS region, the averages of the EU8 and OECD countries are equivalent, while the average of the UNICEF programme countries is 85 points lower; the largest performance gap is in reading. Following is an in-depth discussion of the performance of each participating country in the region.

UNICEF Programme countries

Azerbaijan is ranked second to last in both reading, with a mean score of 353, and science, with a mean score of 382 (the OECD acknowledged that there was a problem with the mathematics data for Azerbaijan, so our analysis only applies to reading and science). The performance gap is smaller than in the Kyrgyz Republic, which is ranked last, but there is still a clear separation when compared to other CEE/CIS countries. On the other hand, we will see in the following chapter that Azerbaijan has very small within-country disparities, but this is hardly good news for a very low-performing country.

Bulgaria has a mean score of 402 in reading, which is comparable to Serbia, Romania and Montenegro, and has an estimated rank of between 42 and 50 among all countries in PISA. Bulgaria’s mean score of 413 in mathematics (PISA rank of 43 to 48) is on a level with Turkey and Romania, and its mean score of 434 in science (PISA rank of 40 to 44) is on a level with Serbia and Turkey. The next chapter shows that Bulgaria has the highest within-country disparities in the region, which will require further study and policy attention.

Croatia is the only UNICEF programme country that is on a level with various EU8 countries in reading and science, and in one case performs better. In reading (mean score 477), Croatia is on the same level as Latvia, Lithuania, Hungary and the Czech Republic, and it performs above Slovakia and the Russian Federation. This means that within CEE/CIS, only Poland, Estonia and Slovenia perform significantly above Croatia, which has a rank of 26 to 31 among all PISA countries in reading. In science, Croatia does better than the Russian Federation and matches the performance of Latvia, Lithuania, Slovakia and Poland (mean score 490 and a PISA rank of 23 to 30). Croatia does not perform as well in mathematics: with a mean score of 467, it is on the same level as the Russian Federation, and performs below the EU8 countries; it has a rank of 35 to 38 among all PISA countries.

There are many inter-country differences that should be kept in mind when comparing average scores. One difference is years of schooling: in most CEE/CIS countries, the majority of 15-year-old students were enrolled in grade 9; only in Slovenia, Czech Republic, Slovakia, Russian Federation and Turkey were the majority in grade 10. By contrast, in the OECD countries, the majority of 15-year-old students were enrolled in grade 10 or above. While only about 30 per cent of 15-year-old students were enrolled in grade 10 or above in CEE/CIS countries, in the OECD it was double that amount. Of the 28 OECD countries in which a sizeable number of 15-year-olds were enrolled in at least two different grades, PISA estimates that the difference of one school year corresponds to a gap of 38 points on the science scale (OECD 2007, p. 55).

An exact rank cannot be given, but only a range of ranks, within which there is a 95 per cent certainty that the rank will occur. This is due to the fact that PISA is a sample survey and is subject to sampling errors. Not all differences between mean scores are statistically significant, thus a confidence interval is applied around the sample mean within which there is a 95 per cent certainty that the population mean will occur. See Figure 24 in Annex for the statistical significance of differences between mean scores of each country.
OVERALL PERFORMANCE
CHAPTER 2

The Kyrgyz Republic performs below all other PISA countries in all three literacy domains, with a mean score of 285 in reading, 311 in mathematics and 322 in science.

Montenegro is also low performing, but its scores fall closer to the average score of UNICEF programme countries than the Kyrgyz Republic and Azerbaijan. Montenegro matches the scores of Bulgaria and Romania in reading, and matches Romania’s score in science. In mathematics, it scores below all CEE/CIS countries except the Kyrgyz Republic. With a mean score of 392 in reading, its estimated rank among PISA countries is between 47 and 50. Its ranking is low in all literacy domains: in mathematics, with a mean score of 399, its estimated rank is 49 to 50, and in science (mean score 412), it has a rank between 47 and 49.

Romania has a mean score of 396 in reading, which is similar to the scores of Bulgaria, Serbia, and Montenegro. Its estimated rank is 44 to 50. In mathematics, its mean score (415) is above Montenegro, and on the same level as Bulgaria and Turkey (estimated rank: 43 to 47). In science, its mean score (418) is below Bulgaria but on the same level as Montenegro and Turkey (estimated rank: 44 to 48).

The Russian Federation, together with Croatia, is one of the two UNICEF programme countries that consistently perform above the CEE/CIS average. In reading, the mean score of the Russian Federation (440) ranks it between 37 and 40 among all PISA countries. The Russian Federation does better in mathematics (mean score 476, rank of 32 to 36), which is comparable to Croatia. In science, the Russian Federation (mean score 479, rank of 33 to 38) is on a level with Lithuania.

Serbia has an average score of 401 in reading, which matches the level of Bulgaria, Romania, and Montenegro, for a rank of 44 to 48. It does better in mathematics (435), matching Turkey’s score, for a rank of 40 to 41, and science (436) where it is on a level with Bulgaria, with a rank of 40 to 42.

Turkey performs below the CEE/CIS average in science and mathematics, but is above average in reading. Turkey’s mean score in reading is 447 (rank 37 to 39), which is on a level with the Russian Federation. In mathematics, with a mean score of 424 and PISA rank of 41 to 45, it is on a level with Serbia, Romania and Bulgaria. In science, Turkey is comparable to Romania and Bulgaria, with a mean score of 424 and rank of 43 to 47. However, results for Turkey may be biased upward since over 40 per cent of 15-year-olds are not enrolled in school – a sizable group that is presumed to be the lowest achievers.4

EU8 Countries

The Czech Republic ranks significantly above the OECD average in science and mathematics performance, but below the average in reading. Estonia and Slovenia are significantly above the OECD average in all literacy domains and have significantly higher average performance than all other CEE/CIS countries. As the next chapter shows, Slovenia has high within-country disparities, while Estonia manages to maintain low within-country disparities as well as high overall performance. Also notable is that among all 57 countries participating in PISA, only Finland and Hong Kong perform significantly better in science than Estonia.

Among the EU8 countries, Latvia, Lithuania and Slovakia always perform below the OECD average even though they are well above the CEE/CIS average. Hungary performs at the OECD average in science, but is below the OECD average in reading and mathematics. Poland is at the OECD average in mathematics and science, and significantly above the OECD average in reading. We will see below

4 OECD 2007, Table A10.1.
how Poland has undergone significant progress in performance, while at the same time reducing disparities between schools. This is attributed to a 1999 reform that delayed separating students into different school tracks until after the age of 15.

Table 2  Mean performance in reading, mathematics and science literacy, PISA 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Reading</th>
<th>Mathematics</th>
<th>Science</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>501</td>
<td>515</td>
<td>531</td>
<td>516</td>
</tr>
<tr>
<td>Slovenia</td>
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</tr>
<tr>
<td>Czech Republic</td>
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<td>498</td>
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</tr>
<tr>
<td>Hungary</td>
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<td>504</td>
<td>492</td>
</tr>
<tr>
<td>Latvia</td>
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<td>490</td>
<td>485</td>
</tr>
<tr>
<td>Slovakia</td>
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<td>492</td>
<td>488</td>
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<td>Lithuania</td>
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</tr>
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<td>Russian Federation</td>
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<tr>
<td>Turkey</td>
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<tr>
<td>Serbia</td>
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<td>Romania</td>
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<td>418</td>
<td>410</td>
</tr>
<tr>
<td>Montenegro</td>
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<td>399</td>
<td>412</td>
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</tr>
<tr>
<td>Azerbaijan</td>
<td>353</td>
<td>m</td>
<td>382</td>
<td>368</td>
</tr>
<tr>
<td>Kyrgyz Republic</td>
<td>285</td>
<td>311</td>
<td>322</td>
<td>306</td>
</tr>
<tr>
<td><strong>CEE/CIS average</strong></td>
<td>440</td>
<td>458</td>
<td>461</td>
<td>451</td>
</tr>
<tr>
<td><strong>OECD average</strong></td>
<td>492</td>
<td>498</td>
<td>500</td>
<td>496</td>
</tr>
<tr>
<td>CEE/CIS – OECD</td>
<td>-52</td>
<td>-40</td>
<td>-39</td>
<td>-46</td>
</tr>
<tr>
<td>EU8 – OECD</td>
<td>-6</td>
<td>0</td>
<td>4</td>
<td>-1</td>
</tr>
<tr>
<td>UNICEF – OECD</td>
<td>-93</td>
<td>-80</td>
<td>-78</td>
<td>-85</td>
</tr>
</tbody>
</table>

Countries are ranked in order of average performance on the three literacy scales.
Values in the last three rows refer to the difference between average scores of country groupings.

Source: OECD 2006, PISA database, Tables 2.1c, 6.1c, 6.2c.

The science scale for the PISA 2006 survey was designed to have a mean score of 500 points among OECD countries (and a standard deviation of 100 points). For reading, the focus of the PISA 2000 survey, a mean score of 500 was established and has served as the benchmark against which reading performance has since been measured. This scale was also adopted for mathematics in the PISA 2003 survey. In PISA 2006, the OECD average score in reading is slightly lower than 500 partly because two countries performing below average joined PISA in 2003. The OECD average score in mathematics is also slightly lower than 500, but this difference is not statistically significant.
2b. Absolute disadvantage

Another way of assessing a country’s educational performance is by measuring absolute disadvantage; that is, by looking at the percentage of students having a low level of achievement relative to a common international benchmark. This may be more meaningful than looking at average scores, which merely indicate the position of each country’s educational system relative to others. Countries in which a large proportion of students fail to reach a minimum level of competence give cause for concern about the ability of their citizens to participate fully in society and in the labour market, as well as about the country’s future productivity and competitiveness.

PISA groups student scores into six proficiency levels in mathematics and science, and into five levels in reading; each proficiency is defined by benchmark skills and abilities. According to the OECD, students classified as being below Level 1 have such a low level of performance that they will be at a serious disadvantage for full participation in society and the economy. Level 2 is identified as the baseline level of proficiency, suggesting that students who achieve this level are capable of the basic tasks that will enable them to participate effectively and productively in life situations related to each of the PISA literacy domains. To reach Level 2 in science, for example, ‘requires competencies such as identifying key features of a scientific investigation, recalling single scientific concepts and information relating to a situation, and using results of a scientific experiment represented in a data table as they support a personal decision’.

Those who do not reach this level have not mastered the basic skills tested and may, according to the OECD, also have serious difficulties in benefiting from further educational and learning opportunities throughout life.

Science

Students who do not reach PISA Level 2 in science often confuse key features of an investigation, apply incorrect scientific information, and mix personal beliefs with scientific facts in support of a decision. Box 3 provides a description of what students can typically do at each of the six proficiency levels on the science scale, and Figure 27 in the Annex gives the percentage of 15-year-olds at each level. On average, there are more students in the CEE/CIS region failing to meet Level 2 in science (32 per cent) than in the OECD (19 per cent). In every OECD country except Mexico and Turkey, at least three in four students are at Level 2 or above in science literacy. In the CEE/CIS region (see Figure 1), only the EU8 countries, Croatia (where just 17 per cent do not reach Level 2) and the Russian Federation (22 per cent of students below Level 2) match this level of science literacy. By contrast, in Serbia, Montenegro, Bulgaria, Romania and Turkey, between 40 and 50 per cent do not reach Level 2 in science literacy. In Azerbaijan and Kyrgyz Republic, the majority of 15-year-old students (73 per cent and 86 per cent, respectively) lack fundamental scientific skills. The situation in the Kyrgyz Republic is even more dire: while in all other countries the majority of those who do not reach Level 2 at least reach Level 1, in the Kyrgyz Republic, 58 per cent of 15-year-old students do not even reach Level 1.

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6 OECD 2007, p. 44.
7 OECD 2007, p. 113.
Box 3 What students can typically do at each of the six proficiency levels on the science scale

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 are willing 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.

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.

At Level 4, students can work effectively with situations and issues that may 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 those explanations directly to aspects of life situations. Students at this level can reflect on their actions and they can communicate decisions using scientific knowledge and evidence.

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 can apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge.

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.

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 that follow explicitly from given evidence.

Source: OECD 2007, Figure 2.8, p. 43.
Reading

Students who do not reach Level 1 in reading are not able to show the most basic reading skills that PISA seeks to measure. Those who are at Level 1 can complete only very simple reading tasks, such as locating a single piece of information, identifying the main theme of a text, or making a simple connection with everyday knowledge. According to the OECD, they may lack the necessary literacy knowledge and skills to benefit sufficiently from their educational opportunities. See Box 4 for a description of what students can typically do at each of the five proficiency levels on the reading scale, and Figure 25 in the Annex for the percentage of 15-year-olds at each level.

An average of 31 per cent of students in the OECD score below Level 2 in reading, compared to an average of 37 per cent in the CEE/CIS region. The gap between CEE/CIS and OECD students is smaller in mathematics and science. The position of individual CEE/CIS countries in terms of absolute disadvantage across the different literacy domains is quite similar. In all three literacy domains, there are an average of 31 per cent more students who do not reach the baseline level of achievement in the UNICEF programme countries, and there is more variation between countries compared to the EU8 countries. The most notable difference between the literacy domains is in Turkey, where students do better in reading (with 32 per cent of students below the Level 2 benchmark) than they do in science and in mathematics (47 per cent and 52 per cent below Level 2, respectively).

Figure 2 shows that the percentage of students not reaching Level 2 proficiency in reading in the EU8 countries ranges from 14 per cent in Estonia, to 28 per cent in Slovakia. Among the UNICEF programme countries, only Croatia is within this range, with just 22 per cent of students reading below the Level 2 baseline. Turkey (32 per cent) and the Russian Federation (35 per cent) are close behind. In the other UNICEF programme countries, underachievement is high, with the majority of 15-year-old students not reaching the baseline level of achievement. In Bulgaria, Romania, Serbia and Montenegro, between 51 and 56 per cent of students are not reaching the baseline, while as many as 79 per cent in Azerbaijan and 88 per cent of students in the Kyrgyz Republic have not attained baseline proficiency in reading.

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* OECD 2007, p. 295.
When looking at Turkey’s relatively high ranking compared to other UNICEF programme countries, it is important to remember that PISA only represents the population of 15-year-olds that are enrolled in and attending school. Out-of-school 15-year-olds did not participate in the survey. Absolute disadvantage of 15-year-olds may be underestimated in countries with low enrolment rates because children who are not enrolled are likely to be those from disadvantaged and socially marginalized communities who would be likely to score poorly on the test. If the achievement tests had been on the total national population of 15-year-olds rather than on the population enrolled and present in school, results may have been worse. Turkey has the lowest secondary school enrolment rates in the region, with a net enrolment rate of 67 per cent; among 15-year-olds, the enrolment rate is 59 per cent. In fact, PISA data for Turkey covers less than half of the total 15-year-old population of the country (47 per cent). Coverage rates depend on school and student exclusions in the national sampling frame, on absence of students during the data collection for other reasons, as well as on enrolment rates. The Kyrgyz Republic and Romania also have low coverage rates (63 and 66 per cent, respectively). For all other CEE/CIS countries, coverage is above 80 per cent. High rates of absenteeism can also contribute to underestimation of absolute disadvantage, because children who are frequently absent from school – and who may have been absent during the PISA testing – are also those who are likely to score poorly.

**Box 4 What students can typically do at each of the five proficiency levels on the reading scale**

**At Level 5**, students can locate and possibly sequence or combine multiple pieces of deeply embedded information, some of which may be outside the main body of the text. They can: infer which information in the text is relevant to the task; deal with highly plausible and/or extensive competing information; either construe the meaning of nuanced language or demonstrate a full and detailed understanding of a text; critically evaluate or hypothesize, drawing on specialized knowledge; deal with concepts that are contrary to expectations and draw on a deep understanding of long or complex texts. In continuous texts, students can analyse texts whose discourse structure is not obvious or clearly marked in order to discern the relationship of specific parts of the text to its implicit theme or intention. In non-continuous texts, students can identify patterns among many pieces of information presented in a display that may be long and detailed, sometimes by referring to information external to the display. They may need to realize independently that a full understanding of the section of text requires reference to a separate part of the same document, such as a footnote.

**At Level 4**, students can locate and possibly sequence or combine multiple pieces of embedded information, each of which may need to meet multiple criteria in a text with familiar context or form. They can: infer which information in the text is relevant to the task; use a high level of text-based inference to understand and apply categories in an unfamiliar context, and to construe the meaning of a section of text by taking into account the text as a whole; deal with ambiguities – i.e., ideas that are contrary to expectation and ideas that are negatively worded; use formal or public knowledge to hypothesize about or critically evaluate a text; and show accurate understanding of long or complex texts. In continuous texts, students can follow linguistic or thematic links over several paragraphs, often in the absence of clear discourse markers, in order to locate, interpret or evaluate embedded information or to infer psychological or metaphysical meaning.

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9 OECD 2007, Table A10.1 for enrolment, and Table A2.1 for coverage.
In non-continuous texts, students can scan a long, detailed text in order to find relevant information, often with little or no assistance from organizers, such as labels or special formatting, to locate several pieces of information to be compared or combined.

At Level 3, students can locate, and in some cases recognize, the relationship between pieces of information, each of which may need to meet multiple criteria. They can: deal with prominent competing information; 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; compare, contrast or categorize, taking many criteria into account; deal with competing information; make connections or comparisons, give explanations, or evaluate a feature of text; demonstrate a detailed understanding of the text in relation to familiar, everyday knowledge, or draw on less common knowledge. In continuous texts, students can use conventions of text organization, where present, and follow implicit or explicit logical links such as cause and effect relationships across sentences or paragraphs in order to locate, interpret or evaluate information. In non-continuous texts, students can consider one display in the light of a second, separate documents or displays, possibly in a different format, or combine several pieces of spatial, verbal and numeric information in a graph or map to draw conclusions about the information represented.

At Level 2, students can locate one or more pieces of information, each of which may be required to meet multiple criteria. They can: deal with competing information; identify the main idea in a text, understand relationships, form or apply simple categories, or construe meaning within a limited part of the text when the information is not prominent and low-level inferences are required; make comparisons or connections between the text and outside knowledge, or explain a feature of the text by drawing on personal experience and attitudes. In continuous texts, students can follow logical and linguistic connections within a paragraph in order to locate or interpret information, or synthesize information across texts or parts of a text in order to infer the author’s purpose. In non-continuous texts, students can demonstrate a grasp of the underlying structure of a visual display such as a simple tree diagram or table, or combine two pieces of information from a graph or table.

At Level 1, students can locate one or more independent pieces of explicitly stated information, typically meeting a single criterion, with little or no competing information in the text. They can recognize the main theme or author’s purpose in a text about a familiar topic when the required information in the text is prominent, and make a simple connection between information in the text and common, everyday knowledge. In continuous texts, students can use redundancy, paragraph headings or common print conventions to form an impression of the main idea of the text, or to locate information stated explicitly within a short section of text. In non-continuous texts, students can focus on discrete pieces of information, usually within a single display such as a simple map, a line graph or a bar graph that presents only a small amount of information in a straightforward way, and in which most of the verbal text is limited to a small number of words or phrases.

LEARNING ACHIEVEMENT IN THE CEE/CIS REGION
A COMPARATIVE ANALYSIS OF THE RESULTS FROM THE 2006 PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)

Figure 2    Percentage of 15-year-old students at Level 1 or below in reading, PISA 2006

Source: OECD 2006, Table 6.1a.

Mathematics

PISA Level 2 in mathematics represents a baseline level of proficiency at which students begin to demonstrate the kind of mathematical literacy skills that enable them to actively use mathematics in everyday life. See Box 5 for a description of what students can typically do at each of the six proficiency levels on the mathematics scale, and Figure 26 in the Annex for the percentage of 15-year-olds at each level.

On average, 34 per cent of students in CEE/CIS countries do not reach Level 2 in mathematics, compared to 21 per cent in the OECD countries. EU8 countries again are the highest performers (Figure 3), with only 12 per cent of students in Estonia and 23 per cent in Lithuania failing to attain the Level 2 baseline; followed by the Russian Federation and Croatia (27 to 29 per cent); then by Serbia (43 per cent), Turkey, Romania and Bulgaria (52 to 53 per cent), Montenegro (60 per cent) and the Kyrgyz Republic (89 per cent).

Box 5 What students can typically do at each of the six proficiency levels on the mathematics scale

At Level 6 students can conceptualize, generalize, and utilize information based on their investigations and modelling of complex problem situations. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understandings along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. They can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situations.

At Level 5 students 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 complicated problems related to these models.
Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.

**At Level 4** students can work effectively with explicit models for complex, concrete situations that may 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 utilize well-developed skills and reason flexibly, and with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.

**At Level 3** students 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.

**At Level 2** students can interpret and recognize 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 making literal interpretations of the results.

**At Level 1** students 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.

Source: OECD 2007, p. 312.
2c. Performance on different science competencies

There is sufficient detail from PISA 2006, which focused on science literacy, to analyse the strengths and weaknesses of different scientific competencies in each of the countries that were surveyed. Students received scores for their capacity in each of three science scales: identifying scientific issues, explaining phenomena scientifically and using scientific evidence (see Box 6).

**Box 6 Essential features of each science competency as measured by PISA 2006**

*Identifying scientific issues*
- Recognizing issues that are possible to investigate scientifically
- Identifying keywords to search for scientific information
- Recognizing the key features of a scientific investigation

*Explaining phenomena scientifically*
- Applying knowledge of science in a given situation
- Describing or interpreting phenomena scientifically and predicting changes
- Identifying appropriate descriptions, explanations, and predictions

*Using scientific evidence*
- Interpreting scientific evidence and making and communicating conclusions
- Identifying the assumptions, evidence and reasoning behind conclusions
- Reflecting on the societal implications of science and technological developments

Source: OECD 2007, Figure 2.3, p. 37.

In general, students in the CEE/CIS region are better at explaining phenomena scientifically than they are at identifying scientific issues or using scientific evidence (see Figure 4). Among the OECD countries, there is an average difference of at most one point between mean scores on each science scale; in the CEE/CIS region, there is an average difference of 18 points between both the ‘identifying scientific issues’ and ‘using scientific evidence’ scales, and the ‘explaining phenomena scientifically’ scale. Only Croatia, Latvia and Turkey have quite similar results on all scales. Students in Azerbaijan and the Kyrgyz Republic (the lowest-performing countries) demonstrate the greatest weakness in using scientific evidence, compared to other competencies. Also relatively weak on this scale are the Czech Republic, Slovakia, Bulgaria, Romania and Serbia (scoring more than 10 points lower than on the combined scale). In identifying scientific issues, we find relative weakness in Azerbaijan, the Czech Republic, Hungary, Slovakia, Estonia, the Russian Federation, Poland, Lithuania and Montenegro.

One possible explanation of the relative strengths and weaknesses of the CEE/CIS countries could be that countries in the region may still be using outdated teaching techniques, with a focus on delivery, accumulation and reproduction of facts, overloaded curricular content and rote learning. Yet to be able to use science in real-life situations, students need to be able to recognize a scientific problem and to interpret and apply findings in ways relevant to the real world. A more flexible approach to learning is needed in order for students to be able to develop wider scientific and thinking skills.

The same conclusions are reached in comparing the results of PISA to those of other international surveys of achievement. CEE/CIS countries tend to do better, relative to OECD countries, in surveys by TIMSS (Trends in International Mathematics and Science Study) and PIRLS (Progress in
International Reading Literacy Study) than in PISA. One common explanation of this is that PISA assesses the use and application of knowledge and skills in real-life situations that are most relevant to the needs of the global economy, while TIMSS and PIRLS focus more on measuring the mastery of an internationally-agreed formal curriculum.

2d. Trends in performance over time

PISA, being an ongoing triennial survey, makes it possible to monitor changes in educational outcomes over time. For each subject, data is comparable only from the point when a first in-depth assessment took place. The first in-depth mathematics-focused test took place in 2003, thus mathematics performance can only be compared between 2003 and 2006. Performance trends are available in reading since PISA 2000, when the first full assessment of reading took place. For science, the PISA 2006 survey was the first full assessment, so it is not possible to compare science learning outcomes from 2006 with those of earlier PISA assessments.

Trend data is available for only ten CEE/CIS countries: the Russian Federation, Latvia, Poland, Hungary and the Czech Republic (participated both in 2000 and 2003), Bulgaria and Romania (participated in PISA 2000 ‘plus’, undertaken in 2002), Serbia, Turkey and Slovakia (participated in 2003).

Reading

There was a statistically significant improvement in reading performance since PISA 2000 in Poland and Latvia; however, there was a decline in mean reading scores of more than 20 points in the Russian Federation, Bulgaria and Romania (see Figure 5). In Poland, Latvia and the Russian Federation, there were also significant changes in performance between 2000 and 2003. Since 2003, the only positive change in performance was in Poland, which now for the first time performs above the OECD average.

Source: OECD 2006, Tables 2.1c, 2.2c, 2.3c, 2.4c.
In the other countries for which trend data is available – Turkey, Hungary, the Czech Republic, and Slovakia – there was no statistically significant change in average reading performance. In order to better understand where these changes in mean reading scores originate, we can look at changes in the distribution of scores, in particular at changes at the 5th, 10th and 25th percentiles in the bottom half of the performance distribution, and the 75th, 90th and 95th percentiles in the top half.

Between PISA 2000 and PISA 2003, Poland raised its average performance in reading mainly through increases at the lower end of the performance distribution (i.e., the 5th, 10th and 25th percentiles). Extensive analyses at the national level have associated this improvement with the reform of the schooling systems in 1999, which now provides more integrated educational structures. The separation of students into different school types now happens after age 15. Since PISA 2003, performance in Poland has also risen at the top end of the performance distribution (75th, 90th and 95th percentiles). Overall, in the period from 2000 to 2006, there has been an increase throughout the entire performance distribution – that is, high performing students and low performing students have both shown increased performance in Poland.

Figure 5  Mean performance in reading literacy, PISA 2000, 2003 and 2006

Symbols for 2000 and 2003 are fully coloured only if difference with 2006 is statistically significant; otherwise, symbol appears empty.
Bulgaria and Romania participated in the PISA 2000 survey in 2002 (PISA ‘plus’).
Countries are ranked by difference in performance between 2006 and 2000 (or 2003, if 2000 not available).
Source: OECD 2006, Table 6.3a.

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12 OECD 2007, Table 6.3c.

13 OECD 2007, p. 302. Before 1999, the school system provided three tracks after eight years of primary education: an academic track, an academic track with a practical orientation, and a vocational track oriented towards direct entry into the labour market. The new system provides six years of primary education, followed by three years of general lower secondary education, followed by a tracked system of upper secondary education (OECD 2007, p. 211). This reform towards a more integrated educational system is in line with UNICEF recommendations (UNICEF 1998), which advised Poland to reconsider streaming and selection into different types of secondary schools in order to avoid polarization of educational opportunities. UNICEF (UNICEF 2007, p. 164) had noted a worrying rise in tracking, streaming by ability, and selective admission to prestigious schools.
In Latvia, the improvement in reading was across the range of performance between 2000 and 2003, while in the period to 2006, the improvement among above-average students was not statistically significant.

Most countries saw overall decreases in reading performance since earlier surveys. In the Russian Federation and Romania, the decreases were across the performance range, while in Bulgaria, it was mainly below-average students who performed significantly worse. In the Czech Republic and Slovakia, where overall performance has remained relatively stable, there were improvements among the better performing students, while performance declined at the lower end of the distribution. This means that in these countries there has been a rise in inequality.

Mathematics

Trend data has only been available for mathematics since 2003, when the first full assessment took place. There was no significant change in average performance in the eight CEE/CIS countries between 2003 and 2006 (Bulgaria and Romania participated only in PISA 2000 ‘plus’, when the mathematics survey was not comparable, and not in 2003). Looking at the performance distribution, there was a significant improvement among the lowest-performing students in Turkey between PISA 2003 and 2006, while overall performance remained unchanged.

Science

Science was first fully assessed in PISA 2006, and results are not comparable with earlier years. We can nevertheless compare science achievement in 2000 with 2003. Among the five CEE/CIS countries that participated in both years, there was statistically significant progress from 2000 to 2003 in Poland, the Czech Republic, Latvia and the Russian Federation, but none in Hungary. For the Russian Federation, progress in science contrasted with a decline in reading performance, but the time span is short and results must be treated with caution. In Poland and the Czech Republic, the increases tended to be driven by improvements in the upper half of the performance distribution.

2e. Conclusions on Overall Performance

- In terms of mean scores in science, reading and mathematics in PISA 2006, the EU8 countries all rank above the UNICEF programme countries, and the CEE/CIS average is lower than the OECD average. It is the UNICEF programme countries that bring the CEE/CIS average down, the EU8 countries being on a level with the OECD.

- The Kyrgyz Republic performs below all other PISA countries in all three literacy domains. Among CEE/CIS countries, Azerbaijan is the second lowest performer.

- Montenegro is next among the low performers, but with less of a gap separating its average result from that of other UNICEF programme countries; then come Romania, Bulgaria, and Serbia. Turkey follows: it is also below the CEE/CIS average in mathematics and science, but does better in reading.

- The Russian Federation and Croatia are the two UNICEF programme countries that consistently perform above the CEE/CIS average. Croatia is the only UNICEF programme country that is on a level with various EU8 countries in reading and science.

- Among the EU8 countries, Latvia, Lithuania and Slovakia are always below the OECD average, but well above the CEE/CIS average, while Hungary is on the level of the OECD average in science.

- Estonia and Slovenia – together with the Czech Republic in science and mathematics, and Poland in reading – are significantly above the OECD average, and perform significantly better than all other CEE/CIS countries.
In terms of **absolute disadvantage** in all three literacy domains, there are on average 31 per cent more students who do not reach the baseline level of achievement (PISA literacy Level 2) in the UNICEF programme countries, compared to the EU8 countries.

**In science:**
- At least three in four students attain the baseline science achievement level in Croatia, the Russian Federation, the EU8 countries, and in every OECD country except Mexico and Turkey.
- In Serbia, Montenegro, Bulgaria, Romania and Turkey, between 40 and 50 per cent do not reach the baseline level.
- In Azerbaijan and Kyrgyz Republic, the majority of 15-year-old students do not have the baseline level of scientific skills.

**In reading:**
- Among the UNICEF programme countries, only Croatia (22 per cent below the baseline level) is within the range of the EU8 countries. Turkey (32 per cent below the baseline) and the Russian Federation (35 per cent below the baseline) are close.
- In the other UNICEF programme countries, underachievement is high, with the majority of 15-year-old students not reaching the baseline level of achievement. In Bulgaria, Romania, Serbia, and Montenegro, between 51 and 56 per cent of students do not reach the baseline, while as many as 79 per cent in Azerbaijan and 88 per cent in the Kyrgyz Republic lack the baseline level of scientific skills.

**In mathematics:**
- In the EU8 countries, only one in four students fail to reach the baseline achievement level in mathematics. The next best mathematics achievement levels are found in the Russian Federation and Croatia (27 to 29 cent of students below baseline), Serbia (43 per cent), followed by Turkey, Romania and Bulgaria (52 to 53 per cent), and lastly, Montenegro (60 per cent) and the Kyrgyz Republic (89 per cent below baseline).

Absolute disadvantage of 15-year-olds may be **underestimated in countries with low enrolment rates**, most notably Turkey, because children who are not enrolled are likely to be those from disadvantaged communities and who would also be likely to score poorly on the test.

Looking at three different **scientific competencies:**
- In general, students in the CEE/CIS region are better at explaining phenomena scientifically than they are at identifying scientific issues or using scientific evidence.
- One possible explanation of this could be that some countries in the region may still be using outdated teaching techniques, with a focus on delivery, accumulation and reproduction of facts. In such countries, a more flexible approach to learning is called for in order for students to be able to develop wider scientific and thinking skills.
- Students in Azerbaijan and the Kyrgyz Republic (the lowest-performing countries) demonstrate the highest levels of relative weakness in using scientific evidence, compared to other competencies.
Concerning trends over time:

- In **reading**, there was a statistically significant improvement in average performance between PISA 2000 and 2006 in Poland and Latvia, and a decline in the Russian Federation, Bulgaria and Romania. There was no statistically significant change in Turkey, Hungary, the Czech Republic, and Slovakia.

- In **mathematics**, for which trend data is available only since 2003, there was no significant change in average performance in the eight CEE/CIS countries.

- In **science**, the 2006 PISA test was not comparable with earlier years. In previous tests, there was statistically significant progress between 2000 and 2003 in Poland, the Czech Republic, Latvia and the Russian Federation, but none in Hungary.

- Poland is the CEE/CIS country that made the most progress since 2000. This is attributed to a 1999 reform that provided more integrated educational structures, as it separates students into different school tracks one year later (that is, after the age of 15) than had been done previously.
CHAPTER 3

INVESTIGATING EQUITY IN PERFORMANCE
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3a. Within-country disparities in performance

Average performance levels mask significant variation in performance within countries. Large within-country differences in performance are a concern when education is seen in its function of furthering equality of opportunity and social cohesion. To give an overview of the extent of inequality in performance within countries, we will look at the performance distribution in terms of the size of the gap between top achievers and the lowest achievers. Later, we will examine inequality in performance in various sub-national populations (by gender, parental educational attainment, socio-economic background, community size).

Table 3 shows the gap between the top achievers (95th percentile) and the lowest achievers (5th percentile) for each country in each of the three literacy domains. It gives us an idea of the range in performance, excluding 5 per cent of students at the top and at the bottom of the performance distribution. Countries are ranked in terms of the average difference in performance among students who are between the 95th and 5th percentile in science, reading and mathematics.

UNICEF programme countries are mostly at the top of the table, having lower within-country differences, except the Kyrgyz Republic and Bulgaria; the EU8 countries are mostly in the lower half of the table, with larger disparities, except Estonia and Latvia. CEE/CIS countries average fewer disparities in performance than OECD countries. Only Bulgaria, the Czech Republic and Slovakia have larger disparities than the OECD mean (averaging across the literacy domains). Bulgaria is the only CEE/CIS country in which the difference between 95th and 5th percentile is larger than the OECD average in all three literacy domains. In fact, on average across literacy domains, there is no OECD country that has larger within-country disparities. This indicates that there are considerable inequalities in what students learn within Bulgaria’s educational system.

It should be remembered that PISA is a sample survey, and due to sampling error, not all differences between countries are statistically significant. In fact, percentile differences have larger standard errors than means, so that the confidence intervals applied around the sample estimates (within which there is a 95 per cent certainty that the real difference in the population will occur) are rather large. Many of the differences between countries are therefore not statistically significant, so there is no precise ranking between countries, and the position of each country should not be analysed in detail. For example, in mathematics, there are eight countries that have no statistically significant difference from the OECD average (light blue), and none of these are significantly different from each other in terms of the difference between 95th and 5th percentile. This is one reason why we do not rely on only one indicator of inequality.

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14 See Annex, Figure 28, for statistical significance of differences between countries.

15 Furthermore, looking at the percentile differences, a less robust pattern emerges across the different tests and sources available, such as the TIMSS and PIRLS surveys, compared to mean outcomes. Results on within-country differences in performance can be influenced by the choice of item response model used to summarize the answers of students into a single score. Rankings of countries by within-country differences in TIMSS changed quite sharply in some cases when the survey organizers applied the 1999 model to the 1995 data, which had been originally scaled using a different item response model (see Brown, et al. 2007). The modelling process, which estimates the unobserved distribution of proficiency in a subject from the observed answers to the test questions, affects the shape of the estimated proficiency distributions.
Table 3  Difference between 95th and 5th percentile in reading, mathematics and science, PISA 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Reading</th>
<th>Mathematics</th>
<th>Science</th>
<th>Average</th>
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</thead>
<tbody>
<tr>
<td>Azerbaijan</td>
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<td>m</td>
<td>185</td>
<td>207</td>
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<td>UNICEF – OECD</td>
<td>-20</td>
<td>-5</td>
<td>-38</td>
<td>-24</td>
</tr>
</tbody>
</table>

Countries are ranked in order of average range in performance (95th to 5th percentile) on the three literacy scales.

UNICEF programme countries are shown in red; EU8 countries are shown in green italic

Source: OECD 2006, Tables 2.1c, 6.1c, 6.2c.

What we can observe here is that disparities are large in all countries. Even in the country with the smallest differences, Azerbaijan, the disparity between the science scores of top performers and lowest performers is equivalent to five times the average progression expected between two school grades. This uses PISA’s estimate of one school year as being equivalent to 38 score points on the science scale, which is based on differences in scores of 15-year-olds in OECD countries enrolled in two different grades. In the country where disparities are largest, Bulgaria, the difference is equivalent to nine times the increase in scores between one year and the next. In all the other countries, the educational gap is equivalent to between 7 and 8.5 years. This gives us an idea in practical terms of how wide the educational gaps are that countries are tolerating within their system.

Is there a relationship between absolute standards and within-country disparities? Looking at the scatter graph of overall performance and within-country disparities for CEE/CIS countries (Figure 6), we can see that in general, overall achievement and within-country disparities are not associated. For example, looking at the two countries with the largest within-country disparities, we find the Czech Republic with relatively high mean performance, and Bulgaria with relatively low mean performance.
Looking at the two countries with the smallest within-country disparities, we find two countries that are at opposite ends in terms of overall performance: low-performing Azerbaijan, as well as top-performer Estonia. Among OECD countries, Finland, which is the best-performing, on average, across literacy domains, is also the OECD country with the smallest within-country differences. What is important for educational policy is that high absolute standards of performance are not incompatible with low levels of within-country disparities.

**Figure 6**  Mean performance vs. 95th to 5th percentile difference: average science, reading and mathematics, PISA 2006

EU8 countries are indicated with a blue square, while UNICEF programme countries are indicated with a red lozenge.

Source: OECD 2006, Tables 2.1c, 6.1c, 6.2c.

Looking at trends, there was a significant reduction in inequality as measured by the difference in 95th to 5th percentile in reading in Latvia and Romania between 2000 and 2006, a significant increase in Bulgaria, the Czech Republic (2000–2006), Slovakia and Serbia (2003–2006), and no change in inequality in the Russian Federation, Hungary and Poland. There was no significant change in disparity in mathematics scores between 2003 and 2006.

**3b. Between-school variance in performance**

What is the pattern of within-country differences in each country? How much of the overall variation in performance is attributable to differences between schools? The PISA 2006 report contains statistics that deconstruct the total variance into a between-school component and a within-school component, distinguishing between the variance that is attributable to differences in results attained by students in different schools, and that attributable to the range of student results within schools.

Between-school variation can be high in countries that group students in schools according to ability (through institutional differentiation, selection, tracking or streaming), but there may be variation between schools even in countries with comprehensive systems that are not explicitly selective – for example, variation can be a result of geographical segregation according to socio-economic background, school choices made by families or differing school quality. Whatever the reason, large between-school differences in what students learn are an indication of inequality in the school system.

16 OECD 2007, p. 172.
As can be seen from Figure 7, the total variance between schools as a percentage of the total variance within each country varies greatly in the CEE/CIS region. Poland, Latvia and Estonia produce more equal performance results across schools. On average, over the three literacy domains, only a quarter or less of all variance in student performance is between schools.\(^\text{17}\) However, in Slovenia and Hungary, two thirds or more of the variance in performance is among schools, indicating that there is a larger variation between the average performance of schools, compared to the variation in individual scores. Students in such countries tend to be grouped in schools in which other students perform at levels similar to their own, but we do not know to what extent the variation may be due to differences in school quality.

![Figure 7: Total variance between schools as a percentage of the total variance within the country in science, reading and mathematics, PISA 2006](image)

Countries are ranked in order of average percentage of between-school variance in performance on the three literacy scales.

*Source: OECD 2006, Tables 4.1a, 4.1d, 4.1g.*

When interpreting these results, it has to be kept in mind that the proportion of between-school variance is also influenced by differences in units chosen for sampling purposes, as well as in how schools are defined and organized within countries.\(^\text{18}\) In any case, it is noticeable that the three countries with the lowest between-school variance (Estonia, Latvia and Poland) also have high levels of performance, and no more than 21 per cent of students fall below the Level 2 benchmark of achievement in any literacy domain. This indicates that providing similar learning opportunities across schools is compatible with high overall achievement. Also notable is that countries with early institutional differentiation – i.e., Hungary, the Czech Republic, Slovakia, Turkey and Bulgaria,

\(^\text{17}\) Although in Estonia, if we look at the results on the basis of the test language, we note that the performance of Russian-language schools was significantly below the performance of Estonian-language schools (Henno & Kitsing 2008).

\(^\text{18}\) ‘For example, in some countries the schools in the PISA sample were defined as administrative units (even if they spanned several geographically separate institutions, as in Italy); in others they were defined as those parts of larger educational institutions that serve 15-year-olds; in others they were defined as physical school buildings; and in yet others they were defined from a management perspective (e.g., entities having a principal)’. (OECD 2007, p. 211)
where students are separated into different school types at 11 years of age – have a relatively high proportion of between-school variance (an average of 48 per cent or more across literacy domains).

**Trends in between-school variance**

Looking at trends in the percentage of between-school variance for reading, for which test results are comparable since year 2000, we can note that there has been a very big change in Poland. The percentage of between-school variation in reading has fallen from 63 per cent in 2000 to 15 per cent in 2003.\(^\text{19}\) This change has been attributed to the institutional reform as a result of which 15-year-old students are no longer separated into different types of schools (see Footnote 13).

When the first round of PISA took place in Poland in 2000, most 15-year-olds were in the first grade of post-primary school, so the reform introduced in 1999 did not affect that age group. The distribution of students from different types of schools in the survey sample was similar to the pattern in the whole age group: 41 per cent came from general secondary lyceums, 36 per cent from secondary vocational schools and 23 per cent from basic vocational schools.

There was a large group of Polish students (21 per cent) who achieved very low results (below 400) in reading in PISA 2000. That group was unequally distributed among different types of schools, as can be seen from Figure 8: 70 per cent of students in basic vocational schools scored below 400, compared to only 2 per cent in general secondary schools.

**Figure 8  Percentage of students by reading score and type of school in Poland, PISA 2000**

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Scoring below 400</th>
<th>Scoring between 400-600</th>
<th>Scoring above 600</th>
</tr>
</thead>
<tbody>
<tr>
<td>General secondary</td>
<td>2.2</td>
<td>75.8</td>
<td>22.0</td>
</tr>
<tr>
<td>Secondary vocational</td>
<td>13.8</td>
<td>82.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Basic vocational</td>
<td></td>
<td>69.5</td>
<td>30.5 0.0</td>
</tr>
<tr>
<td>POLAND</td>
<td>21.4</td>
<td>68.0</td>
<td>10.6</td>
</tr>
</tbody>
</table>


\(^{19}\) OECD 2007, Tables 4.1d-f.
When the second round of PISA took place in 2003, almost all 15-year-olds attended the last grade of the new lower secondary school (gymnasium). Performance levels are now more homogenous across schools. As we saw earlier, this occurred along with the increase in performance of the lowest-achieving students, although total variation in scores remained quite high. Poland proved that with thoughtful strategies based on data, collaboration among stakeholders and well-focused resource allocation, fast changes are possible.

At the other extreme, there has been an evident rise in differences across schools in Hungary, with the percentage of between-school variance growing from 58 per cent in 2000, to 81 per cent in 2006. More research is needed into the possible causes of this change.

**3c. Gender differences in performance**

One of the UN Millennium Development Goals is about reducing gender disparities in access to education, with a concern for the disadvantages faced by females. Among the CEE/CIS countries in PISA, only Turkey has major problems with this target. But once in school, are there any gender disparities in achievement? The concern about underachievement in education is not only for females, but also for males, in particular in reading achievement.

***Reading***

In all CEE/CIS countries, girls have significantly higher average scores in reading than boys (see Figure 9) in all countries participating in PISA 2006. This was explained in previous PISA assessments as resulting from greater engagement of females with reading; from the fact that girls read a greater diversity of material; and that girls have an increased propensity to use school and community libraries.

The gender gap in reading achievement is larger in the CEE/CIS region than it is in the OECD. In the OECD, girls outperformed boys by 38 points, on average – roughly equivalent to a school year’s difference in science – while among the CEE/CIS countries there is a gender gap of 45 score points. However, the gender gaps exist to different extents within the CEE/CIS region. The smallest difference is in Azerbaijan (20 points), with the gap in the other CEE/CIS countries ranging between 38 score points in the Russian Federation, to 58 points in Bulgaria. Regarding the ten countries for which we have trends, only in Romania was there a statistically significant change in gender difference for reading performance in the period 2000 to 2006; the gap in favour of girls grew by as much as 30 points, since boys decreased in average performance more than girls did in that period.

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21 OECD 2007, p. 303.
22 OECD 2007, p. 55.
LEARNING ACHIEVEMENT IN THE CEE/CIS REGION
A COMPARATIVE ANALYSIS OF THE RESULTS FROM THE 2006 PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)

Figure 9  Performance difference between girls and boys in reading, PISA 2006

Source: OECD 2006, Table 6.1c.

Mathematics

In PISA 2006, gender differences in both mathematics and science are much smaller than in reading. In mathematics, boys scored higher than girls in six countries: Hungary, Slovakia, Poland, Croatia, Montenegro and Romania. The gap ranged between 7 and 14 points (see Figure 10). In all other CEE/CIS countries, there is no statistically significant difference between the average scores of boys and girls. Underperformance of girls in mathematics is a longstanding trend that seems to be reversing itself; however, there was no significant change in gender differences from 2003 to 2006 in the eight countries for which we have mathematics trends. Still, in 22 out of 30 OECD countries, boys outperform girls in mathematics. The OECD average difference is 11 points in favour of boys, while in the CEE/CIS, boys outperform girls in math by an average of 6 points. It is interesting to note that in a different survey (TIMSS 2003), the relative performance of boys and girls in mathematics was evenly balanced among all participating countries.

PISA 2003 included a one-off assessment of student problem solving skills, closely linked to mathematics but requiring little or no curriculum content. There were no significant gender differences in the average problem-solving performance in any of the eight CEE/CIS countries participating in PISA 2003, and in only a few of all participating countries did a statistically significant difference exist (in one country in favour of boys, and in five countries in favour of girls). According to the PISA report, ‘The result may be viewed as an indication that in many countries there are no strong overall disadvantages for male students or female students as learners, but merely gender-specific strengths or preferences for certain subjects’. 23

Science

PISA 2006 revealed that girls have a higher average science score than boys in seven countries: Azerbaijan, the Kyrgyz Republic, Turkey, Bulgaria, Latvia, Lithuania, and Slovenia (in none of these was there a gender difference in mathematics). The differences in science performance in favour of girls in these countries are statistically significant even though generally quite small, ranging from six points in the Kyrgyz Republic to 17 in Bulgaria (see Figure 11). In all other CEE/CIS countries, there is no statistically significant difference between the average scores of boys and girls.

However, there are six OECD countries where boys outperform girls in science, although differences are small, with Greece being the only other OECD country (with Turkey) where girls do significantly better than boys in science. On average in the OECD, there are two score points in favour of boys, while in the CEE/CIS, there are 3 points in favour of girls.

Although the science test in PISA 2006 is not comparable with earlier years, we can look at trends in the five countries that participated in PISA in both 2000 and 2003. In the Russian Federation, girls did better than boys in 2000, and boys outperformed girls in 2003; however, the time span is short and results need to be treated with caution. In Latvia, there was a reduction in the gender gap: In 2000, girls performed significantly better than boys, but the difference was smaller and no longer significant in 2003. There was no statistically significant change in Poland, where boys did better than girls in both years, nor in the Czech Republic and Hungary, where there was no statistically significant difference between girls and boys.\(^{24}\)

\(^{24}\) OECD 2004, p. 297.
Attention needs to be given to the fact that ‘the limited gender differences in science performance have not been reflected in equal choices to study science: On average, nearly twice as many males as females in OECD countries are graduating with science degrees’,25 including mathematics and computing. Reducing the gender imbalance in the number of graduates in mathematics, science and technology is one of the EU’s Education and Training benchmarks for 2010. Although progress has been made in addressing the traditional disadvantage of females in scientific subjects at the end of compulsory schooling, much still needs to be done in order to make science and mathematics attractive choices for both females and males in tertiary education.

Also requiring attention is that, in almost all countries, boys do better within schools than they do overall (see Figure 12). Only in Azerbaijan and the Kyrgyz Republic do the average science scores for girls remain significantly above that for boys. In Estonia, Latvia, Lithuania, Bulgaria and Turkey, there is no statistically significant gender difference within schools, and in the other 10 CEE/CIS countries, boys within schools tend to do better than girls. This can be partly explained by the fact that girls attend the higher performing, academically-oriented schools and are placed in the upper academic tracks at a higher rate than males,26 but more research is required in order to understand why girls tend to perform less well in science within individual schools, once various programme and school characteristics have been accounted for.

26 OECD 2007, p. 62.
**Figure 12**  Performance difference between girls and boys in science, in the country overall and within schools, PISA 2006

Source: OECD 2006, Table 2.5.

**Figure 13**  Performance difference between girls and boys in different science competencies, PISA 2006

Countries are ranked by overall performance difference on the combined science scale. Positive differences indicate that girls have higher mean scores than boys. Lighter-shaded bars indicate that differences are not significant.

Source: OECD 2006, Tables 2.2c, 2.3c, 2.4c.
Science sub-competencies

We can observe the differences between the average scores of girls and boys for the three scientific competencies separately (see Figure 13). In all countries, girls are significantly better at identifying scientific issues and, in the majority of countries, also better at using scientific evidence, even though the differences here are less. In most countries, boys are better at explaining phenomena scientifically: only in Azerbaijan is there a statistically significant difference in favour of girls for this skill. Countries in which girls score higher than boys in the combined science scale are those where girls are better at using scientific evidence (as well as in identifying scientific issues).

3d. Parent education and differences in performance

Socio-economic status and family background are two of the most important factors influencing performance in all countries, but having a disadvantaged background does not always lead to poor academic performance. Some countries manage to moderate the relationship more than others, mitigating rather than perpetuating or reinforcing existing inequalities. One indicator of socio-economic background is parental educational attainment, which is closely associated with income, and relates to educational resources in the home.

Figure 14 shows student’s mean science performance by mother’s educational attainment, as reported by students. In all countries, students with mothers having tertiary level qualifications have significantly higher science scores on average than those with at most upper secondary education; these students are at an advantage with respect to students whose mother’s completed at most lower secondary education.27 Except for Azerbaijan and the Russian Federation, the difference in student performance between students with mothers having tertiary education, and those whose mothers had less than upper secondary attainment is equivalent to at least one year of schooling, and is more than three years of schooling in Bulgaria and Slovakia. In different terms, the increased likelihood of students whose mothers have not completed upper secondary education scoring in the bottom quarter of the science performance distribution ranges is between 1.4 times in Azerbaijan and 2.7 times in Bulgaria and Slovakia; on average in the CEE/CIS and OECD countries, students whose mothers have not completed upper secondary education are two times as likely to score in the bottom quarter for science.28 Mother’s education has a significant impact on performance in all countries, but there are large differences between countries, indicating that some systems may be maintaining or even reinforcing inequalities in background, such as Bulgaria and Slovakia, while others may be mitigating such inequalities. Looking at Figure 14, it is notable that six UNICEF programme countries have the smallest differences in student performance between students having mothers with tertiary education and those having mothers with only upper secondary education (Serbia, Montenegro, Azerbaijan, the Kyrgyz Republic, Romania, Croatia), while Bulgaria is among the countries with the greatest differences, together with five EU8 countries. Results are generally similar across different literacy domains.

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27 On average across CEE/CIS countries, 13 per cent have mothers who have completed at most lower secondary education, 53 per cent have mothers who have completed upper secondary school and 35 per cent have mothers with a tertiary degree. In all CEE/CIS countries except Turkey, at least 85 per cent of students report that their mother has at least upper secondary education; in Turkey, it is only 21 per cent.

28 OECD 2007, Table 4.7b.
### Figure 14: Average PISA science score by highest level of mother’s education

Countries are ranked by difference between average score of students with mothers having completed tertiary education and of those students with mothers having at most completed upper secondary education. The Russian Federation and Lithuania had too few observations to calculate a score for those having mothers with less than upper secondary education (2 per cent).

Source: OECD 2006, Table 4.7b

#### 3e. Relationship between socio-economic background and performance

As a criterion for assessing equity in the distribution of learning opportunities, PISA examines the extent to which socio-economic background relates to student and school performance by combining various economic, social and cultural aspects of home background together into a single composite index. The results on the science test are used as indicators of performance, since science was the focus of PISA 2006 and more testing time was devoted to it. The blue bars in Figure 15 show the overall score point difference in science performance associated with one unit of the PISA index of

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29 Socio-economic indicators that are measured include highest occupational status and level of education of mother or father, and home possessions (desk, computer, Internet connection, works of art, own room, dishwasher, DVD player, number of books, cars, televisions, cellular phones, etc.). The index has been constructed to have a mean of 0 and a standard deviation of 1 for the OECD student population. The percentage of students that fall within the lowest 15 per cent of the international distribution on the PISA socio-economic index is low in Estonia, Czech Republic and Slovenia (7–9 per cent), high in Azerbaijan, the Kyrgyz Republic (34–35 per cent), and very high in Turkey (63 per cent). Azerbaijan and Turkey also have the widest range of socio-economic backgrounds, as measured by the difference in 95th to 5th percentile on the PISA socio-economic index, while the range is narrowest in the Czech Republic and the Russian Federation.
economic, social and cultural status. Bulgaria and the Czech Republic are the countries where two students of different socio-economic backgrounds have the largest overall difference in expected science scores, while Azerbaijan has the smallest differences. In the UNICEF programme countries, socio-economic background seems to be associated with science performance to a lesser extent than in most EU8 countries, except for Bulgaria, where there is a large association, and Estonia and Latvia, which have relatively small associations.

**Figure 15** Score point difference in science performance associated with one unit of the PISA index of economic, social and cultural status, PISA 2006

Countries are ranked by overall score point difference in science performance associated with one unit of the PISA index of economic, social and cultural status.

*Source: OECD 2006, Tables 4.4b, 4.4c.*

Figure 15 also shows the association between science performance and the PISA index of economic, social and cultural status separately between schools (the red dots) and within schools (the green triangles). The differences between schools demonstrates how the average level of performance in a school is related to the average socio-economic background of their student intake; the difference within schools shows how students’ socio-economic background is related to their performance within a common school environment. In all countries except Poland, the association of the school’s socio-economic intake with performance correlates more closely than an individual’s own family background and performance; this correlation is particularly strong in Slovenia and the Czech Republic. This means that in these countries, a student attending a school with a socio-economically advantaged intake will tend to have substantially higher science scores compared to a student with the same socio-economic background but in a school with a more disadvantaged intake. Conversely, two students with different socio-economic backgrounds attending the same school will have a smaller gap in performance.
Unfortunately, the data available does not help us understand why there is such a relationship between school intake and performance. Students from more advantaged backgrounds may have access to better learning environments, either by choosing better schools or actively creating better schooling conditions; effects may be due to peer interactions, student selection, but also to differing levels of disciplinary problems, teacher morale or other characteristics that may vary in schools according to socio-economic intake, thus reinforcing the advantage of better-off students. Also, parents of students attending socio-economically advantaged schools may be more engaged in the student’s learning at home, whatever their own socio-economic level.\(^\text{30}\)

### 3f. Conclusions on Equity

The following summarizes the main findings of this chapter:

- **As measured by the difference between 95th and 5th percentile:**
  - UNICEF programme countries have generally lower within-country disparities, except the Kyrgyz Republic and Bulgaria, while the EU8 countries have mostly larger disparities, except Estonia and Latvia.
  - On average, CEE/CIS countries have smaller disparities in performance than OECD countries.
  - Bulgaria is the only CEE/CIS country in which disparities in all three literacy domains are larger than the OECD average, indicating that there are considerable inequalities in what students learn within Bulgaria’s educational system.
  - Disparities are large in all countries. Even in the country with the smallest disparities, the difference between top performers and lowest performers in science is equivalent to five times the average progression between two school grades. In the country with the largest disparities, it is a nine-fold difference.
  - There is no trade-off between high overall achievement and relatively low within-country disparities: the two can go together.

- **In terms of between-school variance:**
  - The three countries with the lowest between-school variance (Estonia, Latvia and Poland) also have high levels of performance. This indicates that providing similar learning opportunities across schools is not incompatible with high overall achievement.
  - Slovenia and Hungary have the largest proportion of between-school variance, with students grouped in schools in which other students perform at levels similar to their own.
  - Countries with early institutional differentiation – i.e., Hungary, the Czech Republic, Slovakia, Turkey and Bulgaria, where students are separated into different school types at 11 years of age – have a relatively high proportion of between-school variance.
  - Since 2000, there was a large reduction in between-school variation in Poland. Since the 1999 reform providing more integrated educational structures, performance levels are now more homogenous across schools.

- **Looking at the gender gap:**
  - In *reading*, girls tend to do significantly better than boys in all countries, but the average gap in favour of girls is larger in the CEE/CIS than it is in the OECD.
  - In *mathematics*, boys do better than girls in 6 out of 17 CEE/CIS countries, but gender differences are generally small. Girls’ underperformance in mathematics is a longstanding trend.

\(^\text{30}\) OECD 2007, p. 195.
that seems to be reversing itself. But the average gap in favour of boys in mathematics is larger in the OECD than it is in the CEE/CIS.

• In science, there are seven CEE/CIS countries in which girls do better than boys, but differences are small. The CEE/CIS average difference in science is slightly in favour of girls, whereas in the OECD it is slightly in favour of boys.

• On average, girls in CEE/CIS countries tend to do better than boys in all three literacy domains relative to OECD countries.

• Compared to girls, boys tend to do better within individual schools than they do overall, and are better at explaining phenomena scientifically than they are at identifying scientific issues or using scientific evidence. They tend to go on to study scientific subjects at university at a higher rate than females.

• In problem-solving skills, there were no significant gender differences in any of the eight CEE/CIS countries participating in PISA 2003, when the one-off assessment was carried out, and in only a few PISA countries did any difference exist. According to the PISA report, this may indicate that there are no gender differences in overall learning capacities, but rather gender-specific strengths or preferences for certain subjects.

➤ Concerning the relationship between family background and performance:

• Family socio-economic background is one of the most important factors influencing performance in all countries.

• Except for Azerbaijan and the Russian Federation, the difference between students with mothers having tertiary and less than upper secondary attainment is equivalent to at least one year of schooling in terms of student performance; in Bulgaria and the Slovakia, the difference is equivalent to more than three years of schooling.

• Bulgaria and the Czech Republic are the countries where two students of different socio-economic background have the largest overall difference in expected science scores, while Azerbaijan has the least differences.

• In the UNICEF programme countries, socio-economic background seems to be associated with science performance to a lesser extent than in most EU8 countries.

• In all countries except Poland, the association of the school’s socio-economic intake with performance is much larger than that of an individual’s own background, and is particularly large in Slovenia and the Czech Republic.

➤ Putting together the information we have examined so far, we can say that Estonia seems to be the example to follow in the region, achieving both quality and equity in learning outcomes:

• It is at the top in terms of high overall performance, with significantly higher average performance than the OECD average in all of the literacy domains, and low absolute disadvantage, with the smallest percentage of 15-year-olds among all CEE/CIS countries not reaching the baseline level of achievement in the three literacy domains.

• At the same time, Estonia has one of the lowest within-country disparities and secures similar outcomes among students from different socio-economic backgrounds.

• It also has consistent performance standards across schools: the percentage of between-school variance is 25 per cent, on average over the three literacy domains, with only Latvia and Poland having a lower percentage.

• It is one of the few countries, with Serbia, the Czech Republic and the Russian Federation, with no statistically significant gender differences in both mathematics and science achievement.
CHAPTER 4

SCHOOL AND SYSTEM-LEVEL FACTORS AFFECTING PERFORMANCE
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CHAPTER 4: SCHOOL AND SYSTEM-LEVEL FACTORS AFFECTING PERFORMANCE

4a. Country wealth and student performance

Before going on to analyse how the organization of schooling may have a part in shaping performance outcomes, we will examine how country wealth and educational expenditure are related to performance. A sufficient level of expenditure is needed for a quality-level education – that is, spending at least enough to cover such elements as basic functioning and investment in infrastructure and teachers – but clearly spending alone is by no means all that counts in producing high performance.

Educational spending is driven first of all by the level of prosperity in a country. The EU8 countries are all richer in terms of GDP per capita than the UNICEF programme countries. Except for the Czech Republic and Slovakia, their public spending on education as a percentage of GDP is also higher (the average for the EU8 countries is in line with the OECD average of 5 per cent of GDP, while the UNICEF programme countries average 3.8 per cent of GDP). In fact, the richer the country the higher the proportion of its GDP tends to be spent by government on education. The notable exception to this rule is the Kyrgyz Republic: It is the poorest country, but spends proportionally more on education than other UNICEF programme countries.

As we can see from Figure 16, GDP per capita is in fact closely associated with student performance in the CEE/CIS countries, but the relationship between prosperity and educational performance does not hold in the richer OECD countries. The same pattern is seen looking at the actual resources invested in education. It seems that money matters below a certain threshold. Some countries in the CEE/CIS region may be too poor to be able to provide sufficient educational opportunities. On the other hand, educational expenditure has been increasing in the OECD countries, but without the desired effects on student performance. Once there is enough for the basics, the way it is used may start to count more.

4b. School factors affecting performance

What can we say based on the information provided by PISA regarding school and system-level characteristics and their influence on performance? Aside from educational spending, what is it that makes a difference in student outcomes? PISA identifies a set of school- and system-level factors that seem to be consistently associated with science performance across 55 countries, and analyses their ‘effect’ using a multilevel regression model (i.e., with some variables at the student level, some at the school level, and some at the system level). Inserting the various variables into the model, including socio-economic background variables, it can estimate how much difference there is in science scores for one unit change on each variable, keeping all other variables constant (that is, controlling or accounting for the other variables). This change is what is meant as ‘the effect of
the variable’, although the relationship is not necessarily a causal one. As some factors tend to go together, their effect in some cases cannot be separated and therefore we will have a joint effect. For example, some performance differences may be jointly attributable to school admittance policies and socio-economic factors, with one factor reinforcing the other.

It is important to keep in mind that the PISA survey relies on self-reports from school principals about school factors, and these may be affected by their perceptions and realities based on their respective countries and contexts. Many variables remain unmeasured, most importantly those relating to the quality of teachers and instruction, elements such as teacher characteristics, teaching methods and curriculum content, and in general what actually happens within schools. Also, a student’s performance level does not depend solely on the current school attended, but on all learning that occurs in and out of school during their entire lifespan.
Another issue to be considered in cross-sectional studies such as PISA is whether it is possible to make causal inferences, rather than just simple statistical associations. Goldstein argues that without longitudinal performance data on the same sample of students (which would adjust for achievement prior to attending a stage of schooling), it is impossible to make inferences about the effects of educational systems that are distinguishable from the influences of social background, economic circumstances and cultural context. Mindful of such limitations, we will make use of the information available, looking first at the general results of the model, and then at some of the system and school factors measured by PISA in more detail.

Even accounting for demographic and socio-economic background, the following school factors, based on school principals’ reports, are positively associated with performance in science: public posting of achievement data, students’ learning time in regular school lessons and in self-study and/or homework, school activities to promote science learning (such as science clubs, fairs, competitions and excursions), and high academic selectivity for school admittance. Having ability grouping for all subjects within school is negatively associated with performance, when looking at combined data for all 55 countries. But if we look at data for each CEE/CIS country, we see that there a positive association between ability grouping and performance in Poland, Estonia, Bulgaria, Romania and Azerbaijan. At the system level, education systems with more schools having autonomy in formulating their school budget and deciding on budget allocations tend to perform better.

The separate effect of all these variables included in the regression model is generally quite small, a change in the value of each variable making sometimes only a few score points difference on the science test; for example, posting achievement data publicly is associated with a change in science score of only 3.5 points (see Table 4). But taken together, these factors make a difference of about 60 score points overall, which we have seen has been estimated to be equivalent to 1.5 times the change in score between one school year and the next.

Nevertheless, much of the variation in scores remains unaccounted for by the variables measured by PISA. The variables included in the regression model – i.e., the school factors mentioned above as well as the demographic and socio-economic background variables – account for 40 per cent of the total variance in science performance. Only 10 per cent of the total variance in science scores is accounted for uniquely by school and system factors; 16 per cent is accounted for by students’ background characteristics, and 14 per cent is accounted for jointly by background and school and system factors, since students with specific characteristics tend to be enrolled in schools with particular features.

Some school characteristics are associated with performance only before taking demographic and socio-economic background into account. That is, their relationship with performance is significant in the model that includes school- and system-level variables only, ignoring any differences in socio-economic context (first data column in Table 4). School characteristics are not significantly associated with performance in the model that also includes background variables, keeping these constant and thereby comparing schools operating in similar contexts (second data column in Table 4). These school factors are: low proportion of funding from government, presence of other schools in the area that compete for students, positive evaluation of the quality of educational materials in school, no perception of a lack of qualified teachers hindering instruction. This suggests that students with higher socio-economic background tend to be in schools with better resources, and make better use of the choice they have among schools.

36 See Footnote 34 for complete list.
37 OECD 2007, p. 266.
## Table 4
Change in science score for a unit change in each significant factor combined in a multilevel regression model,* PISA 2006

<table>
<thead>
<tr>
<th>School and system factors</th>
<th>Unit</th>
<th>Model with school/system factors only</th>
<th>Model with school/system factors controlling for background factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admitting, grouping and selecting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School with ability grouping for all subjects within school</td>
<td>1=yes; 0=no</td>
<td>-7.6</td>
<td>-4.5</td>
</tr>
<tr>
<td>School with high academic selectivity of school admittance</td>
<td>1=yes; 0=no</td>
<td>18.5</td>
<td>14.4</td>
</tr>
<tr>
<td>School with low academic selectivity of school admittance</td>
<td>1=yes; 0=no</td>
<td>-7.0</td>
<td>–</td>
</tr>
<tr>
<td><strong>School funding (public/private)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School with high proportion of school funding from government sources</td>
<td>Each additional 10%</td>
<td>-2.1</td>
<td>–</td>
</tr>
<tr>
<td><strong>School choice</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School with high level of competition</td>
<td>1=yes; 0=no</td>
<td>6.0</td>
<td>–</td>
</tr>
<tr>
<td><strong>Accountability policies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School posting achievement data publicly</td>
<td>1=yes; 0=no</td>
<td>5.3</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>School autonomy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System average school autonomy index in budgeting</td>
<td>1=S.D. across 55 countries</td>
<td>28.6</td>
<td>25.7</td>
</tr>
<tr>
<td><strong>School resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School-level index of teacher shortage</td>
<td>1=OECD S.D.</td>
<td>-3.5</td>
<td>–</td>
</tr>
<tr>
<td>School-level index of quality of school educational resources</td>
<td>1=OECD S.D.</td>
<td>3.9</td>
<td>–</td>
</tr>
<tr>
<td>School average students' learning time for regular lessons in school</td>
<td>1 additional hour per week</td>
<td>14.0</td>
<td>8.8</td>
</tr>
<tr>
<td>School average students' learning time for out-of-school lessons</td>
<td>1 additional hour per week</td>
<td>-11.7</td>
<td>-8.6</td>
</tr>
<tr>
<td>School average students' learning time for self-study or homework</td>
<td>1 additional hour per week</td>
<td>3.8</td>
<td>3.1</td>
</tr>
<tr>
<td>School average index of school activities to promote students’ learning of science</td>
<td>1=OECD S.D.</td>
<td>6.7</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Background variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student’s PISA index of economic, social and cultural status</td>
<td>1=OECD S.D.</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Student is female</td>
<td>1=yes; 0=no</td>
<td>-6.2</td>
<td></td>
</tr>
<tr>
<td>Student has no immigration background (student and parents were born in the country of assessment)</td>
<td>1=yes; 0=no</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Student speaks the test language or other national language most of the time or always at home</td>
<td>1=yes; 0=no</td>
<td>25.1</td>
<td></td>
</tr>
<tr>
<td>School located in a small town or village (fewer than 15 000 people)</td>
<td>1=yes; 0=no</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>School located in a city (with over 100 000 people)</td>
<td>1=yes; 0=no</td>
<td>-4.1</td>
<td></td>
</tr>
<tr>
<td>School size</td>
<td>100 additional students</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>School average PISA index of economic, social and cultural status</td>
<td>1=OECD S.D.</td>
<td>33.3</td>
<td></td>
</tr>
</tbody>
</table>

* Only variables that produce a statistically significant change in score within the model are shown.

S.D. = standard deviation.

Source: OECD 2006, Table 5.19g.
PISA also examines the joint impact of school factors on the strength of the association between students’ socio-economic background and science performance. It notes that, all other things being equal, in education systems where students are placed into different types of schools or programmes at an early age, the impact of the school’s socio-economic intake is strengthened. This suggests that differentiation at an early age might damage equity without improving quality.\(^{38}\) In fact, the example of Poland has shown us how performance has improved after reform to a more comprehensive educational system.

4c. School location

One of the school background variables included in the above-mentioned model is the school’s geographic location. It is interesting to note that among all 55 countries and controlling for other variables, including socio-economic background, schools located in a small town or village (fewer than 15,000 people) tend to do best, followed by schools located in larger towns (15,000 to 100,000 people), while schools located in a city (with over 100,000 people) tend to do the worst (Table 4). On the other hand, if we only look at average scores for schools located in different communities without controlling for other variables, the association is in the opposite direction, with schools in smaller communities performing worse than in larger communities (see Figure 17). By taking socio-economic intake into account, the disadvantage of schools in smaller communities disappears, even before adding other school factors in the model. So it seems that the situation of socio-economic disadvantage explains the difference in performance, rather than the quality of schools or other school characteristics.

The situation is not the same in all countries. Without controlling for any other variables, schools in the largest communities in Hungary, Bulgaria and the Kyrgyz Republic have a science performance that is more than 130 score points higher than schools in the smallest communities, while the difference is only 15 score points or less in Slovenia, Estonia and Montenegro. While the mean difference is of about 60 points in the CEE/CIS countries, it is half this amount in the OECD.

On the other hand, as can be seen from Figure 18, once we control for student background and other school factors using the regression model as discussed above, the effect of going to school in a city (with more than 100,000 inhabitants) is actually negative in nine CEE/CIS countries (Hungary, the Czech Republic, Slovakia, Lithuania, Slovenia, Croatia, Serbia, Montenegro and Turkey), while it remains positive in five countries (Romania, the Russian Federation, Azerbaijan, the Kyrgyz Republic and Latvia). Similarly, once we control for other factors, the effect of going to school in a small town or village (with less than 15,000 inhabitants) is actually positive in five countries (Slovakia, Latvia, Poland, Estonia and Azerbaijan), while it remains negative in another five (the Russian Federation, Kyrgyz Republic, Serbia, Turkey and Hungary).

In sum, we have seen that students in schools in smaller communities generally have lower mean performance than those in larger communities, if we ignore differences in socio-economic context. On the other hand, if we control for socio-economic context, the association seems to be in the opposite direction (looking at the relationship in schools of all PISA countries together). It seems that it is the situation of socio-economic disadvantage of smaller communities that drives the lower performance results; if we keep socio-economic background constant, smaller communities in fact have better performance results. Looking at each of the CEE/CIS countries separately, the picture is mixed, once we control for socio-economic background and other variables. Only in the Russian Federation and the Kyrgyz Republic does the original relationship remain, with students in small towns or villages doing worse than those in larger towns, and students in larger towns doing worse than those in cities.

\(^{38}\) OECD 2007, p. 278.
Figure 17  Mean science performance by school location, PISA 2006

In specific countries, communities with too few schools for reliable estimate have not been included. On average the CEE/CIS countries are 16 per cent villages, hamlets or rural areas (fewer than 3,000 people); 19 per cent small towns (3,000 to about 15,000 people); 33 per cent larger towns (15,000 to about 100,000 people); 25 per cent cities (100,000 to about 1 million people) and 11 per cent large cities (over 1 million people).

Source: OECD 2006.
**4d. School selection and choice**

As stated above, PISA collects information on various school and system factors. If we look at each in turn, no specific characteristic seems to be absolutely essential in order to obtain high performance: The higher-performing countries have different combinations of school and system characteristics, with no specific one in common to all. The same is true for countries with low disparities. Still, there are some patterns that emerge.

First, we have seen how the initial age of selection in the education system is somewhat related to the proportion of between-school variance. In countries with early selection – i.e., the Czech Republic, Slovakia, Hungary, Bulgaria and Turkey – over 50 per cent of variance is between schools (although there are countries, such as Slovenia, in which selection occurs later, with high between-school variation). Except for Turkey, this is also the group of countries, together with Slovenia, where the effect of socio-economic background on performance is highest. Bulgaria, the Czech Republic and Slovakia are also the countries with the largest within-country disparities, in terms of the difference between highest (95th percentile) and lowest (5th percentile) performers. In general, PISA suggests that in countries with a larger number of distinct programme types, where the objective is stratification according to ability, socio-economic background tends to have a significantly larger impact on student performance, with a socio-economic segregation that is of no benefit to overall performance.39

The proportion of 15-year-olds enrolled in programmes that give access to vocational studies at the next programme level or direct access to the labour market is about one quarter or less in all countries;

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39 OECD 2007, p. 221.
that proportion is much higher in Slovenia (52 per cent), Serbia (76 per cent) and Montenegro (68 per cent). Standards-based external examinations are in place in all the EU8 countries, but not in the UNICEF programme countries of Romania, Croatia and Montenegro; in Serbia and Bulgaria, they exist only in parts of the system. In seven countries (Hungary, Croatia, Serbia, Montenegro, Bulgaria and Romania), the majority of students are in schools that are academically selective (based on the percentage of students in schools where the principal reported students’ academic records as a prerequisite or a high priority for admittance to their school). On average in the UNICEF programme countries, 53 per cent of schools are academically selective, while it is just 35 per cent among the EU8 countries and 27 per cent in the OECD. It is an interesting pattern, considering that the UNICEF programme countries are generally the lowest-scoring, but we have seen that the overall percentage of selective schools in a country is not associated with performance.

Concerning school choice, in most CEE/CIS countries the majority of students are in schools that have two or more other schools competing for students in the same area. The exceptions are Romania, Slovenia and Poland (with 31 per cent, 40 per cent and 44 per cent, respectively, of students being in schools that have two or more schools competing for students in the same area), and one in two students in Azerbaijan and the Kyrgyz Republic are in schools with two or more competing schools (48 per cent). It should be kept in mind that even if there are a number of competing schools, it does not mean that all students have equal access or choice to attend them all, given linguistic, ethnic and socio-economic issues. We have seen that being in a school with a high level of competition is associated with high performance only before controlling for socio-economic background factors.

On average in the OECD countries, the difference in performance on the science scale between public and private schools is 25 points in favour of private schools, but this becomes 12 points in favour of public schools once the socio-economic background of students and schools is accounted for. On average in the OECD countries, 15 per cent of 15-year-old students attend private schools compared to only 2 per cent in the CEE/CIS region, where there are generally very few if any private schools. At least 98 per cent of all 15-year-olds are enrolled in government or public schools in all countries in the region except in the Czech Republic, Slovakia and Hungary (where 96 per cent, 92 per cent and 84 per cent of students, respectively, are enrolled in public schools). These are the only three countries where there are enough private schools to be able to calculate a reliable estimate of the difference in performance. Before accounting for socio-economic background, there is a significant difference in favour of private schools only in Hungary, but this difference disappears once socio-economic background is taken into account. In the Czech Republic, a significant difference in favour of public schools is apparent once socio-economic background is accounted for. So the generally better results of private schools seem to be explained by their more socio-economically advantaged student population. Often, it is public schools that do better if we keep socio-economic background constant.

4e. Ability grouping

Even within comprehensive educational systems that do not track students into different school types, students can be grouped by ability within schools. We saw in the multi-level model that included 55 countries in PISA, when accounting for several background, school and system factors, it turned out that having ability grouping for all subjects within school was negatively associated with performance. But looking at the statistically significant effects in each country in more detail, we see

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40 OECD 2007, Table 5.2.
41 OECD 2007, Table 5.1.
42 OECD 2007, Table 5.4.
that among individual CEE/CIS countries, the picture is mixed: having ability grouping for all subjects, controlling for other factors, has a positive, even if generally small, effect in five countries (Poland, Estonia, Bulgaria, Romania and Azerbaijan); ability grouping has a negative effect on performance in Lithuania, Montenegro and Croatia (green bars in Figure 19).

If we look at the difference in science scores according to whether the student is attending a school that has ability groupings in all subjects without controlling for any other factors, the picture is quite different. The only significant – and large – difference in scores is in Montenegro and Slovenia, where students in schools having ability groupings in all subjects tend to do worse in science performance (dark blue bars in Figure 19). Comparing schools with similar socio-economic intake does not change the picture much: There is only a small change in science scores in the Czech Republic. Thus, the absence of ability groupings is statistically significant (dark red bars in Figure 19). This tells us that, in some cases, the difference in performance of schools with ability grouping in all subjects is sometimes due to some other characteristic of such schools, rather than the ability grouping itself. Conversely, in other cases, the difference due to ability grouping is ‘cancelled out’ by the opposing influence of other factors associated with these schools.

**Figure 19** Observed difference in science performance of students in schools with ability grouping for all subjects, after accounting for index of social, economic and cultural status and for several background, school and system factors,* PISA 2006

Percentages next to country names are percentages of students in schools where the principal reported there were ability groupings for all subjects within the school (between and/or within classes). In Hungary, this was only 2 per cent, which was too low to provide reliable estimates of performance (and is therefore not included in the figure).

Countries are ranked by difference after accounting for several background, school and system factors,* Lighter-shaded bars indicate that differences are not significant.

* See Footnote 34 for variables included in the regression model.

Source: OECD 2006, Tables 5.3, 5.21b.
Overall, there are more schools that use ability grouping for all subjects in the UNICEF programme countries (28 per cent on average, reaching 61 per cent in Montenegro) than in the EU8 countries (10 per cent) and OECD (14 per cent). The majority of students are in schools that use ability groupings for some subjects in seven countries (Hungary, Lithuania, the Czech Republic, Slovakia, Azerbaijan, the Kyrgyz Republic and Romania), while there is no ability grouping for the majority of students in six countries (Poland, Slovenia, Latvia, Turkey, Croatia and Serbia). Only in Montenegro are the majority of students in schools with ability grouping for all subjects, as shown in Figure 19. In Estonia, there are about the same number of students in schools with no ability grouping (43 per cent) as there are students in schools with ability groupings for some subjects (42 per cent). In the Russian Federation, 40 per cent of students have ability groupings for all subjects, and another 40 per cent of students have ability grouping only for some subjects. Finally, in Bulgaria, 47 per cent of students do not have ability groupings at all, while 40 per cent of students do have them, but only in some subjects.

4f. Public posting of student results

PISA asks school principals whether the achievement data of their school is posted publicly. The practice of public posting of achievement results is done in many countries in an attempt to promote greater accountability for schools. This policy is intended to function as an incentive for schools to improve standards and to keep parents informed about their schools’ performance, but it needs to be used with caution. For accountability purposes, results need to be related to the school intake. If students’ background and entrance level are not properly controlled for, performance results will be misleading and might induce schools to be selective in order to appear more favourably on the postings, rather than having the schools concentrate on improving quality. However, in those countries where parents can choose schools, the effect of socio-economic intake should not be ignored. Furthermore, problems with equity may arise, since it is often families of high socio-economic status that make use of the available information, although data from PISA do not suggest such an effect. For example, England has been publishing league tables comparing school achievement results since the early 1990s, based on raw scores as well as value-added school estimates. Goldstein and Leckie argue against this. They maintain that due to the small number of children in any one year on which value-added school estimates are based, confidence intervals around these estimates are wide, and very few schools can actually be separated from each other; this is especially true in terms of predicted future achievement results, where an extra uncertainty is introduced. They also make reference to the perverse incentives that public league tables sometimes produce, such as schools discouraging pupils from taking hard subjects in order to appear better on the league tables.

PISA data show that schools posting achievement data publicly seem to do better overall, whatever the reason, even controlling for other factors described earlier. In the CEE/CIS countries, the effect is largest in Romania and Bulgaria, but is still statistically significant in another six countries (Poland, the Czech Republic, Slovakia, Hungary, the Russian Federation and Kyrgyz Republic). In Serbia, the effect is in the opposite direction, where students in schools without public posting of achievement data tend to do better, all other things being equal.

Being in a school that informs parents of a student’s achievement relative to other students in the school, national benchmarks or other schools does not appear to have any effect on performance as measured by PISA. Tracking achievement data, and using achievement data for allocating resources or for evaluating principals or teachers over time also show no effect on performance. It is interesting to note that in the CEE/CIS countries, 79 per cent of students are in schools where the principal reported that achievement data are used in evaluations of teachers’ performance, compared to an OECD average of 43 per cent; only in Croatia and Slovenia do the majority of schools not typically post achievement data.

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43 Goldstein and Leckie 2008.
Another relationship shown by PISA data is that students in educational systems that give more autonomy to schools to formulate the school budget and to decide on budget allocations within the school tend to perform better, controlling for other variables. This is regardless of the degree of autonomy of schools attended by individual students – that is, a school in a country in which a high proportion of schools have autonomy in budgeting tends to do better, even if the principal of that specific school reports not being involved in such decision-making.

Data is not available on performance differences by country within the regression model, but we can see what proportion of schools in different countries are autonomous in various aspects of responsibility. In general, without controlling for other variables, countries in which principals reported higher degrees of autonomy in various aspects of decision-making (except concerning teachers’ salaries) tend to have higher average performance. However, PISA notes that caution is required when interpreting such data on school decision-making, as principals in different countries may interpret the questions differently depending on the context. For example, when asked about school budget responsibilities, some may have related the question to regular budgets while others, who may not have had any involvement in their regular budgets, may have related it to supplementary budgets, such as the contributions from parents or the community.  

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**Figure 20** Difference in science score of students in schools posting achievement data publicly after accounting for several background, school and system factors, PISA 2006

Percentages next to country names are the proportion of students in schools where the principal reported there was public posting of achievement data (average of 57 per cent in UNICEF programme countries and 36 per cent in EU8 countries).

Lighter-shaded bars indicate that differences are not significant.

* See Footnote 34 for variables included in the multilevel model.

Source: OECD 2006, Table 5.21b.

### 4g. School autonomy

Another relationship shown by PISA data is that students in educational systems that give more autonomy to schools to formulate the school budget and to decide on budget allocations within the school tend to perform better, controlling for other variables. This is regardless of the degree of autonomy of schools attended by individual students – that is, a school in a country in which a high proportion of schools have autonomy in budgeting tends to do better, even if the principal of that specific school reports not being involved in such decision-making.

Data is not available on performance differences by country within the regression model, but we can see what proportion of schools in different countries are autonomous in various aspects of responsibility. In general, without controlling for other variables, countries in which principals reported higher degrees of autonomy in various aspects of decision-making (except concerning teachers’ salaries) tend to have higher average performance. However, PISA notes that caution is required when interpreting such data on school decision-making, as principals in different countries may interpret the questions differently depending on the context. For example, when asked about school budget responsibilities, some may have related the question to regular budgets while others, who may not have not have had any involvement in their regular budgets, may have related it to supplementary budgets, such as the contributions from parents or the community.  

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44 OECD 2007, p. 245.
### Table 5

Percentage of students in schools where the principal reported that the school has considerable responsibility for various aspects of school policy and management, either alone or jointly with government, PISA 2006

<table>
<thead>
<tr>
<th>Staffing</th>
<th>Budgeting</th>
<th>Students</th>
<th>Educational Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selecting teachers for hire</td>
<td>Dismissing teachers</td>
<td>Establishing teachers' starting salaries</td>
<td>Determining teachers' salary increases</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Hungary</td>
<td>100</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Estonia</td>
<td>98</td>
<td>99</td>
<td>98</td>
</tr>
<tr>
<td>Spain</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Slovakia</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Latvia</td>
<td>99</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Lithuania</td>
<td>99</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Latvia</td>
<td>99</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Russian Federation</td>
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</tr>
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<td>Slovenia</td>
<td>100</td>
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<td>Bulgaria</td>
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<td>100</td>
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<tr>
<td>Serbia</td>
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</tr>
<tr>
<td>Croatia</td>
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<td>100</td>
</tr>
<tr>
<td>Kyrgyz Republic</td>
<td>74</td>
<td>67</td>
<td>74</td>
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<td>Azerbaijan</td>
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<td>Montenegro</td>
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<td>100</td>
</tr>
<tr>
<td>Romania</td>
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<td>22</td>
<td>96</td>
</tr>
<tr>
<td>Turkey</td>
<td>97</td>
<td>4</td>
<td>97</td>
</tr>
<tr>
<td>CEE/CIS mean</td>
<td>72</td>
<td>57</td>
<td>72</td>
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<tr>
<td>OECD average</td>
<td>70</td>
<td>59</td>
<td>70</td>
</tr>
</tbody>
</table>

Countries are ranked by the average percentage over the 12 decision-making domains of students in schools where principals report that school only, or both school and government, have considerable decision-making responsibility.

Source: OECD 2006, Table 5.10.
EU8 countries are at the top of Table 5 together with the Russian Federation, with an average of 75 per cent or more of responsibility being either shared or entirely managed at the school level over the 12 decision-making domains; this figure rises to 90 per cent or more in Estonia, Hungary and the Czech Republic. For the rest of the UNICEF programme countries, the range of decisions taken jointly or only at the school level is between 39 per cent in Turkey, and 65 per cent in Bulgaria, on average. Romania (47 per cent) and Montenegro (49 per cent) are similar to Turkey in that the majority of decision-making related to school policy and management is taken at the government level.

For the CEE/CIS countries, across all 12 decision-making domains, an average of 70 per cent of students are in schools where principals report that their school has considerable decision-making responsibility, either alone (52 per cent) or jointly with government (18 per cent). The remaining 30 per cent of students are in schools where principals report that decisions are taken by government alone. These shares are about the same as in the OECD countries, but if we look at the separate elements in Table 5 in more detail, we see that CEE/CIS countries tend to have schools more in charge of selecting and dismissing teachers than the OECD average (except Romania and Turkey). However, they have, on average, less responsibility in budgeting and educational content (courses offered, course content, textbooks used). While in the EU8 countries and the Russian Federation, the majority of schools do have at least some responsibility for determining course content (compatible with limitations imposed by external examinations), this is not the case in other UNICEF programme countries.

Still, in most CEE/CIS countries, the majority of schools are at least jointly involved in various decision-making domains. Only in Romania and Turkey are the majority of schools not involved at all in selecting and dismissing teachers. Only in Azerbaijan and Latvia are the majority of schools not involved in deciding on budget allocations within the school. Only in Azerbaijan and Montenegro are the majority of schools not involved in the choice of textbooks. Only in Bulgaria and Croatia are the majority of schools not involved in establishing student disciplinary policies. On the other hand, in both the CEE/CIS and the OECD, schools are generally not involved much in determining teachers’ starting salaries and their salary increases. Only in Hungary, the Czech Republic, Estonia and Slovakia are the majority of schools at least jointly involved.

We have seen that schools in UNICEF programme countries have generally less responsibility in decision making, and government is more in control, compared to EU8 countries: 57 per cent and 84 per cent of students, respectively, are in schools involved in decision-making in the two groups of countries over the 12 decision-making domains. The OECD average for schools involved in decision-making lies between the two (72 per cent). Even though there seems to be an association between mean performance and a higher degree of school autonomy within a country, we cannot say whether increasing involvement of schools in decision-making alone will make a difference to a country’s performance. At the same time, the relationship between school involvement in budgeting and performance generally seems to hold at the system level, even controlling for other variables.

4h. School resources

Based on principals’ perceptions of potential factors hindering instruction at school, PISA shows that a lack of qualified teachers\(^{45}\) is negatively related to science performance at the school level, but that this relationship disappears when accounting for background factors – i.e., comparing schools

\(^{45}\) The PISA index of teacher shortage was created by using responses from school principals to questions about the extent to which the shortage or inadequacy of teachers in science, languages, mathematics and other subjects hindered the school’s capacity to provide instruction.
operating in similar contexts. The same is true concerning the shortage or inadequacy of a school’s educational resources (instructional materials such as textbooks, science laboratory equipment, computers or software for instruction, Internet connection, library materials, audio-visual resources). Pupil/teacher ratios and the number of computers per student are not related to performance even before accounting for background factors. This could indicate that school resources, as measured by PISA, do not necessarily have a direct impact on student performance.

Looking at the relationship with science performance within individual countries, we see that the negative association with teacher shortage is nevertheless significant in three CEE/CIS countries: the Czech Republic, Slovakia and Croatia. A shortage in educational resources is negatively associated with science performance in six CEE/CIS countries: Slovenia, Lithuania, the Russian Federation, Romania, Montenegro and the Kyrgyz Republic.

In the CEE/CIS countries, at most 7 per cent of students are in schools where there are one or more vacant science teaching positions, except in Azerbaijan (13 per cent) and the Kyrgyz Republic (25 per cent), according to the principals’ reports. In these two countries and in Turkey, even in those schools where there was no vacant science teaching positions to be filled, around 60 per cent of principals had the impression that a lack of qualified science teachers hindered instruction to some extent, while it was at most 32 per cent in all other CEE/CIS countries (on average, 10 per cent).46 About three quarters of school principals in the region expressed the concern that the shortage or inadequacy of educational resources hindered the capacity to provide instruction in the Russian Federation, Montenegro and Azerbaijan, rising to 93 per cent in the Kyrgyz Republic.47 In all other UNICEF programme countries as well as in Slovakia, the majority of principals felt that a lack of qualified science teachers hindered instruction. Even where there seems to be no direct relationship between the reported inadequacy of educational resources and school performance, there should be cause for concern for those countries where there is a diffuse sense of inadequacy of resources among school principals.

### 4i. Learning time

The last factor we will examine is learning time and its relationship to performance. Data show that the average students’ learning time for regular lessons in school, as well as learning time for self-study or homework, are overall positively associated with performance. On the other hand, the average learning time for out-of-school lessons is negatively associated with performance. This can be explained by the fact that it is the lower-performing students who need to take extra lessons outside of school to try to catch up with the rest of the class.

Within individual CEE/CIS countries, we see that the relationship between learning time and performance (controlling for other factors) is significant in all countries. It ranges from a small difference of 4 score points in science performance in Croatia and Slovakia for every additional hour per week of science lessons in school, to 12 to 13 points in Turkey and Romania (Figure 21). The effect of extra hours of self-study or homework is generally smaller, and it is not statistically significant in seven CEE/CIS countries; while the negative association between out-of-school lessons and science performance is generally larger, it is not statistically significant in four countries.

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46 OECD 2007, Table 5.13.
47 OECD 2007, Figure 5.15.
Figure 21  Difference in science score of students in schools with one additional hour per week of learning time after accounting for several background, school and system factors,* PISA 2006

Countries are ranked by the impact of an additional hour of regular lessons in school.

Lighter-shaded bars indicate that differences are not significant.

* See Footnote 34 for variables included in the regression model.

Source: OECD 2006, Table 5.21b.

It should be kept in mind that even though there is an association, this does not mean that long hours at school are necessary for high levels of performance. For example, at the system level, countries with less time on regular lessons at school are not necessarily those with the lowest results. Finland is the top-performing country in PISA, with the highest mean performance over the three literacy domains, even having relatively few hours of school lessons a week. In fact, the school average for students’ learning time for regular lessons in school is 9.7 hours per week in Finland, which is below the OECD average of 10.6 hours. Only about a quarter of Finnish students report having an average of four hours a week or more of instruction for reading, mathematics and science, with just 10 PISA countries having a lower average value (OECD mean: 41 per cent). Finland would be just above the Kyrgyz Republic, Bulgaria and Croatia in the left part of Figure 22. But few Finnish students have only minimal instruction in these subjects; only 16 per cent have less than two hours a week on average, with no CEE/CIS country and just 10 PISA countries having a lower value (OECD mean: 21 per cent). So Finland has one of the highest percentages of students having more than two but less than four hours of instruction per week, together with Sweden, Norway and Thailand. The Kyrgyz Republic, the lowest-performing country in PISA, is also the PISA country with the highest percentage of students (50 per cent) averaging less than two hours a week of regular school lessons in reading, mathematics and science.
Looking at how many hours per week are spent on regular lessons in each CEE/CIS country, according to students’ self-reports (Figure 22), we can see that the majority of students spend at least four hours on mathematics in five countries (Turkey, Poland, Estonia, Latvia, the Czech Republic). In Turkey and Poland, the majority of students spend at least four hours a week in reading.

**Figure 22** Percentage of students reporting on time spent on regular science, reading and mathematics lessons in school, PISA 2006

Countries are ranked by the average percentage of students spending 4 hours per week or more (or less than 2 hours per week) on regular science, reading and mathematics lessons in school.

*Source: OECD 2006, Table 5.17.*
Most countries spend less time on science instruction, except for the Russian Federation, where more time is devoted to science than to reading. The Russian Federation has the highest percentage of students with at least four hours a week of science instruction in school (45 per cent), and at the same time it is the only country where the majority of students have less than two hours a week of regular reading lessons. The majority of students in Romania, Slovakia and the Kyrgyz Republic have less than two hours a week of science instruction. In Romania and Turkey, only about two thirds of 15-year-olds in PISA were taking any science course at all, while in other CEE/CIS countries, more than three quarters of students take science courses.\textsuperscript{48} Unfortunately, we do not have enough information from PISA on what actually happens during the time devoted to school lessons. As for educational expenditure, how the time is used (in terms of teaching methods, curriculum content etc.) and not only how much is available may make a sizeable difference.

\textbf{4j. Conclusions on school and system-level factors}

The following summarizes the main findings of this chapter:

\begin{itemize}
  \item \textbf{Country wealth and educational spending} are closely associated with student performance in the CEE/CIS countries, but the relationship does not hold in the richer OECD countries. Some countries in the CEE/CIS region may be too poor to be able to provide sufficient educational opportunities.
  \item Caution is required when interpreting data on \textit{school factors affecting performance} since:
    \begin{itemize}
      \item Data are based on principals’ self-reports;
      \item Many variables remain unmeasured, such as relating to the quality of teachers and instruction;
      \item A student’s performance level does not depend only on the current school attended but on all learning that occurs in and out of school during their entire lifespan;
      \item There is no longitudinal performance data on the same sample of students, which would allow adjustment for achievement prior to attending the current school;
      \item Much of the variation in scores remains unaccounted for by the variables measured by PISA.
    \end{itemize}
  \item Concerning \textit{school location}, students in schools in smaller communities generally have lower mean performance than those in larger communities. But by taking socio-economic intake into account, the disadvantage of schools in smaller communities often disappears. It seems that it is the situation of socio-economic disadvantage of smaller communities that drives the lower performance results.
  \item Concerning \textit{school selection and choice}:
    \begin{itemize}
      \item In countries with a larger number of \textit{distinct programme types}, and where students are placed into different types of schools or programmes at an early age, socio-economic background tends to have a significantly larger impact on student performance, with no benefit to overall performance.
      \item In the UNICEF programme countries, an average of 53 per cent of schools are \textit{academically selective}, compared to just 35 per cent in the EU8 countries and 27 per cent in the OECD.
      \item In the CEE/CIS region, there are generally very few if any \textit{private schools}. At least 98 per cent of all 15-year-olds are enrolled in government or public schools in all countries in the region except in the Czech Republic, Slovakia and Hungary. The generally better results of private schools seem to be explained by their more advantaged socio-economic intake: in fact, public schools tend to do better if we keep socio-economic background constant.
    \end{itemize}
\end{itemize}

\textsuperscript{48} OECD 2007, Table 5.16.
Overall, there are more schools that use ability grouping for all subjects in the UNICEF programme countries (28 per cent) than in the EU8 countries (10 per cent). Having ability grouping for all subjects within school is negatively associated with performance among PISA countries, controlling for other factors. Among individual CEE/CIS countries, ability grouping has a positive, even if generally small, effect in five countries, while it has a negative effect in three countries.

Concerning use of achievement data:
- Keeping in mind critiques of public posting of achievement data, we can note that schools posting achievement data publicly seem to do better overall in PISA, controlling for other factors. In the CEE/CIS countries, the effect is statistically significant in eight countries.
- Being in a school that informs parents of children’s achievement relative to other students in the school, national benchmarks or other schools does not appear to have any effect on performance as measured by PISA.
- Tracking achievement data, using achievement data for allocating resources or for evaluating principals or teachers over time show no effect on performance.

Concerning school autonomy:
- In the CEE/CIS, across 12 decision-making domains, 70 per cent of students on average are in schools where principals report that their school has considerable decision-making responsibility.
- Schools in UNICEF programme countries have generally less responsibility in decision making, compared to EU8 countries.
- Only in determining teachers’ starting salaries and their salary increases are schools generally not involved.
- CEE/CIS countries tend to have schools more in charge of selecting and dismissing teachers than the OECD average. They have less responsibility in budgeting and educational content.
- Countries in which principals reported higher degrees of autonomy in various aspects of decision making (except concerning teachers’ salaries) generally tend to have higher average performance, without controlling for other variables.
- Students in educational systems that give more autonomy to schools to formulate the school budget, and to decide on budget allocations within the school, tend to perform better, even controlling for other variables.

Concerning school resources:
- A lack of qualified teachers and a perceived inadequacy of a school’s educational resources are negatively related to science performance at the school level, but the overall relationship disappears when accounting for background factors. Science performance is negatively affected in three CEE/CIS countries where there is a perceived teacher shortage, and in six countries where there is a perceived shortage in educational resources.
- Pupil/teacher ratios and the number of computers per student are not related to performance, even before accounting for background factors.
- Three quarters or more of school principals expressed the concern that an inadequacy of educational resources hindered the capacity to provide instruction in the Russian Federation, Montenegro, Azerbaijan and the Kyrgyz Republic. In Azerbaijan, Kyrgyz Republic and Turkey, around 60 per cent of principals had the impression that a lack of qualified science teachers hindered instruction, while the CEE/CIS average was 10 per cent.
Even where there seems to be no direct relationship between the reported inadequacy of educational resources and school performance, there should be cause for concern for those countries where there is a diffuse sense of inadequacy of resources among school principals.

**Concerning learning time:**

- The average students’ learning time for regular lessons in school and for self-study or homework are overall positively associated with performance, even controlling for other variables. Participating in school activities such as science clubs, fairs, competitions and excursions is also positively related to performance.
- Nevertheless, the example of Finland has shown us that it is not necessary to have long hours at school to achieve high levels of performance.
- The Kyrgyz Republic is the PISA country with the largest percentage of students having less than 2 hours a week of regular school lessons, on average, in each of the three subjects.

Some school characteristics are associated with performance only before taking demographic and socio-economic background into account: low proportion of funding from government, presence of other schools in the area that compete for students, positive evaluation of the quality of educational materials in school, and no perception that a lack of qualified teachers is hindering instruction. This suggests that students with higher socio-economic backgrounds tend to be in schools with better resources, and make better use of the choice they have among schools.
CHAPTER 5

POLICY RECOMMENDATIONS
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CHAPTER 5: POLICY RECOMMENDATIONS

This chapter builds on reports from the countries under review as well as on findings from PISA data analyses. It will analyse the performance of the nine UNICEF programme countries in PISA from a policy perspective. It will look at policy factors that have contributed to this low achievement, and at policy factors that have contributed to good performance in selected OECD countries; some of the policy issues raised are directly measured by PISA, and some are not. Special attention will be paid to what is occurring in the educational systems of the high-performing countries in the CEE/CIS region, such as Estonia, as well as to the example of Croatia, which is a UNICEF programme country that did relatively well in PISA. These analyses lead to recommendations for action that should facilitate educational improvement and hopefully be used to steer a national debate on the quality and relevance of education in the UNICEF programme countries in the region. Such recommendations will address issues relating to preschool education, curriculum development, assessment systems, teacher selection and training, school leadership and funding management.

Any country’s successful development is linked to a competitive economy, democratic governance and an inclusive society. All these build on competency-based education and high expectations for learners. Each country participating in PISA intends to monitor and improve its educational system; however we have seen from Chapter 2 that the nine UNICEF programme countries participating in PISA, although with different levels of overall performance, lag behind most OECD countries and EU8 countries. Croatia and the Russian Federation are the only UNICEF programme countries that perform slightly better or at the same level as some of the EU8 countries.

National education policymakers in countries in the CEE/CIS region that have not performed well on PISA declared that:

- The poor results are attributed to the testing system, which is inadequate for assessing the quality of their educational programmes;
- The poor results show the incompatibility of their curriculum and what is being tested by PISA;
- The poor results show incompatibility of teaching methods used in their schools and competencies developed by their teachers and what is being measured by PISA; and,
- Educational systems in EU countries are very different from their educational systems.49

Some critics also claim that PISA results are not valid because students from the Russian Federation and some other Eastern European countries that have not performed well on PISA, have on the other hand been doing very well on science and mathematics Olympiads.50 For example, at the 2006 International Physics Olympiad, students from Azerbaijan and Bulgaria (five awards each) performed better than students from Finland (four awards), and students from the Russian Federation and Turkey performed as well or better than students from Estonia and Hong Kong. Similarly, at the International Mathematical Olympiad in 2006, the Russian Federation and Romania outperformed Finland and Hong Kong, in spite of scoring significantly lower on PISA 2006.51 But the Olympiads ‘measure’ the performance of the gifted and talented, while PISA measures average student performance.

49 Vasiliev 2004, p.2
50 The International Olympiads are the World Championship Competitions in Math and Science for High School students and are held annually in a different country. The first International Mathematics Olympiad (IMO) was held in 1959 in Romania, with 7 countries participating. It has gradually expanded to over 90 countries from 5 continents. The IMO Advisory Board ensures that the competition takes place each year and that each host country observes the regulations and traditions of the IMO: Retrieved October 10 from http://www.imo-official.org/.
5a. Common policy challenges of education systems in the CEE/CIS countries

Differing levels of performance are partly explained by political, economic, social and educational factors. For nearly 70 years in the Soviet Union, and 40 years in the countries of the former socialist block, school curricula and teacher training were controlled by the government and political establishment. Curricula were supposed to reflect communist values and disallowed any kind of freedom for schools to make their own choices. Schools promoted knowledge acquisition and not knowledge application. After so many years, it is hard to expect an old system to quickly turn around; none of the former Soviet countries has sufficient resources to train and retrain teachers and produce appropriate teaching materials, including textbooks, software, provide Internet access, etc., to completely remodel the curriculum. However, some countries, such as Estonia, found a way to succeed in spite of the obvious economic limitations and shortages. It is important to mention that the countries that became part of the Soviet system later tend to perform better on PISA than the countries that became part of the Soviet Union around 70 years ago.

In CEE/CIS countries, educational reforms started in the mid-1980s with an attempt to compensate for the past years of lack of educational freedom. Before that, excessive control of education by the ruling Communist Party led to: 1) a lack of democratic relations and procedures in schools; 2) inconsistent rules for placing and promoting students; 3) denying opportunities to pursue higher education to most of the high school graduates; 4) an inconsistent and rigid grading system; 5) over-centralization of educational administration; 6) lack of recognition of the rights of children and parents; 7) outdated and inadequate physical facilities and equipment; 8) lack of or very few private schooling alternatives; 9) little entrepreneurial activity supporting education; 10) lack of continuity in education system; 11) lack of consistent and motivational teacher evaluation system; 12) a lack of professional teaching publications and pedagogical literature useful to most teachers; and 13) poor management of the education system.

Educational reforms accelerated after the break-up of the Soviet Union and socialist block in Eastern Europe; nevertheless, not all countries were able to improve. There was a combination of reasons for this, led primarily by insufficient material and a lack of professional resources, and competing priorities. Schools were still using outdated curricula, textbooks and teacher training methods. The curriculum was focused on knowledge transfer rather than on student development: We have seen in PISA that, in the CEE/CIS region, students are generally still better at explaining phenomena scientifically than they are at using scientific evidence or identifying scientific issues (Section 2c). This could not be changed overnight. Decades of top-down authoritarian governance with little freedom given to individual schools created a lot of inertia and an unwillingness among educators to obtain new skills. In spite of the need for reforms, an outdated curriculum and governance, in combination with economic troubles, led to the situation in some countries, such as Bulgaria, Romania, Azerbaijan, the Russian Federation and Kyrgyz Republic, in which student achievement actually became worse than during Soviet times.

If the quality of school education were similar for all countries of the former Soviet Union, the problems of poor performance in PISA 2006 could have been explained by socio-economic issues. However, some countries that had the same baseline characteristics as most CEE/CIS countries in

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52 We have seen that even in 2006, CEE/CIS countries were better at explaining phenomenon scientifically than at using scientific evidence or identifying scientific issues (Chapter 2c).

53 Estonia, Latvia and Lithuania became republics of the Soviet Union in 1939.

1991, following the collapse of the Soviet Union, have done much better at improving their education; Poland, Croatia and Estonia have proven that, even with limited resources, it is possible to have significant improvement if resources are used effectively and are focused on the most important problems (even though we have seen in Chapter 4a that the resources available in other UNICEF programme countries are fewer). What lessons can be learned from them?

5b. Improving Quality with Equity

Curriculum Reform

Concept of literacy in the curriculum

PISA assumes that the goal of each country’s curriculum is to provide a certain level of ‘literacy’ in science, reading and mathematics (see Box 2). Students should be able to analyse, compare, contrast, evaluate and think imaginatively. They should learn to apply knowledge in real life situations and communicate thoughts and ideas effectively. They must be trained in accessing, managing, integrating and evaluating written information in order to develop knowledge and potential, and to participate in, and contribute to, society using language, symbols and texts, interacting with information, capitalizing on the potential of technologies, interacting in diverse groups and acting autonomously. As discussed in the Introduction, reading literacy assumes using, interpreting and reflecting on written material; mathematical literacy places emphasis on mathematical knowledge put into functional use in a multitude of different situations in varied, reflective and insight-based ways; and scientific literacy is using scientific knowledge, identifying scientific questions, and drawing evidence-based conclusions to understand and make decisions about the natural world.

For many years in the nine UNICEF programme countries participating in PISA, the approach to literacy was much more simple: until the 1990s, reading literacy only required the ability to read a certain number of words per minute, and mathematics and science literacy required memorization of a significant amount of formulae and rules. Many CEE/CIS countries still prefer to concentrate on these approaches to literacy, which are easier to develop and simpler to examine and test. According to the study of PISA conducted by Russian scholars, Russian students are able to deal with the assignments of low levels of difficulty, but they experience significant problems with the assignments of moderate and high levels of difficulty. One of the explanations is that students are doing exactly what their curriculum requires: memorizing facts and establishing simple connections. Higher order thinking is not required.

In the past, all schools were supposed to teach a similar curriculum using similar textbooks by teachers trained to teach in a similar way. The difference was only in the language of instruction, and Russian dominated in most of the Soviet republics. In fact, the word ‘curriculum’ did not even exist in most of the CEE/CIS countries. The term that was used instead means ‘syllabus’. It took more than ten years to realize that a curriculum is much more than a syllabus. A syllabus normally outlines the content to be taught. A curriculum, by contrast, is dynamic and includes all the learning experiences provided for the student. It encompasses the learning environment, teaching methods, resources provided for learning, systems of assessment, school ethos and the ways in which students and staff behave toward one another. All of these provide experiences from which students learn. Together, they add meaning, purpose and enjoyment to students’ lives. Particular attention is required to ensure that there is congruence between the various dimensions of curriculum.

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55 Kasprjak et al. 2006, p.10
56 The word ‘curriculum’ is now used without translation in many languages of the CEE/CIS, including Russian, Kyrgyz, Azeri, Bulgarian, and Polish.
Only a limited number of curriculum aspects existed in the nine UNICEF programme countries in PISA. In most cases, there was content mandated by the government and the methods of teaching directed toward the acquisition of knowledge. Even after political and economic reforms took place, education was far behind. ‘At all levels of education, and secondary schools in particular, the archaic system of knowledge transfer instead of life skills development is still dominating in most of the post-Soviet countries. In spite of the requirements of society and modern educational science, teaching is based on the concept that [the more knowledge in different areas, the better]. This concept sometimes works when we are talking about preparing scholars and scientists (which is the only field where CEE/CIS education can be considered competitive and students do well on international Olympiads). However, in no way does it help in preparing students for life, and therefore requires radical change in both content and structure’.57

CIS countries have traditionally enjoyed high standards in education, and their general enrolment rates have exceeded the levels of many middle-income countries, including the proportion of the population with higher education. In recent years, however, the quality of education in the CIS countries has declined, as has the number of children enrolled in preschools and secondary schools. There are many reasons for the decline, including the shift to a market economy, lack of resources, and the lack of trained teachers and teacher-trainers.

The educational challenges in the CEE/CIS include ensuring that all children receive schooling of equal quality, and utilizing school curricula and teaching practices that are appropriate to the needs of a new market and labour economy. Special attention should be paid to ensuring the right to education, since it is not being enjoyed by disadvantaged communities and excluded groups, such as populations living in remote areas. Countries should also continue to secure access to education for refugee children, especially in Azerbaijan and the Kyrgyz Republic, taking into account their special needs so that they have a real opportunity to access quality education through, for instance, language and catch-up classes. The laws in each of the countries under review formally guarantee the right to receive education in public educational institutions free of charge regardless of gender, race, nationality, social and financial status, specialization, philosophy, party membership, religious preferences, state of health, place of residence and other reasons. Although one would presume that these laws guarantee equal access for all children to quality education, in practice, this is not the case. In spite of the assurances provided in the law, children who are gifted or talented and those from families that are better off socially and economically have a major advantage. So-called ‘elite schools’ provide much better education, but they require parents to pay additional (often hidden) attendance fees. These schools are mostly located in country capitals or areas with significant resources (in Romania, in Bucharest and Brashov, an oil-rich area; in the Kyrgyz Republic, in Bishkek; in Azerbaijan, in Baku only) and far from the districts where low-income families live.

Children of minorities such as the Roma (especially in Bulgaria and Romania, and to a lesser extent in Azerbaijan and Kyrgyz Republic) are particularly disadvantaged when it comes to education and show a low enrolment and high dropout rate. This is primarily due to poverty and the discrimination and stigmatization associated with this minority group, as well as major cultural and language barriers that discourage Roma parents from sending their children to school. In Bulgaria, 88 percent and in Romania 83 percent of Roma children do not attend secondary school at all (15-17 year olds). Inadequate material conditions and the poor quality of education provided by unmotivated teachers contribute to low attendance rates of Roma pupils.58

57 Kuzminov 2002, p.2
In regard to education quality, the curriculum has not been completely transformed to meet the new demands of a developing society. The old Soviet approach to content development, with its overemphasis on polytechnic training at the expense of humanities (which also places females at a relative disadvantage, as they show consistently better results in humanities than males), the extensive reliance on rote memorization, and inadequate attention given to developing other skills and techniques that lead to individual problem solving and creative thinking, are all perceived as obstacles to further development of the education sector, and consequently, to development efforts. There has also been a drop in the quality of teaching, with many qualified teachers leaving the sector. The quality of education is further affected by the absence of a monitoring system, which would help identify the weakest elements and allow the needed improvements to be made.

A developmental approach: curriculum reform in Estonia

Estonia serves as a good example in the region since it did remarkably well on PISA 2006 in its first year of participation, in spite of the fact that it faces the same economic, political and social issues as most of the CEE/CIS countries. We have seen that among all 57 countries participating in PISA, only Finland and Hong Kong did better than Estonia in terms of statistically significant average science performance. In all three literacy domains, Estonia's mean score is higher than all CEE/CIS countries, including its closest neighbours, Latvia, Lithuania and the Russian Federation. Only Poland (in reading) and the Czech Republic (in mathematics) scored at the same level as Estonia (see Chapter 2a). At the same time, we have seen that Estonia has managed to maintain low within-country disparities and generally consistent performance standards across schools, and has secured similar outcomes among students from different socio-economic backgrounds (Chapter 3).

How did Estonia reform its educational system? In Estonia’s education sector, the biggest positive developments are linked to its curriculum development efforts. Students develop and learn at different rates and in different ways, constructing new knowledge and understandings in ways that link their learning to their previous experiences. The developmental approach of the curriculum accommodates these needs. At the same time, it provides students and their parents with a clear sense of the direction of students’ learning and, through appropriate assessment and reporting procedures, of how students are progressing.

Estonia’s Center of Curriculum Development in the University of Tartu was established in 2000 with the responsibility to coordinate the development of the national curriculum for basic and general secondary education. It subsequently prepared a new national curriculum that included extensive changes. Curricula for pre-primary education, for students with moderate and severe learning disabilities and for supplementary learning were also developed. A national curriculum framework, adopted by the Estonian Government in 1996, has given each school the right and obligation to develop its own curriculum, taking into consideration the features particular to the school and the region, as well as the wishes of students. A system of external evaluation for educational achievement has also been implemented. Tests were introduced at the end of various stages of study to determine how close students are to standards, and standardized graduation examinations were introduced at the end of basic and upper secondary school. Also, conditions have been created for inclusive education that allowed students with special needs to study in regular schools (in the past they attended closed ‘special’ schools). The teaching of Estonian to other ethnic groups has become much more efficient as well.\(^{59}\)

It should be noted that, while a very high percentage of students in Estonia acquired the baseline level of competencies in all three literacy domains (more than 85 per cent, above the OECD average),

\(^{59}\) Parri and Aas 2006, p. 258-260
the number of students with higher reading skills is relatively small. Only 6 per cent of Estonian students achieved the highest level in reading, and this is less than the OECD average (see Annex, Figure 25). This indicates that there is still some room for improvement as far as the reading skills of Estonian students are concerned. In terms of gender issues, Estonian males were considerably behind females in the development of their reading literacy skills; the gender gap in Estonia was equivalent to the CEE/CIS average, but above the OECD average (see Chapter 3c).

Collaboration and partnerships: curriculum development in Croatia

Education is the shared responsibility of students, teachers, parents, tertiary educators and the community. Successful implementation of the curriculum requires a collaborative approach to planning by all concerned, and collective responsibility for students’ achievement of intended learning outcomes. A successful strategy adopted by the Croatian government was to create a Council of National Curriculum, which included scholars, teachers from all school levels, Ministry of Education officials, researchers, teacher union leaders, philosophers and even theologians.

The Members of the Council have based national curriculum strategies on Croatia’s development goals, as well as on its educational policy goals at the Ministry of Science, Education and Sports; they have analysed research results and related European Union documents, conducted public discussion with relevant education stakeholders and developed a clear and concise Strategy for the Construction and Development of the National Curriculum for Preschool, General Compulsory and Secondary Education. The document provided Croatians with the goals, objectives and content of education, with guidelines for student, teacher and school evaluation, and a plan for implementation. Thorough follow-up on curriculum implementation, measurement and validation at each stage and enforcement of changes allowed Croatia to achieve stable growth in its students’ academic achievement. Much attention (compared to other UNICEF programme countries) is also being paid to the development of children with special needs, as well as to the opportunities for accelerated progress for gifted children.60

Teaching Practices

Status of the teaching profession

In all nine countries under review, teaching is considered to be an unattractive job. It frequently attracts only those applicants who are not able to compete for more respected jobs such as economists, lawyers, medical doctors or computer scientists. Due to low prestige, teacher-training institutions accept practically anyone who applies. Teachers were (and still are) among the lowest paid categories. Interestingly, the highest average teacher salaries among the nine CEE/CIS countries are paid in Estonia and Poland (approximately $750 and $550 per month, respectively), and the lowest teacher salaries are paid in the Kyrgyz Republic and Azerbaijan (less than $100 a month). In Bulgaria and Romania, average monthly teacher salaries are around $200. In the Russian Federation, teacher salaries vary greatly, from $800 in Moscow to $200 in rural locations.61

In Azerbaijan and the Kyrgyz Republic, the problems with teachers are more acute than in other CEE/CIS countries: There is a significant shortage of teachers, and a lack of qualified teachers in many disciplines. According to a 2004 UNESCO study, only 66 per cent of the graduates of teacher training institutions in the Kyrgyz Republic chose to become teachers; others sought employment elsewhere (although

60 Crighton 2007, p. 36.
Kyrgyz educational authorities in private conversation acknowledged that the accurate number would probably be around 30 per cent). In rural Kyrgyz schools, the aging of the teacher population is another huge problem – over 60 per cent of teachers are older than 60. In the Kyrgyz Republic, teachers are offered double salaries (which is still quite low compared to other graduates of higher education) and free apartments to teach in rural schools. Yet the 2003 Monitoring Learning Achievement Study in the Kyrgyz Republic found that in rural schools, 50 per cent of mathematics classes, 47 per cent of chemistry classes, 43 per cent of geography classes, 64 per cent of physics classes and 39 per cent of biology classes were not conducted because teachers were not available. In addition, school directors in the Kyrgyz Republic tend to hide vacancies so they can share the ‘unused money’ among the teachers with very low salaries. In Azerbaijan, the situation is not much better. The teacher shortage is officially estimated at 5 to 10 per cent, however, actual numbers may be higher. In addition, secondary school teachers in Azerbaijan prefer to devote all their efforts to private tutoring.

**Best experience in teacher selection and training**

The best performing education systems manage to attract good quality teachers. As quoted in McKinsey report, “The quality of an education system cannot exceed the quality of its teachers.” In Finland, all new teachers must have a masters degree. South Korea recruits primary-school teachers from the top five per cent of graduates, Finland from the top 10 per cent (and only one in ten applicants gets accepted to become a teacher), and Singapore and Hong Kong recruits from the top 30 per cent. It is important to mention that teachers are attracted to their jobs not because they make more money – if money were so important, then teachers in Germany, Spain and Switzerland (and New York) would be the best, as they offer the highest salaries. Top performing systems, as a rule, pay average salaries. They also do not try to encourage a big pool of trainees and select only the most successful. Singapore thoroughly screens candidates before teacher training and accepts only the number for which there are places. Once in, candidates are employed by the education ministry and more or less guaranteed a job. Finland also limits the supply of teacher-training places to demand. In both countries, teaching is a high-status profession because of the competition, and there are generous funds for each trainee teacher because there are few of them. It is also important to mention that the top-performing countries recognize that the teacher selection process cannot be perfect. They implement procedures to ensure that the lowest-performing teachers can be removed from the classroom based on their performance.

Lastly, the most successful countries are distinctive not just in whom they employ, but in what they do when students lag behind. Finland has more special-education teachers than any other country. The Finnish Ministry of Education mandates remedial services for needy students, including mother tongue instruction for non-native speakers. Singapore provides extra classes for the bottom 20 per cent of students and teachers are expected to stay on after lessons are over, often for several hours, in order to help students requiring extra assistance.

In CEE/CIS countries up to the mid-1990s, educational laws ensured that all students attained at least a minimum achievement level. Due to low prestige, low salaries, and drastically decreased funding, schools in some CEE/CIS countries lost a large number of teachers – the estimates are that up to 10 per cent of the total teacher population left the profession from 2003 to 2006 in the Russian

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62 Center for Public Opinion Studies and Forecast 2003, p. 56.
64 McKinsey & Company 2007, p. 16.
66 Ministry of Education 2007, p.16.
67 Ginsburg 2005, p.16.
federation, Azerbaijan, the Kyrgyz Republic and Bulgaria. Thus, helping children with special educational needs or children who lagged behind their peers academically for any other reason became a very low priority. Teachers felt that they were not required to help all students any more, and they concentrated only on those who were successful.

In the United States, studies in Tennessee and Dallas have shown that if pupils of average ability are taught by teachers deemed to be in the top fifth of the profession, they end up in the top 10 per cent of student performers; if they are taught by teachers from the bottom fifth, they end up at the bottom 10 per cent. The quality of teachers affects student performance more than anything else. Yet most school systems are not trying to recruit the best teachers. The New Commission on the Skills of the American Workforce, a non-profit organization, says the United States typically recruits teachers from the bottom third of college graduates. Washington, D.C. recently hired as chancellor of its public schools an alumna of an organization called Teach for America, which seeks out top graduates and hires them to teach for two years. Both her appointment and the organization caused a storm from the teachers’ union.

A bias against hiring the brightest happens partly because of lack of money (governments fear they cannot afford them), and partly because other goals get in the way. Almost every rich country has lately sought to reduce class size. Yet all other things being equal, smaller classes mean more teachers for the same pot of money, producing lower salaries and lower professional status. That may explain the paradox that, after primary school, there seems little or no relationship between class size and educational achievement.

Once teachers enter the profession in countries such as Azerbaijan, Kyrgyz Republic, Montenegro, Romania and Bulgaria, they are neither trained nor encouraged to use any of the modern teaching techniques such as small group work, active and interactive learning and projects. Poor teaching methodologies led to a special discussion at the Serbia and Montenegro Ministry of Education. The continuing use of traditional, non-interactive teaching methods that prevail in classrooms is one of the reasons that a number of CEE/CIS countries did not perform well on PISA.

An improvement was noticed in teaching and learning in Slovenia after a professional team was established in the Office for Educational Development of the Slovene Ministry for Education and Sports. The team established five major competencies to be developed during teacher-training: 1) communication and relationships, 2) effective teaching, 3) organization and leadership, 4) cooperation with work and social environment, and 5) professional development. All competencies were to be based on content knowledge. The first and second group of competencies were to be achieved during masters degree study; the third, fourth and fifth groups of competencies were to be developed during the probation period and in-service training.

**School resources**

**Teaching and learning materials**

Another concern in the former Soviet Union is the issue of teaching and learning materials. Until recently, Russian-language textbooks were dominating the school market not only in the Russian

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68 Князев. Класс без учителя. Труд № 21. 8 февраля 2006. [Kniazev. Class without teacher].
69 Stecher, p. 24.
70 Kovač-Cerović 1999. p.2.
Federation, but in countries such as Azerbaijan and the Kyrgyz Republic as well. There are more than 100 ethnicities in the Russian Federation. Of these, only nine per cent were studying in their native language in 1991. After 1991, many ethnic groups decided to have their own schools and teaching materials in their native languages. However, it was not feasible to have a sufficient number of high quality materials in a short period of time. That is why many non-Russian ethnic regions used either poor quality local teaching materials, or continued using Russian textbooks, or translated Russian books into their own language (with poor quality translations).

Furthermore, the humanities textbooks in most of the CEE/CIS countries (with the possible exception of Estonia, Latvia and Lithuania) are not fit to teach critical thinking and problem-solving skills. For example, textbooks in Turkey focus mostly on transmission of knowledge; they do not help student motivation for learning and do not propose innovative ways to make knowledge more accessible. In schools in remote regions of the Russian Federation, Azerbaijan and the Kyrgyz Republic, students are still using outdated mathematics and science textbooks; some are more than 40 years old, and even these are not available in sufficient quantities.

Education in the poorest countries in the region is being undermined by the lack of funding for textbooks, heating and school maintenance, and by the lack of qualified teachers. Thus, educational quality is falling in countries like Azerbaijan, the Kyrgyz Republic, Bulgaria and Romania, and outdated methods raise concerns that children are not being prepared for life.

In 2006, Slovenia, Estonia, Latvia, Lithuania and Hungary had the highest public expenditure on education as a per cent of GDP, ranging from 5.2 per cent to 6.0 per cent. By comparison, Serbia, Montenegro, Romania, the Russian Federation and Azerbaijan were spending between 2.7 per cent and 3.8 per cent of their GDP on education, and their PISA performance was substantially lower. Education expenditure, however, should also be analysed in absolute terms. For example, in 2008, the Kyrgyz Republic is spending 6.7 per cent of its GDP on education, but the national GDP is so low that this amount is barely enough to cover the basic salaries of school teachers.

Quality Assurance

Improving Performance: Slovenia’s assessment system

Another country that achieved relative success on PISA (although it did not do so well in terms of within-country differences) was Slovenia, which took a different approach to improvement than Estonia. The country education experts, in cooperation with EU specialists, decided to use an ‘assessment’ approach, which emphasizes a thorough scientific assessment of academic progress at all stages. This external assessment of knowledge enables pupils, teachers, parents and schools to compare their results with those achieved on the national level.

For the last fifteen years, Slovenia has seen the rise of self-evaluation initiatives. The Ministry of Education and Sport has encouraged and linked numerous institutions and projects whose aim is high quality of educational processes, in order to establish a system of quality assessment and assurance with emphasis on self-evaluation. There are many public institutions in Slovenia that

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72 Karnishev 1997, p. 112.
73 Yildirim 2006, pp. 218–228.
75 See Annex, Figure 29.
77 Krek 2001, p. 45.
deal with the evaluation of educational programmes: the National Education Institute, the National Institute for Vocational Education and Training, the Slovenian Institute for Adult Education, and the National Examination Center.

There are four types of evaluation in Slovenia: external evaluation, internal evaluation, system evaluation, and evaluation of learning outcomes. *Evaluation of institutions* (part of system evaluation) is carried out internally (where the evaluator participates in the institution’s activities either as a teacher, or a principal, or a student), and externally (where the evaluator is not directly involved in the institution’s activities – e.g., school inspection). *External evaluation of the system* is carried out by the Inspectorate for Education and Sport, whose task is to oversee the implementation of legislation, other regulations and acts governing the organization, the targeted use of public finances and the carrying out of educational activities.

*Evaluation of educational programmes or the curricula,* another part of system evaluation, is carried out by the National Evaluation Council, whose task is to coordinate the monitoring and implementation of the new curricula, its elements and new features in the areas of preschool education, compulsory basic education and secondary education. Evaluation of the curricula is carried out through evaluation studies that, as a rule, last two years, and are either commissioned by the Ministry or selected by calls for tenders.

*Evaluation of learning outcomes* is both external – by means of international studies, such as PISA, TIMSS, PIRLS, or by national examinations at the end of primary and secondary school – and internal – by analyzing overall school performance at the end of each school year and, of course, by assessment and testing of knowledge in class.

Sound evaluations help Slovenian educators to identify educational problems very early and deal with these correspondingly. We have seen in Section 4f that publicizing the results of evaluation is positively associated with achievement in PISA.

**Learning time**

The research about learning time has proven that quality of time spent learning is much more important than quantity of time. We have seen in Section 4i that even though Finnish students spend less time at school than students in many other countries, they are still the top-performers in PISA. On the other hand, too little schooling is detrimental: Kyrgyz students are among those who spend the least time in school, and their academic performance is among the lowest surveyed. In the 2008–2009 academic year, Kyrgyz students will spend even less time at school: The country’s Minister of Education announced that, due to the energy crisis, winter recess will last from January 1 until February 28. Although some of the time will be added to the end of the school year, it still will not be enough to compensate for the two month long vacation.

In the U.S., the Massachusetts Board of Education has been conducting an experiment in approximately 80 schools. Since 2006, the schools have been expanding learning time for students from different socio-economic, race and family backgrounds. The preliminary results show that

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78 Matijašič & Gajgar 2007, p. 177
expanded learning time works only if it allows schools to provide children with well-planned and meaningful activities. The extra time is being used for:

1) More project-based and experiential learning – something that can be supported by partnerships with local organizations and institutions of higher education.

2) After-school and community-based partnerships as an integral part of an expanded day. In Massachusetts pilot schools, students are going swimming and learning drumming, dance, filmmaking, and Mandarin Chinese – all as part of the school day.

3) Regular professional development and common planning time for teachers.

5c. Strategies for improving equity without threatening quality

As has been stated earlier, large within-country differences in performance are a concern when education is seen in its function of furthering equality of opportunity and social cohesion. Within this context, it is also important to examine the issue of inclusiveness and flexibility as important components of equity in education.

Inclusion

Inclusiveness and flexibility: quality education for all

The curriculum is intended for all students in all schools. Inclusiveness means providing all groups of students, irrespective of background and special needs, with access to a wide range of knowledge, skills and values. It means recognizing and accommodating the different starting points, learning rates and previous experiences of individual students or groups of students. It means valuing and including the understandings and knowledge of all groups. It means providing opportunities for students to evaluate how concepts and constructions such as culture, disability, race, class and gender are shaped.

Different CEE/CIS countries have taken different approaches to educational improvement. Estonia, Latvia, Lithuania and Poland started with an incremental approach, trying to review educational legislation, educational funding and curricula methodically and systematically. Other countries, such as the Russian Federation, Azerbaijan and the Kyrgyz Republic, tried to use ‘quick fixes’ by concentrating on the best-performing students, and frequently disregarded average and low-performing students. These countries have started numerous magnet schools (i.e., a school offering specialized courses or curricula) and schools for gifted students. These schools were provided with additional resources, instead of trying to provide quality education for all students. The number of schools for gifted students and magnet schools has grown in the Russian Federation from around 700 in 1991 to more than 7,000 in 2006. The argument behind such policy was the necessity to resurrect a national cadre of elite students and professionals. In this ‘rush for excellence’, many non-specialized schools, especially in the CIS countries, were left with minimum budgets and no other resources to cope with the issues of educating all children.

Curricula must be adaptable to the particular needs of different schools and communities. It must also be responsive to social and technological change and meet students’ needs that arise from that processes of change. In particular, it must encourage effective use of new technologies as tools for learning. It should provide a balance between what is common to the education of all students, and the kind of flexibility and openness required for education in the twenty-first century. Instead, countries such as Azerbaijan and the Kyrgyz Republic concentrated resources on elite schools supported directly by the government, leaving the needs of most schools, especially the rural ones,
to the discretion of community or foreign donors.

**Integration, breadth and balance: Poland’s institutional reform**

Effective education enables students to make connections between ideas, people and things, and to relate local, national and global events and phenomena. It encourages students to see various forms of knowledge as related and forming part of a larger whole. While opportunities to specialize must be provided to allow for specific talents and interests, all students need a broad grasp of the various fields of knowledge and endeavors. They also need experience in building patterns of interconnectedness that help them to make sense of their own lives and of the world.

We have seen that countries that separate students early and into a large number of distinct programme types tend to have wide disparities in achievement and have schools with unequal outcomes (see Chapter 4d). Poland is an example of how a country improved performance, as well as produced more equal outcomes across schools by reforming its system in the direction of integration, postponing differentiation of students into different school types by one year. In countries like the Kyrgyz Republic and Azerbaijan, the formal selection of schools occurs at or after age 15; however, informal selection starts as early as at the primary school level when schools begin differentiating students into classes according to their ability. For example, if there are 60 students of the same age group, they will be frequently divided by their academic ability into two classes of 30 students each, and taught using slightly different curricula. Thus, 30 ‘better’ students (in many cases, with more affluent or better educated parents) will get higher quality education than the other 30.

Polish vocational schools, which were an important part of the economy of the socialist system as well as part of the state-owned factories, suffered from the collapse of the economy, increasing unemployment and the absence of a plan to make the necessary changes within this part of the school system. The economic reforms seemed to come as a surprise, and vocational schools did not adapt curricula, teacher training and school management. As a result, graduates of the vocational schools had trouble finding jobs. Vocational education in Poland has never been in favour anyway; suddenly, it became extremely unpopular with both students and parents. Vocational schools used to take in students who were low achievers, and hired teachers who were unwanted by general secondary schools; as a result, outcomes suffered. Previous socialist legislation allowed for only 20 per cent of students to continue in general education after the age of 15. This low percentage was the direct result of the Communist Party policy that was focused on maintaining the dominant role of workers. Thus, at the beginning of the 1990s, Poland was among the European countries with the lowest participation rate in general secondary education and had the lowest rate of participation in higher education. In fact, for all of the second half of the twentieth century, most of the CEE/CIS countries made sure that access to higher education would be very limited, and access was based on academic as well as on non-academic criteria (quota for certain ethnic groups, enrolments based on orders from the Ministry of Planning, etc.).

When dramatic economic reforms started in the 1990s and eventually led to a free market, Poland had an immediate need for a better educated professional workforce. Individuals with skills could find better jobs, so the demand for higher education has grown exponentially. The free market took care of weak vocational schools: most of these schools were subsidized by factories and were not economically viable. The factories were losing money and could not afford these schools, so they were subsequently closed. However, the educational system was obliged to take care of the entire school-age population, thus the reform of the secondary system had to take place. The number of students in vocational schools was cut to a minimum; general secondary schools benefited from extended school autonomy, deregulation of the curricula, and a free market for textbooks, and thus were able to attract more students. Most of their graduates desired a tertiary academic education,
which served as a good motivation for learning.\textsuperscript{81} As a result, the number of students in tertiary institutions has nearly quadrupled in 10 years, from 400,000 in 1991, to 1.6 million in 2001, with corresponding net enrolment rates rising from 10 per cent to 31 per cent. Such significant increase in participation was possible due to changes in the system of financing of state universities based on the number of students, charging fees from students of evening and correspondence courses in public higher education, and allowing for private higher education institutions. Consequently, access to higher education became easier, and many secondary school graduates have seized the new opportunity. They rightly believed that with a higher education diploma, their chances for better employment would improve.

Another important effect of that change was that only a few secondary school graduates were interested in continuing in post-secondary, non-higher education.\textsuperscript{82} When the problem of access was solved, the issue of quality had to be addressed. Therefore, in 1998, the Ministry of Education adopted a major structural change (applied in 1999) by extending the mandatory eight years of primary education to nine years; students were to choose their educational path only after they reached the age of 15.\textsuperscript{83}

Shortly after the parliamentary elections in 1997, the new government presented a package of four reforms covering the pension system, administration, health and education. The aims and preliminary concept of the reform of the education system were defined in a policy document presented by the Minister of National Education in January 1998. The following goals were set for the reform:

- Raising the level of educational attainment in society by increasing the number of those holding secondary and higher education qualifications;
- Ensuring equal educational opportunities;
- Supporting improvement in the quality of education viewed as an integral process of upbringing and instructing.

It was decided that the previous structure of education – an eight-year primary school followed by a four-year general secondary school or a three-year vocational school – would be replaced with a system described in brief as ‘6+3+3’. This meant that the duration of education in primary school would be reduced to six years. Following primary school, the pupil would continue his or her education in a three-year gymnasium, and only upon completion would he or she move on to a three-year general secondary school (specialized lycée) or a two-year vocational school. The structural reform thus postponed by one year the need to choose between general and vocational education at the secondary level.

As we saw in Sections 2d and 3b, this reform was associated with an overall improvement in performance, as well as in a reduction in between-school variance. Poland’s overall performance rose initially, thanks to big improvements among lower-performing students. How can this improvement be explained? Researchers have offered different hypotheses, looking for correlations between the improvement of student performance and school resources, the quality of school equipment, teachers’ qualifications, selection and class composition, the student-teacher ratio and school size. No correlation has been identified. There are two possible explanations. One is that in 2000, basic vocational school students ‘labeled’ as low achievers did not make much effort to answer the questions and solve the problems included in the PISA test. In 2003 and 2006, the attitude

\textsuperscript{81} Wiśniewski 2007, p. 5

\textsuperscript{82} Wiśniewski 2007, p. 9

had changed in the mixed classes in lower secondary schools, and even weaker students tried to perform as well as they could. Another valid explanation refers to the introduction of the national tests in Polish schools in 2002. The PISA students of 2003 had gained experience in preparing and taking exams at primary school level and being trained for the final exam in gymnasium. The 15-year-old student of 2000 did not have such experience. Only those who attended secondary school had passed the entrance exams, which were more similar to traditional class exercises than to the PISA questionnaire.

School Attendance

For many CEE/CIS countries, absenteeism has become a major obstacle to providing quality education for all since the early 1990s. According to a 2005 study sponsored by UNICEF and the Kyrgyzstan Ministry of Education, 22 per cent of 15-year-old students (the PISA testing age) are absent from school on any given day – the highest rate among all age groups. The reasons for such absenteeism vary from field work during the harvest season for rural schools, in fall and spring, to lack of warm clothes in winter, to poor health care.

In Azerbaijan, the rate of absenteeism of 15-year-olds is even higher. However, it is practically impossible to track actual numbers, as absentees are not recorded by schools, which fear sanctions from local and educational authorities. Rural schools in both Azerbaijan and the Kyrgyz Republic have problems with children involved in farm work, while urban schools in Azerbaijan have over 80 per cent of children engaged in private tutoring and not attending schools. Students who choose not to attend schools and instead study with tutors are preparing for the national standardized exam, and are never reported as missing from school. Passing this exam is the only way to gain admission to institutions of higher education, which explains why both students and their parents consider preparing for this exam to be of much higher importance than attending regular classes.

Thus, absenteeism is not a homogeneous phenomenon; instead, it falls into two polar types. The first type of absenteeism is related to poverty: when students do not attend schools due to lack of clothes, books or the need to help families. This type is most widespread in the Kyrgyz Republic, Bulgaria and Romania (especially among ethnic minorities). The second type of absenteeism relates to poor school quality: it results when parents need to hire private tutors because of their concern with public education. This is particularly common in Azerbaijan. The rates of private tutoring can be high in countries that performed quite well on PISA; for example, in Poland, where more than 50 per cent of students reported to be tutored. However, only 9 per cent of these students claimed they used private tutors because they were not happy with the quality of their mainstream education.

Preschool Education

There is a striking difference in attention paid towards preschool education between the CEE/CIS countries that performed well, and those that performed poorly. For example, 100 per cent of six-year-old preschool children in Estonia are involved in some form of education, as are 97 per cent in Poland. By comparison, less than 29 per cent of children are attending preschool in Montenegro.

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84 El Pikir Public Opinion Center 2007, p. 82.
85 Briller 2004, p. 10
86 Silova and Bray, 2006, p. 3.
87 Silova and Bray 2006, p. 4.
88 Ojala and Leida 2007, p. 206
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13 per cent in Azerbaijan and less than 7 per cent in the Kyrgyz Republic (see also Figure 23 showing preschool enrolment rates vs. average performance). A thorough study analysing the relationship between early childhood education attendance and further student performance in secondary schools would be helpful.

Croatia, among very few CEE/CIS countries, has placed considerable attention on preschool education, changing and diversifying its curriculum. It now offers Montessori, Waldorf and other types of preschool educational opportunities, as well as traditional childcare and basic development. Although preschool education is not mandatory, the percentage of children aged between four and seven years old enrolled in preschool institutions increased from 31 per cent in 1996, to 45 per cent in 2006.

Early childhood education (ECE) is clearly very important for student achievement at later school stages; however, it would be overly simplistic to imply direct correlation between ECE involvement and PISA scores. Much more likely is the notion that by providing earlier access to quality education, countries create necessary prerequisites for further success in high school achievement – especially if ECE means early childhood development and not early childhood care.

Figure 23  Preschool enrolment rates vs. mean average performance in PISA science, reading and mathematics, 2006

Due to differing educational structures, enrolment data reflects children aged 3-5 in Azerbaijan, the Czech Republic and Slovakia.

Source: UNICEF 2008; OECD 2006, Tables 2.1c, 6.1c, 6.2c.

5d. Summary of policy challenges and strategies in CEE/CIS
In brief, the countries that performed poorly on PISA share many similarities:
• Poor preschool coverage;
• Inconsistent and outdated curriculum;

90 UNESCO, 2007, p.14
• Outdated textbooks and shortage of textbooks and teaching materials, especially in the languages other than official ones;
• Poor system of teacher pre-service and in-service training, and low incentives for the best individuals to come into the teaching profession;
• Poor school management system;
• Inadequate assessment practices and lack of attention to student learning outcomes.

The countries that performed well also have some things in common:
• A revised and thought-through curriculum;
• Well designed and carefully implemented teacher selection and training systems;
• A well established assessment system;
• Well designed system of student assessment with clearly defined learning outcomes.

The countries that performed well chose different routes to success; Estonia and Poland seem to be the examples to follow in the region, achieving both quality and consistent learning outcomes across schools. Poland dealt particularly well with low performing students, with a large improvement since 2000, while Estonia showed an excellent overall performance that was higher than the OECD average, and among the best, especially in science. We have also seen examples of educational development from Croatia and Slovenia, relating to curriculum and assessment, and from selected OECD countries such as Finland and Singapore, relating to teacher selection and training. The analysis of such policy factors leads us to the following recommendations.

5e. Policy Recommendations

1. Align the curriculum with modern skill needs in the areas of reading, mathematics, science and information literacy. Appropriate curricula should be developed in each discipline area by scientists, practitioners, teachers, politicians and other related stakeholders. The curricula should be directed towards developing adequate competencies at the levels that will advance a country’s economy and promote citizenship, democracy and values designated by the curriculum development group. Student learning outcomes for each educational level should be clearly defined. All students need to attain certain outcomes in order to become lifelong learners, achieve their potential in their personal and working lives and play an active part in civic and economic life. These outcomes apply across all learning areas and are the responsibility of all teachers. The statement of each outcome should be accompanied by a more detailed description of that outcome. Each description should include a number of examples of the ways in which students might demonstrate progress towards the outcome at different stages in their schooling from early childhood education to the end of secondary school.

2. Develop high quality materials and textbooks. Combine curriculum content with teaching materials, teaching methods, technology and a variety of assessment forms. The task of developing quality textbooks is especially important for countries with multiple languages of teaching, such as the Kyrgyz Republic, but even for countries such as Azerbaijan that do not have quality textbooks in their own language and insufficient human resources to develop adequate materials.

3. Make immediate effort to deal with teacher shortage in Bulgaria, Kyrgyz Republic, Azerbaijan, Croatia, Montenegro, Romania and Serbia. While student enrolments in these countries are rising rapidly, many teachers are nearing retirement (between 4 and 8 per cent of the labour force, depending on the country). Teacher recruitment problems, which have reached crisis proportions in some areas, are most acute in rural schools, especially for high-need subject areas.
such as mathematics, science and languages. Low teacher salaries are a significant deterrent to recruitment. Teachers are still paid less than professions that require comparable education and skills. They are still not valued and respected as they should be, considering their contribution to society. Some countries try to provide incentives to attract students to the teaching profession by offering subsidized apartments or small bonuses; however, much more radical approaches are needed. The government should provide significant monetary incentives so that teachers are paid commensurate with the importance of their job. At the same time, teachers should be better selected and better trained in pre-service as well as in-service institutions. Other measures can include: reforming teacher and principal compensation systems so that teachers and principals are rewarded for increases in student achievement; and increasing the number of effective teachers teaching poor, minority, and disadvantaged students in hard-to-staff subjects.

4. **Initiate a nationwide effort in each country to improve teacher quality.** Teachers are key to any educational system; the shortage and poor quality of teachers has proved to be a major indicator of failure. Teacher improvement should include both pre-service and in-service training that should focus on knowledge and understanding of curriculum at a much higher level than is expected of students; mastery of appropriate teaching methods; mastery of formative assessment techniques (used as feedback to improve learning), as well as summative assessment techniques (used to evaluate learning achieved); curriculum leadership and quality assurance.

5. **Improve preschool coverage and preschool education.** Students who start primary school without having attended pre-primary school may have difficulty catching up with their more advanced peers. The example of Estonia clearly points to the importance of an early start. Children who participate in high-quality early childhood education develop better language skills, score higher in school-readiness tests and have better social skills and fewer behavioral problems once they enter school. According to Reynolds’ study of a programme in Chicago, children with high-quality early learning experiences are 40 per cent less likely to need special education or be held back a grade; they outperformed those who did not have such experiences on school achievement tests between ages 9 and 14; they are 30 per cent more likely to graduate from high school; are more than twice as likely to go to college; and they are less likely to be school dropouts, dependent on welfare or arrested for criminal activity. Adults who participated in high-quality early learning experiences had higher median annual earnings and were more likely to be homeowners. Early education is one of the most promising tools in helping children from disadvantaged backgrounds to overcome the handicap of lack of stimulation and development. Effective school readiness programmes are known to make a substantial difference for children’s ability to benefit from compulsory education at age 6. Research also suggests that children from backgrounds where the language is other than that of the school may be more successful in school if they participate in preschool or kindergarten programmes that use their first language for instruction. Thus, early childhood development programmes are a crucial response to the issue of inequitable outcomes of schooling.

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92 Reynolds et al. 2001, p. 2
93 Schweinhart et al. 2004, p. 3
94 Berreuta-Clement et al. 1984, p. 104-105
95 Cummins 1989, p. 3
6. **Develop assessment capacity at each level, beginning with the classroom teacher up to education minister.** While teachers should be involved in mastering precise methods of assessment to improve learning, school management should be involved in summative evaluation for planning and accountability purposes. Currently, schools in CEE/CIS countries are not viewed by the public as transparent or sufficiently accountable. Clear standards and outcomes should be established at completion of each stage – primary, secondary and tertiary. Assessment strategies should include targets for student performance and basic competencies expected of students. These strategies will be enhanced by rigorous external testing at the end of each stage. The results should be regularly analysed and improvement plans developed. The reviews of student progress should be made public.

7. **Improve leadership quality at each level.** Especially in the CEE/CIS countries, where most of the educators have gone through the experience of authoritarian governance, the quality of school leadership is critical to raising the standards of teaching and learning. Teachers will not volunteer to do much without sufficient support from their leaders. The most effective school leaders should be identified and encouraged to lead educational systems and networks with appropriate training and remuneration. This type of leadership should be expanded to the regional and national levels as well. Current school leaders should be trained at in-service institutions; in addition, the programmes for pre-service school manager training should be developed in countries that currently do not have any, such as Azerbaijan, Bulgaria, Croatia, Kyrgyz Republic, Montenegro, Romania and Serbia. In the Russian Federation and Turkey, school managers are trained but on a very limited scale, and the training has not proved to be effective.

8. **Improve educational funding management.** Educational funding in most of the CEE/CIS countries is insufficient; at the same time, even those scarce funds are not managed well. For example, in the Kyrgyz Republic, education received 6.7 per cent of the GDP in 2008. Percentage-wise, this is more than in many other countries that have outperformed the Kyrgyz Republic on PISA by a wide margin. Closer analysis showed that money is not managed well; in many cases, this happens because school administrators are not trained in budget management or strategic planning.
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## ANNEX

### Figure 24  Multiple comparisons of mean performance, PISA 2006

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<th>Reading scale</th>
<th>Poland</th>
<th>Estonia</th>
<th>Slovenia</th>
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<td>(1.0)</td>
<td>(4.2)</td>
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<td>(4.3)</td>
<td>(6.9)</td>
<td>(3.5)</td>
<td>(4.7)</td>
<td>(1.2)</td>
<td>(3.1)</td>
<td>(3.5)</td>
</tr>
</tbody>
</table>

- Mean performance statistically significantly higher than in comparison country.
- No statistically significant difference from comparison country.
- Mean performance statistically significantly lower than in comparison country.

Scores on dark blue background are above the OECD average, scores on light blue background are not different from the OECD average, while scores on white background are below the OECD average, all with statistical significance. Scores on a dotted background are below the CEE/CIS average.

Source: OECD 2007, Figures 6.8a
### Figure 24  Multiple comparisons of mean performance, PISA 2006 (cont.)

<table>
<thead>
<tr>
<th>Mathematics scale</th>
<th>Estonia</th>
<th>Czech Republic</th>
<th>Slovenia</th>
<th>Poland</th>
<th>Slovakia</th>
<th>Hungary</th>
<th>Lithuania</th>
<th>Latvia</th>
<th>Russian Federation</th>
<th>Croatia</th>
<th>Serbia</th>
<th>Turkey</th>
<th>Romania</th>
<th>Bulgaria</th>
<th>Montenegro</th>
<th>Kyrgyz Republic</th>
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<tbody>
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<td>413</td>
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<td>(3.6)</td>
<td>(1.0)</td>
<td>(2.4)</td>
<td>(2.8)</td>
<td>(2.9)</td>
<td>(2.9)</td>
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<td>(3.9)</td>
<td>(2.4)</td>
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<td>(4.9)</td>
<td>(4.2)</td>
<td>(6.1)</td>
<td>(1.4)</td>
<td>(3.4)</td>
</tr>
</tbody>
</table>

- **Estonia**: 515 (2.7)
- **Czech Republic**: 510 (3.6)
- **Slovenia**: 504 (1.0)
- **Poland**: 495 (2.4)
- **Slovakia**: 492 (2.8)
- **Hungary**: 491 (2.9)
- **Lithuania**: 486 (2.9)
- **Latvia**: 486 (3.0)
- **Russian Federation**: 476 (3.9)
- **Croatia**: 467 (2.4)
- **Serbia**: 435 (3.5)
- **Turkey**: 424 (4.9)
- **Romania**: 415 (4.2)
- **Bulgaria**: 413 (6.1)
- **Montenegro**: 399 (1.4)
- **Kyrgyz Republic**: 311 (3.4)

▲ Mean performance statistically significantly higher than in comparison country.

No statistically significant difference from comparison country.

▼ Mean performance statistically significantly lower than in comparison country.

Source: OECD 2007, Figures 6.20a
## Figure 24  Multiple comparisons of mean performance, PISA 2006 (cont.)

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<th>Science scale</th>
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<th>Czech Republic</th>
<th>Hungary</th>
<th>Poland</th>
<th>Croatia</th>
<th>Latvia</th>
<th>Slovakia</th>
<th>Lithuania</th>
<th>Russian Federation</th>
<th>Serbia</th>
<th>Bulgaria</th>
<th>Turkey</th>
<th>Romania</th>
<th>Montenegro</th>
<th>Azerbaijan</th>
<th>Kyrgyz Republic</th>
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<td>(1.1)</td>
<td>(3.5)</td>
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<td>(2.4)</td>
<td>(3.0)</td>
<td>(2.6)</td>
<td>(2.8)</td>
<td>(3.7)</td>
<td>(3.0)</td>
<td>(6.1)</td>
<td>(3.8)</td>
<td>(4.2)</td>
<td>(1.1)</td>
<td>(2.8)</td>
<td>(2.9)</td>
</tr>
</tbody>
</table>

↑ Mean performance statistically significantly higher than in comparison country.

No statistically significant difference from comparison country.

↓ Mean performance statistically significantly lower than in comparison country.

Source: OECD 2007, Figures 2.11b
Figure 25  Percentage of 15-year-old students at each literacy level on the reading scale, PISA 2006

<table>
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<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
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<tbody>
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<td>22</td>
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<td>28</td>
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<td>28</td>
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<tr>
<td>Serbia</td>
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<td>25</td>
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</tr>
<tr>
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<td>13</td>
<td>23</td>
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</table>

Countries are ranked in alphabetical order within country groupings.

Source: OECD 2006, Vol. II, Table 6.1a
### Figure 26  Percentage of 15-year-old students at each literacy level on the mathematics scale, PISA 2006

<table>
<thead>
<tr>
<th></th>
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<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
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<td><strong>UNICEF-programme countries</strong></td>
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<td>22</td>
<td>24</td>
<td>19</td>
<td>10</td>
</tr>
</tbody>
</table>

Countries are ranked in alphabetical order within country groupings.

*Source: OECD 2006 vol.II, Table 6.2a*
Figure 27  Percentage of 15-year-old students at each literacy level on the science scale, PISA 2006

<table>
<thead>
<tr>
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<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNICEF-programme countries</strong></td>
<td></td>
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<td></td>
</tr>
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Countries are ranked in alphabetical order within country groupings.

*Source: OECD 2006, Vol. II, Table 2.1a*
**Figure 28** Multiple comparisons of difference between 95th and 5th percentile, PISA 2006

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<th>Slovakia</th>
<th>Kyrgyz Republic</th>
<th>Poland</th>
<th>Lithuania</th>
<th>Hungary</th>
<th>Russian Federation</th>
<th>Turkey</th>
<th>Serbia</th>
<th>Romania</th>
<th>Latvia</th>
<th>Montenegro</th>
<th>Croatia</th>
<th>Slovenia</th>
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<td>(7.6)</td>
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- ▲ Difference (95th–5th percentile) statistically significantly higher than in comparison country.
- ▼ Difference (95th–5th percentile) statistically significantly lower than in comparison country.
- ▶ No statistically significant difference from comparison country.

Source: OECD 2006, Tables 6.1c
Figure 28  Multiple comparisons of difference between 95th and 5th percentile, PISA 2006 (cont.)

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- ▲ Difference (95th-5th percentile) statistically significantly higher than in comparison country.
- ◀ No statistically significant difference from comparison country.
- ▼ Difference (95th-5th percentile) statistically significantly lower than in comparison country.

Source: OECD 2006, Tables 6.2c
### Figure 28  Multiple comparisons of difference between 95th and 5th percentile, PISA 2006 (cont.)

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▲ Difference (95th-5th percentile) statistically significantly higher than in comparison country.

No statistically significant difference from comparison country.

▼ Difference (95th-5th percentile) statistically significantly lower than in comparison country.

Source: OECD 2006, Tables 2.1c
**Figure 29**  GDP per capita (in US$ converted using Purchasing Power Parities) vs. public expenditure on education as percentage of GDP, 2006

Figure 30  Mean average performance in PISA science, reading and mathematics vs. public expenditure on education per capita (in US$ converted using Purchasing Power Parities), 2006


No adjustment has been made for differing school-age populations in different countries.

LEARNING ACHIEVEMENT IN THE CEE/CIS REGION

A COMPARATIVE ANALYSIS OF THE RESULTS FROM THE 2006 PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)