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Quality of Education: International Comparison. Latvia in OECD Programme for International Student Assessment

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The 8th monograph of the series „Educational Research in Latvia" aims to provide an analysis of the most recent indicators characterising the quality of education in Latvia, and the contextual characteristics thereof. The analysis is based on the research data obtained in OECD PISA and other universally recognised international programmes. The result is intended to address the relevant development issues in the Latvian education – ensuring the equal opportunities to obtain good quality education everywhere in Latvia, the impact of students' socio-economic status on their study performance, optimisation of the school network, increase in the relative number of high-performing students, the effect of ICT use, the methodologies of teaching mathematics, testing, etc. The monograph, by using the data of international comparison, shows the rising educational quality levels in mathematics, science and reading in the schools of Latvia over the entire period of the country's independence and the current status among the world's developed countries. The monograph is intended for researchers and practitioners of education, education policy makers and supervisors, teachers, the masters' and doctoral programme students of the relevant fields.

The decision to publish the monograph "Quality of Education: International Comparison. Latvia in OECD Programme for International Student Assessment" was passed on 16.06.2015, at the meeting of the University of Latvia Faculty of Education, Psychology and Art Council (Minutes of the Meeting No. 2040/97).

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Content

Abbreviations

AHELO – Assessment of Higher Education Learning Outcomes

CIVED – Civic Education Study

COMPED – Computers in Education Study

EC – European Commission

ECER – European Conference on Educational Research

ECES – International Early Childhood Education Study

EERA – European Educational Research Association

ESF – European Social Fund

ESLC – European Survey on Language Competences

EU – European Union

FEPA – University of Latvia Faculty of Education, Psychology and Art

ICCS – International Civic and Citizenship Study

ICILS – International Computer and Information Literacy Study

ICT – Information and communication technologies

IEA – International Association for Evaluation of Educational Achievement

IER – University of Latvia Institute of Educational IRC – International Research Conference

MoES – Republic of Latvia Ministry of Education and Science LES – Language Education Study

NAEP – National Assessment of Educational Progress

NCE – National Centre for Education NDP – National Development Plan of Latvia

OECD – Organisation for Economic Cooperation and Development

PIAAC – Programme for the International Assessment of Adult Competencies

PIRLS – Progress in International Reading Literacy Study

PISA (SSNP) – Programme for International Student Assessment

RLS – Reading Literacy Study

SACMEQ – Southern Africa Consortium for Monitoring Educational Quality

SES – socio-economic status

SEDA – State Education Development Agency

SITES – Second Information Technology in Education Study

TALIS – Teaching and Learning International Study

TEDS-M – Teacher Education and Development Study in Mathematics

TIMSS – Trends in International Mathematics and Science Study

UL – University of Latvia

UNDP – United Nations Development Programme

UNESCO – United Nations Educational, Scientific and Cultural Organization

Introduction

Today welfare of countries greatly depends on human resources, opportunities to obtain competitive knowledge and skills, which can be successfully applied in people's lives. The education system should be of a good quality, ensure a possibility to acquire the necessary proficiency and strengthen young people's motivation and ability to continue education after leaving the school. All stakeholders – parents, students, teachers, education managers, education policy-makers, as well as the general public – should be informed about how well the respective education system can prepare young people for life. European Union's (EU) Strategic Framework of Education and Training (ET 2020) has defined improving the quality and efficiency of education as one of the four strategic objectives for education development by 2020 (*http://ec.europa.eu/education/policy/strategic-framework/index_en.htm*). One of the Republic of Latvia key education development policy documents is "Education Development Guidelines 2014-2020", and its main goal is "high-quality and inclusive education for personal development, human welfare, and sustainable national growth" (*http://polsis.mk.gov.lv/view.do?id=4781*).

Thus, education quality issues are among the most important in the development of national education systems. Fundamentally, the quality of education and its evaluation is not a simple concept, it is constantly in academic, practical and political focus of attention (see Subchapter 1.1.). There is an issue that emerges quite regularly in political debates concerning education in Latvia, that, firstly, an agreement is needed on what is denoted by the concept 'quality of education', what methods should be used to assess it, and only subsequently the respective steps in education policy and practice should be taken.

Currently the countries usually do not content themselves with using only their own national quality assessment. Usually, internationally recognized criteria, methods and assessments are taken into account, and Latvia is not an exception. Ever since Latvia regained its independence in 1991, our country has introduced and applied an education quality assessment method that has been developed and gained huge popularity all over the world for more than 55 years, ensuring a direct comparative assessment of what students in different countries know and can do in various areas.

International organizations – OECD (*Organisation for Economic Cooperation and Development, www.oecd.org*), IEA (*International Association for Evaluation of Educational Achievement, http://www.iea.nl*), EU – perform great organizational and research work: they develop scientifically justified, education assessment programmes that conform to high standards and methodologies. Based on the assessment results, these institutions elaborate recommendations for education policy to assist governments in addressing the issues in the sphere of education quality and those regarding enhancement of education system. In the modern globalized world, the results of regular international assessment programmes (OECD PISA (*Programme for International Student Assessment, www.pisa.oecd.org*), IEA TIMSS (*Trends in International Mathematics and Science Study*), IEA PIRLS (*Progress in International Reading Literacy Study, http://www.iea.nl/current_studies.html*), etc.) – involving about 80 countries in total, which include all the industrially developed countries, always cause an extensive response in the world; these results are being analysed and used by EU, OECD, UNESCO (*United Nations Educational, Scientific and Cultural Organization*), the World Bank and other institutions, as well as the participating countries.

Each of the countries participating in research programmes attach a great importance to the performance level of its students in comparison to their peers all over the world, and, furthermore, benefits from additional internationally evaluated comparative information, thereby enhancing its education system and undertaking required reforms. For example, structural reforms of education system are a very important aspect of policy in Latvia, the need of which has been widely discussed in recent years. A certain downsizing of school system is also intended thereof, as well as optimization of school network due to significant decrease in number of students (approximately by half) caused both by demographic reasons and migration of population to other countries. Reforms of school networks should be linked to education quality provided by schools; many other indicators are required that can be found in international education studies. Indeed, it turns out that already 15 years ago researchers, basing on results of international comparative assessments of education have suggested school network reforms in Latvia (see, e.g., A. Kangro (2000), A. Kangro (2002), A. Geske, A. Kangro (2004)), which only now (i.e., in 2014) are included in "Declaration of the Intended Activities of the Cabinet of Ministers Headed by Laimdota Straujuma" (*http://www.pkc.gov.lv/images/LS_MK_deklaracija.pdf*) and subject to vigorous political discussions.

Ultimately it comes to evidence-based education policy decision making, which today to a great extent is founded on internationally obtained data and analysis. All developed countries work toward improvement of their education systems and participate in international comparative assessments dedicated to education, obtaining and accumulating internationally recognized and significant data characterising the quality of their education system and many of its contextual characteristics, and regularly receive international expertise regarding various aspects. Of course, implementing the research results in education policy directly depends on the countries participating in the research, the same goes for appropriate detailed national analysis (i.e. secondary analysis of international research data).

All monographs of the series "Educational Research in Latvia", like many other publications of monograph authors, are devoted to analysis of Latvian results in international comparative evaluation and assessment of education.

The 8th monograph of the series – "Quality of Education: International Comparison. Latvia in OECD Programme for International Student Assessment" is aimed at the analysis of the most recent education quality indicators in Latvia and their contextual characteristics in international comparison, to perform their secondary analysis in order to address the current education development issues in Latvia. The publication predominantly draws on the most recent data (OECD PISA 2012), however, researchers exercise one of the major advantages characteristic to this cyclical research – the opportunity (and, simultaneously, the necessity) to compare the changes over time that have affected any particular quality indicator or the factors affecting it. Consequently, many parameters have to be analysed in comparison with the data provided by PISA 2000, 2003, 2006, 2009. Thus, various trends are examined in the light of the entire OECD PISA data obtained within the previous cycles, as well as the data from IEA TIMSS and PIRLS cycles. The monograph is intended for researchers and practitioners in education, educational policy-makers and education managers, teachers, graduate students, whose interests lie in the respective sphere.

Chapter 1 of the current monograph focuses on the education quality assessment and general characterisation of OECD PISA. At the beginning of the chapter a whole set of quality assessment activities is highlighted – assessment of students, appraisal of teachers and school principals, evaluation of schools and education system in various countries in order to improve learning and to achieve the planned results thereof. The important role of student assessment is discussed by showing international comparative student performance assessment origin and its place in quality assessment activities as a whole. A brief description of IEA (since 1958) and OECD (since 1998) activity is provided, both in the context of developing regular international comparative assessment in the countries of the world, as well as the advancement of this research direction in Latvia since 1991. The problem of research result implementation in the education policy is studied particularly. The chapter provides a description of OECD PISA cycles and their main features.

Chapter 2 reflects the international comparative educational research methodology, describing the research sample selection and the research implementation process, performance scale and building proficiency levels, as well as formation of the context indices by using the survey data. Several of abovementioned issues have not yet been described in Latvian language, therefore this chapter could contribute to improved understanding of the rather complicated methodological issues.

Subchapter 3.1 examines the changes in trends of Latvian student average performance in mathematics, reading and science over a rather long period of time. OECD PISA cycles enable the comparison of quality levels since year 2000, using the assessment results obtained every three years. Results achieved by Latvian students in mathematics, science and reading in OECD programme overall have improved. IEA TIMSS initiated in 90s of the 20th century and subsequently also IEA PIRLS cycles and their continuation simultaneously with PISA cycles in the next decade provide an opportunity to assess the trends of education quality level in 49 countries around the world from 1995 to 2009. Publications cited in Subchapter 3.1 demonstrate that the average annual increase of Latvian education quality is the highest among all 49 countries, taking into account the results of Latvia not only in OECD PISA, but also in IEA research. Results of Latvia in IEA TIMSS and PIRLS until 2009 (after that Latvia temporarily ceased to participate in IEA research, remaining only in OECD PISA) were significantly above the average level of the participating countries and with an upward trend. Thus, essentially, in a long-term perspective – throughout the entire period after

Latvia regained its independence in 1991 – our education system has ensured an increase of education quality level.

Undoubtedly, this raises the question as to the currently attained level of education quality in Latvia in comparison to other countries. Subchapter 3.1 provides an answer to this question by using the results, which combine the data from PISA 2012 and TIMSS 2011 – Latvia is the 24th out of 76 countries. The analysis of Latvia's relative position in each OECD PISA cycle is performed, taking into account the total number of countries participating in the research. It is evident that Latvia takes a stable position on the average level among OECD countries or is close to it, but the performance of students in the new participating countries, whose number is growing, almost always is lower. Thus, the relative rank of Latvia among all the participating countries significantly improves.

Subchapter 3.1 mainly provide analysis of the Latvia's students' performance in an international context – OECD PISA tests, in the particular content area, respectively, mathematics, reading and science, but the continuation of Chapter 3 is devoted to performance of Latvia's students in relation to various contextual factors (e.g., socio-economic status of the family (SES), location of the school and the type of the school, school network, truancy, etc.), which, in essence, similarly affect student performance in any content area. Naturally, the most recent data is usually used for the purposes of illustration (i.e., PISA 2012 main content area – mathematics), although the analysis often deals also with other content areas and the previous PISA cycles.

Subchapter 3.2 examines the generally known student performance relation with student SES in the context of Latvia. It is shown that relation of student performance and family's material well-being, educational and cultural resources available at home, education and profession of parents (i.e. family SES) in Latvia in recent years has become somewhat more pronounced, as our country from being in a higher position, according to international comparison, has reached the average level of OECD countries in the field of equal opportunities in education. Thus, it is necessary to monitor the situation and look for the ways to help students from families with a lower SES and especially schools attended by greater number of these students, to achieve a higher study performance.

To characterise the situation more precisely, the Subchapter 3.2 continues by giving analysis of the average level of school SES, as well as the average school performance in Latvia within an international comparison. The level of school's SES is the particular factor that significantly influences student performance, comparing various schools in Latvia and also on the average in OECD countries. In this respect, the greatest attention should be directed toward the groups of schools with low SES and low performance, and average SES and low performance. There are 9.0% and 11.5% of students, respectively, that study in these schools in Latvia. The schools with low SES in Latvia are often located in areas with a less developed socio-economic level, therefore in this case the quality improvement is definitely also a matter of regional development. By contrast, in case of schools with low performance and average SES, the decisive improvement factor should be the analysis and advancement of educational work. This topic is further addressed in Subchapters 3.4 and 3.5 and other subchapters of the monograph by linking the previously described school performance and SES group with urbanization, type of school and other factors.

Subchapter 3.3 provides a performance analysis of the students who have a very high family SES (10% of students with the highest level of SES) comparing the situation in nine countries of the Baltic Sea region: Finland, Estonia, Latvia, Lithuania, Russia, Poland, Germany, Denmark and Sweden. Analysing the relation between performance in mathematics and reading, and the SES group, certain differences between the countries can be observed, especially in the lowest group of SES – Latvia, Lithuania and Germany have a pronounced sharp decline in performance. The analysis shows that the increase in performance of students with a high SES is positively related to support of teachers in students learning, discipline and student interest in the study subject.

Subchapter 3.4 commences with analysis of Latvia's student variation of performance distribution, which in Latvia has always been substantially below the average in OECD countries. Also, one of the components thereof – variation between schools – in Latvia is approximately two times smaller than the average in OECD. Thus, it can be concluded that the education system in Latvia overall provides an improved equity in education quality and students with different performance levels are studying in the same school more often than on the average in OECD countries. This analysis also shows that the relative number of students in Latvia in lowest and highest proficiency levels, which are defined according to OECD countries' average distribution, will be below the average in OECD, since the average student performance in Latvia is close to the OECD average, but the variation of performance distribution is smaller.

Following the general review of variation of performance distribution, Subchapter 6.4 proceeds with analysis of relationship between Latvia's student performance and the location of the school, type of school and study programme, students' gender. A particular attention is dedicated to the relatively large differences between rural and urban school performance, exposing one of the causes – significantly lower SES of rural students. A very significant difference between student SES in different types of schools in Latvia is revealed – from the highest level of SES in national gymnasiums to the lowest level in basic schools. Similar tendencies in differences can be observed with regard to the performance of students – the highest performance in gymnasiums, followed by secondary schools and the lowest performance in basic schools.

Subchapter 3.5 examines the relation that the autonomy level of Latvian school management, the number of students at school and in classroom, the high competition among schools has with student performance and a particularly important issue in our country – the optimization of school network. For example, number of fifteen year old students in Latvia has decreased by half in 10 years, number of students in general education day schools in Latvia since 1998 has decreased by 42%, while the number of teachers and schools has decreased only by 25%.

It is a situation where, on average, a higher student performance in Latvia can be observed in schools and classes with a greater number of students, however, it should be noted that this is also related to urbanization, SES of schools and students, and student selection procedures in schools. The relatively free choice of schools in Latvia foster the impact of parent SES on the choice of schools, the relative number of schools that are chosen by socio-economically most favourable families is rapidly decreasing (since 2006, the relative number of schools in Latvia chosen by families with very high SES has decreased from 75–77 % to 55%).

Optimization of school network is considered as an issue of state administrative territorial division and state's regional development, because it is not solely a matter of educational policy. The authors recommend during the school network optimization process, which includes merging, closure and transformation of schools, to take into account also the quality of education provided therein, and choosing appropriate methods for comparing the education quality level of individual schools – these are centralized exams, international comparative studies of education, particular quality monitoring activities in order to determine both the level of student performance and, possibly, its growth, etc., trying to take into account also student SES and overall SES of the school. With regard to research and implementation of research results into the policy, it is interesting to look at the publications by the authors released 15 years ago. Therein, based on TIMSS of 90s and other international assessment programmes in Latvia, it is proposed to implement the school network optimization reforms that are currently included in the government declaration on the measures to be taken and are subject to vigorous political discussion. Thus, international comparative research of education quality in Latvia for at least 20 years signals the need to devote particular attention to the school network and for opportunities to obtain education of equity in our country.

Chapter 4 is mostly dedicated to performance of Latvia's students and analysis of correlation with other factors with student skills and activities to ensure future career. Additional career module was included in student surveys in three PISA cycles, however, unfortunately it was not possible to perform a trend analysis as the questions included in the module were different in each cycle. In PISA 2012 cycle the answers of Latvian students to the questions about the performed activities that would assist in the choice of their further education and career, signal a relatively low student participation in different activities (for example, talks with career counsellors, shadow days, school and workplace visits, etc.). The exception is activities like information search over the Internet about secondary school or university study programmes, general career opportunities and filling in survey in order to find out one's interests and skills. This was done by 70-80% of students. These students, who apparently want to purposefully build their future education and career, had a higher performance in mathematics. On the other hand, it is alarming that only 14% of these are students from rural basic schools. Is not surprising, that, according to the opinion of the majority of students themselves, the skills required for online search of career-related information they have mastered outside school. At school they have dedicated more time to learn to write a summary of their qualifications and to prepare for a job interview. However, in this aspect the result of analysis is particularly important, showing that students from families with lower SES mostly have mastered all skills related to future careers at school rather than outside it, purposefully thinking about their future career.

Chapter 5 considers Latvia's students with high performance, who have reached proficiency level 5 and 6 in reading, mathematics or science in OECD PISA tests. The beginning of chapter is dedicated to differences between students with high performance and gifted students. The issue addressed in this chapter arises from the results of PISA cycles – the proportion of students in Latvia who have high performance is lower than the average in OECD countries, although overall student performance in Latvia coincides or is close to average performance of students from OECD countries.

However, the fact that the proportion of students with low and high performance is lower, in Latvia is also determined by smaller variation of performance distribution – less diversity in the quality of provided education (see Subchapter 3.4), nevertheless, it is very important to look for factors associated with higher performance of our students, which could potentially increase performance of students and proportion of students with high performance in Latvia.

Chapter 5 provides analysis using binomial logistic regression method, to explore the factors (indices) that would allow students of Latvia with performance from 500 to 600 points in reading, mathematics and science to join the group with performance exceeding 600 points. The result allowed to obtain both general factors, such as a higher education level of parents, and a number of factors specific to each content area, such as more frequent solving of formal mathematics tasks, overcoming unnecessary anxiety and insecurity in this subject, more frequent reading for pleasure, more correct learning strategy in order to comprehend and remember texts or write a text summary. High performance in science could be promoted by a number of specific factors, such as students being well-informed on environmental issues, confidence and satisfaction with their study results in science, a positive attitude about science's role in people's lives and development of society, and the possibility of tying their careers with science. The chapter also looks at the experience of countries with a large number of students in the highest performance levels. The results allow to offer a number of recommendations to education policy makers, school principals, teachers, parents and students.

The monograph reflects the result of shared, purposeful work of the authors, obtained in joint research and various seminars particularly during drafting of the monograph. Professor, *Dr. phys.* Andris Kangro has written the Introduction, Chapter 1, Subchapters 6.2, 6.4, 6.5 and the Summary, professor, *Dr. oec.* Andrejs Geske – Chapters 2, 4, 5, Subchapter 6.1 (together with A. Grīnfelds) and Subchapter 6.3, assistant professor, *Dr. admin.* Rita Kiseļova – Chapters 3, 7,10; professor, *Dr. phys.* Andris Grīnfelds – Subchapter 6.1 (together with A. Geske), Subchapter 6.6 and Chapter 8, PhD student Linda Mihno - Chapters 9 and 11. The monograph has been developed under scientific editorship of A. Kangro.

In Latvia the study of OECD PISA 2012 was supervised by Republic of Latvia Ministry of Education and Science (MoES), its implementation and pre-financing was commenced by the University of Latvia (UL), and since 2011 it was implemented by State Education Development Agency (SEDA) in close cooperation with researchers of the University of Latvia, Faculty of Education, Psychology and Art, Institute of Educational Research (director, prof. *Dr. oec.* A. Geske) in the framework of the project "Support to Education Studies" funded by European Social Fund, Agreement No. 2011/0011/1DP/1.2.2.3.2/11/IPIA/VIAA/001, UL reg. No. ESS2011/123. Advisory Council for supervision of the project delivery was established, chaired by the Director of *SEDA* Dita Traidās. PISA National project manager in Latvia is prof. *Dr. phys.* Andris Kangro, leading researchers (group managers): assist. professor. *Dr. admin.* Rita Kiseļova, prof. *Dr. phys.* Andris Grīnfelds, prof. *Dr. oec.* Andrejs Geske, PhD student Linda Mihno. Latvian representatives on the OECD PISA 2012 Governing Board are Dita Traidās, Director of SEDA European Union Lifelong Learning Programme Department Ennata Kivriņa and Andris Kangro. The abovementioned ESF project also supports implementation of PISA 2012 secondary analysis and publication of the results. Practically all the chapters in the monograph concerning the research data analysis and discussion thereof, also contain the elements of secondary analysis, while three main secondary studies advanced within the project are reflected in Chapters 6, 8, 9 and 10. Since 2014 Latvia is in accession process in OECD organization, therefore, currently there is a particularly pronounced interest in our country concerning participation in OECD programmes.

The results published in monograph have been widely announced and discussed with the key stakeholders – education policy makers and implementers, directors of education authorities, school principals, teachers, education researchers, representatives of parent organizations and journalists, postgraduate students of respective study directions – in several conferences with wide participation of parties involved. Thus, for example, the conference "Quality, Teaching and Learning in International Comparison. Latvia in OECD PISA and OECD TALIS programmes" held on 17.06.2015 in the *Aula Magna* of the University of Latvia brought together about 150 participants.

On the forum of directors of general and vocational education establishments and municipal education specialists "Education in Crossroads: Opportunities and Choices" held on 19.08.2015 with approximately one thousand participants, a report "Equity in Education of Latvia: International Comparison" was discussed, considering the international comparative research results and recommendations for Latvian education policy making. There have been other conferences where the results of the latest OECD PISA and other international studies are announced and discussed, press conferences, seminars at the School Boards and schools, regular meetings of project Advisory Council, special consultations with heads of MoES and with OECD representatives during Latvia's accession negotiations. Mass media have shown a great interest with regard to the results of OECD PISA data analysis, for example, information about the equity issues and quality of education in Latvia, rural schools, necessity to optimise the network of education institutions, and other matters. The main daily news programme at Latvian National Television Channel 1 "*Panorāma*" dedicated 12 exclusively prepared news stories "School as opportunity" (I. Spriņģe), broadcasted in September 2015, organised the TV discussion "Direct speech", and National Radio of Latvia, Programme 1 dedicated a radio broadcast "Family Studio" to the issues addressed in research. Many publications appeared in newspapers and magazines of national and local level.

The results of secondary analysis have been regularly reported in international scientific conferences, for example, the annual European Conference on Educational Research, organized by European Educational Research Association (EERA), as well as in International Research Conference (IEA IRC) organized by International Association for Evaluation of Educational Achievement (IEA).

All the international comparative educational research comprehensive databases are available to researchers and interested parties globally (*http://www.oecd.org/pisa/pisaproducts/, http://www.iea.nl/data.html*). New instruments for more convenient use of the databases are being constantly developed and are available to all

(*http://www.iea.nl/fileadmin/user_upload/IEA_Software/Installing_the_IDB_ Analyzer__Version_3_0_.pdf*). A further joint database has been created (*Cross – Time, Cross – System – XTXS*), containing both IEA and OECD organized international comparative research data as well as other UNESCO, World Bank, United Nations Development Programme (UNDP), *Statistics Canada* and other databases, encompassing 232 education systems (*http://www.iea.nl/data.html*). Currently within the framework of the implemented OECD PISA 2015 cycle student testing in most countries, including Latvia, is already fully computer-based, thus marking a new level in student assessment development.

The authors express their gratitude to the tens of thousands of Latvian students, hundreds of teachers and school principals for participation in research cycles, hoping that the achieved results in comparison with the most advanced countries of the world will yield a certain satisfaction and strengthen their self-confidence, while bestowing new energy and ideas for future education development path.

The authors would particularly like to thank the reviewers Dr. admin. Ieva Johansone (Boston College, USA) and Dr. admin. Andris Sarnovičs (BA School of Business and Finance (Banku augstskola), Latvia) for the input of developing the monograph, to the Ministry of Education and Science representatives for continuous interest in the progress of research and the obtained results, and the colleagues from State Education Development Agency for their constructive cooperation on a daily basis.

1. Evaluation of the Quality of Education and General Characteristics of OECD PISA

1. International Assessment of Students' Educational Achievement

In order to improve the learning and teaching process and to achieve the educational targets, a whole range of education quality evaluation activities and tools is being developed and used globally, including evaluation and assessment of students, teachers, school principals, education establishments and systems. Different countries choose different emphases and approaches (OECD, 2013d; Scheerens, Glas, Thomas, 2003; European Commission, 2015), determined by traditions, infrastructure, the capacity of human resources, assessment practices and political understandings. Overall, quality assessment has played an increasingly important role in the national education systems over the last 30 years. Naturally, a question arises of balanced, harmonized and efficient implementation of all the components of evaluation and assessment. A question of even greater importance concerns the purposeful use of the quality evaluation results in order to verify (through licensing, accreditation, certification procedures) the credibility of the defined and achieved quality levels and to demonstrate and actually improve the quality of the learning process, the teacher's work in the classroom, teachers' training and further education, development of the school system, etc.

Assessment of student performance, too, is diverse and essential (OECD, 2013d; OECD, 2005c; National Testing ..., 2009; Fitz-Gibbon, 1996). On everyday basis, students are assessed in various subjects by their teachers, they take compulsory centralized exams with assignments developed and results evaluated outside school. Everyday classroom performance assessment (formative assessment) and the marks given by teachers are important for the learning process, and the most significant indicator of academic progress for an individual student and his/her parents, yet they are not applicable for the comparison of student performance on a national or international scale.

The international comparative education studies have been evolving worldwide already since 1958 (Ross, Genevois, 2006; Papanastasio, Plomp, Papanastasio, 2011);

where the main methodological approach is comparative assessment of students' knowledge, skills and attitude to various curriculum areas, such as mathematics, science, reading, foreign language, information and communication technology, finance, civic education, etc., using standardized tests and questionnaires. In such studies, the student's test results cannot be used individually, but in an aggregated form, as the main object of the study ultimately is the overall national performance of students and also the performance of sizeable segments, such as urban and rural schools, various types of schools, different regions, families of different social and economic backgrounds, boys and girls, etc. Purposefully created questionnaires of students, school principals, teachers, parents, education experts provide an extensive characterisation of the education processes in various countries and allow implementing a comparative analysis of the common and different relations between the student performance and the contextual factors at the level of education system, school, family and student. Test items are developed with the focus on the modern framework structure assessing, for instance, the student's ability to apply the knowledge in real-life situations. The items are numerous, covering a wide range of content (different groups of students receive different sets of items, containing, however, a part that is common to all). Normally, at least a half of the items requires the student to demonstrate an appropriate solution rather than choose from a number of answers (see chapter 2).

Thus, the founders of this direction have come up with the idea of "the world as an education laboratory" (Husen, Postlethwaite, 1996); we are able to compare and analyze education systems, processes, practices and policies in the countries with different student performance and, possibly, we can understand better, which methods and what education policy can ensure a higher student performance in our country. One of the reasons, why such comparative studies of education were initiated in the 1960s of the 20th century, was the upsurge of students from abroad at the universities of North America and Western Europe. Thus, a great disparity in the quality and level of secondary education in different countries and parts of the world can be observed. The development of research direction also has been triggered by recognizing the education as one of the factors ensuring a country's economic, technological and military progress. State governments and international organizations prepared many questions for the researchers, for example, what role was played by the quality the education in the USSR as the country that launched the first artificial satellite into the Earth orbit in 1957, and in Taiwan's and Japan' spectacular technological breakthrough? Consequently, large scale comparative international studies of student performance were initiated in a wide context of education system, and the IEA was founded to develop and manage such studies.

Currently, 64 countries representing all continents are taking part in IEA activities and carrying out comparative international studies in education *(http://www.iea.nl/institutional_members.html)*. IEA conducts the studies including PIRLS 2016, ICCS 2016 *(International Civic and Citizenship Study),* TIMSS 2015 and ECES *(International Early Childhood Education Study),* and prepares research like ICILS 2018 *(International Computer and Information Literacy Study)* and ETLS *(English Teaching and Learning Study).*

Since 1998, under the leadership of Andreas Schleicher, OECD has initiated the cycles of OECD PISA *(www.pisa.oecd.org)*; at present already the 6th cycle (PISA 2015) and 7th cycle (PISA 2018) is taking place. Within PISA, OECD assesses to what extent fifteen year old students, who are about to finish lower secondary education (in Latvia – basic education), have acquired the knowledge and skills necessary for the full participation in civil society, and the ability of students to analyze the experience gained at school and apply it to different life situations outside school and in further education. The objectives of OECD PISA are set to help develop and introduce the evidence-based education policy and national education reforms while fostering labour market and competition. Therefore, the cycles of studies are regularly implemented, fully internationally verified, and comparable databases are created for analysis generating recommendations applicable to education.

OECD also conducts a study on teachers and learning environment: OECD TALIS 2013 *(Teaching and Learning International Study, http://www.oecd.org/edu/school/talis-2013-results.htm)* and a study on adult competencies: PIAAC *(Programme for the International Assessment of Adult Competencies),* etc. The European Union has accomplished a study on foreign language competencies: ESLC *(European Survey on Language Competences, http://ec.europa.eu/languages/policy/strategic-framework/documents/language-survey-final-report_en.pdf)*. The African countries are engaged in similar studies within the framework of SACMEO *(The Southern and Eastern Africa Consortium for Monitoring Education Quality)* (Ross, Genevois, 2006).

The studies mainly embrace the primary school students (grades 3 to 4) and those attending the last grades of the basic school (grades 8 to 9 or 15-year-olds), assuming that on these levels of education the best comparison of school education in different countries and continents can be achieved by measuring the basic competencies acquired in compulsory education. However, in several cases analogical studies have been conducted in upper secondary schools (such as TIMSS *Advanced*), modified studies are carried out also for pre-school educational institutions (IEA ECES) and for adults OECD PIAAC, OECD IALS *(International Adult Literacy Survey)* and OECD ALL *(Adult Literacy and Life Skills Survey)*, based on surveys and testing at research participants' homes.

So far, the efforts to introduce such direct assessments of the quality of education in higher education have not been successful, although from 2009 to 2013 OECD has carried out a wide feasibility study AHELO *(Assessment of Higher Education Learning Outcomes)* (Tremblay, Lalancette, Roseveare, 2012), involving 248 higher education institutions, 23 000 students and 4800 academics from 17 countries. AHELO feasibility study included last year students of bachelor's level studies in economics, engineering or any other area, who had to complete computer based tests in economics or engineering, or take a test of generic skills. Large scale comparative studies to explore teachers' work also are carried out, which either give simultaneous assessment of student knowledge and skills (IEA TEDS-M *(Teacher Education and Development Study in Mathematics)* study on mathematics teachers), or do not (OECD TALIS 2013). However, OECD TALIS 2013 strives to connect teachers' work with the level of their students' performance, using data on student performance from OECD PISA 2012.

The rather complicated methodology of comparative international studies in education is being continuously developed, involving the best experts, particularly the complicated mathematical data procession methods. ICT development opportunities are used more widely, including the ongoing transition to computer-based assessment where students receive and complete tests on computer (OECD PISA, IEA ICILS, IEA PIRLS, IEA TIMSS, etc.).

When debating about the quality of education and searching for a suitable policy solution for education, in most countries globally the results from comparative international studies, such as OECD PISA, IEA PIRLS, IEA TIMSS etc., are used. International organizations in their analysis widely use education indicators derived from the comparative international studies (*OECD (Education at a Glance, Education Today* etc.), *EU (Key data on Education, Education and Training Monitor, Eurydice* reports etc.), UNESCO *(Education for All* etc.), analytical reports of World Bank). Europe 2020 strategy lays down EU targets in education for 2020, such as the relative number of students (less than 15%), who have low performance in mathematics, reading and science, data acquired within the framework of OECD PISA *(http://ec.europa.eu/education/policy/strategic-framework/index_en.htm)*. The results of Latvia in OECD PISA cycles have been included in OECD's annual editions of Education at a Glance. Education Indicators encompassing all cycles of the programme, and commencing with the edition of 2014, even more extensive data on Latvia is included, because Latvia has become involved in a programme of the OECD INES (Indicators of Education Systems). Naturally, the indicators obtained within OECD PISA assessment have been included in the main strategic documents of Latvia; for example, the *National Development Plan of Latvia for 2014–2020*, strategic objective "Development of Competencies" establishes that by 2020 the number of 15-year-old students with low reading literacy (the 1st level or below within OECD PISA), will be reduced by up to 13%, simultaneously increasing the number of students with higher levels of literacy: levels 4 and 5, by up to 9%.

Participation in comparative international studies on the quality of education and acquiring their implementation methodology provides an opportunity and stimulates countries to develop somewhat similar assessments on national level that are carried out by most of the OECD countries (Synergies for Better Learning: an International Perspective on Evaluation and Assessment, 2013). Objectives of such national studies can differ: to explore the impact of concrete reforms on the quality of education, to compare performance among different regions of a country, separate groups of schools or individual schools, etc. Such studies don't intend to use results of individual students, but the studies can be compulsory and results are assessed centrally. Methodology can be very similar to methodology of comparative international studies, but it can also differ, for example, studies can use all students in the selected grade group, not the statistical sample. Latvia hasn't carried out such national assessments.

Naturally, such extension and evolving of comparative international studies and the great attention paid to it by politicians, in particular to OECD PISA, also raises a scientific debate both on various aspects of assessment and on alternative explanations to the results achieved, and on the practical contribution of study results as regards education policy, and on the dominance of OECD PISA that is also referred to as emergence of global education governance (Meyer, Benavot, 2013; Nordin, Sundberg, 2014; Sahlgren, 2015; Wyatt-Smith, Cumming, 2009, Smith, 2016).

The issue of the development of evidence-based practical recommendations and its concurrent contribution to policy has always been topical, and comparative international studies in education aren't unique in this context. Such principles of policy development are usually recognized both by researchers and policy-makers. However, we can often hear discontent from policy-makers regarding insufficient contribution of studies, but researchers are discontent because their recommendations aren't implemented. The connection between study results and their implementation in education policy isn't direct and immediate. In order to promote more complete understanding of the situation and better cooperation among researchers and policy-makers, it is useful to take into consideration interaction of several powerful factors (Nordin, Sundberg, 2014, Ross, Genevois, 2006, pp.265–275).

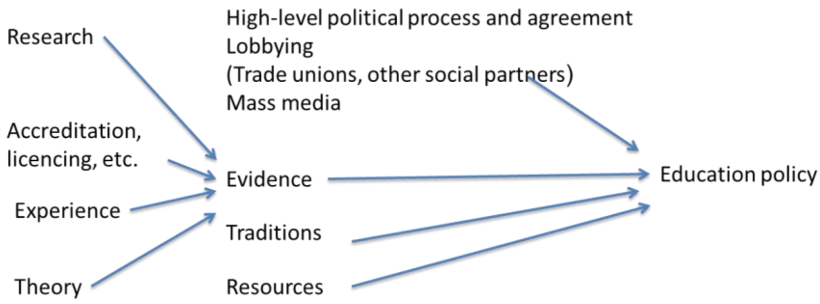


Figure 1.1

Interrelation between research and policy (Hegarty, 2014, p. 54)

Evidence to be used for political decisions can be derived not only from the research results provided by studies, but also from other evaluation (such as accreditation, etc.), practical experience, potentially also from scientific theories that have not been applied in the concrete studies. On the other hand, in order to implement results in real life, besides the evidence politicians must also take into account the policy defined by their parties or coalitions (for example, in Latvia they must consider the content of government declaration and decisions by the Coalition Council), the resources available, opinions and traditions of media and various actors, which uphold rather influential positions in the education system.

Latvia gained an opportunity to take part in comparative international studies only after its independence was restored, the USSR or its republics did not participate, ignoring invitations from IEA. The independent Latvia immediately accepted the invitation from IEA, because the newly sovereign state was interested to compare our education quality to other countries, to acquire internationally acknowledged comparative data characterising the strengths and weaknesses of Latvian education system, to obtain evidence-based insights for reforms. Ministry of Education and Science entrusted University of Latvia (UL) with this task. Consequently, the researchers from UL began to implement the relevant studies after state sovereignty was restored, in 1991–1992. Latvian researchers, using the advice from international experts, had to leap in the study programmes that had already begun, acquiring study methodology and carrying out research under pressing time constraints. This was the case with the IEA studies RLS (Reading Literacy Study) (national coordinator of the study was I. Dedze), COMPED (Computers in Education Study) (A. Grīnfelds) and TIMSS

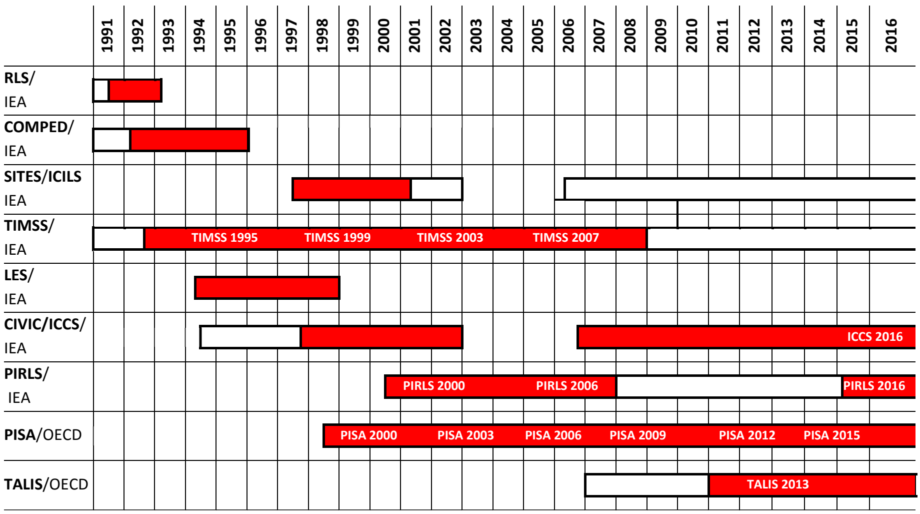


Figure 1.2.

Figure 1.2. depicts the time scale when Latvia joined the studies described above (coloured bars). Naturally, at first all the international contacts and initial study materials were in English, the allocated finances were rather limited, therefore, for example, participation in international study conferences for UL researchers was possible only with the financial help from the Soros Foundation Latvia or international study centres.

Soon after that, the first rather optimistic results were received: the last-year-students from the Latvian upper secondary schools took the 2nd place in the COMPED study, running up with the Austrian students, and just above the students from the USA and Slovenia. Thus, the initial introduction of informatics to the Latvian education system gave benefits to the international comparison (Grīnfelds, Kangro, 1996). Importantly, the experience and results from this international study were promptly used for the development of education in Latvia. MES invited researchers from UL (A. Kangro, A. Grīnfelds, etc.) to develop a standard for informatics, which was also one of the first standards in the newly created system of standards for study subjects in secondary schools of Latvia. The standard included many internationally acknowledged approaches of that time, for example, that students of informatics should acquire computer skills working with various data (text and graphic editors, databases, spreadsheets). On the other hand, COMPED study showed that Latvian teachers of informatics often focused on the basics of programming, therefore it was necessary to foster a further education of teachers in other directions and provide school computers with a corresponding software to be able to fully implement the new standard.

UL researchers, with the support from MES (Minister A. Piebalgs, Department Director J. Bokāns, etc.), became involved in comparative international studies of education very actively. In 1993, Latvia became an official member state of IEA, and A. Kangro represented Latvia at the General Assembly of IEA. UL in 1993, by the decision of its Senate and the recommendation of the Minister, formed the national institution of IEA in Latvia, the IEA National Research Center (headed by A. Kangro), and its opening ceremony was attended by Bill Loxley, Executive Director of the IEA, and researchers from Sweden, University of Latvia, officials from MES. In 1995, IEA entrusted UL with organizing the 36th General Assembly of the IEA, attended by education researchers, experts and ministry representatives from approximately 60 countries. Latvia and nine other countries learned the best global practice in comparative international studies of education with the help of a special IEA's project – IEA NCEE or IEA Network for Central/Eastern Europe (1993–1997), which included an extensive international learning programme, development of scientific collaboration, information exchange and creation of a specialized ICT basis.

University of Latvia continued its intensive participation in international research programmes (see Figure 1.2.), which increased the necessity to develop, as regards theory, methodology and infrastructure, the efforts of Latvia in scientific studies of comparative international education assessment as a part of education management science, based on internationally approved criteria and methods. Within institutional development, the next step after the foundation of the IEA National Research Center was to establish the Institute for Educational Research (IER) in 1996. The 1st director of the Institute was professor J. Zaķis, rector of the University of Latvia at that time (1996–1999), succeeded by professors A. Kangro and A. Geske (since 2013).

As a result, Latvia (LU UL IERI) successfully took part not only in OECD PISA 2000, but also in all the subsequent cycles of the programme: PISA 2003, 2006, 2009, 2012, and now is participating in the study cycles PISA 2015 and PISA 2018 (the National project manager of OECD PISA is A. Kangro). Russia successfully participated in the first cycle of OECD PISA, as well as the next cycles, but China has not yet completed any of the cycles, however, the students from Shanghai are achieving top results. Today, OECD PISA includes all the OECD, EU and other countries of the world, encompassing 80–90 countries.

We can conclude that the successful participation of ERI researchers in all cycles of OECD PISA created our scientific capacity and provided comparative results on the quality of our education among the most developed countries of the world, and, furthermore, brought Latvia nearer to full OECD membership. Currently, Latvia is under accession process to the OECD, and Latvia's results in OECD PISA cycles are being analysed.

Currently UL IER represents Latvia at OECD PISA and OECD TALIS *(Teaching and Learning International Study)* programmes, as well as at IEA and the studies thereof – ICCS 2016 and PIRLS 2016.

The total number of international studies and programmes performed by UL researchers already exceeds 20. Study results are regularly discussed with policy makers and implementers, school principals and teachers. They are published as monographs and books (for example, the series of monographs "Educational Research in Latvia" and books about particular study results), and international scientific magazines. Dissemination includes articles, scientific conferences, congresses and other events in Latvia and abroad.

Advancement of human resources, i.e., educating researchers how to work in the international comparative education research projects and to develop a suitable analytic potential for the Latvian education system, as well as up-to-date university programs in Latvia, is doubtlessly a very important issue. Learning from international experience, Faculty of Education, Psychology and Arts (FEPA) created a professional master's programme " Educational Management" (director A. Geske), a doctorate programme " Educational Management" (director A. Kangro), and other bachelor's and master's programmes including education research methods, education quality assessment, education management, etc. Professors A. Geske, A. Grīnfelds and A. Kangro are actively conducting the cycles of international studies, heading groups of researchers and supervising doctorate papers. I. Johansone, R. Kiseļova, R. Kalvāns, A. Ozola, R. Geske and I. Čekse, the former doctoral students of educational management, today – doctors of science, have elaborated their doctorate thesis in the area of comparative international studies of education. They continue their academic work and international research at FEPA and IER, working at the TIMSS and PIRLS International Study Center at Boston College (USA) (I.Johansone), or contributing to education policy at MES (R.Kalvāns).

The successful involvement in IEA's studies for 25 years since Latvia regained its independence in 1991, and in entire OECD PISA for the duration of 18 years, since the programme was opened, undoubtedly has brought Latvia nearer to understanding globally highest standards and approaches to education quality assessment and improvement, simultaneously gathering the corresponding scientific potential, experience and internationally acknowledged basis of data and knowledge to enable making informed decisions in education management. Moreover, the collected data demonstrate, for example, that the quality of education in Latvia ascends. The most recent data analysis (OECD, 2015b) shows that, according to the data from TIMSS, PIRLS of the IEA and OECD PISA for a period from 1995 to 2009, Latvia has the highest growth in education quality compared to other countries that have participated in these cycles of international education quality assessment. International assessments show Latvia as a country that has successfully managed to reform its education system *(PISA in FOCUS 2013/11)*, and a place where students' performance level, based on the data of OECD PISA and IEA TIMSS, has risen from " fair" to "good" thanks to many concrete reforms in education system (Mourshed, Chijioke, Barber, 2010). These reforms are summarized and analysed internationally and involved introduction of student and school assessment and evaluation (centralized examinations, comparative international studies, accreditation, licensing, etc.), re-structuring the management – the organizational and financial basis of education system (development of school management and financing mechanisms, to some extent their decentralization, etc.), and revising the pedagogical foundation of education system (reforms in curriculum, education standards, textbooks, etc.). This set of reforms has been the basis for increasing the education quality in Latvia and other countries (for example, in Poland, Lithuania, Hong Kong (China), Singapore) during particular periods of their education system's development, generally achieving a good level of education quality in line with the international criteria. At the same time, naturally, the data from OECD PISA and other studies and their analysis reveal many aspects that require a further improvement.

Thus, it is necessary to ensure a systematic and full participation of Latvia in global processes of education evaluation and improvement, maintaining and developing a corresponding international level of scientific potential in our country, taking part in respective research and development programmes of OECD, EU and IEA, thus acquiring comprehensive, credible and internationally-comparable information and up-to-date knowledge about Latvian education system and its developmental trends, which would help developing and adopting evidence-based decisions in education management and policy.

Summary

In order to improve student learning and to achieve the planned results, a whole set of education quality assessment instruments is being developed and used globally,

including the evaluation and assessment of students, teachers, school principals, school systems and education systems.

The assessment of student performance is one of the main components forming the evaluation of education quality, which is being internationally reviewed on a comparative basis already since 1958, and in Latvia starting from 1991.

Latvia needs internationally comparable and internationally acknowledged data characterising the knowledge of the students, their skills and the related characteristics of education system, school, student and their family. Such data can only be acquired with the help of the regular cycles of comparative international studies such as OECD PISA and the wide range of IEA's studies (PIRLS, TIMSS, ICCS, etc.). This data and its analysis is included in all the main education editions issued by OECD, EU, UNESCO and World Bank, for example, *Education at a Glance, Key data on Education in Europe*, and many others. They form the main international set of data for the evidence-based education system improvement and development.

The results from studies should always be communicated and discussed with a wide range of stakeholders. The connection between study results and their implementation in education policy is not direct and immediate. Interaction of several important factors must be considered – the evidence basis for political decisions is derived not only from research results, but also from other evaluations (for example, accreditation, etc.) and the practical experience. On the other hand, in order to apply the research results in real life, politicians must take into account not only the evidence basis, but also the policy defined by their parties or coalitions, available resources, the opinions and traditions maintained by media and various actors, which are rather strongly represented in the education system.

Latvia, a developed country that is devoted to the improvement of its education system, needs to ensure a systematic and full participation in global processes of education assessment and improvement, maintaining and developing a corresponding international level of scientific potential, taking part in the respective research and development programmes of OECD, EU and IEA, thereby acquiring comprehensive, credible and internationally-comparable information and new knowledge about Latvian education system and its developmental trends, which would help to elaborate and adopt well-founded decisions in education management and policy.

2. OECD PISA Cycles and their Main Features

The international student assessment programmes are cyclic, because it is thereby possible to track the changes in education quality, assessing the impact of varying factors, including the impact of different education policy decisions and reforms on student performance.

The first cycle of Programme for International Student Assessment of the OECD (PISA 2000) with reading as the main content area, took place from 1998 to 2001. This cycle involved 32 countries (including 28 OECD countries and four partner countries: Brazil, Russian Federation, Latvia, Liechtenstein), but PISA 2000 data was collected in 11 more partner countries in 2002.

The second cycle of OECD PISA (PISA 2003) with mathematics as the main content area took place from 2001 to 2004. PISA 2003 involved 41 countries: 30 OECD countries and 11 partner countries.

The third cycle of OECD PISA (PISA 2006) with science as the main content area, took place from 2004 to 2007. This study cycle involved 57 countries: all the OECD countries and 26 partner countries. In PISA 2006, for the first time, the participants included our neighbouring countries – Lithuania and Estonia.

The fourth cycle of OECD PISA (PISA 2009) was carried out from 2007 to 2010. Its main content area was reading. The study involved 65 countries, including 34 OECD countries and 31 partner countries, but nine more countries participated in the 2nd phase of PISA 2009.

The fifth cycle of OECD PISA (PISA 2012) was carried out from 2010 to 2013. Its main content area was mathematics. The study involved 65 countries, including 34 OECD countries and 31 partner countries.

The on-going 6th OECD PISA cycle (PISA 2015) has concluded the phase of gathering the main data; its core content area was science. It involved a computer based assessment of students, and 73 countries participated therein (34 OECD countries and 39 partner countries). Announcing of the first results of PISA 2015 will take place in December, 2016.

The preparatory work for the 7th cycle of OECD PISA (PISA 2018) has already begun, and its main content area will be reading.

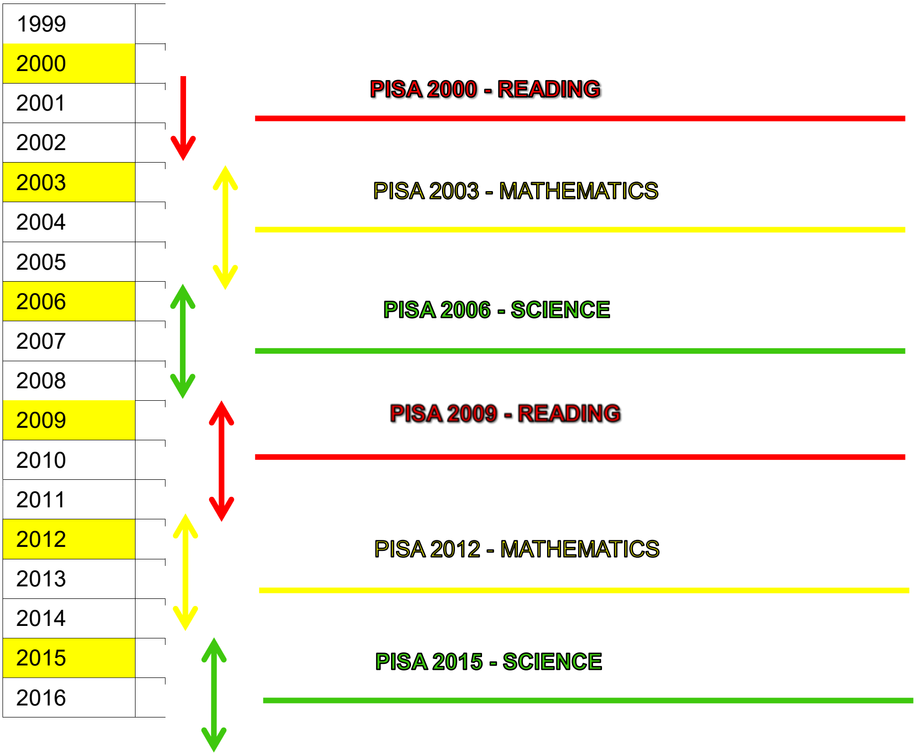


Figure 1.3

Cycles of the OECD Programme for International Student Assessment (OECD PISA)

Figure 1.3 shows the time frame of OECD PISA. Only the main content area of each cycle is provided. The years when the main data of the respective cycle have been collected in schools are marked in colour (see also chapter 2). A year before collecting the main data (for example, for PISA 2012 – in 2011) all countries participating in the study carry out field trial (pilot studies), whereby the suitability of items and research procedures at schools and national and international study centres are verified. Two years beforehand (for PISA 2012 – in 2010) the research procedures and instruments (tests, questionnaires, marking guides, etc.) are developed, including the necessary translation and verification. In the next year after the collection of the main data, it is analysed internationally and nationally, and the announcement of the first results is possible only by the end of the year (for PISA 2012 – on December 3, 2013). Thus, a study cycle lasts at least 4 years, but the collection of the main data for the next cycle is carried out every 3 years. At least for a year, an intensive work is carried out for two study cycles simultaneously: analysis of the data from the previous study cycle to acquire the first results, and a rather intensive developing of study instruments for the next cycle. Such a tight schedule of OECD PISA originates in its main characteristic – the focus on education policy, which often requires obtaining results and recommendations as soon as possible. Naturally, an in-depth analysis of data (i.e., the secondary analysis) is possible only after the four-year-cycle described above. Such analysis is carried out both in the countries participating in the study and internationally; for example, both extensive full OECD thematic reports on particular subjects and short reports, such as PISA in Focus, etc.

The OECD Programme for International Student Assessment is characterized by the following features:

- focusing on the needs for defining and improving education policy;
- theoretic improvement of the term "literacy" and its application in practice, referring to the ability of students to use their knowledge in basic subjects in real life, to analyse, reason logically and communicate skilfully, by defining, interpreting and solving problems in various situations;
- relevance to lifelong learning: PISA is not limited to assessment of student literacy in individual subjects, students are asked to report on their motivation to learn, their beliefs about themselves, and their learning strategies;
- regularity: assessment cycle repeats every three years, which enables the countries to monitor the achieved improvement of education quality;
- extent of coverage: for example, more than 80 countries plan to participate in PISA 2018.

Further on a complete list of countries and education systems from the latest completed OECD PISA cycle: PISA 2012, is provided, as well as the diagram of their geographic location, characteristics of the study, because the data and results of this cycle will be widely analysed in this monograph.

Table 1.1

Countries Participating in OECD PISA

OECD member countries	*OECD partner countries*	*Countries that have participated in the*

				previous cycles
Unites States	Korea	Albania	Latvia	Azerbaijan
Australia	United	Argentina	Lithuania	Georgia
Austria	Kingdom	Brazil	Liechtenstein	Himachal (India)
Belgium	Luxembourg	Bulgaria	Macao (China)	Kyrgyzstan
Czech	Mexico	United Arab	Montenegro	Macedonia
Republic	Netherlands	Emirates	Peru	Mauritius
Chile	Norway	Hong Kong	Romania	Miranda
Denmark	Poland	(China)	Serbia	(Venezuela)
France	Portugal	Croatia	Singapore	Moldova
Greece	Slovakia	Indonesia	Shanghai	Antilles,
Estonia	Slovenia	Jordan	(China)	Netherlands
Italy	Finland	Qatar	Taiwan	Panama
Ireland	Spain	Kazakhstan	(China)	Tamil Nadu
Iceland	Switzerland	Cyprus	Thailand	(India)
Israel	Turkey	Colombia	Tunisia	
Japan	Hungary	Costa Rica	Uruguay	
New	Germany	Russian	Malaysia	
Zealand	Sweden	Federation	Viet Nam	
Canada				

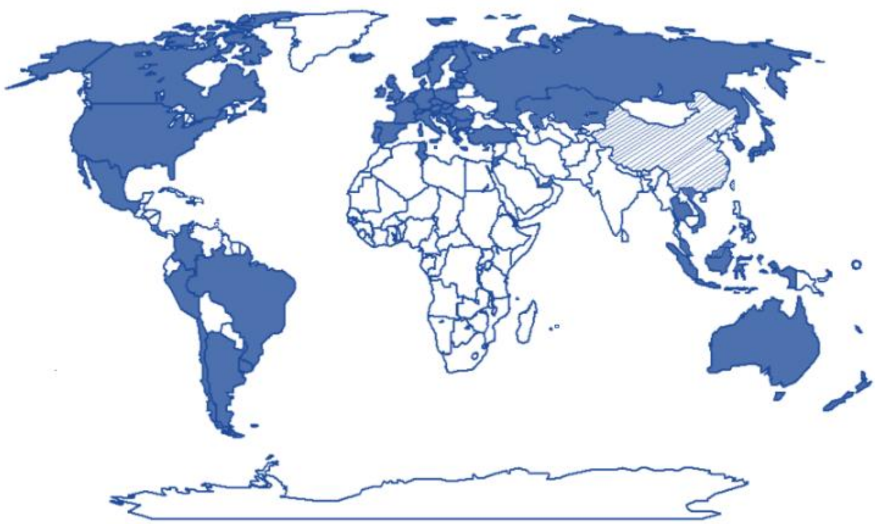


Figure 1.4

Map of OECD PISA 2012

The main content area in PISA 2012 was mathematics, but, naturally, the study also encompassed reading and science. PISA 2012, for the first time ever, included a module for testing the financial literacy of students. In this study, the student knowledge was assessed in close connection with their skills to reflect on the material acquired, the aim was to evaluate the students' own knowledge and experience and also the application thereof in real life situations.

PISA 2012 involved approximately 510 000 students who represented around 28 million 15-year-old students from 65 participating countries.

Each student had to complete the written tasks in 90 minutes. PISA items included both questions with selection options and questions, where students had to provide their own answer. Questions were grouped according to a concrete real-life situation.

Approximately 40 minutes were dedicated by students to fill a survey questionnaire, answering questions about themselves, their learning habits, attitudes towards mathematics, motivation, skills in ICT usage and the performance at school.

The school principals of the participating schools filled a survey questionnaire about their schools, providing demographic characterization and evaluating the quality of education environment at their school.

The results of the study cycle:

- detailed information on literacy of 15-year-old students in mathematics, reading and science;
- contextual indicators that connect student performance to characteristics of the student, family, school and country;
- trends of performance shown by the students and their contextual parameters.

Starting with PISA 2015, most of the participating countries used only computer-based tests and surveys, thus reflecting the great significance of information technology in modern life.

2. Research methodology

In order to ensure a high level of validity and reliability and to achieve high measurement standards, it is necessary to develop an appropriate research methodology, and to strictly observe it throughout the research. The methodology in each cycle of the study must ensure that the results are comparable with the previous cycles. The major research stages are as follows: (1) elaboration of a research conception, (2) selection of a students' sample, (3) test task development, (4) formulation of survey questions, (5) conducting of tests and surveys in schools, (6) definition of the performance scale and competence levels, (7) definition of contextual indicators.

2.1. Selection of a sample

OECD PISA target group is formed of the students aged between 15 years and three full months to 16 years and two full months during testing, and enrolled in any type of educational institution, grade seventh or above, within the boundaries of the respective country. This age group is chosen in order to make it relatively easier to include students in the sample, taking into account only their year of birth, but ignoring the month of birth. It is also related to the fact that the study took place in schools within six weeks in March and April. The general sample of PISA 2012 consisted of the students born in 1996.

Creating the sample of research participants, it is important to ensure that it encompasses the students from all regions of Latvia, and from all types and sizes of schools. For example, student performance in big schools differ from that of small-school students – on average in Latvia the performance of students from bigger schools is higher, whereas in other countries it could be the other way around. To ensure accurate measurement results, the sample should include an appropriate proportion of students from big and small schools. It cannot be done by selecting a simple random sample.

The statistical sample of participants for PISA 2012 main study was established in two phases. In the first phase, using systematic sampling, which is proportional to the size of the schools, 221 participating schools were selected, including into the general group not only the general education schools, but also vocational and technical schools, where there are fifteen-year-old students. Random selection is never used in this type of research. Instead, stratified sampling is always applied. It provides more accurate measurements and lowers the research costs. In practical terms, this means that all schools according to particular parameters are divided into several groups (the outer strata) and a separate sampling is carried out in each group. In case of Latvia's schools, in all PISA cycles the size of school was chosen as the outer stratum variable.

The schools were divided into three groups: large schools (the schools with more than 35 fifteen-year-old students), small schools (schools with less than 35 but more than 18 fifteen-year-old students), very small schools (schools with less than 18 fifteen-year-old students). The chosen inner strata variables are urbanization and the type of school. Urbanization was considered at four levels: Riga schools, schools of large cities (Daugavpils, Jelgava, Jēkabpils, Jūrmala, Liepāja, Rēzekne, Valmiera, Ventspils), town schools, rural schools. The schools were grouped according to several types: state gymnasiums and gymnasiums, secondary schools, basic schools, as well as other educational institutions (vocational schools, technical schools, art schools, evening schools, etc.).

In the second phase, using random selection, from all the fifteen-year-old students of each of the participating schools, 43 PISA participants were chosen. If there were less students of the appropriate age in a school, all of the students were included in the PISA sample. Overall, the main study sample included 5922 students who represent Latvia's fifteen-year-old students. The sample did not include the students from special schools, and the students studying according to special programs at their school.

Of 5922 students included in the sample, 5279 students participated in testing, but after data cleaning and checking the information about 5276 students, i.e., 89% of students, were entered in the international database. A part of the students included in the sample participated in the Sub-study of Financial Education. PISA 2012 main study included the data about 4306 students of Latvia. The division of schools and students among the strata is shown in Table 2.1, and the distribution of students according to grades (class) is reflected in Table 2.2. The stratum "Russian language of instruction at school" includes educational institutions, which implement national minority (Russian) education programmes. The stratum "Latvian and Russian language of instruction at school" (bilingual schools) includes the educational institutions, where education can be obtained in the official national language or an ethnic minority language (Russian) education programme. Students who are studying in the minority (Russian) education programmes, performed the test and survey in the Russian language. The distribution of schools and pupils in the strata shown in Table 2.1 will be further used in the data analysis of the study.

Table 2.1

Distribution of PISA 2012 main study participants by strata

Title of strata	Strata	Number of schools	Number of pupils	Distribution of the number of students (%)
Urbanisation	Riga	58	1407	33
	Cities *	36	926	22
	Towns **	45	1046	24
	Rural areas	76	927	21
Type of school	State gymnasiums and gymnasiums	27	794	18
	Secondary schools	125	2907	68
	Basic schools	58	593	14
	Other (vocational schools, technical schools, art schools, etc.)	5	12	0,3
Language of instruction at school	Latvian	167	3096	72
	Russian ***	36	962	22
	Latvian and Russian*** (bilingual schools)	12	248	6
Total		215	4306	

*Daugavpils, Jelgava, Jēkabpils, Jūrmala, Liepāja, Rēzekne, Valmiera, Ventspils

** Remaining 67 towns of Latvia

*** Schools implementing minority education programmes

Table 2.2

Distribution of students (%) by grades (classes), OECD PISA 2000, 2003, 2006, 2009 and 2012

Grade	2000	2003	2006	2009	2012

Grade 7	2	2	2	2	1
Grade 8	8	17	15	14	13
Grade 9	39	76	78	81	83
Grade 10	50	6	3	3	3
Other grades	1	0	2	1	0,3

Since in the 90s of the last century, the education system had underwent reforms related to the age when school had to be started. The fifteen-year-old student division among the grades (class groups) in the year 2000 was different from the distribution of students in 2003, 2006, 2009 and 2012 (Table 2.2).

2.2. Study at schools

Preparation for OECD PISA fifth cycle (PISA 2012) began as early as in 2010. Overall, 62 new mathematics items with 172 questions were prepared for the pilot study.

The pilot study was carried out in March and April of 2011, involving 1627 fifteen-year-old students from 49 schools of Latvia and 49 principals of these schools.

After the analysis of pilot study results at the end of 2011, the toolkit of the main study was fully completed – 13 test booklets, three different student surveys and a survey of schools. Tests for mathematical competency measurement included 36 questions from the previous study cycle, ensuring measurement of changes in performance, as well as 74 questions of the items tested during the pilot study (OECD, 2014a). The test booklets and student surveys were prepared both in Latvian and Russian, and the other study materials – in Latvian. All study materials were translated from the original English and French texts, and the layout was approved by the international study management group.

In Latvia, the study took place at schools from March 19, to April 27, 2012. The administration of testing and surveys (involving students and principals) was conducted by 21 specially prepared test administrators – UL FPPA researchers, doctoral and master's students. In total, 226 testing sessions were conducted.

The responses to the test items were reviewed by a specially created panel according to strictly defined instructions. Most of the brochures were evaluated once, while a portion of them – four times. Such a procedure is necessary to carry out the evaluation as coherently and objectively, as possible. The data were processed both in the international research centre and in Latvia.

2.3. Performance scale formation

Student performance was calculated using the Item Response Theory (IRT) enabling the administrator to adequately assess each student's performance, regardless of which test booklet the student had worked with. Similarly, the IRT allows for an accurate evaluation of student performance should in any participating country an item be removed from the test (for example, because of a rough translation or a layout error, or if the item does not comply with the country's cultural or geographical context). In PISA 2012, none of the items prepared in Latvia was removed, while in Estonia one task of the Russian-language test was removed, and in the German version, which was used in a number of countries, two items were removed. Within the IRT framework there are a whole lot of models, differing by mathematical expressions and a number of parameters included in the model. Each model must contain at least one parameter that characterizes the item, and at least one parameter, which characterizes the examinee. In OECD PISA study, one-parameter model in dichotomous tasks is used for scale formation, and a partial credit model – in the tasks, which are evaluated with several points.

The results of the test in the framework of the study are not given in the above-mentioned IRT scale, but in further data processing the so-called plausible values are obtained. These include random variance of components and are not applicable to individual evaluation, yet they are suitable for the mutual comparison of large groups (e.g., national, regional, school groups). Each student is given five plausible values, and, when processing personal data, each operation must be repeated five times, at the end calculating the average value. The calculation of the plausible values takes into account not only the students' answers to the test questions, but also the answers to the survey questions (OECD, 2009).

The major domain of PISA 2000 was reading. Student performance in mathematics and science was also measured, however, the number of these tasks was insufficient to form stable scales in these subjects. The mathematics scale was constructed in the 2003 survey, in which the emphasis was laid on mathematics. The scale was formed, taking into account solely the OECD countries' student performance.

The mean value of the scale was set at 500 points, the standard deviation – at 100 points. This means that 64% of the students' results were between 400 and 600 points, while 95% of the students' results were between 300 and 700 points. This mathematics scale in subsequent cycles of study was not changed, therefore it is possible to assess the changes in mathematics performance over the period from 2003 to 2012. Similarly, in 2006, the science scale was constructed (OECD, 2012a; OECD 2014).

2.4. Formation of competency levels

On the basis of the students' answers to the test questions, each student obtains a certain number of points in the PISA scale. Using this scale, it can be easily determined, whether a country's student performance is higher or lower than the OECD average performance, higher or lower than another country's average student performance. Similarly, such comparisons can be made between individual schools or school groups (such as rural and urban schools). However, it does not provide any information about the performance in mathematics (or other areas) of a student having the respective number of points. If a student has, for example, 700 or 400 points, what are his or her mathematical competencies? To answer this question, the levels of competencies are established, in which the obtained points are linked to certain knowledge and skills. Such a practice for publishing and interpretation of extensive educational research results has existed since the last century, the early 1980s.

The basis of competency level formation is the calculation of the overall results of the test, using the item response theory. It is based on the assumption that the students with higher competencies (abilities in the respective test) are more likely to provide a correct answer to an item. In this case, a single scale displays both the student performance and the difficulty level of each item. If a student's competency coincides with the difficulty level of the item, then the probability that his or her reply will be correct, is 50%. Schematically it is shown in Figure 2.1.

If a student C has a competency (see Figure 2.1) that is slightly lower than the difficulty level of the first item, then the probability that he or she will respond correctly to this item will be slightly below 50%. The probability that he or she will provide the right answer to the second item is already lower, but the probability that the correct answer will be found to the sixth item is very small, but still greater than 0. The student B with a relatively high probability will provide a correct answer to the first item, with less probability (but more than 50%) will correctly answer the second and third items. Also, he has a certain probability (below 50%) to correctly answer items with a higher level of difficulty (4, 5 and 6), but as the task difficulty level increases, this probability decreases.

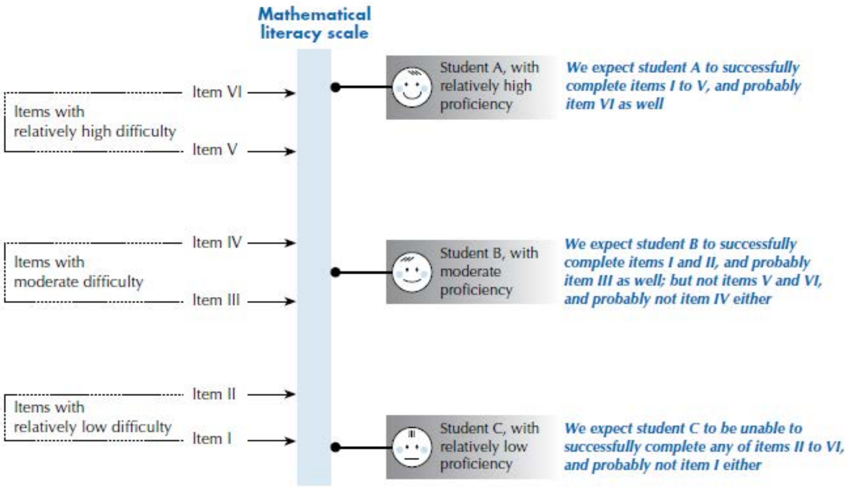


Figure 2.1

Relationship between student performance and the difficulty level of items (OECD, 2014a)

Using the continuous performance scale and analyzing the test items, the scale can be divided into several sections (competency levels) and each section can be provided with the corresponding competency characterizing descriptions. Implementing the quantitative data analysis (both the psychometric analysis of items and the analysis of student performance), it is possible to determine each item's degree of difficulty. The qualitative analysis of each item allows us to determine what knowledge and skills are necessary for the student to provide the correct answer. Such analyses use both pilot research and main research data, which provides a large number of students for each item, and a relatively great number of items.

Each competency level scale is constructed, previously determining 1) the potential likelihood of a student from this level to provide a correct answer to the items of this level, 2) the level width, 3) the probability of a student from the mid-level to respond correctly to the item of medium difficulty. The scheme of PISA competency levels is shown in Figure 2.2.

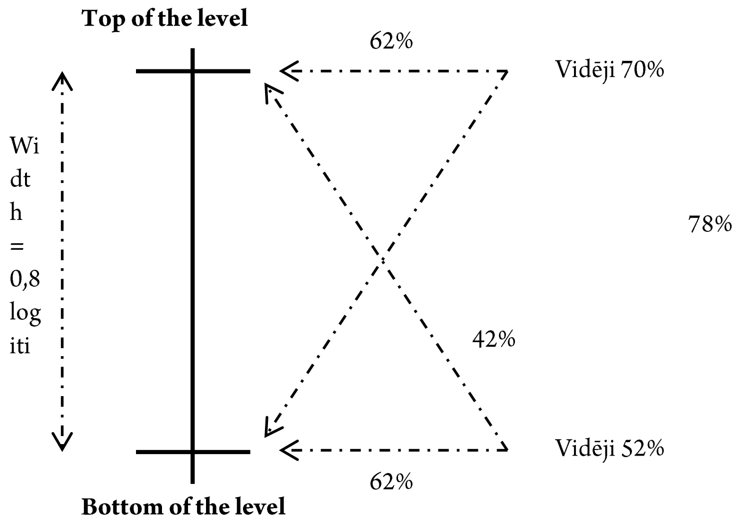


Figure 2.2

Scheme of determining PISA competency levels (OECD, 2014a)

The selected level width is 0.8 logits (logit is a measurement unit of both item difficulty and the ability of students within the item response theory). In PISA mathematics scale it is about 62 points. A student whose competence corresponds to the top of the level, has a 62% chance to correctly answer the most difficult item of this level, 70% probability of correctly answering all of the items of the level, and 78% probability to correctly respond to the easiest item of the level. A student whose competencies correspond to the bottom of the level, has a 62% probability to provide a correct answer to the easiest item of the level, 52% probability to answer correctly all items within the level, and a 42% probability of correct answer to the hardest task of the level.

For constructing and describing the mathematics competency levels, the data about 290 items from the pilot study of 2011 and the data about 150 items from the main study of 2012 were used. The test items had very different degrees of difficulty to enable measuring both the low and the high competencies. For example, the difficulty of item PM995Q02 was 840 points, and the correct answer was provided only by 3.47% of all students in all countries, to whom this item was assigned. The difficulty of item PM985Q01 was 328, and correct answers were given by 81% of all students. In 2012, the entire set of mathematics items was analyzed independently, but subsequently, using shared items, calibrated according to the scale defined in 2003. Since the definition of the levels in 2012 was the same as in 2003, it is possible to compare the two studies, using the competency levels.

The description of overall mathematics scale competency levels is given in the chapter on students' mathematical competencies, and the definition of level division is shown in Table 2.3. Here it should be noted that both the top (sixth) level, and the bottom (below level 1) are not clearly defined, they are open (unrestricted) levels. If a student is on the sixth level, he or she is able to perform at least according to the description of the level, but possibly his or her mathematics competencies are much higher, and can no longer be measured by the PISA test. If a student performs according to the lowest level, then his or her mathematical competencies can be very, very low, even so poor that they cannot be measured by the PISA test (OECD, 2014a).

Table 2.1

Mathematics competency level definitions according to PISA mathematics scale (OECD, 2014a)

Level	
6.	Above 669.3
5.	From 607,0 to 669,3
4.	From 544,7 to 607,0
3.	From 482,4 to 544,7
2.	From 420,1 to 482,4
1.	From 357,8 to 420,1
Below 1.	Below 357,8

2.5. Surveys and contextual indices

Survey data in PISA study are necessary for two important reasons – firstly, to gather information about the students' families, attitude toward school and mathematics, learning habits, process of lessons and other factors possibly related to performance. The second reason is obtaining the information necessary for the formation of the performance scale. The students' performance is expressed as plausible values. The survey data are necessary to generate these variables.

The survey participants were students and school principals. Since the selection of students in the school is made up of all 15-year-olds who are studying in grades 7 to 10, they do not have the same teachers, and teacher surveys are not carried out. The students in about 30 minutes completed the questionnaire, answering the questions about themselves, their learning habits, attitudes towards mathematics, motivation. Each principal of a participating school completed a questionnaire about his or her school, giving its demographic characteristics, the assessment of the learning environment quality at the school, existing resources.

In the educational research, it is very important to determine the social, economic and cultural status of the students' families. A long time ago, it has been found to be linked to the student performance and achievements, and the effect is relatively very high. Seeking the factors that influence student achievement, one should always take into account the students' family status, because the significant effect of this factor may interfere with noticing the influence of other factors.

Therefore, within the PISA study, the student surveys contain a series of questions about the students themselves and their families. The students' answers are used to form several indexes characterizing a student's family. The first to be mentioned is the International Socio-Economic Index of Occupational Status (ISEI). It characterizes both the prestige of a profession and the work complexity. The index values range from 1 to 99. Students had to answer two open questions about their parents' occupation: "What is your mother's (father's) main job?" And " What does your mother (father) do in her (his) main job?" Student responses to these two questions were coded according to the International Standard Classification of Occupations (ISCO-2008). The resulting code was then recoded to obtain the ISEI value.

The students were also asked to provide information on their parents' education – what kind of education has been obtained by parents at school and at other educational institutions after graduation. Indexes of parental education were prepared according to ISCED (International Standard Classification of Education) levels.

The survey included questions about the use of a language at home (the extent to which it corresponds to the test language), as well as about the family structure. A series of questions were about the things owned by the family – which of the things listed in the survey were at the student's home and at his or her disposal, such as a desk to study at, a room of one's own, a computer, internet access, classic literature, poetry, etc. There were also questions about how many of the following were owned by the family – books, mobile phones, television sets, computers, cars and bathrooms. From the responses of the students, three indexes were created: the family wealth index, the index of cultural possessions and the index of home educational resources. Combining these three indices, the overall index of home possessions was established.

By combining all of the previously reviewed indices characterising a student's family, the PISA index of social, cultural and economic status (ESCS) was formed. This is the main index characterising the students' families. Like most other indices, ESCS for OECD countries is calibrated to the normal scale – the average value of 0, standard deviation – 1 (OECD, 2014a).

In all OECD PISA cycles, starting from the year 2000, student performance in mathematics, science and reading was also evaluated in the context of the indicators characterising the socioeconomic status of a family and a school. The index helps explain a great number of differences in student and school performance, however, it must be taken into account that the index is not a panacea for explaining all the differences. For the purposes of the study it was assumed that the student is in a socio-economically advantageous position, if he or she is among the 25% of the students enjoying the highest social, cultural and economic status index in the country, and the student is socio-economically disadvantaged, if he or she is a part of the 25% of students having the lowest social, cultural and economic status index in the country. OECD PISA enables to compare the average performance in mathematics and SES impact on this performance in each country participating in the study. On average, in OECD countries, 15% of the performance variance can be explained by the impact of the SES (OECD, 2013c).

To explore the impact of other factors (attitudes, schools, teachers) on student performance, a number of other indices were developed –mathematics interest, the index of anxiety regarding mathematics, index of mathematics self-concept, etc.

3. The relation of Latvia's student performance to various contextual factors

3.1. The changes of student performance over time

OECD PISA was designed as a cyclic long-term study, and one of its most important tasks is to study the trends in student performance in relation to various social and economic factors affecting the learning process and achievements. Any trend research framework is characterized by the cyclical nature of the study, similar principles of participant sampling as well as by the opportunity to associate and compare the achievements of different study cycles.

The data in OECD PISA study are collected every three years. Each time, the sampling follows the same principles – this allows to compare the results obtained at different times and to identify trends in performance. As we know, all of the OECD PISA cycles have involved 15-year-old students. The most serious weakness of the trend studies is that during the preparation of the study one cannot foresee all the possible trends (changes) that appear during the study and that should be explained by biological, environmental or intervention factors. Therefore, school and student survey questions in each subsequent cycle of the study are partially modified or supplemented. Test items also vary from cycle to cycle, yet to be able to link the students' performance in different study cycles, which is required for the detection of trends, the so-called link items were included in all of the OECD PISA cycles – the set of tasks, whose content, presentation, questions to be answered, remain unchanged. Consequently, the set of the study variables consists of the linking items and the standard part of the surveys, as well as each study cycle-specific test items and survey questions.

The first full-scale OECD PISA study in reading took place in 2000 (reading was the main content area), in mathematics – in 2003, and in natural sciences – in 2006 (see Figure 6.1). In OECD PISA 2009 cycle, reading again was the main content area, and for the first time it was possible to carry out a full-scale evaluation of trends compared to 2000. The main content area of OECD PISA 2012 cycle again was mathematics, allowing to assess student achievement trends in mathematics compared to 2003. In OECD PISA 2015 survey the main content area was science, permitting to complete the first full-scale evaluation of student performance trends in all content areas of research since the start of the research program in 2000.

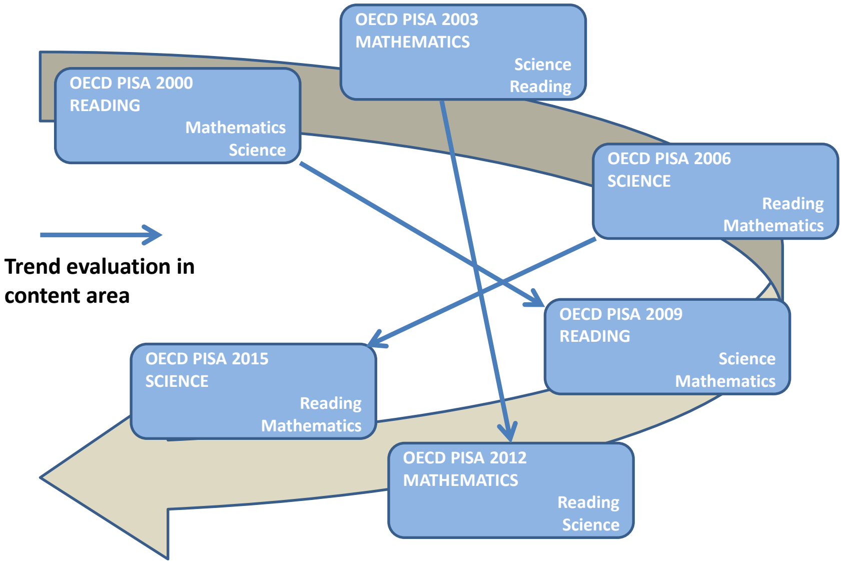


Figure 6.1

OECD PISA 2000 -2015 – trend research process

Each participating country has an interest both to ascertain their student performance trends in the OECD PISA reading, mathematics and science content areas and to obtain the public education system assessment in an international context. Latvian student performance in the OECD PISA test within the period from 2000 to 2012 is shown in Figure 6.2. Summing up the results of the five research cycles, there emerges a positive overall trend – the performance of 15-year-old students of Latvia in the OECD PISA is clearly getting better – the comparison of the average results of 2000 and 2012 demonstrates that the students in all content areas have improved their results by 30 points.

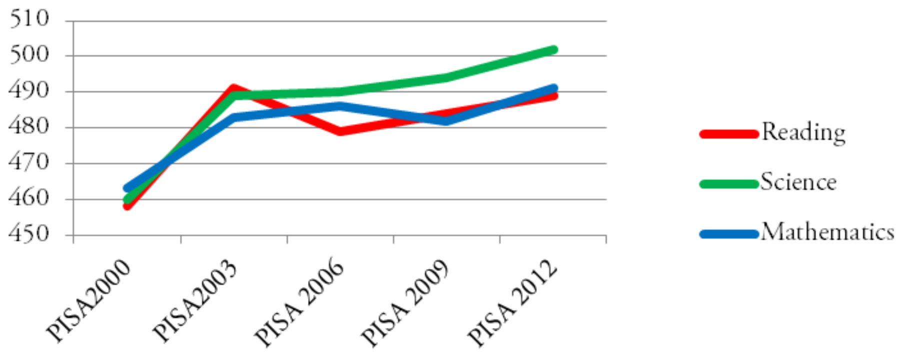


Figure 6.2

The average results of Latvia's students in OECD PISA mathematics, science and reading content areas

The growth of Latvian student performance was not uniform, as the most significant performance peak in the test results was observed in the first two cycles of OECD PISA in 2000 and 2003. This is partly explained by the fact that additional difficulties for Latvian students in the first study cycle were caused by the unconventional test format. Subsequently, a steady positive tendency in the growth of the results was seen only in the science content area. On the other hand, not only growth, but also decline was observed in mathematics and reading within some of the study cycles, such as reading in 2006 and mathematics in 2009. Thus, the Latvian student performance in the OECD PISA over 12 years can be characterised as slightly improving, yet the positive trend leaves something to be desired.

Although currently OECD PISA can be considered the major international comparative education study, in the period from 1995 to 2009 Latvia also participated in several other international studies, such as IEA TIMSS and IEA PIRLS. Researchers (Hanushek, Woessmann, 2015) made a number of calculations on the changes in OECD PISA student performance in mathematics (see Figure 6.3), as well as in the overall study content areas on average per year between 1995 and 2009 (see Figure 6.4). Latvia showed the highest score in performance change – about 4.5% of the standard deviation. At the same time, countries like France, Ireland, Norway, the Czech Republic, Slovakia and Sweden showed a negative performance change indicator. This result illustrates that Latvia's student performance in international studies over a longer term has a growth trend positively characterizing the national general education system and its development.

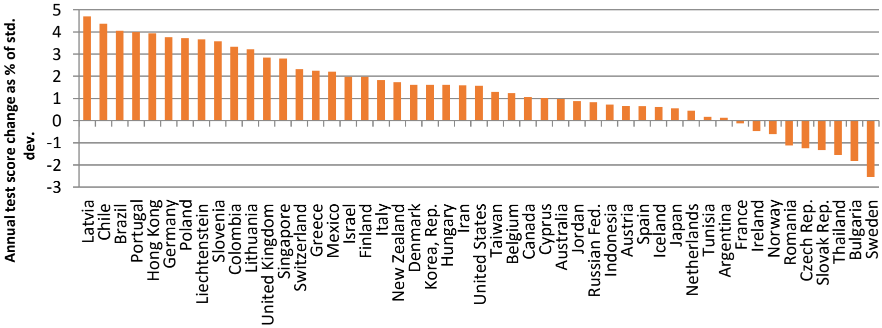


Figure 6.3

Average performance growth of OECD PISA participating countries' students in mathematics content areas 1995–2009 (% of standard deviation)

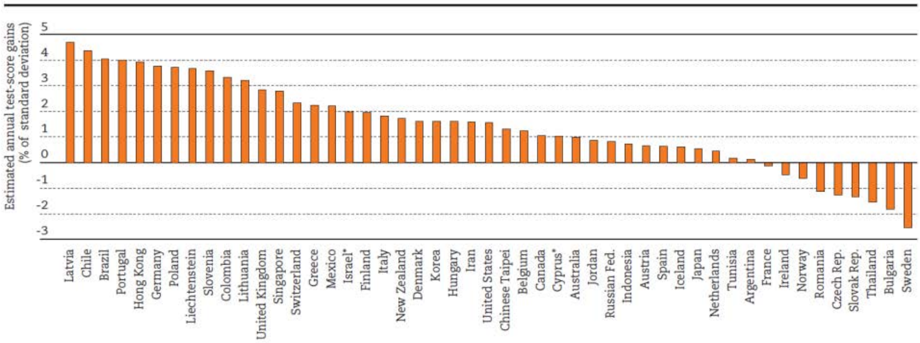
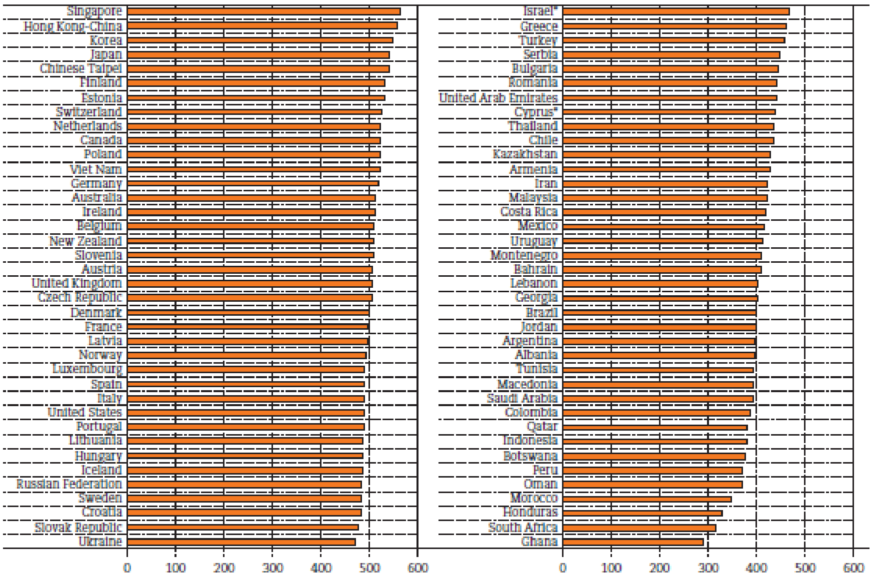


Figure 6.4

Annual average performance growth of OECD PISA participating countries' students in all content areas 1995–2009 (% of standard deviation)

Figure 6.5 shows the average performance of students by country, combining the results of two studies (OECD PISA and IEA TIMSS). Latvia in this chart occupies the 24th place among 76 countries.

Once more the positive performance growth tendency was shown by Latvian students in IEA TIMSS results for the period from 1995 to 2007 (after 2007, Latvia ceased to participate in this study). Tables 6.1 and 6.2 provide a summary of data on the changes in performance shown by IEA TIMSS participating countries' students of 4th to 8th grades in mathematics and science. In both cases, Latvian student performance growth was remarkable indeed: the average performance of the 4th grade students in science rose by 56 points, and in mathematics – by 38 points (respectively, the second and the fourth fastest growth rate). Notably, the positive trend of performance growth in science was observed in eight countries, while in mathematics – in 12 countries out of more than 20 countries participating in the study.



Note: Latvia occupies the 24th place among 76 countries.

Figure 6.5

The average performance of students in OECD PISA 2012 and IEA TIMSS 2011 in the countries of the world (Hanushek, Woessmann, 2015)

The average performance in science and mathematics shown by IEA TIMSS participating countries' students of the 8th grade in TIMSS 2003 and the changes in performance since 1995 are displayed in Table 6.2. The average performance growth of Latvia's 8th graders both in science and mathematics was the third highest among the countries participating in the study (respectively, 37 and 17 point increase).

Table 6.1

The average performance of 4th grade students in TIMSS, science, from 1995 to 2007 (IEA TIMSS databases)

Country	Average performance in 2007	Difference between 1995 and 2007 average performance	Country	Average performance in 2007	Difference between 1995 and 2007 average performance
	Science			Mathematics	
Singapore	587	63	England	541	57
Latvia	**542**	**56**	Hong Kong	607	50
Iran	436	55	Slovenia	502	40
Slovenia	518	54	**Latvia**	**537**	**38**
Hong Kong	554	46	New Zealand	492	23
Hungary	536	28	Australia	516	22
England	542	14	Iran	402	15
Australia	527	6	USA	529	11
New Zealand	504	-1	Singapore	599	9
USA	539	-3	Taiwan	576	1
Japan	548	-5	Japan	568	1
Netherlands	523	-7	Scotland	494	1
Austria	526	-12	Norway	473	-3
Scotland	500	-14	Hungary	510	-12
Czech Republic	515	-17	Netherlands	535	-14
Armenia	484	-27	Austria	505	-25
Norway	477	-27	Czech Republic	486	-54
Russia	546		Armenia	500	
Italy	535		Russia	544	
Taiwan	557		Italy	507	
Tunisia	317		Lithuania	530	
Lithuania	514		Morocco	341	
Morocco	297		Tunisia	326	

Table 6.2

The average performance of 8th grade students in TIMSS, science, from 1995 to 2003 (IEA TIMSS databases)

Country	Average performance in 2003	Difference between 2003 and 1995 average performance	Country	Average performance in 2003	Difference between 2003 and 1995 average performance
	Science			Mathematics	
Lithuania	519	56	Lithuania	502	30
China, Hong Kong	556	46	China, Hong	586	17
Latvia	**512**	**37**	**Latvia**	**508**	**17**
USA	527	15	USA	504	12
Australia	527	13	Korea	589	8
Korea	558	13	Netherland	536	7
Scotland	512	10	Scotland	498	4
New Zealand	520	9	Hungary	529	3
Slovenia	520	7	Romania	475	1
Hungary	543	6	Slovenia	493	-2
Romania	470	-1	Singapore	605	-3
Japan	552	-2	Australia	505	-4
Singapore	578	-3	Iran	411	-7
Netherlands	536	-6	New	494	-7
Iran	453	-9	Cyprus	459	-8
Russia	514	-9	Japan	570	-11
Cyprus	441	-11	Belgium	537	-13
Slovakia	517	-15	Russia	508	-16
Belgium	516	-17	Slovakia	508	-26
Norway	494	-21	Norway	461	-37
Sweden	524	-28	Sweden	499	-41
Bulgaria	479	-66	Bulgaria	476	-51

Although the authors of OECD PISA study have emphasized on several occasions that the study should not be regarded as a competition with the most important goal to win a place in the ranking table, in each cycle of the study this result draws quite a lot of attention. Latvia's students in the period from 2000 to 2012 in all content areas achieved results which enabled them to take 21st to 36th position in the overall list of the countries participating in the study within various study cycles. It must be admitted that over the 12 years a significant growth has hardly been observed. The place achieved in mathematics could be considered a relative exception, when after the negative scores over the period from 2000 to 2009, in the 2012 survey cycle the students obtained a considerably higher result. Science and reading content areas also showed similar, yet less pronounced dynamics of the scores gained until 2009, and a better result in 2012.

OECD PISA study is steadily expanding, more and more countries or educational systems take part in it:

- In 2000 – 45 countries,
- In 2003 – 41 countries,
- In 2006 – 57 countries,
- In 2009 – 75 countries,
- In 2012 – 65 countries

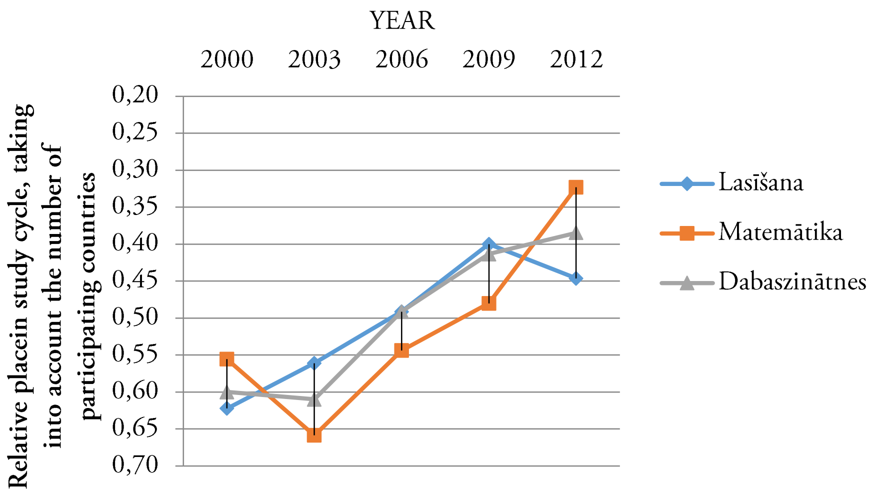


Figure 6.6

The place of Latvia in the OECD PISA ranking table, taking into account the total number of countries participating in the study cycle

Thus, the place obtained by each participating country or education system should be adjusted according to the total number of participants. For example, the fifth place in the competition of ten countries is certainly not the same as the fifth place among 30 countries. The relative place of Latvia in the countries' ranking table in each study cycle, taking into account the total number of participating countries, is shown in Figure 6.6. The relative place of Latvia in the ranking table was calculated by dividing the obtained place with the total number of participants of the respective study cycle. For instance, Latvia's students in mathematics content area in 2000 ranked 25th among 45 participating countries, in 2003, with 41 countries participating, they obtained the 27th place, in 2006, among 57 countries – the 31st place, in 2009, among 75 countries – the 36th place, and in 2012, among 65 countries, o their highest – 21st place. The relative place in ranking table is determined by dividing the place obtained by Latvia with the total number of countries participating in the relevant cycle of the study. In this case, we clearly see a positive trend– Latvia’s result in the ranking table, taking into account the total number of countries participating in the study, improves from cycle to cycle. It could be taken somewhat for granted, assuming that the education systems of the new countries acceding to the study were "weaker" in comparison with Latvia. However, there is no unequivocal evidence to support this statement

Summary

Summarizing the above-discussed achievements of Latvia's students in the OECD PISA study over 12 years, a number of important results should be specified:

- five study cycles show a positive overall trend – the performance of Latvia's fifteen-year-old students in the OECD PISA test is improving, an increase by approximately 30 points in all test content areas in the period from 2000 to 2012 was observed; likewise, Latvia ranked first in the growth of performance from 1995 to 2009, taking into account the performance growth dynamics in several international educational studies (PISA, TIMSS, PIRLS);
- the growth of Latvia's student performance has not been equable, – only the science content area showed a stable positive growth of results, whereas in the content areas of mathematics and reading within particular cycles of the study not only the growth of results, but also the decline was observed;

- the overall positive growth tendency of student performance is an affirmation of the successful work and development of Latvian general education system;
- while generally the performance growth trends among the Latvia's fifteen-year-old students has been positive, it should be still faster, given that during the entire OECD PISA study Latvia did not achieve a higher place than the 21st in the ranking table encompassing all the participating countries – it confirms the need to accelerate the growth in the future study cycles;
- the comparative analysis of the results obtained in various cycles of IEA TIMSS educational study suggests that the period from 1995 to 2007 was marked by pronounced average performance growth among the Latvia's students of the 4–8th grade both in mathematics and science;
- the 24th place taken by Latvia among 76 countries in the joint OECD PISA and IEA TIMSS average result chart proves that the general basic education provided in Latvia is competitive. Given that there are 196 independent countries in the world and that all the developed countries already participate in the OECD PISA study, Latvia is among the 15–25% of the countries enjoying the best education systems worldwide.

3.2. Socio-economic status of students and schools, and its relation to achievement

One of the most important goals of any education system is to provide all students with equal public education opportunities. In all OECD PISA cycles as of the year 2000, pupils' performance in mathematics, science and reading were also evaluated in the context of a indices characterizing the SES of a family and a school. The term "socio-economic status" is quite an extensive set of parameters characterizing a student, a school or an education system. OECD PISA evaluates students' SES according to the social, cultural and economic status index consisting of such parameters as the education of the student's parents and their employment status, as well as the resources allocated for education and household needs in the family's possession.

The relationship between student performance and their families' SES is schematically shown in Figure 6.7. Each point represents one student and his or her performance (on the vertical axis) and the family's SES (on the horizontal axis). Important aspects are both the slope of the regression line, which is characterized by the extent of change in performance, if the SES index changes by one unit, and the extent of point concentration around regression line, which is characterized by the correlation coefficient value. The greater slope of the line and the lower variation level of the points around it – points are closer to line (i.e., the higher the value of the correlation coefficient), the relatively stronger is the impact of the SES on performance.

This approach allows us to display the research results and to measure the SES impact to performance of a particular country, group of countries, for example, the OECD countries, or a sufficiently large group of students inside the country.

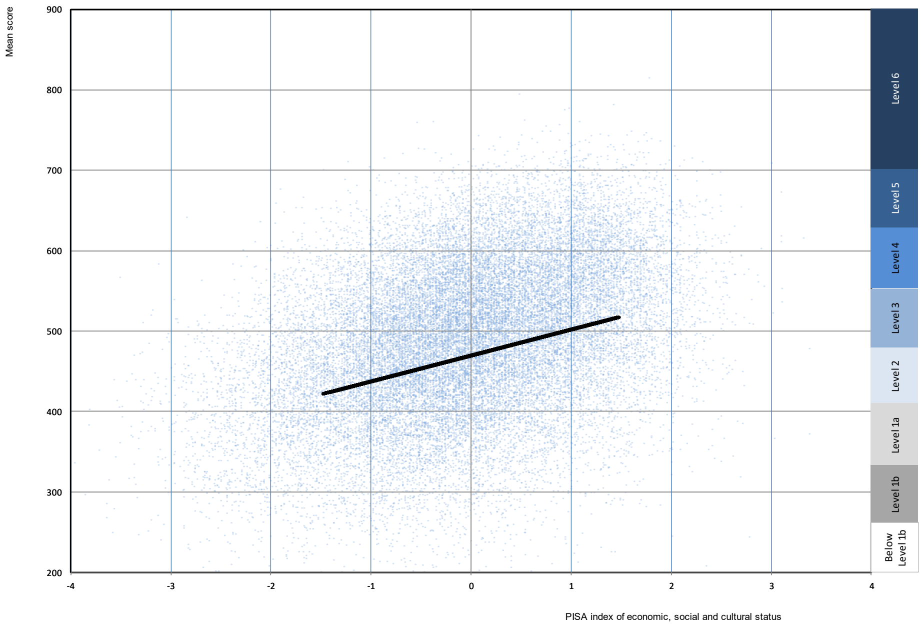


Figure 6.7

The relationship between students` SES and performance

OECD PISA 2012 enables comparing each participating country's average performance in mathematics and the impact of the SES upon it. On the average in the OECD countries, 14% of the performance variance can be explained by the impact of the SES. In Figure 6.8, each country corresponds to a point whose coordinates consist of two figures - the average score in mathematics received by the students of the respective country, and the percentage of variance in mathematics performance explained by the SES index. The chart is divided into four quadrants:

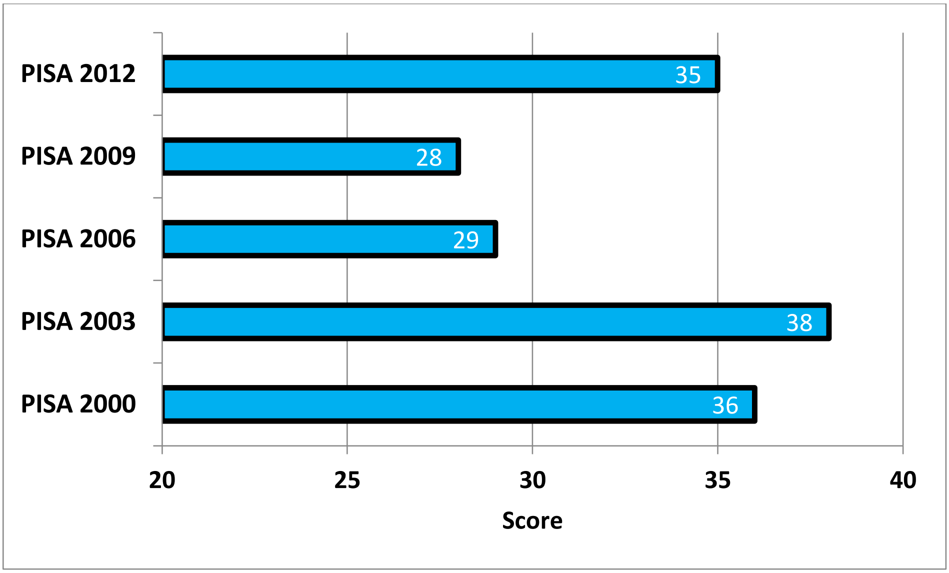
- the average student performance in mathematics is above the OECD countries' average, and the equity of education is above the overall OECD countries' result;
- the average student performance in mathematics is above the OECD countries' average, but the equity of education is below the overall OECD countries' result;
- the average student performance in mathematics is below the OECD countries' average, and the equity of education is below the overall OECD countries' result;
- the average student performance in mathematics is below the OECD countries' average, and the equity of education is above the overall OECD countries' result.

Figure 6.8

The average mathematics performance in PISA 2012 and impact of SES

As shown in Figure 6.8, Latvia is positioned near the relative origin of the coordinates. The Latvian students' average performance is only slightly lower (difference is not statistically significant) than the OECD average, but the performance variance, which can be explained by the SES index, is close to the OECD average. Hence we may conclude that the equity of education in Latvia is the same as the average in the OECD countries. Similar analyses in the previous PISA cycles showed that the equity of education in Latvia was somewhat higher than the average of the OECD countries.

The increase of the student's SES impact on his or her performance is also manifested by the change in the average performance of students, as the SES index changes by one unit, because, in comparison with 2009, it has increased (see Figure 6.9).



6.9. attēls

Latvijas skolēnu vidējo sasniegumu izmaiņas, SES indeksam mainoties par vienu vienību

The changes in the Latvian students' performance in mathematics over the period from 2003 to 2012 within OECD cycles showed a slight increase in performance (see Figure 6.10), although the dependence of performance in mathematics on the SES also slightly rose during that period – it is considered an undesirable trend indicating that the performance of various educational institutions has become less equal.

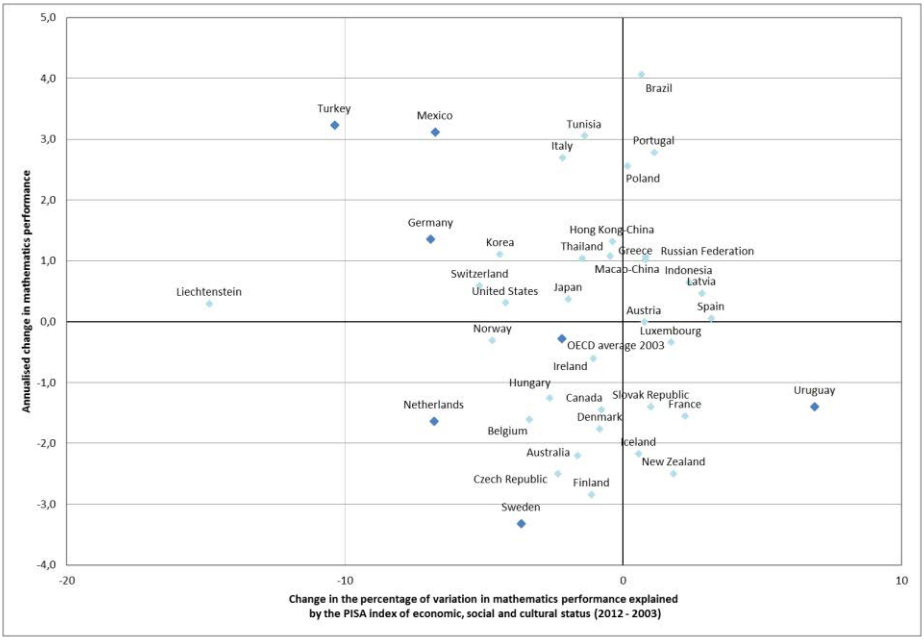


Figure 6.10

Change between 2003 and 2012 in the percentage of variation in mathematics performance explained by SES and annualised mathematics performance

Note: Changes in both equity and performance between 2003 and 2012 that are statistically significant are indicated in a darker tone

For more detailed understanding and analysis of the situation, the SES index of a specific school (or a group of schools) is defined, by dividing the sum of all the student's SES in that school by the number of students. Thus, the school's SES is an average value characterizing the corpus of students in that particular school in relation to their families' SES. By applying the two-level (SES of school and students) regression analysis (OECD, 2013c, p. 200), the obtained result shows that the school's SES differences are responsible for 62.2% of the PISA 2012 mathematics performance variation among the Latvian schools , while only 5.5 % of the performance variation is determined by the students' SES. Both results shown by Latvia practically coincide with the corresponding OECD average, 62.8% and 5.3% respectively. It means that the school's average SES greatly determines the difference in the school's performance in comparison with other schools with their specific SES.

Consequently, the school's SES is a particularly important factor in the analysis of performance differences among schools, therefore, the schools are primarily divided into groups according to their SES, which can be done in different ways. One of the methods (OECD, 2013c, p. 49) is to divide the schools into three groups: schools with an average SES – if the difference between school`s SES and student`s average SES in the respective country is not statistically significant, schools with a high SES – if the school's SES is statistically significantly above the average students' SES in the country, and schools with a low SES – if the school's SES is below the average SES in the country. If the school is represented in the study only by a few 15-year-old pupils, then that school most often falls into the middle group. According to this division, the average SES of each of these three school groups in Latvia is: -0.95 – for the schools with a low SES, -0.32 – for the schools with an average SES, 0.32 – for the schools with a high SES. The respective average values of OECD countries are: -0.56, -0.02, 0.60. And, of course, the average performance of students in these school groups differs in all countries – it is lower in the group with the lowest SES, and best in the group with the highest SES. The mathematics performance of Latvia in PISA 2012 resulted in the average of 452 points in the schools with a low SES, 480 points in schools with an average SES, and 534 points in schools with a high SES. These groups of schools in Latvia with low, medium and high SES have the following respective proportion of students: 20.2%, 50.3% and 29.5%. About half of Latvia's rural schools belong to the group with a low SES, and virtually no rural schools have a high SES.

According to earlier observations, the SES, however, is not the only factor that is related to the student performance. PISA results show that there are also groups of schools with a low SES performing at a medium level. To conduct a comprehensive analysis of this aspect, it is necessary to divide the schools into groups, not only by their average SES, but also by their average performance in a given measurement, such as PISA 2012 mathematics test. The groups of schools with high, medium and low test performance are constituted similarly to the groups of schools with differing SES. The group of schools with average performance include the schools where the average performance of students in the test are not statistically significantly different from the average national performance indicator (for example, in PISA 2012 mathematics test that indicator for Latvia was 491 points), the schools with low performance, in this sense, are the ones whose average performance is statistically significantly lower than the average in the country, and the schools with high performance are those whose average performance is statistically significantly higher than the national average. In

Latvia, 20.5% of the students attend the group of schools with low performance, 54.7% of the students study at schools with average performance, whereas 24.9% of the students – at the schools with high performance . It is essential to distinguish between the schools defined above as having low, medium and high overall performance of the school, and the performance of students in the test, according to one or another level of proficiency, such as students with low achievements – the first level of proficiency and lower, students with high achievements – the fifth level of proficiency and higher.

Figure 6.11 shows the percentage of students in each country attending schools having a particular combination of a specific SES group and a group of performance. Of course, the division exactly in these nine groups is relative, it must be taken into account that every school has its own specific SES and performance level, the distribution of these parameters is continual, and part of the schools are very close to the boundaries of this notional division (corresponds to them). However, this enables drawing some general conclusions. Figure 6.11 shows that different countries have diverse situations, because the division of schools according to their SES is determined by the influence of various circumstances, and the education system in every country is capable to offset the impact of low school SES at a differing degree. In the OECD countries, on average, 18% of students study in schools with both low SES and performance, while 20% attend schools with high SES and high performance. The smallest number of students attending schools with low SES and performance is in Finland (only 4% of students). Finland is followed by such countries as Norway (4.1%), Iceland (7.1%), Estonia (7.8%), Sweden (8.1%), Latvia (9.0%), Canada (9.5 %) and Denmark (10.1%). Consequently, in the international context, comparatively few students in Latvia attend schools with low SES and low performance in mathematics test of PISA 2012, while 11.2% of students attend schools with a low SES, whose performance corresponds to the average level. However, it is those 9% of students (school percentage is higher than that of the students, because this group also contains the relatively small schools) that create considerable problems for us, because the education system is not able to fully compensate for the low school SES, this being a regional development issue (see also Chapter 6.5). Figure 6.11 also demonstrates that 11.5% of the students in Latvia attend schools with low performance and average-level SES. An increase in the level of performance achieved by these students could certainly be addressed by upgrading the education system. By all means, Latvia also has many schools with high performance – 21.3% of Latvia's students have a high level of performance, learning in schools with a high SES level. They are joined by yet another 3.8% of the students who attend schools with high performance, but an average level of SES.

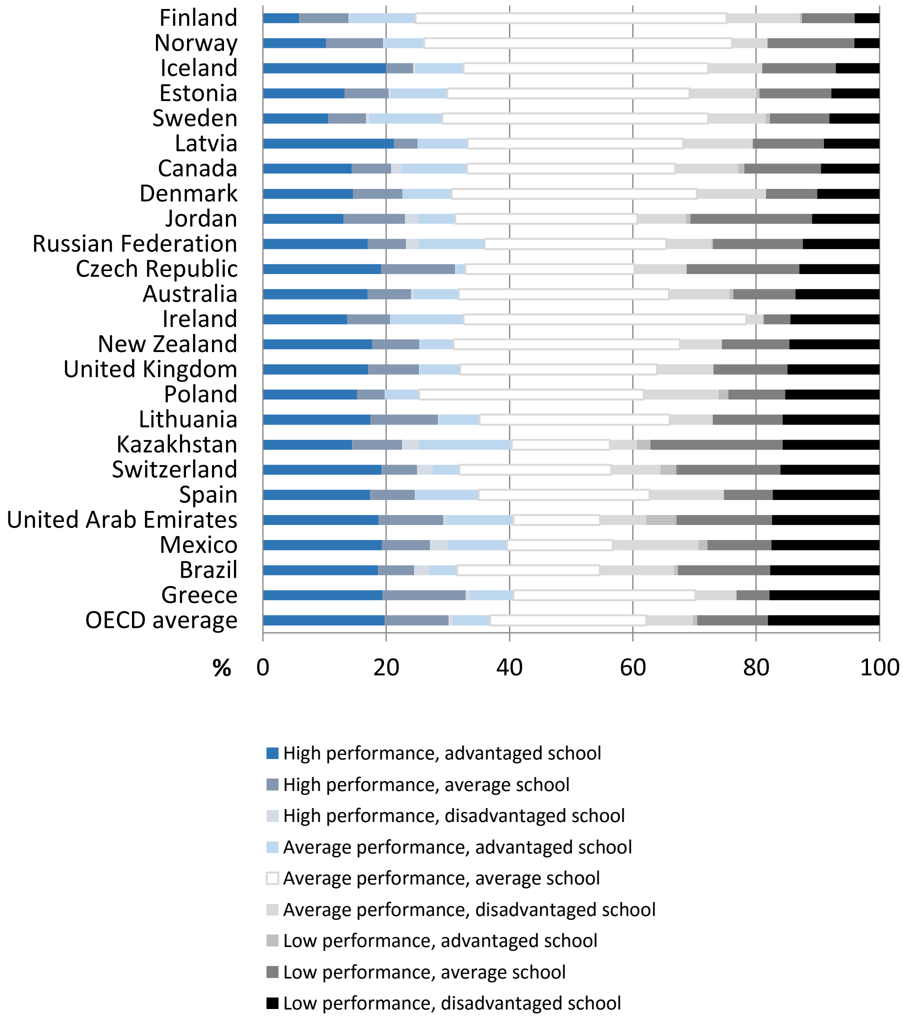


Figure 6.11

Distribution of students across school performance and socio-economic profile

Note: Countries are ranked in ascending order according to the proportion of students in low-performing schools that are also with low school SES.

Chapters 6.4 and 6.5 confirm the fact that the performance analysis, depending on the location of the school (Riga, urban, rural area) and type of school (gymnasiums, secondary schools, primary schools) to a great extent must take into account the SES index.

Summary

The correlation between the student performance and the SES exists in all countries – the students from families with lower SES on the average show lower performance in the OECD PISA test and all the other comparative studies across all content areas and all age groups, yet the strength of this correlation varies in different countries.

The analysis of PISA 2012 results shows that the extent to which the test results achieved by fifteen-year-old Latvian students depend on their family's material status, availability of educational and cultural resources at home, parental education and occupation (i.e., student SES), is broadly consistent with the average of the OECD countries. However, in the recent years this dependency has become a little more pronounced in Latvia, because our country has descended from the previous, higher position within the international comparison to an average level of OECD countries with respect to equity of education. Although, according to international comparison, this relationship is still relatively moderate in Latvia, a slight deterioration in overall situation has been observed lately. It prompts us to assess the situation and look for the ways to help students from families with lower SES, and especially schools having relatively large number of these students, to raise their educational performance.

The average SES level of a school has a significant impact on its students' performance – it can be observed when comparing various schools in Latvia and the average results in the OECD countries. The family's SES does not have as great an influence on the same school students' performance differences, the overall school performance level is determined by the SES level of that school.

The more detailed analysis of the schools' SES and average school performance shows that 21.3% of Latvia's students attend schools with a high overall level of performance and a high SES level. These are joined by a further 3.8% of the students who attend schools with a high performance, but an average level of the SES, while 9% of Latvia's students study at schools with a low school SES and a low performance level.

Raising the students’ performance level at these schools is certainly not just a matter of the education system, but, above all, a regional development issue, if the school is located in an area, where the families’ SES are generally low, and perhaps in part it is also a matter of student enrolment in these schools. 11.5% of students attend schools with low performance level, yet a medium SES level, and in this group of schools the facilitating of the quality of the educational work should be a decisive factor in improving its results.

The international comparison with regard to performance of schools and their SES is favourable to Latvia – in the OECD countries, on the average, 18% of students attend schools with low SES and low performance, and 20% attend schools with a high SES and high performance. The relative proportions of these students in Latvia are, respectively, 9.0% and 21.3%. Consequently, according to the international comparison, in Latvia the number of students who attend schools with low performance and low SES, is relatively small. The smallest number of students attending schools with low SES and low performance is seen in Finland – only 4%. Finland is followed by Norway (4.1%), Iceland (7.1%), Estonia (7.8%), Sweden (8.1%), Latvia (9.0%), Canada (9.5 %) and Denmark (10.1%).

3.3. Students with a high socio-economic status and their performance

On the average, students' achievements are related to the socio-economic status of their families – the students with a high SES show higher performance, while the students with a lower SES – lower achievements (OECD, 2013). Looking at the SES as a single, separate factor, it has the greatest impact on student performance (OECD, 2004). Quite a lot of research work has been dedicated to the factors influencing the performance of students with a low SES, particularly emphasizing the socially elastic students (resilient) group (in the educational context, the term “socially elastic, flexible students” denotes those with a low SES and high performance). The research dedicated to these topics in Latvia was carried out by Ieva Kārkliņa (Kārkliņa, 2012; Kārkliņa, 2013a; Kārkliņa, 2013b). The factors that affect the progress of students with a high SES have been examined less – the analysis of these factors is the goal of the current chapter.

Different indicators can be chosen to characterize the students' SES, for example, parents' education, parents' occupation, the number of books at home, etc. It has been found that some of the SES indicators are positively correlated with student performance – e.g., the number of books at home, musical instruments at home, the student's own desk for studies, but some have a negative influence – e.g., a personal TV or DVD player, also a mobile phone (Twist, Schagen, Hodgson, 2007). Some authors, for example, Martin Carnoy with colleagues (Carnoy, Khavenson, Ivanova, Rothstein, 2013), use only the number of books at home for the purpose of classifying social groups. This indicator is obtained as the manifesting variable without complex calculations, and is similarly measured in virtually all studies. The OECD PISA chief characteristic indicator of the SES is the socio-economic and cultural status index ESCS, which includes parental education, parental occupation, the number of books at home, and the presence or absence of a variety of things in the family's possession (OECD, 2013). This index will be used for the students' SES characterization in this chapter.

International comparative education research is a unique opportunity to make a comparison between a number of countries, it gives a better chance to discover regularities. On the other hand – as more than 60 very different countries participated in PISA, it is not productive to compare one country (Latvia) with all the participating countries. This chapter will review the Baltic Sea countries. The choice was determined by the fact that all the Baltic Sea countries are geographically close, and this, in turn, determines intensive cultural exchanges both in a peaceful (voluntary) environment and as a result of various wars (forced processes). The selected countries and their students' average performance in PISA 2012 is shown in Table 6.3. The difference between the country with the highest performance in mathematics (Estonia), and the country where it is the lowest (Sweden) is 43 points, therefore it can be concluded that the difference in performance of the Baltic Sea countries' students is not very large. The mathematics performance of the students from Estonia, Finland, Poland, Germany and Denmark is statistically significantly higher than the OECD average. Latvia's student performance does not differ from the average, whereas the Russian, Lithuanian and Swedish students' performance is lower than the OECD average. Latvia's students' average performance in mathematics is statistically significantly lower than that of Estonia, Finland, Poland, Germany and Denmark, yet statistically significantly higher than the Russian, Lithuanian and Swedish student achievements. Looking at the changes since 2003, we can see that the performance of students in the Baltic Sea countries tend to converge. The average national student performance in reading from 2003 to 2012 is shown in Figure 6.12.

Table 6.3

The average performance of Baltic Sea countries' students in mathematics, science and reading

Country	**Average performance in mathematics**	**Average performance in science**	**Average performance in reading**
Estonia	521	541	516
Finland	519	545	524
Poland	518	526	518
Germany	514	524	508
Denmark	500	498	496
Latvia	491	502	489
Russia	482	486	475
Lithuania	479	496	477
Sweden	478	485	483

Note: The table is arranged according to performance in mathematics..

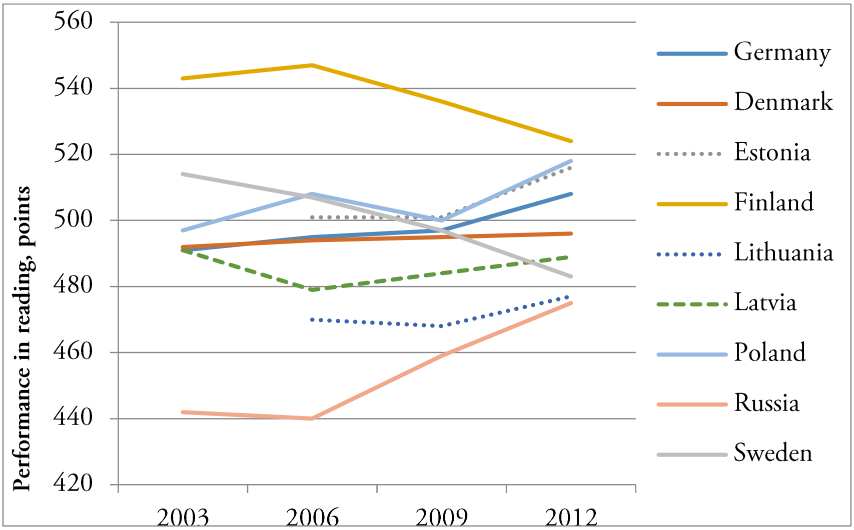


Figure 6.12

The average performance of Baltic Sea countries' students in reading from 2003 to 2004

Method of data analysis

Each country's students were divided into 10 approximately equal groups according to the socio-economic status index (ESCS). The division was made separately in each country, irrespective of the differences in the national ESCS average values. The first group consisted of about 10% of the students with the lowest SES in the country, while the tenth group contained the students with the highest SES. The average ESCS of each country and each group is shown in Table 6.4. The highest average ESCS values are shown by the Scandinavian countries (Denmark, Finland and Sweden) and Germany, the medium – by Estonia, Russia and Lithuania, while Poland and Latvia have the lowest values. Notably, the index values remain unchanged linearly by the SES groups. The greatest difference in index values between the adjacent groups is observed between the first and the second, as well as the ninth and the tenth group. Both are "open groups", i.e., the first is not limited from the bottom, but the tenth – from the top. The first group consists of the students with extremely low ESCS values, which significantly lowers the average value of the group, but the tenth is formed by the students with extremely high ESCS values increasing the group's average value. The great difference between the first and the second group indicates that the first group has very low average index values. It is expected that the performance of the first SES group's students will be significantly lower than those of the second group. The average index values of Latvia's students in almost every SES group are the second lowest – in the first and the second group they are only slightly higher than those of Lithuania, in the fourth to the seventh group slightly higher than those of Poland, and in the ninth and the tenth group – higher than those of Russia. The average ESCS values in the higher SES groups of the analysed countries differed even 1.5 times (Denmark and Germany with higher average values, Russia and Latvia – with lower ones).

The average performance shown by each of these groups is shown in Figure 6.13, but the average performance in reading – in Figure 6.14. As expected from the comparatively very low values of ESCS in the first SES group, the performance of students in this SES group is significantly lower than that of the second group's students. In all countries except Estonia, Finland and Poland, we have seen a remarkable decline in performance of the student group with the lowest SES.

Table 6.4

Vidējās ESCS vērtības Baltijas jūras valstīs un šo valstu SES grupās

	1. SES group	2. SES group	3. SES group	4. SES group	5. SES group	6. SES group	7. SES group	8. SES group	9. SES group	10. SES group	Average
Denmark	-1,3	-0,7	-0,4	-0,1	0,2	0,5	0,8	1,0	1,3	1,7	0,43
Finland	-1,1	-0,6	-0,2	0,1	0,3	0,6	0,8	1,0	1,2	1,5	0,36
Sweden	-1,2	-0,6	-0,3	0,0	0,2	0,5	0,7	0,9	1,1	1,5	0,28
Germany	-1,4	-0,8	-0,5	-0,2	0,0	0,3	0,6	0,9	1,3	1,7	0,19
Estonia	-1,2	-0,8	-0,5	-0,2	0,0	0,3	0,6	0,8	1,1	1,4	0,11
Russia	-1,4	-0,9	-0,6	-0,4	-0,2	0,1	0,3	0,5	0,7	1,1	-0,11
Lithuania	-1,7	-1,2	-0,9	-0,6	-0,3	0,1	0,4	0,7	0,9	1,3	-0,13
Poland	-1,5	-1,1	-0,9	-0,7	-0,5	-0,2	0,1	0,6	1,0	1,4	-0,21
Latvia	-1,6	-1,2	-0,9	-0,6	-0,3	0,0	0,3	0,5	0,8	1,2	-0,26

Note: The table is arranged according to the countries' socio-economic and cultural status index average value.

Figures 6.13 and 6.14 reflect that in all the reviewed countries student achievement is related to their SES – on the average, the students with a higher SES show higher performance. The difference between the achievements of the students with a high and a low SES within one country is higher than the difference between the average performance between countries. In the countries with high average performance, Estonia, Finland and Poland, there is a relatively lower dependence of student performance on their SES – the curves' gradients are lower. This is achieved by increasing the low-income students' performance. It should be noted, that the Swedish and Danish student performance is relatively closely related to their SES: this contradicts our perception of the Scandinavian countries' successful policy of student equality.

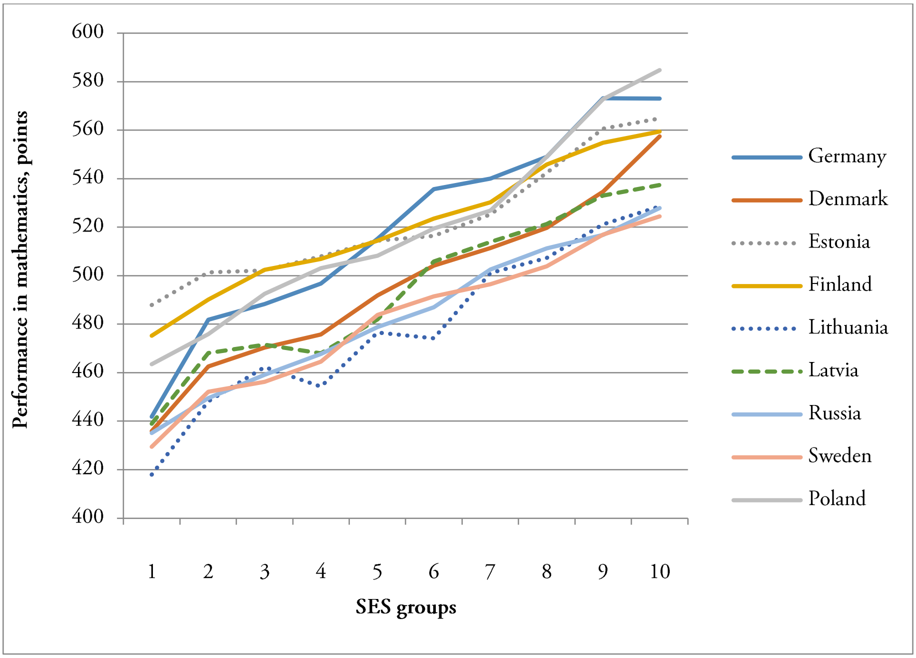


Figure 6.13

Performance of Baltic Sea countries' students in mathematics, in particular SES groups

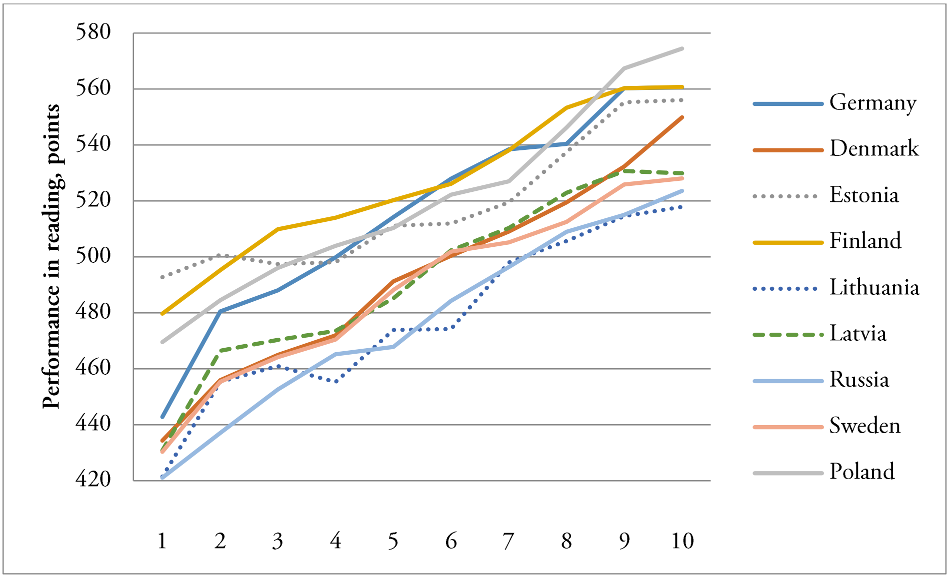


Figure 6.14

Performance of Baltic Sea countries' students in reading, in particular SES groups

Performance distribution according to the SES tends to persist over a long period of time. Figure 6.15 shows Latvian student performance in certain SES groups according to study cycles, from the year 2003 onwards. It shows that particularly low average performance is shown by the group of students with the lowest SES (this was most pronounced in the studies of 2006 and 2012, but somewhat less conspicuous in the studies of 2003 and 2009). Student performance in the second to the fifth group is relatively similar, with minor differences. Student performance in the sixth to the ninth group is markedly growing. The tenth group of students did not show a higher average performance than the ninth group of students only in the 2012 cycle. The decline in performance or failure to increase is also characteristic of other countries, – Finland, Germany, Estonia.

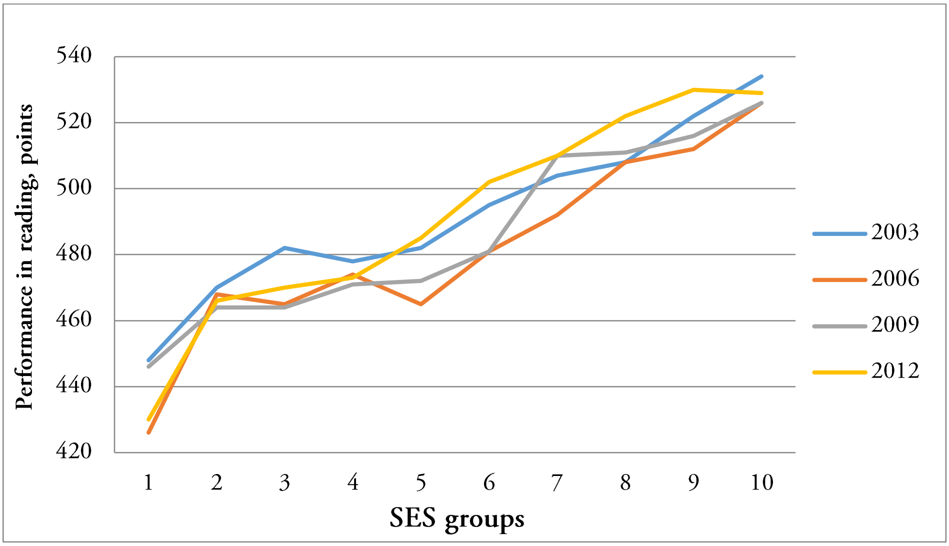


Figure 6.15

Performance of Latvia's students in reading according to SES groups in four PISA cycles

Hereafter the chapter will provide a review of the students from the highest socio-economic status group. The interrelations between the SES of this group of Latvia's students and their performance are shown in Figure 6.16. First of all, it should be emphasized that the SES differences in this group are great, as there is no previous group limiting it from above. Most students' performance is higher than 491 points, which is the average of all Latvia's students, many students' performance exceeds 544 points (in accordance with the fifth level of competence in mathematics). Of course, there are also students whose performance is below 420 points (the threshold of the second level of competence). In this group of students, the achievements do not correlate with the SES. A similar relationship is present also in reading (see Figure 6.16).

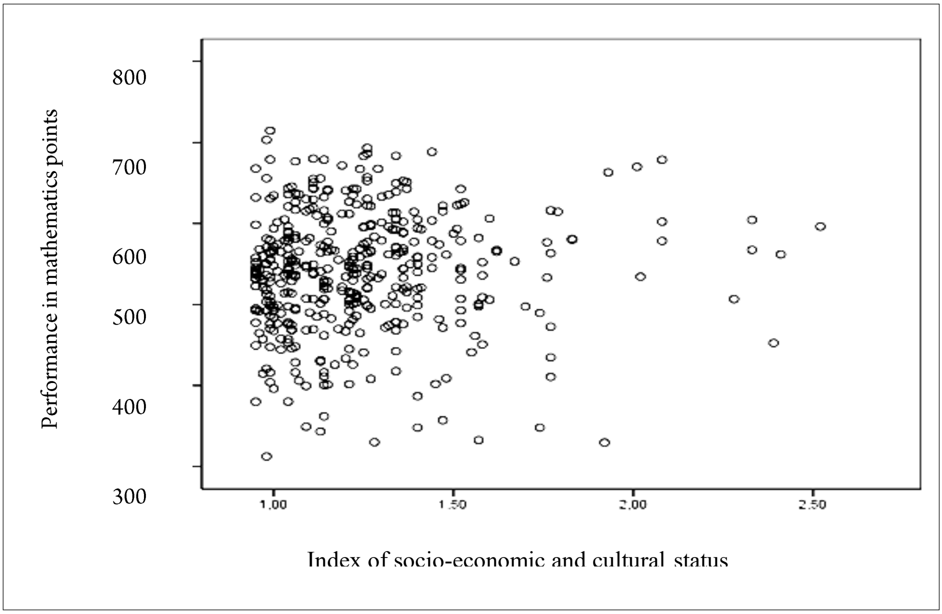


Figure 6.16

Graph of interrelations between student SES and performance in mathematics

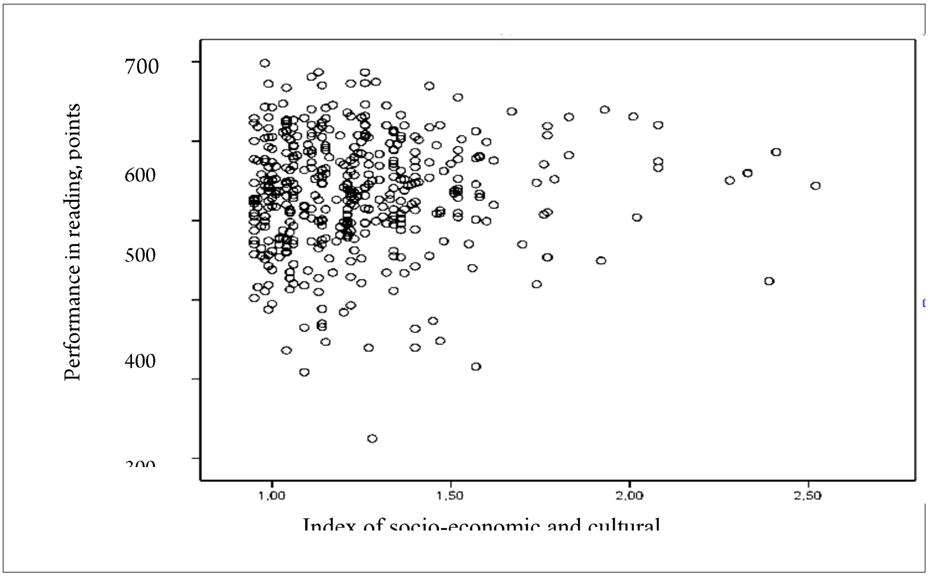


Figure 6.17

Graph of interrelations between student SES and performance in reading

Students with high SES do not study only in Riga or the city schools, they also study in small towns and rural areas. Altogether, 211 Latvia's schools participated in PISA 2012, and the students belonging to the tenth SES group studied in 116 schools, which is 55% of all schools. 34 schools (29%) had one student with a high SES, 21 schools(18%) – two students, and 91 schools(78%) had five or less students with a high SES. It should be emphasized that the relative number of schools, which are attended by the wealthier students, characterizes the equality or inequality of the schools in the country. Consequently, it can be seen that a relatively large cluster of schools (45%) has formed in Latvia, where there are no students from families with a high socio-economic and cultural capital. If the individual schools have a lot of students with a low SES, it is a threat of low performance (Johansson, Preuschoff, 2008). Scandinavian countries, Poland, and also Estonia are more socially cohesive (see Table 6.5).

Table 6.5

Te number of schools in PISA 2012 in Baltic sea countries and the number of schools with students of the 10th SES group

Country	Number of schools in PISA 2012	Number of schools with students of Group 10	Proportion of schools (%) with students of Group 10
Denmark	341	256	75
Estonia	206	143	69
Finland	311	257	83
Germany	230	148	64
Latvia	211	116	55
Lithuania	216	131	61
Poland	184	140	76
Russia	227	136	60
Sweden	209	160	77

Contemplating the difference between the performance of the highest SES group and the average performance, it can be observed that this difference has a tendency to decline (see Figure 6.18). It is particularly pronounced in Germany, where the difference from 89 points has dropped to 53 points. Also, the relatively large difference in Poland has decreased significantly.

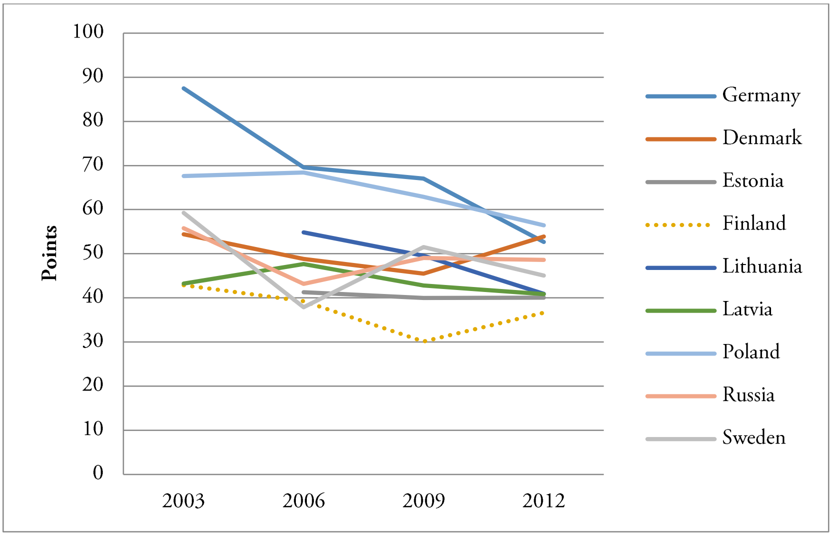


Figure 6.18

Difference between the performance of the highest SES group and the average performance in reading, Baltic Sea countries, from 2003 to 2012

Results of data analysis

Student performance is influenced by many factors. At the national level, one of the factors is the national wealth – richer countries with a higher per capita GDP show a higher student performance. For example, looking at OECD countries' performance in mathematics, in PISA 2003 the corresponding regression coefficient of determination was 0.28, which indicates a strong performance and GDP connection (OECD, 2004). At the national level, one must take into account the location of the school – city, town, rural areas. In Latvia, significantly higher performance is observed among the students of Riga and larger cities, lower results are shown by the students of rural schools (Geske, Grīnfelds, Kangro, Kiseļova, 2013).

An important factor in achieving high performance is the discipline – both school attendance and behaviour during the lessons. The survey of students in the framework of the study included three questions regarding truancy – late arrival at school, skipping one or more school days, or skipping a lesson within a school day. Looking at the group with a high SES, the relationship between late arrival at school and performance, as well as skipping an entire day and performance was observed. Tables 6.6 and 6.7 show the absences of the students in the highest SES group. Admittedly, Latvia's students in this comparison show the lowest discipline – only 44%

of the students have not arrived late at school, and only 79% have not skipped an entire school day. Just as bad is the discipline of Russia's students. The German students represent a stark contrast – 95% have not skipped a single day without justification.

Table 6.6

Answers to the question "How many times did you arrive late at school in the last two full weeks of school?"given by students with a high SES

Country	Never (%)	Once or twice (%)	Three or four times (%)	Five times or more often (%)
Denmark	58	28	9	5
Estonia	58	30	8	4
Finland	52	33	10	5
Germany	77	18	3	2
Latvia	44	35	13	8
Lithuania	56	31	8	5
Poland	57	28	8	6
Russia	52	31	8	8
Sweden	45	34	13	8

Table 6.7

Answers to the question " How many times did you skip a whole school day in the last two full weeks of school?" given by students with a high SES

Country	Never (%)	Once or twice (%)	Three or four times (%)	Five times or more often (%)
Denmark	89	9	1	1
Estonia	85	12	2	1
Finland	89	9	1	1
Germany	95	4	1	0
Latvia	79	17	2	2
Lithuania	81	16	2	1
Poland	84	13	1	1
Russia	79	16	3	3
Sweden	93	6	1	1

Of course, the unjustified absences of students are related to low performance. This is shown in Tables 6.8 and 6.9, and Figure 6.18. These tables show the standardized regression coefficients of one-parameter regression equations. In the regression, the dependent variable is the students' performance in mathematics, the independent variable – students' responses in the Likert Scale to the questions addressing late arrival to school and skipping school days. The negative coefficients point to the decrease in performance in relation to increased truancy. The observation that late arrival for school in Latvia is not connected with performance can be explained by the fact that also the students with high performance tend to arrive late at school in Latvia. A similar conclusion could be true regarding the German students, however, the German students seldom are late. In Poland this relationship also is not statistically significant. A relatively strong relationship between missing the beginning of lessons and performance in mathematics is observed in Russia, Sweden, Estonia and Finland. The connection of performance with skipped days is not statistically significant in Germany, Poland and Sweden. However, as we see in Figure 6.18, the truants show lower performance.

Table 6.8

Standardized coefficients of regression equation

Country	Standard regression coefficient	Standard error of coefficient
Denmark	-0,10	0,04
Estonia	-0,17	0,06
Finland	-0,18	0,04
Germany	-0,01	0,06
Latvia	-0,05	0,07
Lithuania	-0,14	0,05
Poland	-0,10	0,06
Russia	-0,20	0,06
Sweden	-0,22	0,06

Note: the independent variable – student performance, the dependent variable – students' answers regarding late arrival for school within the last two weeks

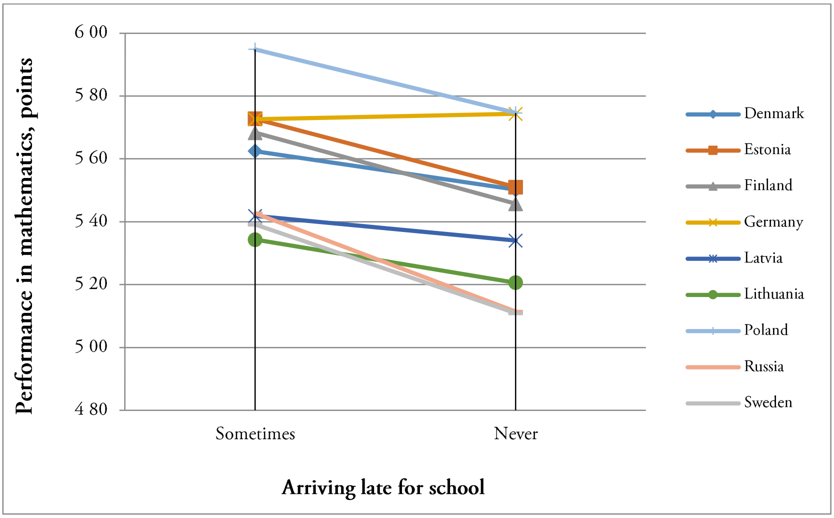
Table 6.9

Standardized coefficients of regression equation

Country	Standard regression coefficient	Standard error of coefficient
Denmark	-0,14	0,04
Estonia	-0,14	0,05
Finland	-0,16	0,04
Germany	-0,07	0,10
Latvia	-0,18	0,06
Lithuania	-0,18	0,07

Poland	-0,09	0,05
Russia	-0,22	0,05
Sweden	-0,04	0,04

Note: the independent variable – student performance, the dependent variable – students' answers regarding unjustified skipping of one or more days within the last two weeks.



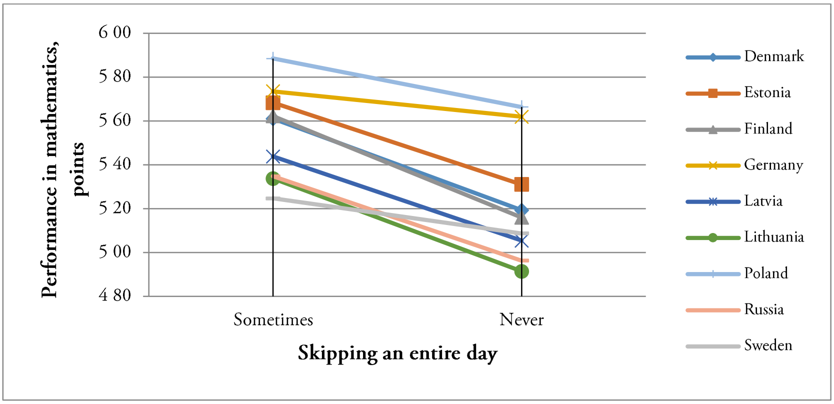


Figure 6.19

Correlation of student performance in mathematics with missing the beginning of lessons (a) and skipping an entire day (b)

The disciplinary climate at school is characterized by an index designed on the basis of the students' answers to the question " How often do these things happen in your mathematics lessons? a) Students don't listen to what the teacher says. b) There is noise and disorder. c) The teacher has to wait a long time for the students to quiet down. d) Students cannot work well. e) Students don't start working for a long time after the lesson begins." The average values of the index for students with a high SES in the Baltic Sea countries are shown in Table 6.10. This index, like other PISA indices, are regulated on an average value of 0 and a standard deviation of 1. A higher index value indicates a higher discipline in the classroom. The following table shows the standardized regression coefficients of the equation, where the dependent variable is the students' performance, and the independent value is the disciplinary climate. For comparison – the lowest disciplinary climate values are shown by the Finnish and Swedish students, but the highest ones – by Lithuanian and Russian students. Positive relation of discipline to performance exists in all the Baltic Sea countries, only in Finland and Sweden this relationship is not statistically significant.

Table 6.10

Standardized coefficients of regression equation

Country	**Average value of disciplinary climate index**	**Standard regression coefficient**	**Standard error of coefficient**
Denmark	0,09	0,10	0,05
Estonia	0,20	0,18	0,11
Finland	-0,29	0,09	0,06
Germany	0,06	0,19	0,06
Latvia	0,10	0,13	0,06
Lithuania	0,43	0,15	0,06
Poland	0,11	0,25	0,07
Russia	0,36	0,24	0,06
Sweden	-0,13	0,14	0,07

Note: the independent variable – student performance, the dependent variable – disciplinary climate index.

The teachers' support in learning mathematics and, of course, also other subjects, is of a paramount importance. Teacher support is characterized by teacher support index. The lowest teacher support index is observed in Germany and Poland, the highest – in Sweden, Russia and Denmark. Looking at the relation of high-SES students' index to performance, it is obvious (see Table 6.11) that the relationship is determined – the students with higher performance feel a greater teacher support. This effect is well depicted in the graphs showing the relation of student performance and student answers regarding teachers' help and support during mathematics lessons. The group of questions addressed the situations during the lessons of mathematics. Figure 6.19 shows the connection between performance and assertion "The teacher shows an interest in every student's study progress". The students with high performance are more inclined to think that the teachers are interested in their students' achievements. Figure 6.20 shows the relation between performance and assertion "The teacher gives extra help when the students need it". Here again the students with higher performance indicate a greater teacher's assistance. Those with higher performance also assert that "The teacher helps the students with their studies" (see Figure 6.21). On the average, higher performance is characteristic of the students, who say, that often "The teacher continues teaching until the students understand" (see Figure 6.22). However, the Lithuanian students are an exception here. The teacher should also give the students an opportunity to express opinions, which it is also related to higher performance (see Figure 6.23).

6.11. tabula

Regresijas vienādojuma standartizētie koeficienti

Country	**The average value of teacher support index**	**Standard regression coefficient**	**Standard error of coefficient**
Denmark	0,28	0,17**	0,05
Estonia	-0,13	0,18*	0,09
Finland	0,21	0,08	0,06
Germany	-0,39	0,13	0,07
Latvia	-0,02	0,18*	0,08
Lithuania	0,04	0,08	0,07
Poland	-0,35	0,20**	0,05
Russia	0,27	0,05	0,06
Sweden	0,39	0,15*	0,06

Note: the independent variable – student performance, the dependent variable – teacher support index.

* Coefficient statistically significant with 95% confidence.

** Coefficient statistically significant with 99% confidence.

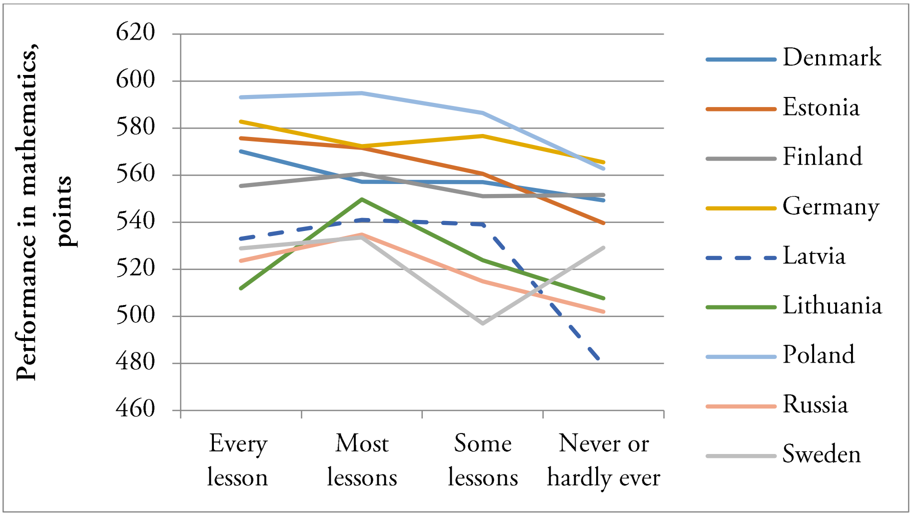


Figure 6.20

The relation of high-SES student performance with the assertion "The teacher shows an interest in every student's learning"

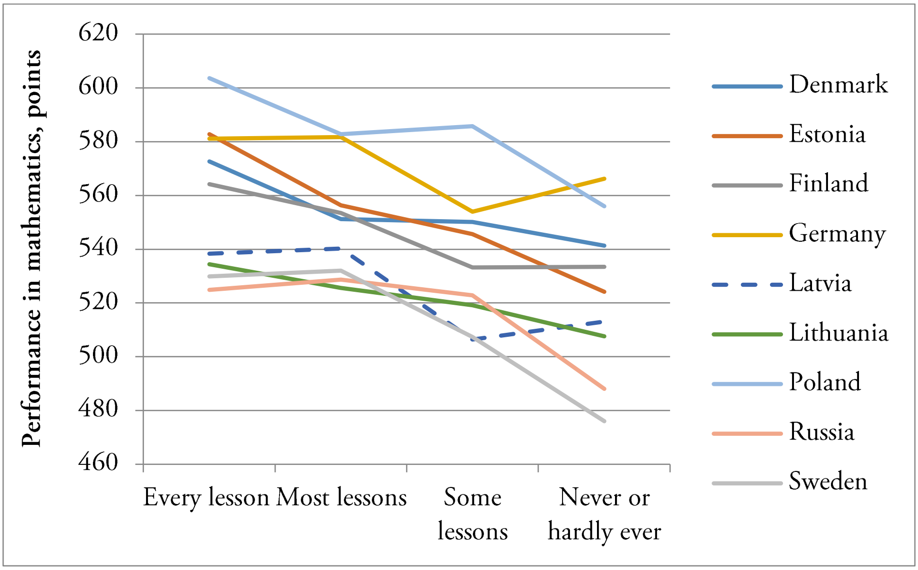


Figure 6.21

The relation of high-SES student performance with the assertion "The teacher gives extra help when students need it"

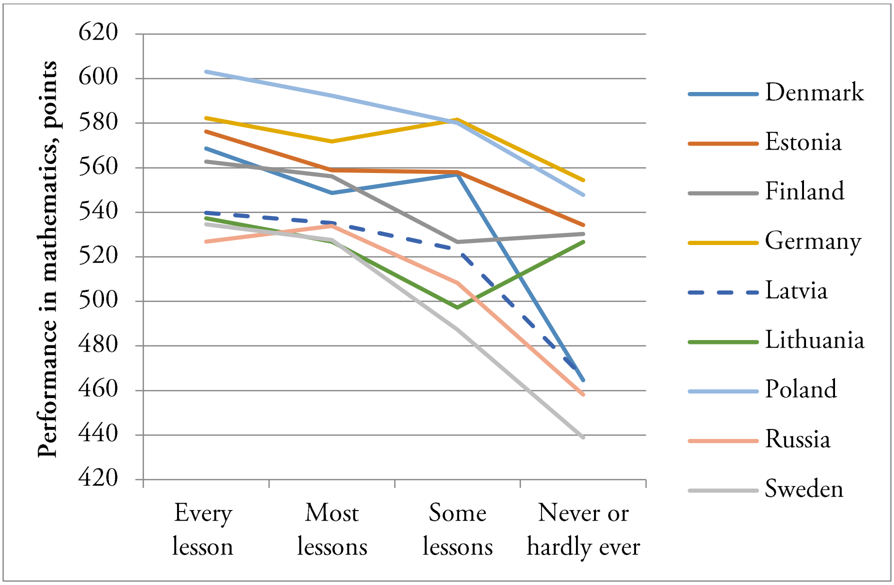


Figure 6.22

The relation of high-SES student performance with the assertion "The teacher helps students with their learning"

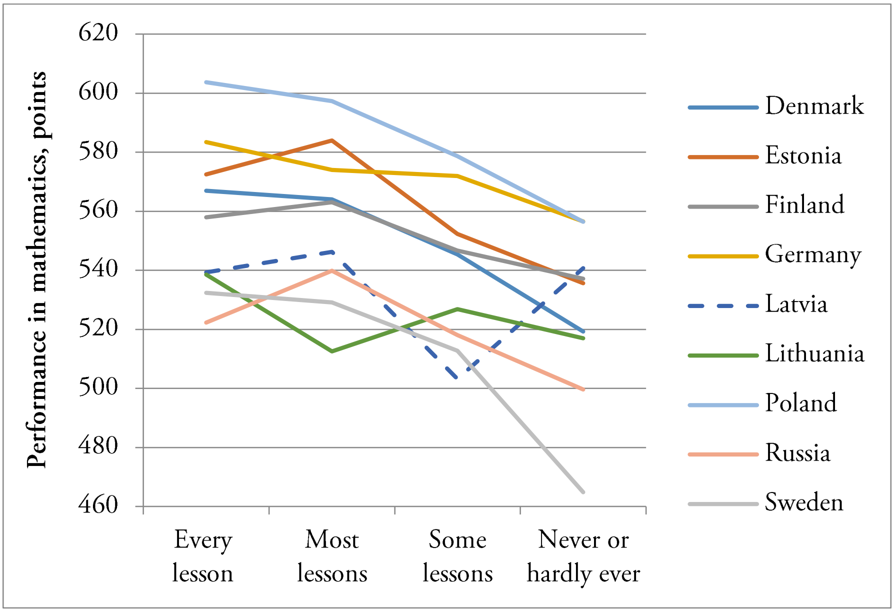


Figure 6.23

The relation of high-SES student performance with the assertion "The teacher continues teaching until the students understand"

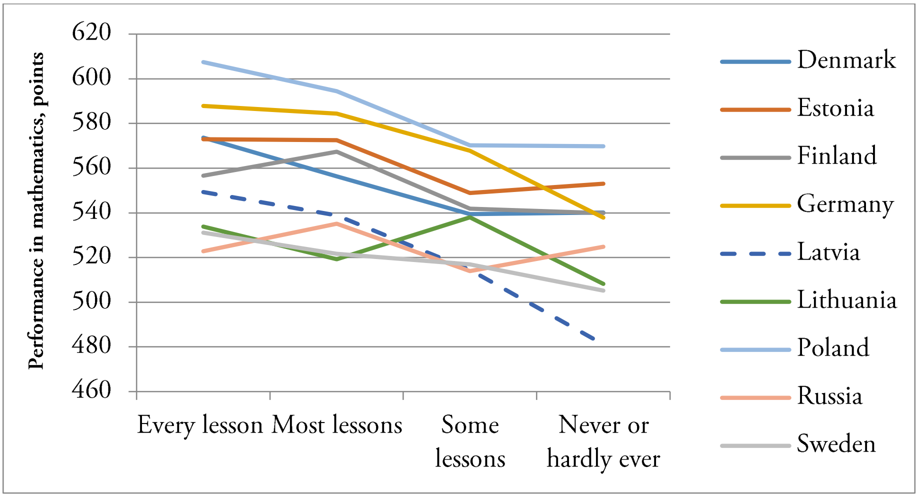


Figure 6.24

The relation of high-SES student performance with the assertion "The teacher gives students an opportunity to express opinions"

Table 6.12

Time devoted by high-SES students to homework

Country	Hours on average	Division of students according to time devoted to homework (%)			
		0–4 hours	5 – 9 stundas	10 - 14 stundas	0–4 hours
Denmark	4,9	55	36	7	2
Estonia	7,4	35	37	18	11
Finland	3,1	80	18	2	0
Germany	5,0	57	29	10	3
Latvia	7,0	35	36	20	10
Lithuania	7,6	33	33	23	11
Poland	7,2	42	31	15	12
Russia	10,9	18	29	27	26
Sweden	4,5	64	25	8	3

Traditionally, lessons at school are planned with a view that homework will also be done. This is particularly characteristic of the post-Soviet countries. Among the Baltic Sea countries, the greatest amount of time to homework is devoted by Russia's students with high SES (on average almost 11 hours, or about two hours every day). Estonian, Latvian, Lithuanian and Polish students devote an average of 7 to 7.6 hours per week to homework. The least time to housework is devoted by Finnish students – an average of only three hours a week (see Table 6.12). Here we actually see two different approaches to studies. High performance group includes Poland, Estonia (a lot of homework), Germany (medium amount of homework), Finland (little homework). The lowest performance is shown by the Russian students who relatively have the biggest amount of homework.

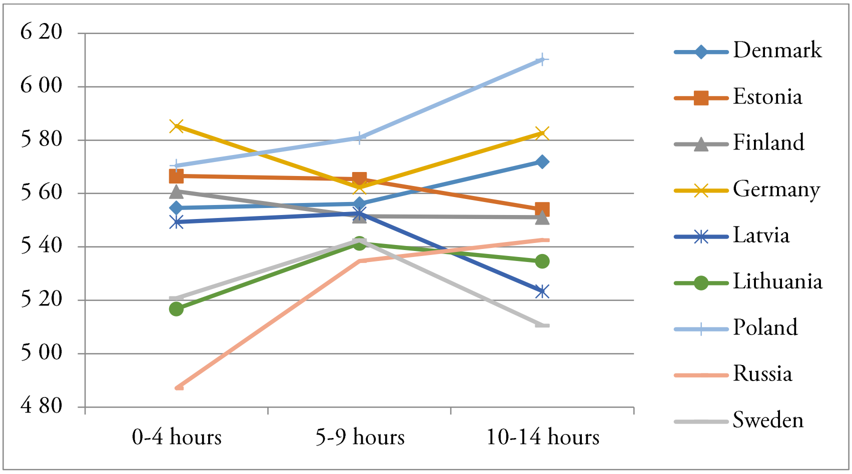


Figure 6.25

The relation of high-SES student performance with the time devoted to homework

Figure 6.25 shows the relationship between performance and the time spent at homework. The increase in performance level with increasing duration of homework is observed in Poland, Denmark and Russia. In Latvia and Estonia, where students spend long hours doing homework, they have even slightly lower results. This can be explained by the less talented students' desire to obtain good grades or inefficient homework assigned by the teacher, requiring a large input of time.

And, of course, an important factor in performance is the students' motivation. We shall review three indexes related to students' attitudes towards mathematics: anxiety about mathematics, interest in mathematics and external motivation for learning mathematics.

The index "interest in mathematics" is formed on the basis of student opinion regarding these assertions: "I enjoy reading about mathematics", "I look forward to my mathematics lessons", "I do mathematics because I enjoy it", "I am interested in the things I learn in mathematics".

The index "external motivation for learning mathematics" is formed on the basis of the students' opinions regarding these assertions: " Making an effort in mathematics is worth it because it will help me in the work that I want to do later on", "Learning mathematics is worthwhile for me because it will improve my career prospects", " Mathematics is an important subject for me because I need it for what I want to study later on", "I will learn many things in mathematics that will help me get a job".

The index "anxiety about mathematics" is formed on the basis of the students' opinions regarding these assertions: "I often worry that it will be difficult for me in mathematics classes", "I get very tense when I have to do mathematics homework", "I get very nervous doing mathematics problems", "I feel helpless when doing a mathematics problem", "I worry that I will get poor grades in mathematics."

The external motivation for learning, in this case, is related to the students' perception of their future careers, and not with any immediate rewards for the accomplished work. It is a long-term motivation that in many 15-year-olds can be very weak – they do not yet seriously plan their lives. A teacher with interesting lessons will not promote it, either. It is therefore natural that the external motivation does not have a very strong impact on student performance, yet it has a positive effect on performance in all the Baltic Sea countries, the effect is statistically significant (except Latvia) (see Table 6.12). The highest influence of the external motivation is observed in Finland and Poland. Of the countries under consideration, the highest external motivation index values are achieved by Danish, Swedish and Lithuanian students, the lowest – by German and Russian students.

Table 6.13 shows the extent to which the performance is affected by the interest in mathematics (internal motivation). Standardized regression coefficients are significantly higher than in the case of the external motivation, all of them, except the one for Lithuania, are statistically significant. On average, the greatest interest in mathematics has been expressed by the Danish, Swedish and Russian students, the least – by the Polish, German and Latvian students.

Student performance has a very strong correlation with the anxiety about mathematics (see Table 6.14). In other words – the students with lower performance are afraid to do mathematics problems, doubt their abilities, feel helpless in solving mathematical problems. This could be due to the previous negative experiences. If the teacher ensured that the students solve the tasks assigned to them, these fears would not arise. Students need both psychological support and assistance in solving specific tasks.

Table 6.13

Standardized coefficients of regression equation

Country	Average value of index "external motivation for studying mathematics"	Standard regression coefficient	Standard error of coefficient
Denmark	0,56	0,14**	0,05
Estonia	0,19	0,19*	0,08
Finland	0,32	0,30**	0,05
Germany	-0,04	0,15*	0,06
Latvia	0,22	0,10	0,06
Lithuania	0,41	0,15*	0,06
Poland	0,14	0,28**	0,06
Russia	-0,06	0,18*	0,07
Sweden	0,50	0,24**	0,08

Note: the independent variable – student performance, the dependent variable – index "students' external motivation for studying mathematics".

* Coefficient statistically significant with 95% confidence.

** Coefficient statistically significant with 99% confidence.

Table 6.14

Standardized coefficients of regression equation

Country	Average value of index "internal motivation for studying mathematics"	Standard regression coefficient	Standard error of coefficient
Denmark	0,62	0,33**	0,05
Estonia	0,13	0,30**	0,09
Finland	0,06	0,31**	0,05
Germany	0,03	0,33**	0,06
Latvia	0,04	0,26**	0,06
Lithuania	0,27	0,13	0,07
Poland	-0,04	0,30**	0,06
Russia	0,34	0,26**	0,05
Sweden	0,41	0,36**	0,06

Note: the independent variable – student performance, the dependent variable – index "students' internal motivation for studying mathematics".

* Coefficient statistically significant with 95% confidence.

** Coefficient statistically significant with 99% confidence

Table 6.15

Standardized coefficients of regression equation

Country	Average value of index "anxiety about mathematics"	Standard regression coefficient	Standard error of coefficient
Denmark	-0,80	-0,49**	0,04
Estonia	-0,36	-0,39**	0,07
Finland	-0,41	-0,47**	0,04
Germany	-0,48	-0,43**	0,05
Latvia	-0,17	-0,38**	0,08
Lithuania	-0,24	-0,44**	0,05
Poland	-0,09	-0,51**	0,05
Russia	-0,09	-0,45**	0,05
Sweden	-0,69	-0,44**	0,05

Note: the independent variable – student performance, the dependent variable – index "student anxiety about mathematics".

** Coefficient statistically significant with 99% confidence.

Summary

The analysis focussed on discovering, what factors influence the performance of students with high SES. For data analysis the Baltic Sea countries were chosen, all of which participated in the PISA study and are geographically close – this, in turn, determines the mutual influence and intense cultural exchanges both in peaceful times and as a result of warfare at different times throughout history. The socio-economic and cultural status index extensively used in PISA – ESCS – was chosen for SES measurement. The high SES group in each country was defined as 10% student group with the highest indicator values of the socio-economic and cultural status.

The average mathematics performance of the students with a high SES is higher than the average performance shown by the students from other SES groups in all countries except Germany. In Latvia, the students of the group with high SES study in 116 schools from 211 schools participating in the study. In other words, students with a high SES study only in 55% of all schools –compared with other countries, it points to the socially heterogeneous school system in Latvia, that poses the threat of segregation.

Looking at the factors that influence the performance of students with a high SES, student discipline is of a particular importance (truancy, behaviour during lessons) and motivation, the teacher's assistance in learning and psychological support. Although it is sometimes argued that the students with a high SES can afford to take time off and still show high performance ("they are smart and learn at home"), it cannot be proved. On the contrary – both late arrival at school and skipping whole days of school haves a negative impact on student performance in all the reviewed countries. It should be noted that the Latvian student discipline with regard to school attendance is particularly low. Also essential is a student discipline during the lessons.

The performance has a greater relation to the internal motivation of the 15-year-olds (interest in mathematics), but it is less related to the external motivation (relationship of mathematics to further training and employment). This is easily explained by the assumption that the students have not yet defined their goals in life, which leads to lack of long-term motivation. Students live in the present and do not plan their future. Such a lack of goals can lead to infantilism in adulthood. Performance in mathematics has a strong negative correlation with anxiety about mathematics, i.e., fear to solve mathematics problems. Students need help both in the form of psychological support and explanation of mathematics themes.

The highly performing students more often point out that the teacher shows an interest in every student's progress; that additional assistance is provided, if required; that the teacher keeps explaining the subject matter until the students have understood it. Contrary to the popular opinion that teachers help students with low performance more, the students with high performance indicate this assistance more frequently.

The study once more confirmed the cornerstones of a good education – requirement of high student discipline, strong teacher support in mastering the subjects, and that all the stakeholders – parents, teachers, intellectuals, the media – should persevere in raising the students' motivation to learn.

3.4. Performance distribution of Latvian students in international comparison and its dependence on urbanization, type of school, education program implemented by the school and the student's gender

The comparison of students' performance distribution in Latvia with the OECD average and the relative number of students with low and high performance

Latvian students' performance distribution in mathematics is close to normal (see chart in Figure 6.26), and it can be asserted that the test objectives and items were appropriate for the students of Latvia. Similarly to reading and science, also in mathematics there are pupils with very poor literacy (in level 1 or below – less than 358 points), and students with very high achievement (in level 6 – more than 669 points).

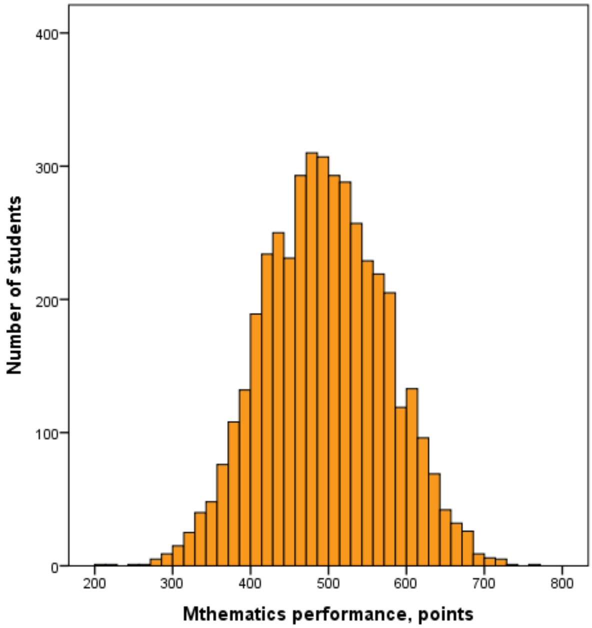


Figure 6.26

Latvia's student performance distribution in mathematics

The average proficiency of Latvia's students in mathematics according to PISA 2012 complied with the OECD average. However, the average level of achievement in the country and the average level within one or another group of countries (OECD, EU, etc.) is only one basic indicator, which by itself is insufficient for making comprehensive conclusions and recommendations. A lot more detailed information is provided by Latvia's performance distribution analysis (Figure 6.26) and comparison with the various OECD country average performance distribution parameters, as it is conventionally done in the OECD PISA cycles.

One of the most important distribution indicators is variation of performance – the difference between the students with the highest and the lowest performance. A smaller variation shows that the education system provides a comparatively greater equity regarding the education quality throughout the country, and consequently students have a greater opportunity to obtain education of equal quality. Of course, the average value of student performance distribution is also of great importance. The OECD average distribution and the distribution in Latvia often nearly matches the so-called normal distribution. The variation parameters of distribution can be measured in different ways, for example, as distribution variance (if the average OECD distribution variance is taken as 100%, the variance in Latvia constitutes only 78%), as standard deviation, or as the score-point difference between the top 10% and bottom 10% of students, and similar methods. Figure 6.27 shows that on the average in OECD countries in the mathematics PISA 2012, the score-point difference between the 90th and 10th percentiles was 238 points, in Latvia this difference constituted 210 points. Only two other OECD countries had a similarly low variation – Estonia (209 points), and Mexico – (190 points) (OECD, 2013a, p. 305). It should be noted that in case of countries with a significantly lower average value of performance (as in Mexico and many non-OECD countries) the small variance is explained by the fact that the distribution encompasses very few students with a high and average performance compared to the OECD average.

Consequently, PISA 2012 mathematics performance variation in case of Latvia was one of the smallest in comparison with other OECD countries. Performance variation of Latvia's students has been lower than the OECD average also in other PISA cycles and in all content areas, it has also decreased with simultaneous increase in performance (Figure 6.28).

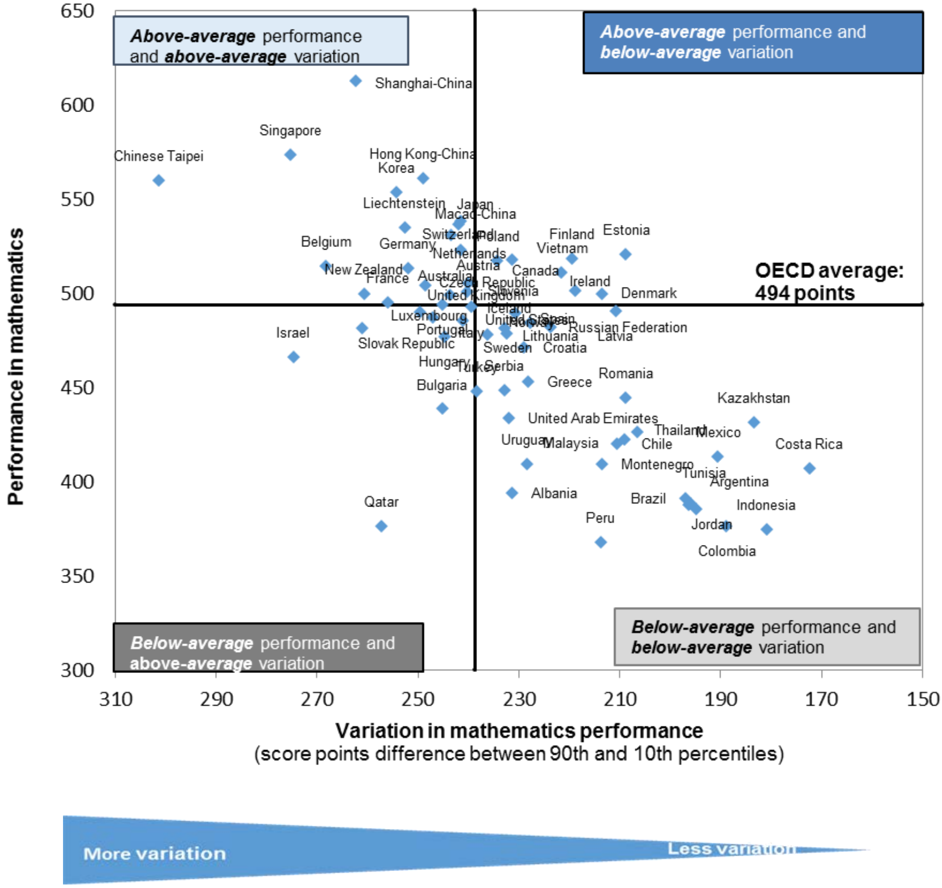
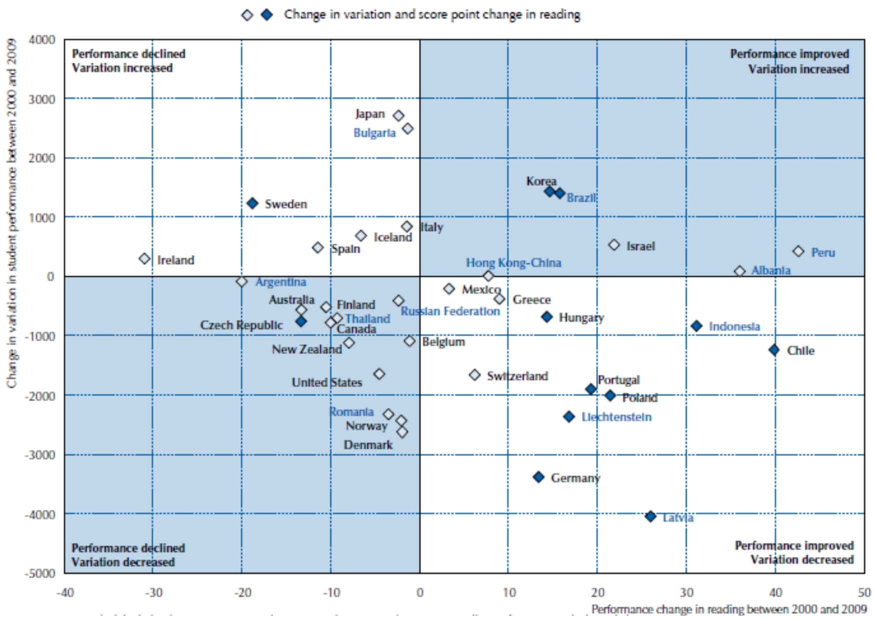


Figure 6.27

Relationship between performance in mathematics and variation in performance, PISA 2012

Figure 6.28 depicts the situation regarding reading literacy. It certainly characterises Latvia's education system positively, because it means that the proficiency of diverse students (showing high, low and average performance) in various schools is less disparate than on the average in OECD countries – therefore, the education system ensures a comparatively greater equity in the quality of education in comparison to the OECD average.

The facts described above – the average results in Latvia and OECD are practically the same, distribution in both cases is close to normal, while the indicators of Latvia's student distribution variation are considerably lower – seem to automatically indicate that there should be relatively fewer students with low performance and, unfortunately, fewer students with high performance in Latvia than the average in OECD countries, because the low and high performance boundaries are determined according to the average OECD countries' distribution, which has a significantly greater variance.



Note: Countries, in which both the change in variation and score-point change in reading are statistically significant, are marked in darker shade.

Figure 6.28

Change in variance and change in reading performance between 2000 and 2009

This is generally confirmed by the results obtained in the research cycles. We are satisfied, of course, that Latvia has relatively fewer students with lower performance than the average in OECD countries, but the concern is caused by the fact that there are few students with high performance in comparison with the OECD average within the given cycle of research and the content area, considering that those brightest students will have a major role in the country's future.

The situation is schematically represented in Figure 6.29, where the blue curve shows the OECD student performance distribution, and the continuous orange curve marks the Latvian students' performance distribution. OECD and the Latvian students' average performance is the same, as shown by the identical position of the maximum values of the curves with respect to the horizontal axis. The curves have different heights in order for the area below to be the same, it does not denote higher performance of Latvia's students. The vertical line marks the limits of students with low and high performance in the OECD countries' performance distribution. It is evident that in proportion to the total number of students (i.e., the area under the respective distribution curve part) there are less students with low and also high performance in Latvia than in the OECD. However, the increase of Latvian student performance (i.e., the shift of the distribution designated with the orange curve in the direction of the high performance shown by the dashed curve) would increase the relative number of students with high performance, and reduce the relative number of students with low performance.

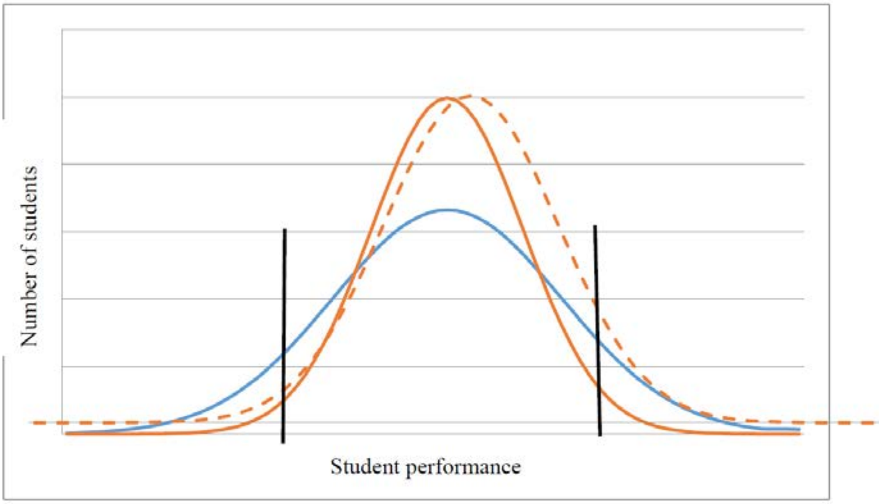


Figure 6.29

Schematic student performance distribution in Latvia and OECD countries

The analysis given previously shows that in Latvia it is essentially necessary to raise the quality of education (students' literacy in mathematics, science and reading) as a whole, thereby increasing both average achievement and the relative number of students with high performance, and decreasing the number of students with low performance. That is the result to be achieved according to the strategic development documents of Latvia, for example "The National Development Plan of Latvia for 2014–2020," sets forth the aim to "reduce the proportion of children and young people with low basic competencies, while increasing the number of students who demonstrate the highest level of competencies". The document defines the following performance indicators related to achievement of this goal: the relative number of students in the OECD PISA highest (levels 5 and 6) and lowest (level 1 and below) literacy levels in reading in 2020. Admittedly, the benchmarks to be reached in Latvia by 2020 are quite ambitious – 9% with regard to the highest performance and 13% to the lowest, especially concerning the highest performance, given that the corresponding measured values in PISA 2012 were 4.2% and 17%. European Union Strategy for 2020 (European Education and Training 2020 Strategy) proposes to reduce the number of pupils with low performance in mathematics, science and reading to 15% by 2020. The above documents are also used in planning the courses of action in "Education Development Guidelines 2014–2020."

It is important to be aware of the approximate number of students encompassed by the above-mentioned relative indicators, for example, 4% correspond to approximately 750 students with high performance in reading, 9% –to as many as 1700 students, if the number of students has not changed (according to the OECD PISA data, 18.8 thousand pupils aged 15 studied in the schools of Latvia in 2012). Therefore, this is not a discussion about, say, a few dozen winners of international competitions, although, of course, the teachers' efforts in training many students for Latvian and international school subject Olympiads greatly contribute to raising the performance.

Certainly, respecting each student's everyday accomplishments and the level achieved so far is an important mission of the teacher's work, and the educators know that teaching good and excellent students is different from teaching weaker students, who study in the same class and attend the same lessons. It has always been a great challenge for teachers, demanding great professionalism. Therefore the current secondary analysis of the PISA data is dedicated to finding the factors contributing to higher student performance (see chapter 9). Another aspect important for improvements in the quality of work encompasses other issues related to educational work organization and policy – how and why the quality levels significantly differ in different schools, and whether any reforms are needed (see further), etc.

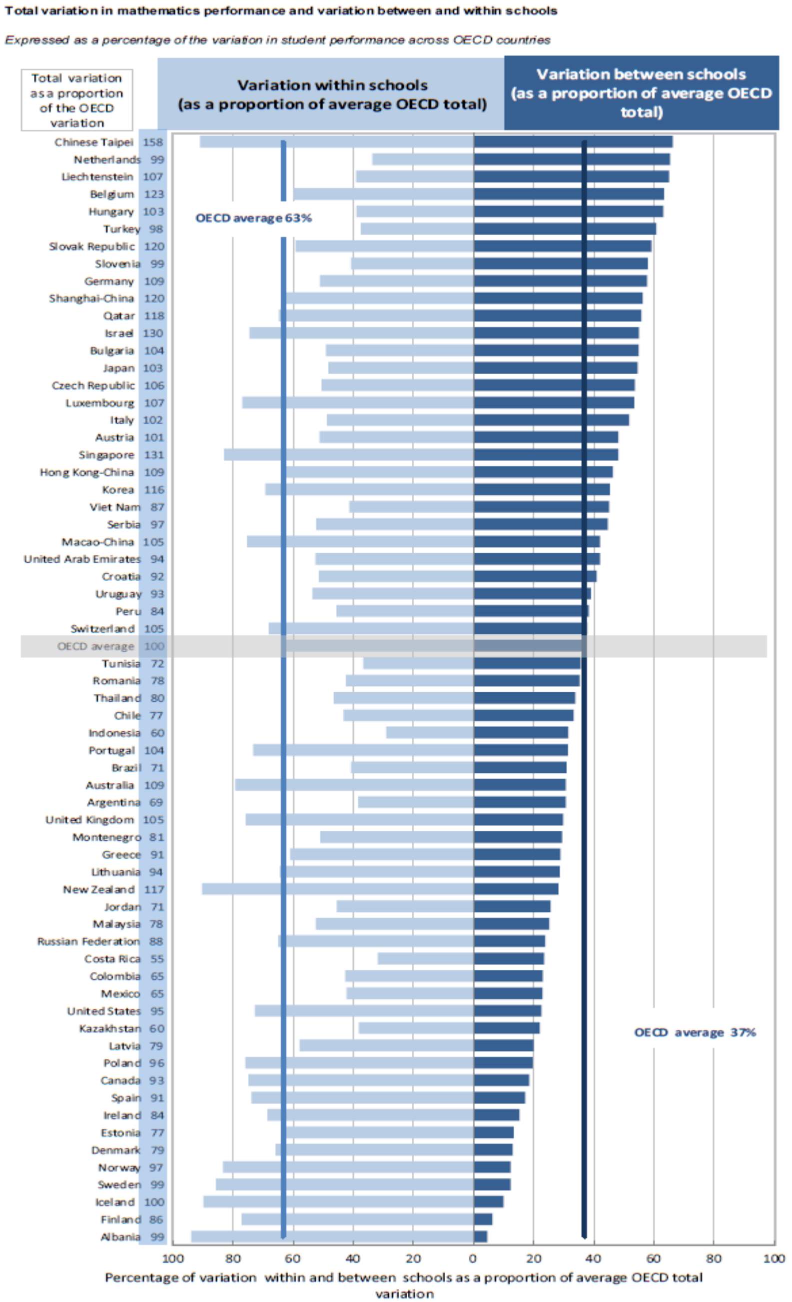


Figure 6.30

Total variance in mathematics performance and variance between and within schools.

Note: countries are ranked in descending order of the between-school variance as a proportion of the total variance in performance across OECD countries.

To continue the analysis of Latvia's student mathematics performance variation in the international context, it is important to clarify what part of the variation is determined by the differences between the student performance within a school and what part is influenced by the difference between the schools.

Figure 6.30 shows the extent to which the fifteen-year old students' performance in mathematics has been dispersed at the student and school level in each country participating in the study. The red-coloured columns represent the difference between the results achieved by students in different schools (between school variance), while the gray columns show the performance variation part, that is attributable to that segment of differences in the results, which is due to the differences in the school. The vertical lines mark the average value of OECD countries' students' performance variance related to the differences between schools (37%) or within the same school (63%).

In comparison with the OECD PISA 2006 and 2009 cycles, Latvian students' performance variation on the between school and within school level has changed slightly, maintaining a constant tendency – the variance is lower than the average of OECD countries (see Table 6.15). This is particularly true of the between school variance, which in Latvia is about two times lower than the average for OECD countries

Table 6.15

The change between school and within school variance n in Latvia, PISA 2006–2009–2012

OECD PISA cycle	Variance between schools (%)		Variance within schools (%)	
	LATVIA	OECD average	LATVIJA	LATVIA
2006	15	33	65	68
2009	16	42	60	65
2012	19,9	37	57,9	63

Figure 6.30. and table 6.15 show the differences in performance between the schools in Latvia, which generally are much smaller than the average in OECD countries, and which largely are determined by SES differences, see chapter 6.2). Consequently, to look for possible causes and solutions for decreasing the performance disparities between schools, the school groups with different SES should be

distinguished and analyzed in greater detail. In this respect, the biggest difference can be observed between rural and urban schools.

The relation of students' average performance to the location and type of school

The comparison of students' performance (in mathematics, science and reading) by urbanization or the location of the school is shown in Figure 6.31. Similar to the results of previous PISA cycles (see Figure 6.32), in PISA 2012 the best results again were demonstrated by the students of Riga schools, and the weakest – by the students of rural schools. Similarly, the average performance of Latvia's students in Riga, urban and, particularly, rural schools was higher in science in comparison with the results achieved in other content areas.

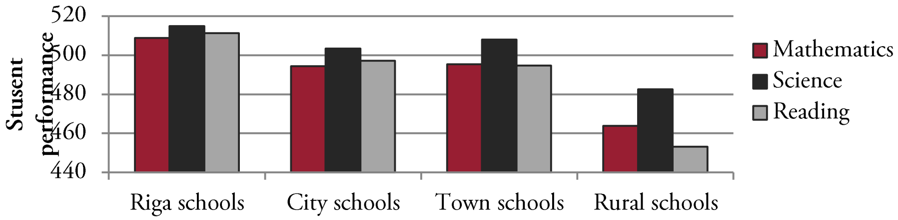


Figure 6.31

The average mathematics, science and reading performance distribution of Latvia's students according to school location, PISA 2012

As of 2003, student performance in mathematics depending on the location of the school has not considerably changed. The performance of students from Riga schools has slightly increased, while others have virtually remained on the level of 2003 (see Figure 6.32).

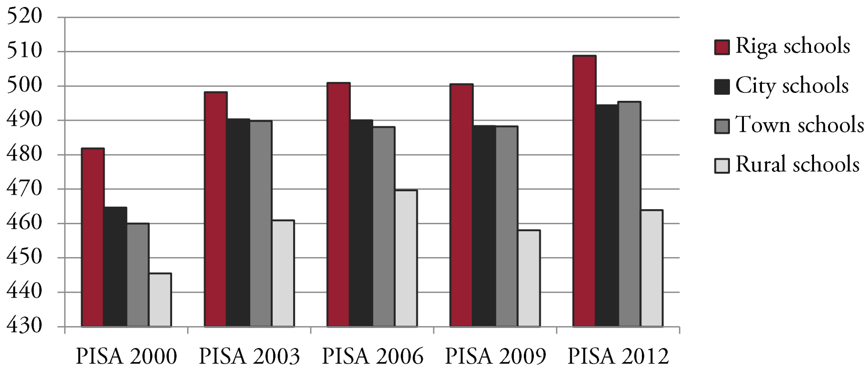


Figure 6.32

The average mathematics performance distribution of Latvia's students according to school location PISA 2000–2003–2006–2009–2012

Latvia's student performance distribution according to the school location and type of school (see Figure 6.32) is similar, because half of primary school students attend rural schools, yet their share is small in Riga and the largest cities (see Table 6.16). On the other hand, about one fifth of the secondary school students learn in rural areas and there are no gymnasiums

Table 6.16

The distribution of students participating in PISA 2012 according to the type of school, language of studies, and school location

	Riga schools (%)	City schools (%)	Town schools (%)	Rural schools (%)
Type of school				
Gymnasiums	31%	33%	36%	0%
Secondary schools	37%	21%	20%	22%
Primary schools	12%	8%	29%	51%
Language of studies				
Latvian	19%	16%	27%	38%
Russian	64%	22%	4%	10%
Schools with two types of programs (Latvian and Russian)	1%	25%	15%	59%

Figure 6.33 shows the average performance distribution of Latvia's students in PISA 2012 in all PISA content areas, depending on the type of school. In order to compare the performance of basic school (grades 1-9) students to the secondary school (grades 7-12 or 1-12) and gymnasium student performance (grades 7-12), the results of the tenth and higher grade fifteen-year olds are not included in the comparison (in PISA 2012, 3% of all participants belong to that category). Schematic diagram of Education System of Latvia is available, for example, European Commission/EACEA/Eurydice, 2015. The Structure of the European Education Systems 2015/16: Shematic Diagrams. Eurydice Facts and Figures. Consequently, the average performance in mathematics, reading and science shown by Latvia's basic school students is lower than the performance of the secondary school and gymnasium

students. An analogous correlation can be observed within the previous PISA cycles and in other international studies.

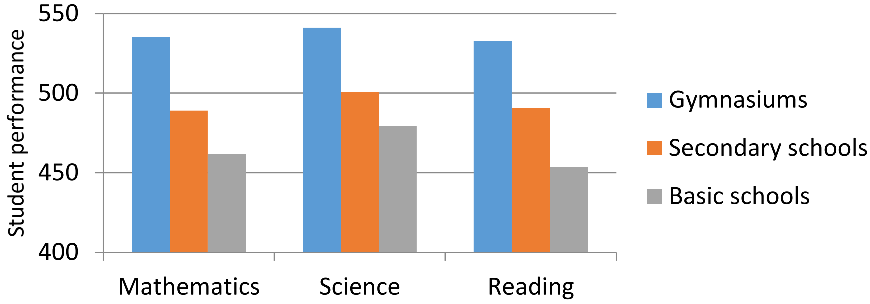


Figure 6.33

The average performance distribution of Latvia's students according to the type of school

In order to make a more accurate conclusion about the higher performance in secondary schools in comparison with basic schools, one should take into account the previous analysis regarding the relative numbers of students in different types of schools, depending on their location (Table 6.16). It is more correct to compare the achievements of secondary schools and basic schools separately in rural areas, in the cities, the urban environment and Riga (see Figure 6.34). The greatest difference can be observed particularly in Riga, where the performance of a student attending a secondary school on the average is higher by 30 points in comparison to the student of a basic school. The difference is less pronounced in the respective rural schools and schools of cities – 18–20 points, the performance gap in the towns secondary schools and basic schools is very small.

Comparing the change in students' performance in mathematics from 2003, both according to the school location and type (see Figure 6.34), the rise in performance can be observed everywhere, except among Riga basic school students and the students of gymnasiums in cities. The largest and statistically significant increase is observed with regard to Riga gymnasium students.

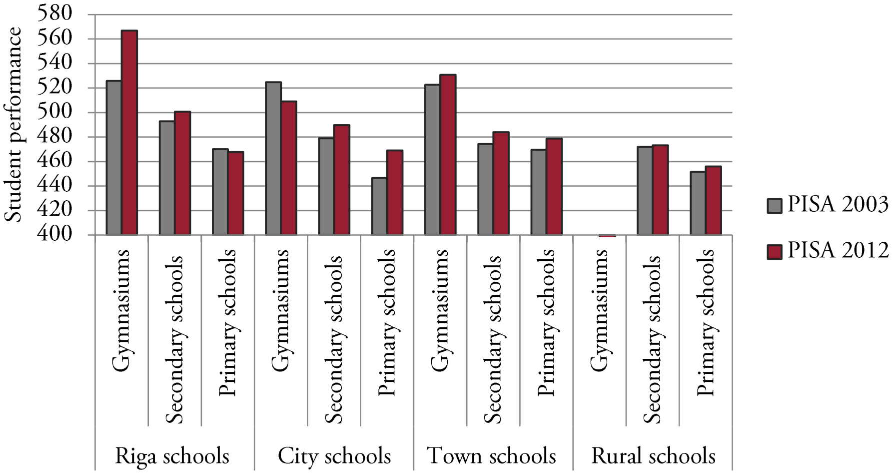


Figure 6.34

The average performance distribution of Latvia's students according to the type of school and its location PISA 2003 – PISA 2012

The previous analysis confirms that the equity of education in Latvia has a definite relation to the differences in the SES in rural, urban areas and Riga, and to various types of schools (see Table 6.17).

Table 6.17

Student SES differences in rural schools and schools of major cities

Year of research	Latvia			OECD		
	Rural areas	**Large cities**	**Starpība**	**Rural areas**	**Large cities**	**Starpība**
2012	-0,79	0,12	0,91	-0,33	0,15	0,48
2009	-0,5	0,26	0,76	-0,3	0,19	0,49

Note: The data in the table is presented according to the OECD classification, the group of large cities includes Riga schools, the rural school group – rural schools and schools in the towns with population up to 3000.

According to PISA 2012 data, the average SES index in Riga is 0.12, in large cities of OECD 0.15, whereas in the rural schools of Latvia this index is relatively much lower than in OECD countries, i.e., -0.79, in comparison with -0.33 on average in OECD countries (besides, it complies with the OECD classification, where a school is considered rural, if it is located in a place with less than 3000 inhabitants, therefore a certain number of Latvian small town schools is included in the OECD rural school category). The difference of the SES index value in large cities and rural areas in 2012 on the average in OECD countries was 0.48, while in Latvia – 0.91. The comparison of

PISA 2012 and 2009 results shows that this difference has grown in Latvia – in 2009 it was 0.76, in 2012 – 0.91, and 0.49 – an average in OECD countries. The proportion of the rural students in the total number of Latvia's fifteen-year-old students is about twice as large as the average in OECD countries. Therefore, it is understandable that the rural students in Latvia due to objective reasons need a lot more support than on the average in OECD countries.

The results given by PISA cycles and other studies (IEA TIMSS, PIRLS, CIVIC - Civic Education Study, ICCS) constantly show lower average student performance levels in the Latvian rural schools with regard to all content areas compared to the performance shown in towns, cities and in Riga. It basically corresponds to the situation in most of the countries participating in PISA. However, PISA 2012 results show that the differences observed in Latvia with regard to performance (especially the disparities between the rural and Riga schools) are relatively large compared to other OECD countries. The differences in performance significantly decrease after accounting for SES differences in rural areas and large cities (in case of Latvia – Riga). The correction means that, using the linear regression, the difference in achievement is computed for an essentially hypothetical situation, in which the SES is the same in urban and rural areas. The measured performance differences in the rural areas and Riga equal 52 points (PISA 2012, mathematics, classification into urban and rural areas according to the OECD scale), after accounting for SES, the difference still remains statistically significant – 21 points. Figure 6.35 shows that the SES differences do not explain everything in the case of Latvia, consequently, there are other factors why rural areas show lower performance. However, in some other countries after correction the performance in rural areas and cities begins to converge (the difference in Estonia decreases from 25 to 8 points), or even improves in rural areas (for example, in Finland, from the prevalence of 8 points in urban areas the situation is changing in favour of rural areas, reaching the prevalence of 11 points).

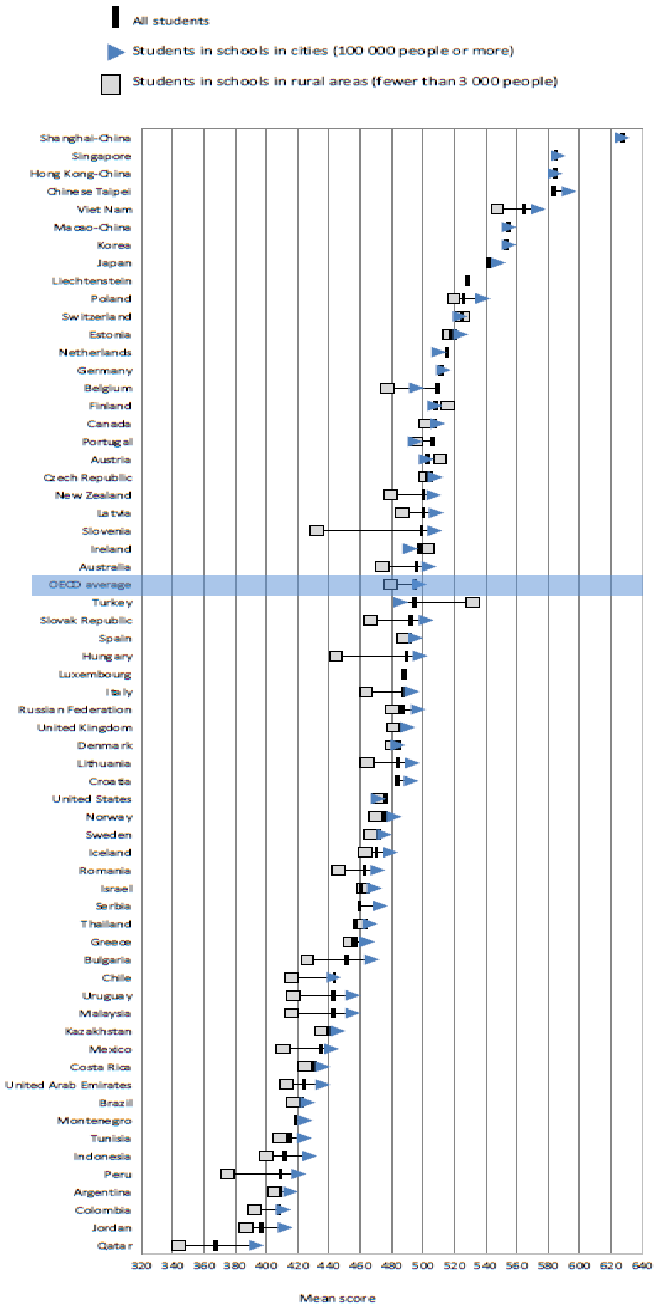


Figure 6.35

Mean mathematics performance (PISA 2012), by school location, after accounting for SES

Note: Countries are ranked in descending order of the mean performance of all students after accounting for SES

Admittedly, a rather detailed study of students' achievement in the Latvian countryside and cities (Johansone, 2009) using PIRLS 2006 and TIMSS 2007 data on the fourth grade students, shows that if the class of a rural school has a great share of the students with a low SES (more than 60%), the difference in performance is entirely attributable to the low SES of the class.

Table 6.18

Student SES in various types of schools, Latvia

Type of school	Average SES	Standard deviation
All gymnasiums (state gymnasiums and gymnasiums together)	0,24	0,76
State gymnasiums	0,29	0,76
Gymnasiums	0,14	0,77
Secondary schools	-0,24	0,86
Basic schools	-0,65	0,87
Total	-0,26	0,89

The previously shown differences in performance between different school types (Figure 6.33) to some extent can also be explained with differences in the students' SES. This is clearly shown in Table 6.18 – the SES of gymnasium students is much higher than in secondary schools, and in basic schools it is generally low. The state gymnasiums, in turn, stand out with an even higher SES than gymnasiums.

Table 6.19

Mathematics performance in PISA 2012 and the correlation coefficient R of student and school SES in various types of schools in Latvia

Type of school	*R*, level of students	*R*, level of school	Number of schools in the sample
State gymnasiums	0,29	0,18	18
Gymnasiums	0,22	0,10	9
Secondary schools	0,35	0,21	122
Basic schools	0,31	0,20	56

Obviously, the different types of educational institutions are situated in different locations (e.g., rural areas have no gymnasiums, see Table 6.16), and they have different enrolment procedures, for example, gymnasiums implement the selection of students, and, as a result, the students' SES in different types of schools is quite different (see chapter 6.5). Also, nowhere within the same type of schools throughout Latvia there is a homogeneous students' SES and performance, therefore the relation of student performance and SES exists both with regard to an individual student and average values of different schools (see the corresponding correlation coefficients in Table 6.19).

The relation of student average performance to the type of education programs implemented by school and to the student's gender

The comparison of average students' performance in Latvia depending on the language of instruction at school was implemented only for Riga and cities schools, where instruction was carried out in Latvian or which implement minority education programs (with Russian language of instruction), because the sample contains a small number of students from rural and town schools studying according to the minority education programs. As shown in Figure 6.36, across all content areas there is no significant difference in performance of the students who are studying at schools with the Latvian language of instruction, and the students who attend schools implementing the ethnic minority education programs (in the Russian language).

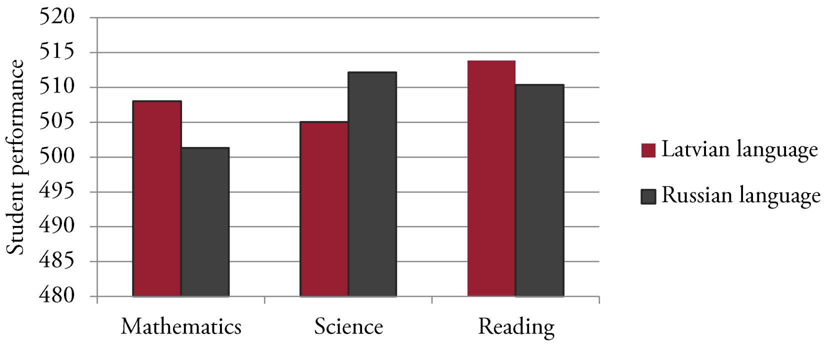


Figure 6.36

Distribution of Latvian students' average performance according to the language of instruction at school, PISA 2012

The issue of the difference between the girls' and boys' performance always remains topical (OECD, 2015i). Table 6.20 shows the comparison of boys' and girls' performance in all PISA 2012 content areas..

Table 6.20

The average performance of Latvia's boys and girls in PISA 2012

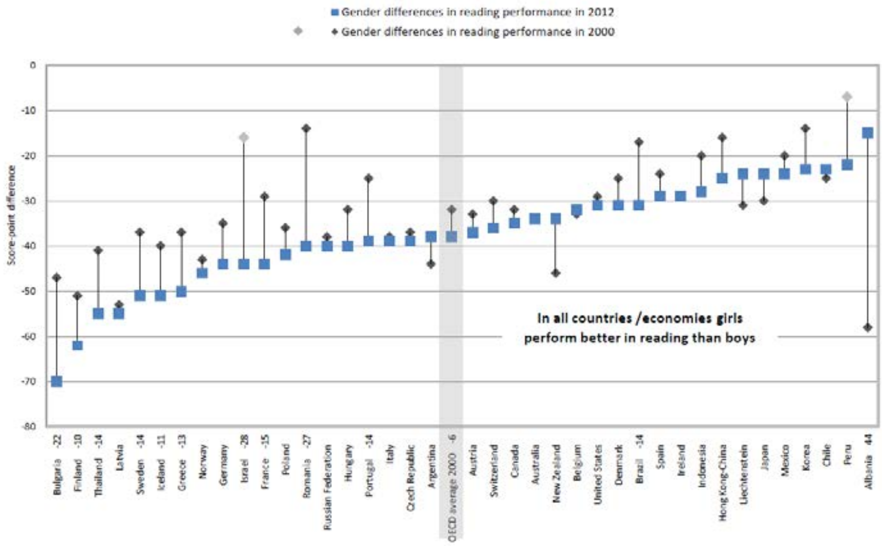
	Performance of boys		Performance of girls		Difference (B - G)	
	Points	S. E.*	Points	S. E.	Points	S. E.
Mathematics	489	3,4	493	3,2	-4	3,6
Science	495	3,6	510	2,8	**-15**	3,6
Reading	461	3,3	516	2,7	**-55**	4,0

*S.E. – standard error

Note. Statistically significant differences in the table are marked in darker tone.

The difference in the performance of boys and girls in Latvia varies in PISA content areas. Mathematics is the only area in which, as in previous cycles, the performance of boys and girls in Latvia is not statistically significantly different (although girls' performance in PISA 2012 were higher by four points). Overall, the mathematics performance of most countries' boys in PISA cycles is statistically significantly higher or the differences are not statistically significant, and there are only very few countries where girls' performance in mathematics statistically significantly exceeds the performance of boys. Consequently, so far in all PISA cycles Latvia has been within the group of countries, where the difference between the performance of boys and girls in mathematics is small.

Just like in all participating countries and all previous cycles, the girls' reading performance in Latvia was statistically significantly higher than that of the boys – 55 points, which was the tenth largest difference among PISA 2012 participating countries. Altogether, the primacy of girls in reading literacy in most PISA participating countries has even increased over the period from 2000 to 2012. The advantage of Latvia's girls in reading is virtually constantly high in all PISA cycles.



Notes: 1)All gender differences in PISA 2012 are statistically significant. Gender differences in PISA 2000 that are statistically significant are marked in a darker tone. 2) Statistically significant changes in the score-point difference between boys and girls in reading performance between PISA 2000 and PISA 2012 are shown next to the country name

Figure 6.37

Change between 2000 and 2012 in gender differences in reading performance

The supremacy of girls in Latvia is also observed in science. It was 23 points in PISA 2000 (the largest difference among participating countries), four points in PISA 2003, which was not statistically significant, in PISA 2006 and PISA 2009 the performance of girls in Latvia again was statistically significantly higher (by seven points), while in 2012 this difference rose by 15 points and was the eighth biggest among the participating countries.

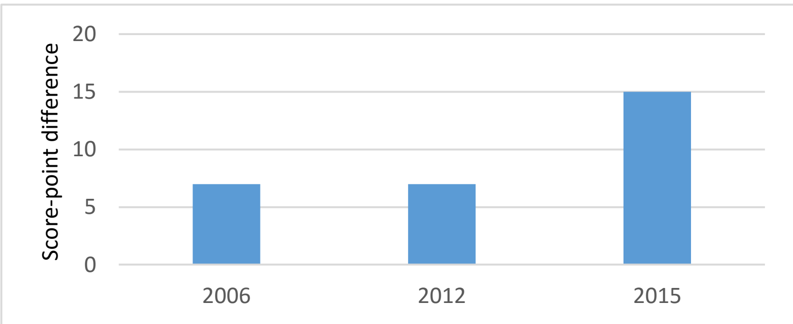


Figure 6.38

The difference in performance of girls and boys in science, Latvia

PISA 2012 shows that the difference in performance in Latvia is quite similar to that of Lithuania (the 9th greatest difference) and Finland (the 7th greatest difference), in Estonia the advantage of girls in science is just by a few points – not statistically significant. On average in OECD countries in PISA 2012 the performance of boys and girls in science is the same, consequently, there is a group of countries, in which boys show better performance in science than girls. It is possible that in Latvia the higher performance of girls in science is based on their unquestionably higher reading literacy – therefore the girls are able to read and understand the provisions of the task more accurately.

Summary

In PISA 2012 Latvia had one of the smallest variations of students' performance in mathematics compared to the OECD countries, it was virtually the same only in Estonia and even smaller in Mexico. Finland, in turn, has a greater variation than Latvia. Undoubtedly, this, positively characterizes the Latvian education system, because it means that the difference in the literacy of our various students (with high, low and average achievements) is generally less distinct than on the average in OECD countries – consequently, Latvia provides a relatively good equity of education quality throughout the education system. A more detailed analysis shows that the differences in performance in Latvia within the same school rather than between schools occur more frequently than on the average in OECD countries. It is also an encouraging phenomenon, because it testifies that the segregation into the good and bad schools in Latvia is relatively less pronounced – the students with the better or weaker achievements in Latvia are relatively more dispersed among different schools than on the average in OECD countries.

The improvement of basic education quality in Latvia, based on the data of international and national monitoring, is an important condition for the development of our national education system – it is necessary to achieve a further overall improvement of the quality, the work with outstanding students must be reinforced, while continuing to devote sufficient attention to the weakest.

The average performance of fifteen-year-old students in mathematics, science and reading in Latvian rural schools still lags behind the performance of their peers in Riga and the schools of other Latvian cities. The analysis shows that this difference in performance is determined both by the objectively lower students' SES in the rural areas, as well as by other relevant factors.

The students' SES in Latvia's rural areas is significantly lower than in Riga, the relative differences are much higher than the average in OECD countries and still growing, also the relative number of rural students in Latvia is twice as high as the average in OECD countries. Thus, the role of the regional development policy in providing support to rural development is very significant indeed. Without the rural development, the education system alone will definitely not be able to ensure the equity of education throughout the country.

In Latvia, PISA 2012 showed that girls outperformed boys in all content areas. In reading and science this difference was statistically significant, while in mathematics it was not so. In all PISA cycles since 2000 the advantage of Latvia's girls in reading has been almost consistently high, the girls show a higher performance also in science, although the difference in points is varied. Until now, the performance difference between Latvia's girls and boys in mathematics is not statistically significant.

The average performance of Latvia's students in all content areas and all PISA cycles does not significantly differ in the schools with the Latvian language of instruction and schools, where ethnic minority educational programs are implemented in Russian.

The average performance of Latvia's students is different for students studying in different types of educational institutions. Gymnasium students show the highest performance, followed by that of secondary school students, and then - the average performance of basic school students. An analogous relationship between Latvia's student performance and type of attended educational institution has been observed in all PISA cycles since 2000, and in other international studies. For example, PISA 2012 showed that the performance of Riga gymnasium students in mathematics was almost 570 points, which places them immediately after the average performance of Shanghai (China) and Singapore, relatively the 3rd place in the international performance table, all the rest of the PISA 2012 participating countries had achieved lower average results in mathematics. Admittedly, it must be understood that thereby we compare only the best and relatively small segment of the Latvian education to other countries' average. It is well-known that the gymnasiums implement selection of students, also by entrance examinations, the students prepare for entering the gymnasiums (with private tutors, in-depth classes in interest groups, etc.), the average student SES there is quite high, and the atmosphere is achievement-oriented. It clearly shows that such a high result in Latvia is not unattainable. At the same time, the results of students in Latvia's basic schools are much lower, for, example, in PISA 2012 mathematics they were within the range from 480 to 455 points (depending on the location of the school), which is below the OECD average. However, for the sake of comparison it can be mentioned that the average performance in mathematics of such countries as the United States, Lithuania, Sweden, Hungary and Greece were also within this interval. Striving for equity of education, particular attention must be focused on the inferior performance of Latvia's basic school students compared to those of secondary schools. This phenomenon is particularly pronounced in Riga, a little less – in the cities and in the rural areas, but almost non-existent in towns. Perhaps it also has to do with a certain selection of students.

When comparing the performance in different types of school, one must also take into account the data provided in this chapter on the students' SES in different types of school. The SES is very high in gymnasiums, especially in the state gymnasiums, followed by secondary schools and basic schools, where this indicator is the lowest. Consequently, the performance differences in different types of school to a certain extent can be explained by the difference in the SES, which, in turn, depends on both the location of the school, the student selection procedures and other factors.

3.5. Governance of schools and school network, and other characteristics: impact on student performance

School autonomy

The degree of autonomy is of particular importance in school governance and operation. In this respect, the PISA summarizes the school principals' views in two groups of questions – school autonomy over resource allocation (the responsibility for formulating the school budget, deciding on budget allocations within the school, selecting teachers for recruitment and hiring teachers, establishing teachers` starting salaries, determining teachers` salary increases) and school autonomy over curriculum and assessment (textbook selection, selection of subjects and defining the content thereof, choice of student assessment methods). The principals expressed their opinion, whether the respective issues are decided upon by principals and/or teachers, or the decision-making also involves regional and/or national education authority and the school governing board, or whether it is entirely decided by the regional and/or national education authority.

In view of the school principals in Latvia, the autonomy of schools with regard to resources is much stronger than over curriculum and student assessment. In terms of resources Latvia occupies the 10th position from the top in the chart of countries, which is significantly higher than the OECD average, the schools in Lithuania have a still slightly higher degree of autonomy, Estonia – lower, while Finland in the matters of school resources' autonomy is actually below the OECD average. On the other hand, in the matters of determining curriculum content, in PISA 2012 Latvia was below the OECD average level, Finland was practically on the OECD average level, while Estonia and Lithuania had a higher degree of autonomy than the OECD average. Also in PISA 2009, our principals observed a significantly higher degree of autonomy in resource matters, admittedly, the relative indices were lower than in 2012 – in terms of resources we were practically on the average OECD level, while in curriculum content – below the OECD average level and also with a relatively lower autonomy than in 2012.

In the cross-national comparison the school autonomy in terms of resources practically does not affect the students' performance, while a greater autonomy in curriculum matters has an overall positive influence on performance. However, in certain countries, the relationship between school performance and curriculum autonomy most often is not statistically significant, and it is also the case in Latvia.

The fact that there is no direct relationship between performance and study autonomy in the country may also be explained by the school performance evaluation and control methods (examinations, centralized examinations, disclosure of school examination results, school evaluation, etc.), which in different countries are handled differently. Often, the national education policy shows a tendency to link a greater autonomy allowed in school operation to a more pronounced assessment of the outcomes – competencies acquired by students.

Latvia has a greater interest in the results related to differences of opinion in the matters of governance autonomy between Riga and other school groups (PISA 2009 data, see PISA in FOCUS, No. 28). The principals of Riga schools see less autonomy in the issues of resources and curriculum governance than the rest of the school management in Latvia. In most countries, the situation is reversed – either the degree of autonomy in the big cities is higher or there is no significant difference. Perhaps the principals' views regarding a greater degree of autonomy in the schools of rural areas, cities and towns of Latvia than in Riga are based on the phenomenon of closer co-operation between the school principals and the smaller municipalities, and the resulting impact on their decisions. For example, the school principals are often elected as officials in these municipalities (or even heads of municipalities), and in this capacity may have a decisive voice in passing municipal decisions regarding education in the interests of their schools. This, on the one hand, could be a positive tendency, as the principals in Riga apparently feel more distanced from their municipality, with less possibility to influence decisions directly and with relatively fewer opportunities to thus ensure their operational autonomy. However, a seemingly greater degree of school autonomy in this sense in the Latvian countryside and smaller towns can also have a negative role, for example, in relation to the possible reform of the school network (see further below) – the principals generally want to retain their school at all costs, and the local authorities support them.

Decrease in the number of students in Latvia, and relation of class and school size to student performance

OECD PISA data show a very significant reduction in the number of students in Latvia. The main cause of this process is the demographic trend as well as the fact that people are leaving for other countries together with their school-age children. The number of fifteen-year-old students (forming the OECD PISA participant sample) in the Latvian educational institutions has decreased by 50.5% in the period from 2003 to 2012 (see Figure 6.39). It is the greatest decrease among PISA participating countries, followed by Russia (-46.4%), Poland (-27.9%), Slovakia (-27.6%), and the Czech Republic (-26.2%).

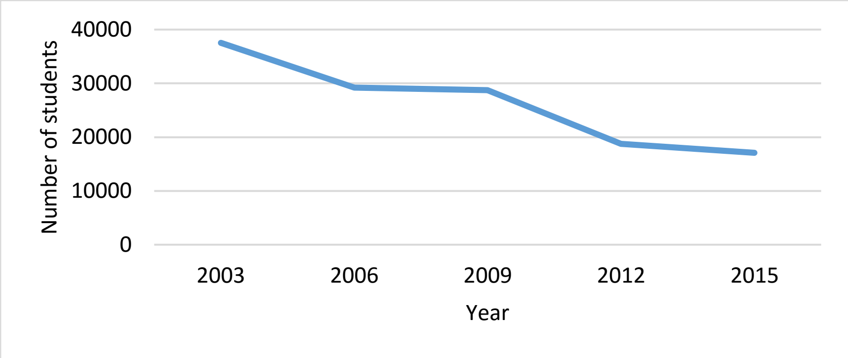


Figure 6.39

The number of fifteen-year-old students in Latvia (according to PISA data)

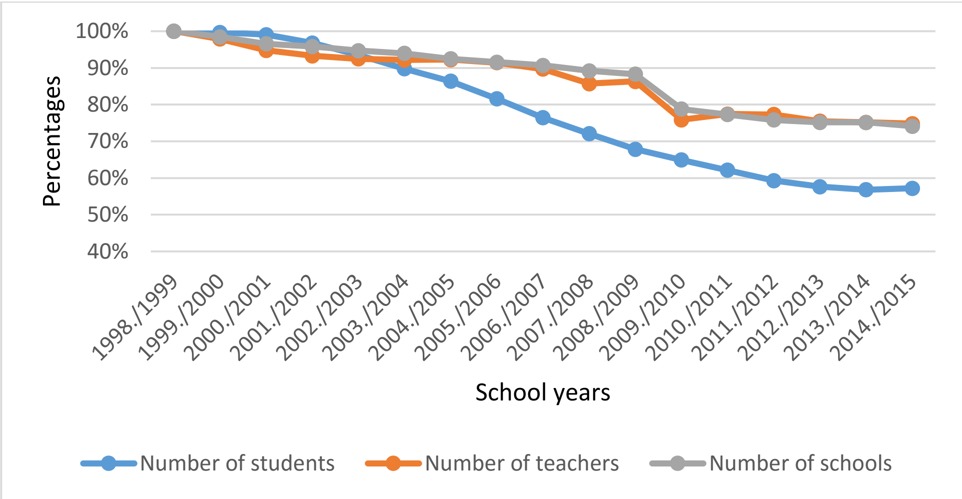


Figure 6.40

Relative number of general day schools, students and teachers in Latvia

The statistics published by the Republic of Latvia Ministry of Education and Science (http://www.izm.gov.lv/lv/publikacijas-un-statistika/statistika-par-visparejo-izglitibu) Figure 6.40 shows in relative units, the number of students, schools and teachers in the school year 1998 / 1999 taken as 100%. The decline in the number of students continues. For example, in the period from the school year 1998 / 1999 to 2013 / 2014 the number of students has dropped by 43.2%. At the same time, the number of general day schools in Latvia over these 15 years has fallen only from 1074 to 807, that is, by 24.9% (the least decrease is seen in the secondary schools – by 6.8%), the number of teachers has dropped from 29 838 to 22 421, also constituting 24.9%.

The authors do not feel that the decline in the number of schools and teachers should necessarily be relatively the same size as the decline in the number of students, but a significant disproportion poses problems.

Consequently, in Latvia over 15 years the number of students has dropped by 43.2%, while the number of schools has decreased by 24.9%, thus, the average number of students per school and class has also shrunk, albeit, differently within different urbanization groups. The correlation between the number of pupils at school and in class in Latvia and the students' performance in international studies (PISA, TIMSS, PIRLS) is usually positive – hence, higher performance is achieved by those students who attend schools and classes with a greater number of pupils. Table 6.21 shows such vivid correlation in PISA 2012 and PISA 2009.

Table 6.21

The correlation coefficient between the school and class size, and the Latvian students' performance in mathematics

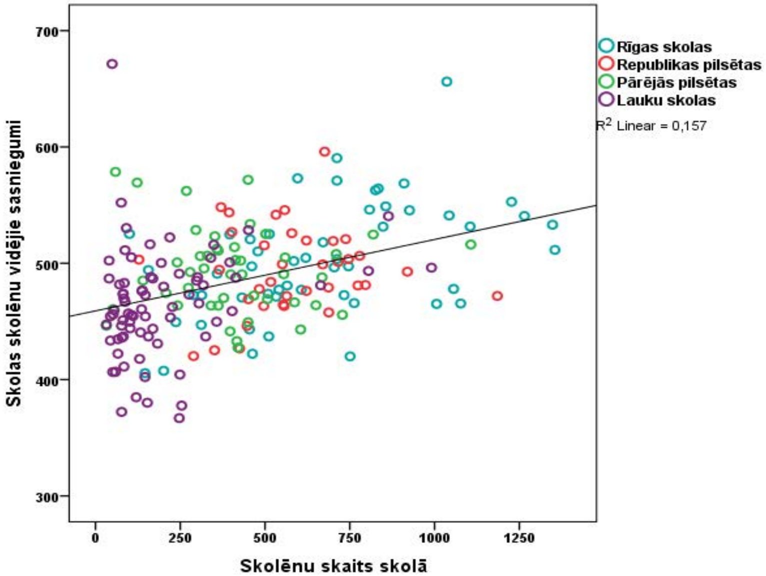
	Correlation of school size (number of students in school) and student average performance	Correlation of class size (number of students in class) and student average performance
PISA 2012	0.397**	0.309**
PISA 2009	0.335**	Nav datu

No data available – PISA 2009 did not include a question regarding the size of class

**A statistically significant correlation, at 99% confidence level.

However, by analysing the correlation relationships, it should be taken into account that the correlation does not automatically prove causal relationship. This particular relationship also does not mean that a sufficiently large school or class itself is the reason of a higher student performance. This is well illustrated by two further figures, – in each of them the school participating in PISA 2012 is shown in terms of average performance of its students in mathematics and in terms of the number of students in the school. Overall, the relationship between these two variables is considerable – the correlation coefficient is 0.397. However, the colour codes in Figure 6.41 show that the rural schools, are generally smaller than Riga schools and on the average, their performance is poorer. We already compared the average performance of rural and urban schools (chapter 6.4) and found that one of the causes of lower performance in rural areas is the substantially lower SES. Lower performance of students with lower SES is confirmed by very many studies. However, in chapter 6.4 we also found that SES is not the only cause of low performance in rural schools. Therefore, if we assume that the education process in small rural schools and classes is characterised by certain pedagogical and psychological or other positive features in comparison with the larger urban schools, yet they cannot yield a similar student performance level (even after accounting for equal student SES).

Figures 6.41 and 6.42 also show the great disparity in the size of Latvia's schools, the number of schools with fewer than 100 students is relatively large, there are schools with over 1000 students. It can be observed, how the above correlations work on the average statistically, because, at the same time, the figures show individual rural schools with outstanding performance, as well as small yet underperforming schools in Riga. The gymnasium superiority can also be noted.



Note: Classification of school locations: Riga – the capital city of Latvia (approximately 700 thousand inhabitants); cities of national importance – Daugavpils, Jelgava, Jūrmala, Jēkabpils, Liepāja, Rēzekne, Valmiera and Ventspils, number of inhabitants ranging from 98 thousand to 25 thousand; other towns, rural areas.

Figure 6.41

The relation of student number at school and mathematics performance in PISA 2012 according to school location

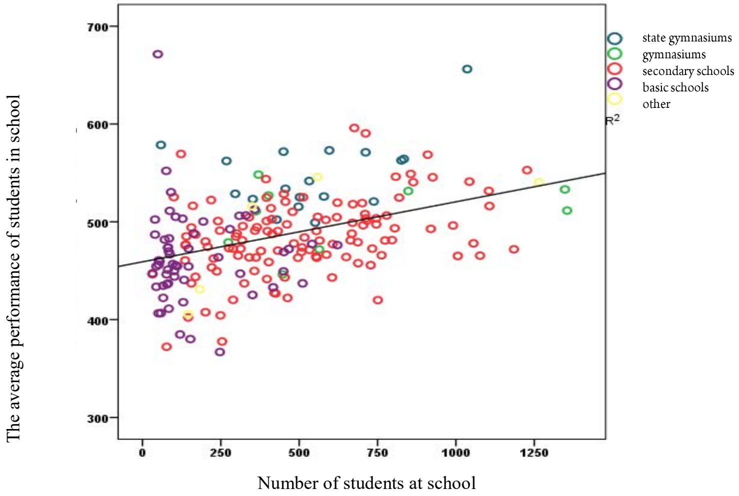


Figure 6.42

The relation of student number at school and mathematics performance in PISA 2012 according to school type

According to the student survey data within PISA 2012, the average number of fifteen-year-old students in a class during language lessons (i.e., Latvian or Russian language) in Latvia was 18.7. This is one of the lowest averages, only Liechtenstein with 17.6 and Finland with 18.3 have slightly lower averages. Less than an average of 20 pupils in the class is in Belgium – 18.8, Switzerland – 19.0, Iceland – 19.2, Kazakhstan – 19.5, Denmark – 19.7. The average class size in OECD countries is 23.9 pupils. The Asian countries with very high student performance traditionally have a really big average number of students in a class: Taipei – 39.0, Shanghai (China) – 35.9, Japan – 37.2, Korea – 30.5, Singapore – 33.0. The student performance comparison in these and other Asian and European countries, however, does not support the assertion that larger class sizes are the basis for higher student performance. Here one must take into account the learning traditions and culture in various countries, possibly, the use of an assistant teacher in the classroom work and other factors. In any case, such an statement would be contrary to the indisputable pedagogical truth about the attention required by each individual student – in a very big class the opportunity of individual approach is minimal. PISA 2012 did not show any relationship between the class size and student performance in mathematics in cross-national analyses comparing EU countries (Isac, Costa Araujo, Calvo, Albergaria-Almeida, 2015).

However, in Latvia (see Table 6.20) there is a correlation – on the average, higher performance is shown by schools with a greater number of students per class. In order to analyze this relationship, one should take into account that the average number of students per class in Latvia differs greatly: in Riga – 22 students, in other cities – 19.9, in rural areas – 12.5 (calculations made according to OECD classification: including among the rural areas also the small towns with population up to 3000). The size of class in the rural schools of Latvia is the smallest of all PISA 2012 participating countries, it is similar to that in Russia – 12.6, followed by Estonia – 14.9, Finland and Iceland – 16.1. The large cities in OECD countries have 24.6 students per average class, and the rural areas – 20.1. Another important aspect is the distribution of class size by the school's SES. In Latvia, it is essentially close to the distribution by urbanization (Riga and rural areas). The schools, where the average student SES is statistically significantly higher than the national average, the average number of students per class is 22.8. The schools, where the average student SES is lower than the national average, the average number of students per class is only 13.5. The respective class sizes in OECD countries on the average are 25.6 and 21.9, for example, in Estonia – 25.4 and 17.5. To a certain extent, the number of students in a class is also related to the student-teacher ratio in school. In PISA it is determined according to the data provided by the school principal in the questionnaire. In Latvia, it is 10.0, which is below the OECD average – 13. In the rural schools, on the average, it is even lower: in Latvia – 7.5, in OECD countries – 11.7. According to other research results (Baltic Institute of Social Sciences, 2013), in many rural schools of Latvia this ratio is much lower.

Just like in the analysis of the correlation between the student performance and the school size given above, in the context of the class size we return to Riga and rural schools, to the striking differences in the SES and student performance. The situation is clearly also affected by other factors, such as student selection procedures (if any), focus on learning outcomes at school and in class, etc. As a result, the potential pedagogic benefits of a small number of students in the small schools and classes of Latvia are unable to compensate for the influence of the negative factors, and the student performance in these schools on the average is lower (also after accounting for SES).

On the other hand, the relationship between students and teachers in the learning process, the disciplinary climate, the provision of learning materials and teachers, after-school activities are evaluated by principals as equally good throughout the urban and rural schools of Latvia (see also PISA in FOCUS, No. 28).

Competition among schools and SES impact

In comparison to the average index of the OECD countries, in Latvia there is a considerably higher competition among schools to attract students from the same area, which certainly has been intensified by the declining number of students. 74% of the fifteen-year-old students in Latvia attend schools whose principals believe that the school competes for attracting students with two or more schools in the same area, 19.5% believe that they compete with one school, and only 6.5% admit that they have no competition with other schools (OECD, 2013, p. 386). The competition degree in Latvia – the relative number of fifteen-year-old students who attend schools that compete with one or more schools in their area for student attraction is 93.5%, the OECD average – 76.2%, in Estonia – 81.4%, in Lithuania – 74%, while in Finland only 47.0% (see Table 6.22).

In Latvia, only 1% of students attend secondary schools, whose principals believe that there is no competition with other schools. On the other hand, only 20.5% principals consider that residence in particular area "always" results in admission to school, 79.5% of principals respond "Sometimes" or "Never".

Table 6.22

Competition among schools in the same area

Country	**Number of students (%) in competing schools**
Latvia	93,5
Estonia	81,4
Lithuania	74,0
Finland	47,9
OECD average	76,2

The relationship between the degree of competition between schools and the national average performance in mathematics within PISA 2012 is very weak – a positive correlation is quite small, and its size is not statistically significant. Consequently, according to the research data, we cannot argue that the degree of competition between schools to enrol students is a factor that determines a higher student performance on the average. Admittedly, the schools that do not compete for students with any schools in the area, have lower performance in mathematics in almost all countries participating in the study, in comparison with the competing schools, for example, on the average in OECD by 17 points, in Latvia – by eight points. Further analysis shows that accounting for student SES and especially for school SES makes this difference in performance completely opposite in very many countries participating in the study – including Latvia. Therefore, after accounting for SES, for example, in Latvia, in these non-competitive schools the performance in mathematics becomes higher by 21 points compared with the schools, which compete with two or more schools for the student enrolment. In other words, it means that in Latvia and other countries with similar SES correction results most of the students in these non-competitive schools have relatively very low SES.

It is believed that in general a free choice of school in the country increases the parents' and students' opportunities to satisfy their educational needs and motivates the schools to diversify and improve the education they offer. On the other hand, the question arises, what information about the schools is available to the public and parents, and how competently it is used in the selection of school, whether a school stratification is taking place, for example, according to the parents' SES or other characteristics.

Accordingly, PISA 2012 survey data show that a relatively free choice of school exists in Latvia, the student is not guaranteed a place in any particular school chosen by himself / herself and the family in their area (although the local government at the request of parents provide the child a place in one of the schools selected by the municipality from the schools within the area), schools apply marketing ploys to attract students, the local governments try to draw students to their schools, because "money from the Ministry of Education and Science follows the student to the local government". Consequently, the opportunities for choosing schools are clearly affected by the students' SES, and the school segregation trend according to student SES is rising in Latvia, as demonstrated by PISA data analysis.

Table 6.23 provides a comparison of the relative number of schools in the Baltic Sea region attended by students with the highest SES, that is, 10% of students from the wealthier families in each country. Each country's fifteen-year-old students who participated in PISA, were divided into 10 approximately equal groups according to their SES measured in the study. The division was implemented in each country separately, without taking into account the differences in the average values of SES in the countries (see also Chapter 6.3).

Table 6.23 shows the relative percentage of schools attended by the students from the group 10 – with the highest SES in each country. We can see that in 2012 the relative number of such schools in Latvia was the lowest – 55%, while in Finland the relative number was 83%, in Sweden – 77%, in Poland – 76% and in Denmark - 75%. Consequently, in that sense we have the most socially heterogeneous school system in comparison with these countries, and this inequality has a tendency to rise, which is also shown by the data from the previous PISA cycles shown in the table. Since 2006, the number of schools in Latvia chosen by the families with very high SES has decreased from 75–77% to 55%. A similar trend is observed in Russia and Estonia, yet it is not as pronounced as in Latvia..

Table 6.23

The relative number of schools attended by students with a very high SES (10% of students in each country)

Country	**PISA 2003**	**PISA 2006**	**PISA 2009**	**PISA 2012**
Denmark	72%	78%	74%	75%
Estonia	...	81%	78%	69%
Finland	82%	88%	81%	83%
Germany	56%	73%	60%	64%
Latvia	75%	77%	67%	55%
Lithuania	...	67%	66%	61%
Poland	77%	70%	72%	76%
Russia	74%	71%	63%	60%
Sweden	82%	75%	77%	77%

Optimisation of school network in Latvia

A very significant decrease in the number of students in Latvia calls for a number of measures, including the optimization of the school network, reducing the number of schools, closing, merging or converting some of them (e.g., basic school into primary school, secondary school into primary school, or the like). The issue of school network reform is a very painful and politically undesirable process for the Ministry of Education and Science (MES), and especially for local governments, which as a rule are the founders of general education schools. It causes dissatisfaction of the particular schools' principals, teachers, parents and students and loud protests covered by the media.

Of course, the question must be analyzed and addressed in the context of regional development, because the school closures are a possible reason of increased outflow of people from that area. Human resources, education and health networks, roads and availability of various other communications and services are matters essential to the functioning of the region and its development, which certainly cannot be solved only by the MES, it is a cross-cutting policy issue. Preservation of the historical schools in the old manor houses and other buildings in circumstances where the number of students has fallen to a few dozen, cannot be the responsibility of the MES.

The strategic documents of the state and the "Declaration of the Intended Activities of the Cabinet of Ministers Headed by Laimdota Straujuma" (http://www.pkc.gov.lv/images/LS_MK_deklaracija.pdf, paragraph 41) adopted by the current government in 2014 provides for the development of the regions: "In accordance with "Latvia 2030", "NDP2020" and Regional Policy Guidelines for 2013–2019, we will support national and regional development centres, rural, Baltic Sea coast, Latgale and border area development by promoting accessibility of these areas and access to public services, as well as by improving the business environment in line with their development facilities and priorities, and taking into account the availability of public resources." However, there are some inconsistencies in the implementation of the regional policy. Administrative and territorial reform is long overdue, and probably the adopted solution is not optimal, because it results in a highly fragmented structure. The situation is exacerbated by the radical views predicting the prospective development of Latvia only in the Riga region.

The former president of Latvia Andris Bērziņš in his speech at the Saeima spring session of June 18, 2015 (http://www.president.lv/pk/content/?cat_id=603&art_id=23124) referred to the necessity to continue the administrative and territorial reform as one of the state's main tasks: "Administrative territorial reform is the key to many of the pressing issues, in particular those related to the areas of education and health care that need to be addressed urgently in order to ensure accessibility and quality of health care and education in the country, especially in rural areas and small towns."

If there is a clarity about administrative territorial division and regional development of the state, it is possible to implement the task defined in the current government declaration (http://www.pkc.gov.lv/images/LS_MK_deklaracija.pdf, paragraph 95): "We shall establish the strategic model of school network development, which will provide the pupils of first six grades with a quality education as close as possible to the pupil's place of residence, while maintaining the Latvian rural schools as important local community centres. Secondary education will be concentrated in schools with developed pedagogical and technical basis." However, besides developing the model of school network, concrete steps should also be taken, as the school network reforms already are in constant progress. It would only be necessary to implement them systemically, also including a well-founded administrative territorial division and a regional development plan.

It is interesting to note that the international research results in Latvia already in 1990s enabled researchers to provide the recommendations that are essentially exactly the same as the abovementioned current government declaration of 2014, the tasks stated therein regarding the school network development – a primary school close to home, secondary schools well provided with resources and located further from the place of residence, sufficiently high quality of education also in rural areas, the school as a multi-purpose cultural centre. The researchers widely published these recommendations and the data on which they were based as early as in 2000, 2002 and 2004 (see, e.g., Kangro, 2000; Kangro, 2002; Geske, Kangro, 2004).

While implementing the school network optimization process, the quality factor of education must necessarily be taken into account, not only, for example, the costs of the infrastructure of educational institutions, which have far fewer students than in the past and the premises are intended for a greater number of students. Monitoring the quality of education provided by the particular schools would enable the local authorities and the Ministry of Education and Science to maintain and develop the schools of the best quality. The quality of student performance in secondary schools should be assessed on the basis of the centralized examination results in grade 12. In order to evaluate the quality of basic schools, to some extent the results of examinations in grade 9 can be used, – the content of these examinations is designed centrally, but the marking is carried out at school. In this respect, the governments should at least arrange for the examination papers to be evaluated in a centralised and anonymous manner – in the municipalities. This could help to accumulate a more reliable comparative information on the quality of education at the schools subordinated to municipality. On the other hand, international comparative research to some extent helps to navigate within the education quality level of municipality with regard to the situation in the country in the international context. The research contributing to knowledge about basic and secondary schools with elementary classes are OECD PISA and IEA TIMSS cycles, and to primary schools – IEA PIRLS and IEA TIMSS. In this respect, the inclination of the MES to restore the Latvia's participation in the IEA PIRLS is a very positive factor.

The daily and even end-of-the-year marks of the students cannot be used for these purposes. The marks given by a teacher (formative assessment) have a very important role in the teaching and learning process, they are the most significant assessment of achievements and progress shown by a particular student and informative to his or her parents, but they are not designed to compare student performance between the schools within a municipality, a region or even across the country. In many countries, particular quality monitoring measures are implemented, and their central element consists of tests for students. In England such a process is designed also to measure student growth by retesting after a certain period (once a year or even more frequently). Of course, in such a quality monitoring process the student's SES can be easily identified in order to take it into account in the analysis of results (see chapter 6.4).

The MES currently plans to develop a program dedicated to the education quality monitoring measures for the next EU funding programming period up to 2020. Along with the international studies dedicated to the quality of education, the program could contain a plan for quality evaluation measurements of particular municipal schools to assist them in the school network optimization efforts.

The funds saved by the optimization of school infrastructure (school closure or merging in shared premises) should be earmarked for the education process development and professional growth of teachers in order to ensure an equity of education quality throughout Latvia's education system.

Summary

The work of Latvia's school principals with regard to resource management issues (the responsibility for formulating the school budget and expenditure, selecting teachers for hire and hiring teachers, establishing teachers` starting salaries, determining teachers` salary increases) are significantly more autonomous than on the average in OECD countries, while the degree of autonomy over curriculum choices and student assessment (textbook selection, selection of subjects and defining the content thereof, choice of student assessment methods) is lower than the OECD average. The relative degree of school autonomy in Latvia has a tendency to rise.

The principals of Riga schools in their activities see less autonomy in the matters of resources and curriculum management issues than the school principals in the rest of Latvia. On the other hand, student and teacher relations, disciplinary climate, supply of learning materials and teachers, after-school classes are valued by the principals as equally good throughout Latvia, both in urban and rural schools. The schools in rural areas on the average are smaller, they have fewer students to a teacher, a smaller number of students in classes.

Compared to the OECD average, there is a higher competition in Latvia between the schools of the same area with regard to attracting students, it certainly has intensified, as the number of students decrease. 74% of principals believe that their school competes for attracting students with two or more other schools, 19.5% – with one school and only 6.5% admit that there is no competition with other schools. On the other hand, only 20.5% principals consider that residence in area near the school is "always" results in admission to school, 79.5% of principals respond "Sometimes" or "Never". The relatively free choice of schools in Latvia promotes the parents' SES impact on the choice of school, and there is a rapid decrease in the relative number of the schools chosen by the most socio-economically favourable families (since 2006, the relative number of schools in Latvia chosen by families with a very high SES has decreased from 75–77 % to 55%).

There is an observation in Latvia that in international studies higher performance is shown by the schools and classes with a greater number of students. However, it should be remembered that the correlation between two variables does not mean a direct causal link. The situation is also greatly influenced by other factors such as student SES, school location, student selection procedure (if any), focus on learning achievements at school and in class, etc. Consequently, the potential pedagogic benefits of a small number of students in the small schools and classes of Latvia are unable to compensate for the influence of negative factors, and student performance in these schools on the average is lower (also after accounting for SES).

The very significant reduction in the number of students in Latvia calls for the optimization of the school network. The number of 15-year-old students in Latvia in the period from 2003 to 2012 has decreased by 50.5%. It is the greatest drop among PISA participating countries.

A greater school governance autonomy in smaller municipalities could be a hindering factor in the optimization of the school network. School principals and some teachers are often elected officials in these municipalities, and they may have a decisive voice in various municipal decision-making processes in the field of education with regard to their school. The result is that the principals usually want to keep their schools alive under any circumstances and the local governments support them.

The factor of education quality must certainly be taken into account in the optimization process, not only such aspects as infrastructure costs. The funds saved in the optimization of infrastructure, should be directed to the improvement of the educational process and the teachers' professional growth. To compare the education quality levels of individual schools, appropriate methods should be chosen – centralized examinations, international comparative education studies, specific activities for monitoring the quality in order to determine both the level of student performance and its growth, etc. A particular effort should be made to take into account the student SES and school SES.

Undoubtedly, the issue of the school network reform is very closely linked to the state administrative territorial division, its possible modification (the continuation of the reform) and the regional development policy as a whole. It is difficult to provide the quality education in the regions with no development, and the regions cannot properly develop without schools. Consequently, it is a cross-cutting policy issue.

If there is a clarity about the administrative territorial division and the regional development, it is possible to implement the task defined in the current government declaration: "We shall establish the strategic model of school network development, which will provide the pupils of first six grades with a quality education as close as possible to the pupil's place of residence, while maintaining the Latvian rural schools as important local community centres. Secondary education will be concentrated in the schools with developed pedagogical and technical basis." This statement exactly matches the recommendations published by researchers as early as in 2000, based on the international comparative education studies implemented in Latvia already in 1990s.

4. The relevance of Latvia's student performance and other factors to a potential educational career in future

The additional module of Educational Career was included in the student surveys of 2003, 2009 and 2012 PISA. The main goal of this module initially was to obtain information about the student's previous education and related events, the current process of learning and a possible future educational career. Unfortunately, the survey module content was formed differently in each study cycle, for example, PISA 2012 did not include the questions about the student's plans of future education. PISA 2012 Education and Career module included three groups of questions:

- regarding ongoing truancy;
- regarding preparation for the future career;
- regarding support with heritage language learning.

The question group dedicated to the native (heritage) language learning content is not relevant in Latvia, because these questions were intended solely for the students whose native language was neither Latvian nor Russian. Only 5% of the PISA 2012 participants corresponded to this criteria, and these questions will not be analyzed here.

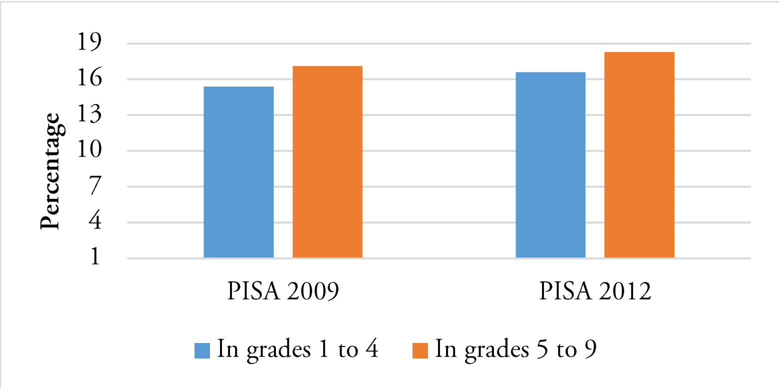


Figure 7.1

The percentage of students in PISA 2009 and PISA 2012, who have missed two or more consecutive months of school

The questions about the long-term truancy were the only ones included in the study for at least two cycles. Students were asked if during the primary school (grades

1 to 4) or basic school (grades 5 to 9) they had ever missed two or more consecutive months of school. Possible answers: No, never; Yes, once; Yes, twice or more. In the further analysis, the positive responses were combined. Figure 7.1 shows the percentage of pupils in PISA 2009 and PISA 2012, who responded in the affirmative.

As shown in Figure 7.1, the number of students who had missed school for lengthy periods of time, in 2009 and 2012 were similar, and in 2012 slightly increased approaching one fifth of the PISA 2012 participants. 5.6% of the students responded that they had missed school for lengthy periods of time both during the grades 1 to 4 and 5 to 9. Among the students who had not missed school for lengthy periods of time, and students who had done so, there were students with very low (less than 300 points) and very high (over 700 points) achievements, but the average achievements of these student groups were statistically significantly different (see Figures 7.2. and 7.3).

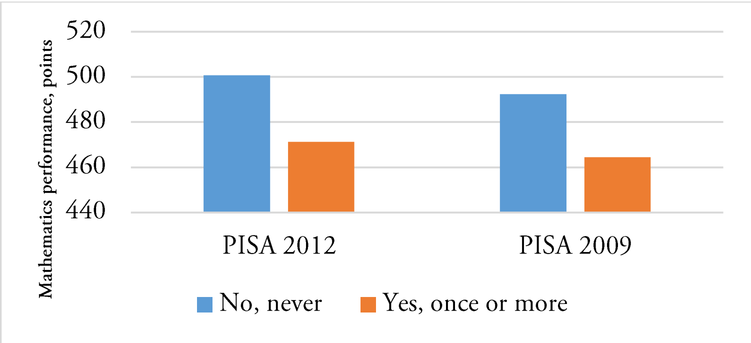


Figure 7.2

Students who have and have not missed school for lengthy periods of time during grades 1 to 4: comparison of average performance in mathematics

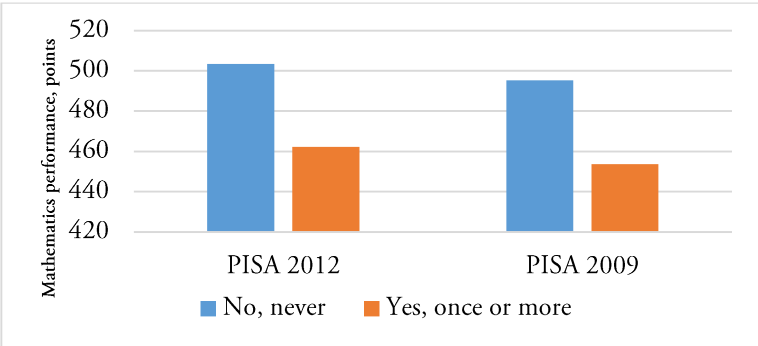


Figure 7.3

Students who have and have not missed school for lengthy periods of time during grades 5 to 9: comparison of average performance in mathematics

The group of questions addressing preparation of students for future career included questions about what students had done in order to find out the future study or work prospects (see Table 7.1), and what career-related skills they had learned at school or outside it (see Table 7.2).

Table 7.1

Student activities to find out the future study or employment opportunities

	Yes (%)
I did an internship	21
I attended job shadowing or work-site visits	35
I visited a job fair	35
I spoke to a career advisor at my school	20
I spoke to a career advisor outside of my school	25
I completed a questionnaire to find out about my interests and abilities	73
I researched the Internet for information about careers	79
I went on an organised tour in an secondary school or higher education institution	30
I researched the Internet for information about secondary school or higher education programmes	70
I participated in career school on specific subject	10

Most often, the students responded that they had searched the Internet for information on career opportunities and / or secondary school, college or university programs, they had completed questionnaires to determine their interests and abilities. Figure 7.4 shows that the average performance of these students in mathematics is higher, consequently, either the students with higher performance are more interested in a purposeful building of their careers, or the students who are interested in further studies, are motivated to study well. Notably, among these students only 14% are the students of rural basic schools.

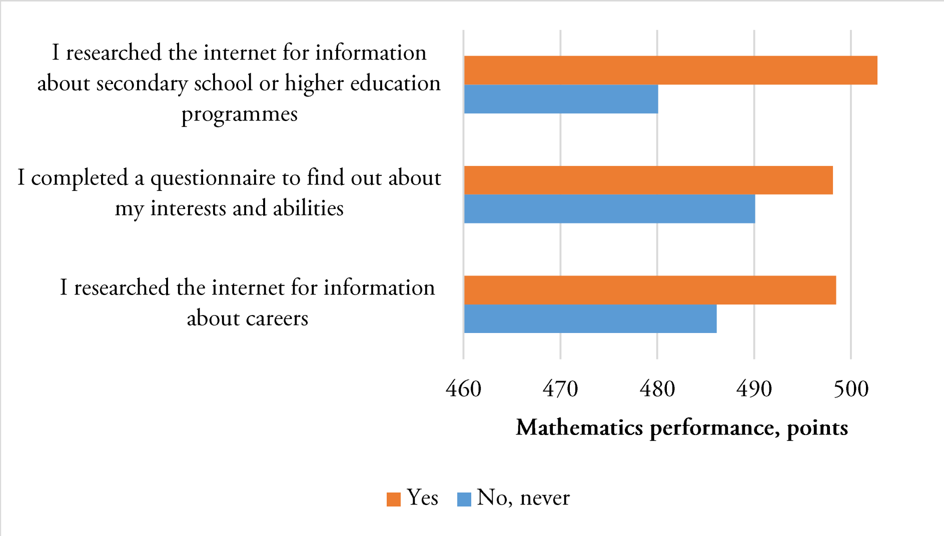


Figure 7.4

The relation of future career-oriented activities to students' performance in mathematics

Table 7.2

Career-related skills

	Yes, at school (%)	*Yes, out of school (%)*	*No, never (%)*
How to find information on jobs I am interested in	26	69	5
How to search for a job	19	46	11
How to write a résumé or a summary of my qualifications	65	23	10
How to prepare for a job interview	42	34	23
How to find information on secondary school or higher education programs I am interested in	26	63	12
How to find information on student financing (e.g. student loans or grants)	18	53	11

The students most often acquired the career-related skills outside of school (see Table 7.2). Around two-thirds of the students indicated that they had learned to write a summary of their qualifications at school, and 42% of the students had learned to prepare for a job interview at school.

Comparing the average performance in mathematics shown by the students who have mastered the abovementioned skills at school, outside of school or have not acquired them anywhere (see Table 7.3), it can be observed that there is no link between performance and students' views on the acquired skills – average performance does not significantly differ for the students who have or have not acquired career-related skills. The exception is the ability to search for information on the secondary and higher education programs that students are interested in. Two thirds of the students admitted that this skill was learned outside of school, and the average performance of those students was statistically significantly higher than that of the students who had mastered this skill at school or had not acquired it at all. Moreover, the performance of the students who use this skill is significantly higher than the performance shown by the rest of the students (see Figure 7.4).

Table 7.3

Career-related skills and their relation to the performance in mathematics (points)

	Yes, at school	*Yes, out of school*	*No, never*
How to find information on jobs I am interested in	483	502	496
How to search for a job	494	497	503
How to write a résumé or a summary of my qualifications	506	482	476
How to prepare for a job interview	497	488	507
How to find information on secondary school or higher education programs I am interested in	485	505	483
How to find information on student financing (e.g. student loans or grants)	481	500	499

Table 7.4 below shows the trend that the SES index of those students who stated that they had acquired career-related skills at school (see Chapter 2.5) is lower than that of the students who have mastered these skills outside of school. This trend reflects

the capacity of schools to motivate students from less affluent families to choose to continue their education.

Table 7.4

Career-related skills and their relation to the student SES index

	Yes, at school	*Yes, out of school*	*No, never*
How to find information on jobs I am interested in	-0,26	-0,14	-0,17
How to search for a job	-0,23	-0,16	-0,17
How to write a résumé or a summary of my qualifications	-0,17	-0,10	-0,34
How to prepare for a job interview	-0,22	-0,09	-0,20
How to find information on secondary school or higher education programs I am interested in	-0,25	-0,10	-0,32
How to find information on student financing (e.g. student loans or grants)	-0,28	-0,09	-0,25

Summary

Although the additional module of Educational Career was included in the student surveys of three PISA cycles, the module questions did not allow to establish the trends related to the future educational career of the students (these questions have been different in each cycle). Only the questions about the long-term truancy (two months or more at least once in grades 1 to 4 or 5 to 9) were included in the surveys of two PISA cycles in 2009 and 2012. Students who had missed school for a long period of time at least once every four years, showed statistically significantly poorer average performance in mathematics than the students who responded that they had not missed school for long periods of time. Analysing the students' answers to the questions about the activities focussed on further educational career choices, it can be concluded that the students' activity is low. Most often the students look for information on the Internet regarding the future career opportunities and secondary school, college or university programs, as well as try to define their interests and abilities. However, among these students there are few rural basic school students (14%). The students' interest in their future career can be a motivating factor for better educational achievement, therefore the career education at school is particularly important.

5. Students – top performers in Latvia

5.1. Students – top performers: definition

The term "top performers" denotes the students who are the highest achievers among their peers in the respective fields. Usually they are the top performers in their class or class group. The term "top performers" is mostly used referring to 10–25% of the students who have attained the best results in the group (Xiang, Dahlin, Cronin, Theaker, Durant, 2011). This definition does not help identify the students' specific characteristics distinguishing them from the rest. The definition only indicates that in any group there are students with high achievements, regardless of the results obtained and their compliance with the maximum obtainable points. Thus, it is reasonable to conclude that such a definition is inaccurate and does not answer the specific needs of the given study.

In the printed sources , the authors tell about the abilities and capabilities of the students – top performers. For example, Lili Allen from Brown University (USA) writes that top performance is ensured by such competencies as problem solving, information management, communication and negotiation skills (Allen, 2000).

Kevin J. Coyle points out that a student- top performer is motivated, inquisitive, even hungry for knowledge. He or she is creative, has problem-solving skills as well as broad perspective, he or she sees every problem as an intriguing new puzzle to be solved (Coyle, 2010).

Carol Bainbridge, who has a doctorate in linguistics, talking mainly about verbally gifted children, claims that the top performers are those who reach their targets. At school those would be the students receiving high assessments and good grades. They are doing what is necessary, and doing it well. They tend to be organized, with good time management skills enabling them to accomplish tasks accurately and on schedule. They usually behave well, easily fit in the class, and enthusiastically participate in classroom discussions (Bainbridge).

The students – top performers are often mistakenly referred to as gifted. However, they are not always gifted, but may have invested a lot of time and effort in the learning process and their results may have been achieved with hard work; most often these students are highly motivated. Significant achievements in a particular field can also be shown by the students who are interested in this field and the results come easy to them (Kingore, 2004a; Bainbridge).

There is no uniform definition of the term "gifted students" or "gifted people". Most authors, talking about the gifted, also mention the talented.

Psychology professor Françoys Gagné believes that giftedness means that a person has excellent natural abilities, particularly, the abilities in at least one of the ability areas. Whereas talent signifies a systematically developed mastery of abilities in one of the areas known as competencies and skills (Gagné, 2008; Gagné, 1985).

Joseph S. Renzulli, the Director of the USA *National Research Center* on the *Gifted* and *Talented*, in 1978 wrote that "giftedness consists of the interaction between the three basic groups of human traits: above-average abilities, high-level implementation of tasks (motivation), a high level of creativity. Gifted and talented children are those who have this composite set of characteristics or those, who could develop and exploit it in any potential area of human performance" (Renzulli, 1978).

Giftedness is like a "label" given to the persons whom we can associate with the type of learning that ensures the supremacy (Ziegler, Stoeger, Vialle, 2012).

Thus, the main difference between the gifted and the talented is that the gifted possess excellent natural abilities (above average) in at least one of the ability areas, whereas the talented have mastered the abilities, systematically developing their skills and competencies.

Although the theories and definitions of giftedness differ, the majority believes that, in order for the gifted children to be able to use their abilities, these abilities must be developed and particular work with these children is required (Kingore, 2004a, Renzulli, 1978; Renzulli, 2012; Ziegler, Stoeger, Vialle, 2012).

A lot of effort must be invested by parents as well as by teachers. The most appropriate approach would be to use the methods especially developed for work with gifted children and the techniques for the development of these children's special abilities. Hence, teachers should understand and be able to recognize gifted pupils and successfully promote their development in a particular area.

However, the students who achieve high results are often mistaken for gifted students. Usually it is the parents who believe that if their child is a top performer, he or she is gifted or talented whereas, most often these children are simply shrewd, advanced and have acquired the ability to learn. The gifted do not always achieve high performance results, because they think and perceive things differently. Bertie Kingore distinguishes among three different types of students, who are often confused for each other at school: students who reach high achievements, gifted students and creative thinkers. Kingore does not preclude exceptions, when a gifted student can also be a creative thinker, or a student who shows high performance can also be gifted, and so on (Kingore, 2004b).

In the PISA study students performing at level 5 or 6 are frequently referred to as "Top Performers" meaning those who have reached at least the level of competence in one of the content areas (OECD, 2010a).

Consequently, the students with high achievements show good results in a certain area, they are strongly motivated and have the skills and abilities to achieve their goals, such as problem solving, time management, information management and communication skills, and creativity. They can also be the students who are gifted in one area, and to them the tasks of this content area come easy.

5.2. Factors influencing students' top performance in Latvia

The analysis is based on the data from 2000, 2003, 2006, 2009 and 2012 PISA studies. In order to determine the factors, two groups were selected – the students with high achievements (over 600 points, hereinafter – Group 1), and the students who were close to top performance, although did not quite reach it (from 500 to 600 points, hereinafter – Group 2).

As mentioned before, the concept of "students – top performers" in PISA means the students who in one of the content areas of the study have reached at least level 5. To set a threshold of top performance for all content areas and to include in the analysis more students with high achievements, it is assumed that the top performing students are all those students who have obtained at least 600 points (Group 1). The lower limit of Group 2 is determined by reference to the average defined by OECD countries in all content areas, that is, 500 points, while the highest average indicator in the OECD countries is plus one standard error (100 points), that is 600 points.

In order to forecast the opportunity of Group 2 students to join Group 1, the binomial logistic regression method was used. The method was chosen on the basis of the dependent variable specificity and the need to compare two different groups - students with high achievements and those who were most likely to become top performers. Binomial logistic regression is used when it is necessary to model the cases in which the dependent variable is binary or dichotomous (Hosmer, Lemeshow, 2000).

The analysis of the data in each study cycle was carried out, taking as a source data the results shown by students in each given cycle's main content area, and on these grounds Group 1 and Group 2 were formed.

The regression model allows to determine the extent to which the independent variables affect the group and how, as they change, the group will change, too. The chosen independent variables were the indices of the particular PISA cycle, removing beforehand those indices from the model, whose correlation with the dependent variable was low (less than 0,100). Most indices are related to the students' learning habits, interests, motivation to learn and attitudes towards each content area of the study. Therefore, these indices are the factors to be considered in order to determine the students' top performance in PISA.

In the first phase, the analysis included all the indices correlating with the dependent variable. At this stage, the importance of each variable to the corresponding model was considered, as the inclusion of the variable in the model gives a statistically significant benefit. If the importance of the variable is above 0.05, then the corresponding variable is excluded from the model.

In the second phase, all the statistically significant independent variables were simultaneously included in the model. The variable importance was measured also in this stage: if the variable did not produce a statistically significant benefit for the model, then it was excluded and a new model was created.

To ensure the effectiveness of the model and its compliance with the data, *Cox & Snell's* R^2_{CS}, *Nagelkerke's* R^2_N and Hosmer and Lemeshow test are commonly used. Since in the analysis contained in this chapter the regression model is built from a relatively large sample, these figures have not been taken into consideration when assessing the effectiveness of the model and its compliance with the data (University of Strathclyde).

In the linear regression, the relationship between the dependent (Y) and the independent variable (X) is determined by the equation $Y = A + BX$ where A is the intercept, B - the regression coefficient. The equation demonstrates how the value of the dependent variable changes, following the change in the independent variable. Consequently, the higher the regression coefficient, the greater will be the changes of the dependent variable, as the independent variable changes (Geske, Grīnfelds, 2006). On the other hand, in the interpretation of the results within the logistical regression, a greater importance is given to the regression coefficient exponent (exp B), since it determines what is the probability of the dependent variable (Y), as the independent variable (X) changes (Burns, R., Burns, R.).

Students – top performers in reading

Table 9.1. compares the ratios of the students at the highest competency levels within the study cycles in the countries such as New Zealand, Finland, and Hong Kong

(China), starting from the year 2000. These countries are among the strongest average achievers, and the proportion of the students at the highest levels of competence in all content areas of the study is among the largest. Comparison includes Latvia's neighbouring country Estonia, as the Estonian students' achievements in the OECD PISA studies were better than those of Latvian students, and in the last cycle there was even an increase in the percentage of the students that reached those high levels. The neighbours of Latvia - Lithuania and Russia are also included (these countries are also contemplated in the subsequent comparisons). The average proportion of OECD countries' students at the highest levels of competence in the previous cycles decreased, but in 2012 it slightly rose both in OECD countries on average, and in Latvia. It can be observed that the proportion of Lithuanian students in the higher levels of competence in all cycles has been slightly lower than those of Latvia. By contrast, in Russia, where until the 2006 cycle, the proportion of students in the highest levels of competence was lower than in Latvia, from 2009 onwards the proportion grows larger than in Latvia.

Table 9.1

The comparison of student proportion (%)at the highest levels in the reading competency in all cycles of the study

Year	2000	2003	2006	2009	2012
Hong Kong	9,5	5,7	12,8	12,4	16,8
New Zealand	18,7	16,3	15,9	15,8	13,9
Finland	18,5	14,7	16,7	14,5	13,5
OECD country average	9,5	8,1	8,6	7,6	8,4
Estonia	-	-	6	6	8,4
Russia	3,2	1,7	1,7	3,1	4,7
Latvia	4,1	6	4,5	3	4,2
Lithuania	-	-	4,4	2,9	3,3

- – the country did not participate in the study
The countries are arranged according to the proportion of students at the highest levels of competency in 2012
Data from the OECD PISA data base

The distribution of students in top performance groups in reading

In Latvia, more girls than boys showed high results in reading (Figure 9.1) in all PISA cycles. 10% of all girls in 2000 and 11% in 2012, while only 4% of boys in 2000 and in 2012 managed to earn more than 600 points. In 2009, when the reading was the key area of the study, 8% of girls and only 3% of boys managed to show top performance. The boys' share in the highest achievement group tends to decline, while that of the girls – to increase. The drop in the proportion of boys is higher than the increase in the proportion of girls. Although more girls are able to achieve 600 points and get into Group 1, a lot more girls than boys are also in Group 2. In 2012, 51% of girls were capable to get more points than the average of the OECD countries. This could be explained by the fact that girls are greater readers, they are more interested to read for pleasure (Geske, Grīnfelds, Kangro, Kiseļova, 2010). The explanation to the observation that boys read less than girls was also sought by the researcher Antra Ozola in her doctoral thesis "The opportunities for improving boys' text comprehension in the context of education management." The researcher notes that the boys consider reading as a women's pastime, because most children are read to by their mothers (Pottorff, Phelps-Zientarski, Skovera, 1996; Ozola, 2012), and the primary school class teacher is almost always a woman (Delamont, 1990; Ozola, 2012). Furthermore, the boys lack suitable, interesting literature (Ozola, 2011). Schools and parents should devote great attention particularly to encouraging the boys to read. Parents themselves should read a great deal more, focusing on the comprehension of the text, and thus setting a positive example to their offspring. As shown in the OECD study on adult skills (PIAAC), an average of 0.7% countries participating in the study were able to achieve the highest level of competence (OECD, 2013h). Although Latvia did not participate in this study, in the light of PISA results, where the performance of Latvia's students is close to the OECD average, we can assume that there would probably be similar results in Latvia. Teachers and parents should be offered the literature that would also interest the boys, without limiting the choice of the reading material.

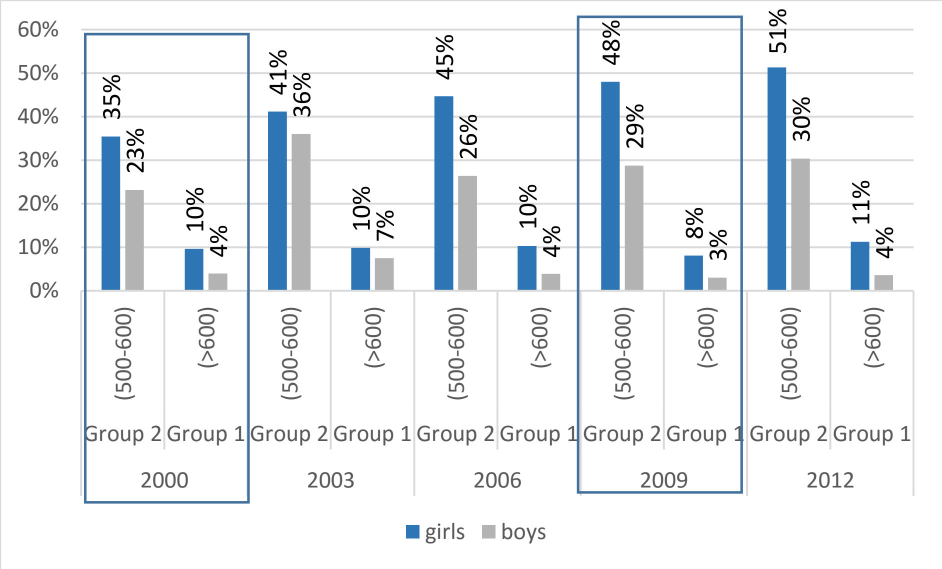


Figure 9.1

The proportion of students (%) in high achievement groups in reading, PISA cycles from 2000 to 2012, according to gender

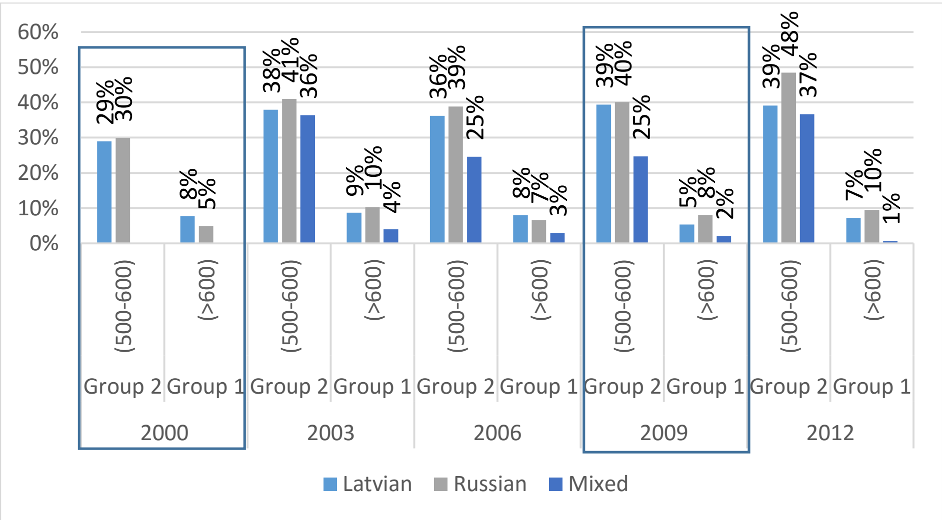


Figure 9.2

The proportion of students (%) in high achievement groups in reading, PISA cycles from 2000 to 2012, according to the language of instruction at school

If we look at the division by group, taking into account the students' language of instruction (Figure 9.2), we see that in 2000, in Group 1 there were more pupils whose language of instruction was Latvian, 8% of all students who studied in Latvian, and only

5% of all those who were learning in Russian. By contrast, in 2012 – 600 points were obtained by 7% of all students who studied in Latvian and as many as 10% of those who learned in Russian. Even though the students who study in Latvian and in Russian have no statistically significant difference, , there is a tendency that the proportion of students studying in Russian in the group of highest achievement increases. In the mixed schools the number of students able to reach 600 points decreases with each cycle; from 2003 the proportion of these students each year is reduced by one per cent.

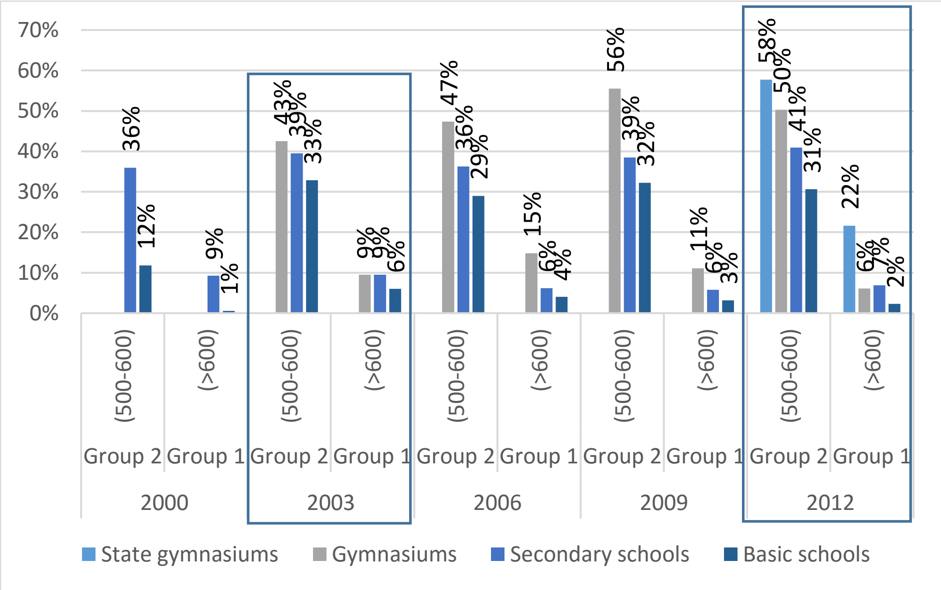
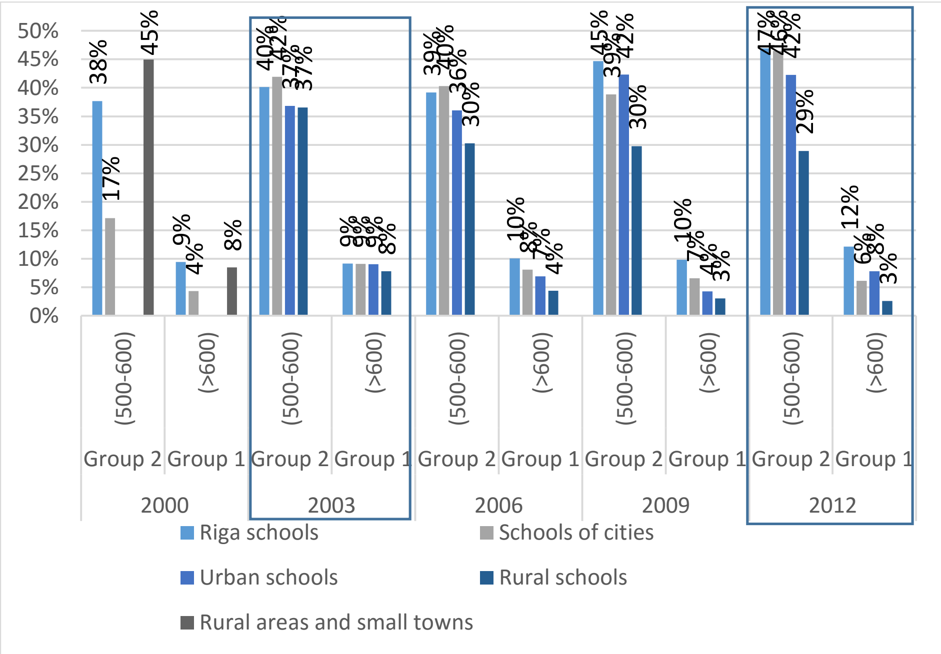


Figure 9.3

The proportion of students (%) in high achievement groups in reading, PISA cycles from 2000 to 2012, depending on the type of school

In 2012, 80% of the Latvia's State Gymnasium students were capable of earning more points than the average for OECD countries, pupils (see Figure 9.3). By contrast, 22% of the State Gymnasium students could obtain more than 600 points. Naturally – to enter the state gymnasiums, the students have to pass entrance examinations. Consequently, these schools enrol the best students who are able to pass these tests. 7% of students studying in secondary schools, are able to achieve more than 600 points, while 6% of the students in the regular gymnasiums are able to achieve more than 600 points. In the latest cycles the secondary school student performance has been rising, and, evidently, more and more students of secondary schools are able to achieve more than 500 points. In the cycle of 2006, there was a drop from 48% in 2003 to 42% in

2006, but in 2012 over 48% of the students could achieve more than the students in the OECD countries on average. The students who study in basic schools, every year are observed to be less capable of excelling, not only above 600 points, but also above 500 points. This can be explained by the shrinking number of basic schools, as since 2000, nearly 170 basic schools have been closed (527 schools in 1999/2000, and 354 in 2011/2012 (Ministry of Science and Education statistics)). It is likely that many parents prefer their children to learn at local schools, next to the place of residence, while they themselves work in the nearby towns. Commuting with the children to schools in cities and towns means extra costs. And if there is no local school, it is more practical to move to a city. Consequently, the population in the rural areas declines. There are much more basic schools and fewer secondary schools in the rural areas, as opposed to the urban areas where secondary schools prevail over basic schools.



In 2000 the data of rural areas and small towns were combined in one group

Figure 9.4

The proportion of students (%) in high achievement groups in reading, PISA cycles from 2000 to 2012, according to the location of the school

With each cycle, the proportion of students in Group 1 in Riga schools is increasing – in contrast to other big city schools, where it decreases (see Figure 9.4). In the schools of other towns the percentage of students in Group 1 particularly increased during the last cycle, compared to the previous cycle, while in the rural schools the percentage of students in Group 1 remained unchanged in the last two cycles. However, reviewing particularly the student achievement in those cycles when the reading has been the main content area of the study, it appears that student achievement compared to 2000 and 2009, when the reading was the main content area, has been on the riseg. The number of students able to obtain more than 500 points has increased both in Riga and urban schools, and the number of students who are able to achieve more than 600 points has grown, too.

Opportunities of Latvia's students to achieve high results in reading in PISA

While overall the percentage of Latvia's students who are able to achieve high results in reading tends to decrease when comparing the data in cycles, where reading was the main content area, the number of students who are able to obtain more points than the OECD average, tends to increase (Table 9.2)

Table 9.2

The proportion of students (%) in different performance categories in reading, PISA cycles of 2000 and 2009

Year	Top performing students according to OECD PISA classification	Top performing students, if the threshold is 600 points	Students achieving between 500 and 600 points
2000	4,1	6,8	29,3
2009	3	5,6	38,5

Using the binomial logistic regression, the possible factors affecting high achievement in PISA 2000 were identified. The following were recognised as the most important: parental education, family support in learning, reading for pleasure, satisfaction with their mathematical abilities, satisfaction with their academic abilities (see Table 9.3).

Table 9.3

Student performance in reading, PISA 2000: results of logistic regression

	B	Standard error	Significance	Exp(B)
Mother's education	0,721	0,053	0,000	2,057
Reading for pleasure	0,643	0,035	0,000	1,903
Satisfaction with own mathematical abilities	0,260	0,032	0,000	1,296
Satisfaction with own academic abilities	0,248	0,038	0,000	1,281
Father's education	0,168	0,040	0,000	1,183
Family support in studies	-0,514	0,034	0,000	0,598

Then PISA 2009 survey data were analyzed. However, it is not possible to compare the achievement-influencing factors in PISA 2000 and PISA 2009, because a number of the indices –factors were no longer used in PISA 2009, except for two – parental education and reading for pleasure, which were also included in the PISA 2009 binomial logistic regression model. It was found that student achievement could be positively affected by the changes in the following factors: higher parental education level, presence of cultural possessions at home, availability of educational resources at home, reading for pleasure, as well as the reading strategies used – "understand and remember" and "summarizing" (see Table 9.4).

The Indices „mother's education" un „father's education" are formed on the basis of student survey questions as to the higher education obtained by each of the parents, on the basis of national education qualification and ISCED levels. Two questions were asked about each of the parents: "Did your mother / father complete upper secondary education?" The variants of answers: "No, she / he did not go to school"; "No, she / he completed primary education only"; " No, she / he completed lower secondary education only"; "No, she / he completed vocational school without obtaining upper secondary education"; "Yes, she / he completed upper secondary education (at secondary school, vocational school, technical college)"; and "Has she / he obtained higher education?"

Table 9.4

Student performance in reading, PISA 2009: results of logistic regression

	B	Standard error	Significance	Exp(B)
Reading for pleasure	0,906	0,045	<0,001	2,475
Reading strategy "summarizing"	0,441	0,046	<0,001	1,554
Availability of educational possessions at home	0,441	0,052	<0,001	1,555
Reading strategy "understand and remember"	0,381	0,040	<0,001	1,464
Presence of cultural possessions at home	0,156	0,048	0,001	1,169
The highest level of parental education	0,118	0,016	<0,001	1,125

The parental education is an important factor that can affect the increase of student achievement – it is confirmed by PISA 2000 and PISA 2009 data. An educated person reads more and thus, both directly and indirectly, affects his or her children's attitude to reading. As shown in Table 9.4, the maternal education is the most influential factor. This means that if the mother would have a higher education, then the probability of a child to move from Group 2 into Group 1 increased by 105%, assuming that the rest of the indices' values remain the same. Although PISA 2009 data show that higher parental education level is no longer likely to raise student achievement as testified by PISA 2000 data, one should note however that in PISA 2009 the mother's and father's education was combined in one index (OECD, 2012a), thus, it cannot be argued that the impact has decreased.

The index "family support in studies" is derived from students' responses on how often mother, father, brothers or sisters help with the homework assigned by school. The increase of this index would have a negative impact on the student's achievement. Increasing this index by a single unit, the probability that the student will qualify for Group 1 falls by 59%. Assistance in learning is a lot more vital to those students who have problems in learning or who have difficulties completing a task. The assistance may also undermine the student's reliance on his or her own abilities.

The second of the most influential factors in PISA 2000, and the most influential one in PISA 2009 is "reading for pleasure". This index is derived from the extent to which the student agrees to the following questions about reading (in creating this index, the negative statements are encoded with the opposite sign) (OECD, 2000):

- I read only if I have to.
- Reading is one of my favourite hobbies.
- I like talking about books with other people.
- I find it hard to finish a book.
- I feel happy if I receive a book as a present.
- For me, reading is a waste of time.
- I enjoy going to a bookstore or a library.
- I read only to get the information I need.
- I cannot sit still and read for more than five minutes.

In PISA 2009, this index was supplied with two questions not included in PISA 2000 survey (OECD, 2012a):

- I like to express my opinion about the books I have read;
- I like to exchange books with my friends.

If the value of this index increases by one unit, the probability that a student will qualify for the Group 1 will increase by 90%, according to PISA 2000 data, while PISA 2009 data show that the increase is already by 148%, assuming that the values of the rest of the indices remain the same.

Among PISA 2000 indices that are significant for increasing student performance there is also the index "satisfaction with own mathematical abilities" and index "satisfaction with own academic abilities." The increase of these indices by one unit would increase the likelihood of a student to move from Group 2 to Group 1, by 30% and 28% respectively, provided that other indexes remain unchanged. The index "satisfaction with own mathematical abilities" is formed on the basis of the extent to which the student agrees to the following statements (OECD, 2000):

- I get good marks in mathematics.
- Mathematics is one of the subjects that I am best at.
- I have always done well in mathematics.

Index "satisfaction with own academic abilities" is formed on the basis of the extent to which the students agree to the following statements:

- I learn things quickly in most school subjects.
- I'm good at most school subjects.
- I do well in tests in most school subjects.

Mathematics develops the algorithmic thinking, which means that these children have a greater ability to perform precise instructions, consequently, the description of the task is read carefully and fulfilled. These students have stronger logical thinking, reasoning, and, possibly, have a clearer text perception.

PISA 2009 data shows that the student performance levels are affected by the application of appropriate learning strategies. These learning strategies are special indices developed by experts comprised of student responses to questions about the learning habits and of the number of points obtained by the students in various reading tasks (OECD, 2012a). Reading strategy index "understand and remember" rshows, whether the students select the most appropriate strategy to understand and remember the text. This index determines that the most successful strategy would be as follows: after reading the text to discuss its contents with others, underline the most important parts of the text, summarize the text in one's own words. A less appropriate strategy is described by the students as follows: I focus on the parts of the text that are easier to understand, I read the text fast twice, I read the text aloud to another person. The increase of this index by one unit would increase the likelihood that student would move from Group 2 to Group 1 by 46%.

By contrast, the strategy index "summarising" shows whether students select the most appropriate strategy to write a summary of a complex two-page text. The most successful strategy would be to do the following: to read the text, underlining the most important sentences, and then to relate it in one's own words in a summary; to verify that all the key facts are included in the summary. A moderately successful strategy would be to write a summary; to check whether each paragraph of the text is included in the summary, because that is how it should be; before writing the summary to read the text as many times as possible. The least fruitful strategy included in the index is the student's attempt to rewrite the summary accurately, using as many sentences as possible from the text. The increase of this index per one unit would increase the likelihood that student could move from Group 2 to Group 1 by 55% provided that other indices remain unchanged.

Several indices were created on the basis of students' answers to 13 questions about the possessions at home, including the "educational possessions at home" and "cultural possessions at home." Of these two indices, the greatest likelihood of a student to move from Group 2 to Group 1 by 56% is ensured by the increase of index "educational possessions at home" by one unit. This index was created from students' responses on whether they have access to the following things: a desk for study, a quiet place to study, a computer that can be used for studies, educational software, the books useful for school assignments, technical manuals, a dictionary (OECD, 2012a). By contrast, the index " cultural possessions at home" was made up of students' answers on the availability of the following: classic literature (e.g., Rainis), books of poetry, works of art (e.g., paintings) (OECD, 2012a). The increase of this index only by one unit would increase the opportunity for a student to enter the group of the excellence by 17%, on condition that the other indices remain unchanged.

Students with top performance in mathematics

Table 9.5 shows the comparison between Latvia's, the OECD average indicators and selected countries' proportion of students (as a percentage) in PISA cycles from 2003 to 2012. It demonstrates that the proportion of Latvia's students in the highest levels of competency is below the OECD average. It is important to note that the percentage of Estonia's students in the highest levels of competency in mathematics corresponds to the OECD average proportion of pupils at these levels.

Table 9.5

The comparison of student proportion (%)in the highest levels of mathematical competency in all cycles of the study

Year	2003	2006	2009	2012
Hong Kong	30,7	28,7	30,7	33,7
Finland	23,4	24,4	21,6	15,2
New Zealand	20,7	18,9	18,9	15
Estonia	-	12,6	12	14,6
OECD country average	14,6	13,3	12,7	12,6
Lithuania	-	9,1	7	8,1
Latvia	7,9	6,6	5,7	8
Russia	7	7,4	5,2	7,8

- – the country did not participate in the study

The countries are arranged according to the proportion of students at the highest levels of competency in 2019

Data of the OECD PISA data base

The distribution of students in top performance groups in mathematics

As shown in Figure 9.5, the proportion of boys in Group 1 (achieving top results in mathematics) is greater than that of girls in all cycles, except for 2003, when mathematics was the main content area. In 2003, nearly 50% of girls were able to get more points than the OECD average. By contrast, the proportion of boys and girls in Group 2 during the other cycles was not significantly different, except for 2012, when the mathematics once more was the main content area and again more girls than boys were able to achieve higher results than the OECD average, while the proportion of boys who were able to acquire more than 600 points was higher. Comparing the 2003 and 2012 cycles, when mathematics was the main content area, it must be concluded that the proportion of boys in Group 1 has increased by 3%, while the proportion of girls has dropped by 2%. Comparing the data across cycles, there is a tendency – the proportion of boys achieving more than 600 points, is rising faster than the proportion of girls.

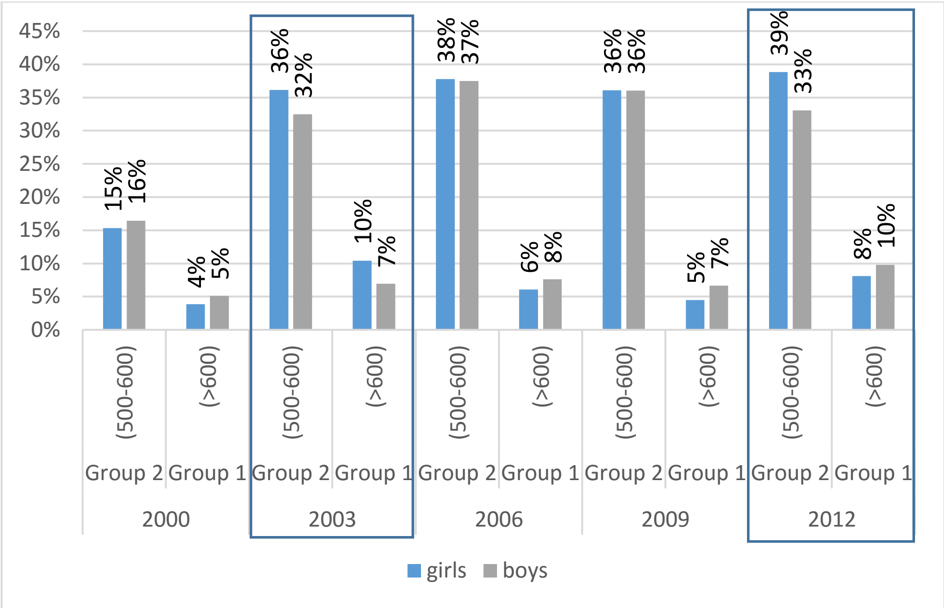


Figure 9.5

The proportion of students (%) in high achievement groups in mathematics, PISA cycles from 2000 to 2012, according to gender

Comparing the proportion of students in Group 1 and Group 2, taking into account the language of instruction, there emerges a similar situation as in reading (see Figure 9.6). The percentage of pupils studying in Russian in Group 1 is increasing, while of those learning in Latvian, it is falling, with the exception of the year 2012. Similar to the analysis of the proportion of boys and girls in Group 2, also the Russian and Latvian student proportional division shares similar trends, namely, the Russian and Latvian proportion of students in Group 2 is not significantly different. The comparison of the cycles when mathematics was the main content area shows that the percentage of students in Group 1, whose language of instruction is Latvian, slightly increases, while of those, whose language of instruction is Russian, slightly declines. Consequently, the gap between students with different languages of instruction is narrowing.

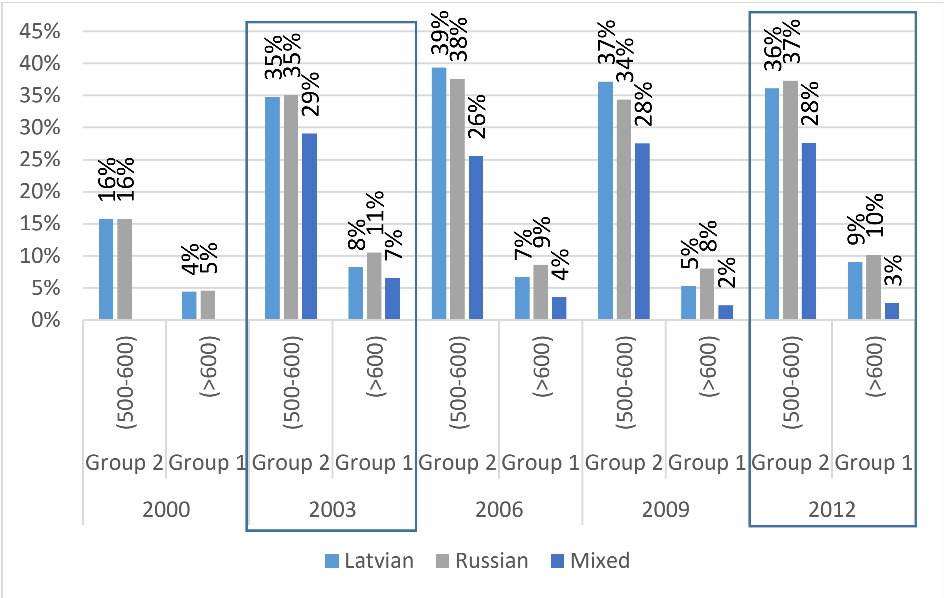


Figure 9.6

The proportion of students (%) in high achievement groups in mathematics, PISA cycles from 2000 to 2012, according to language of instruction at school

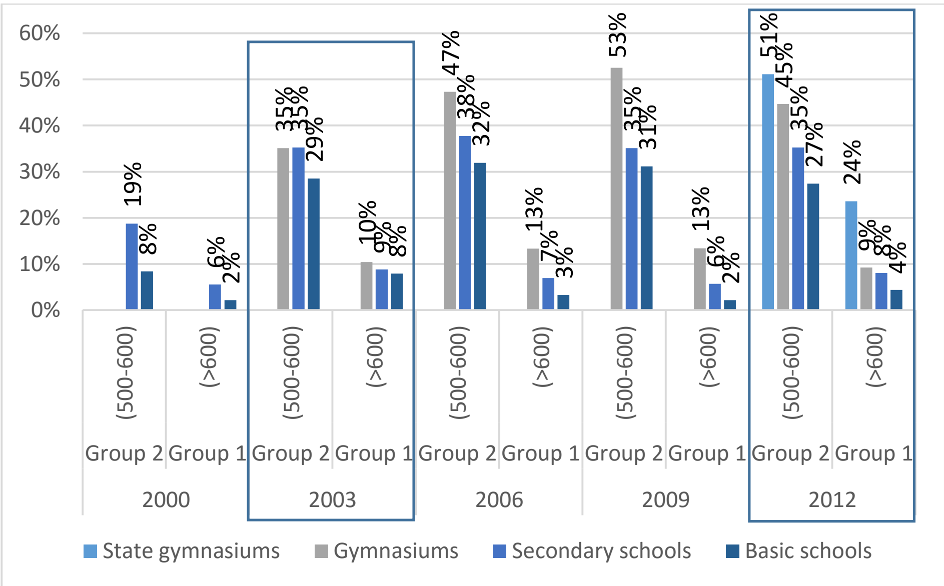
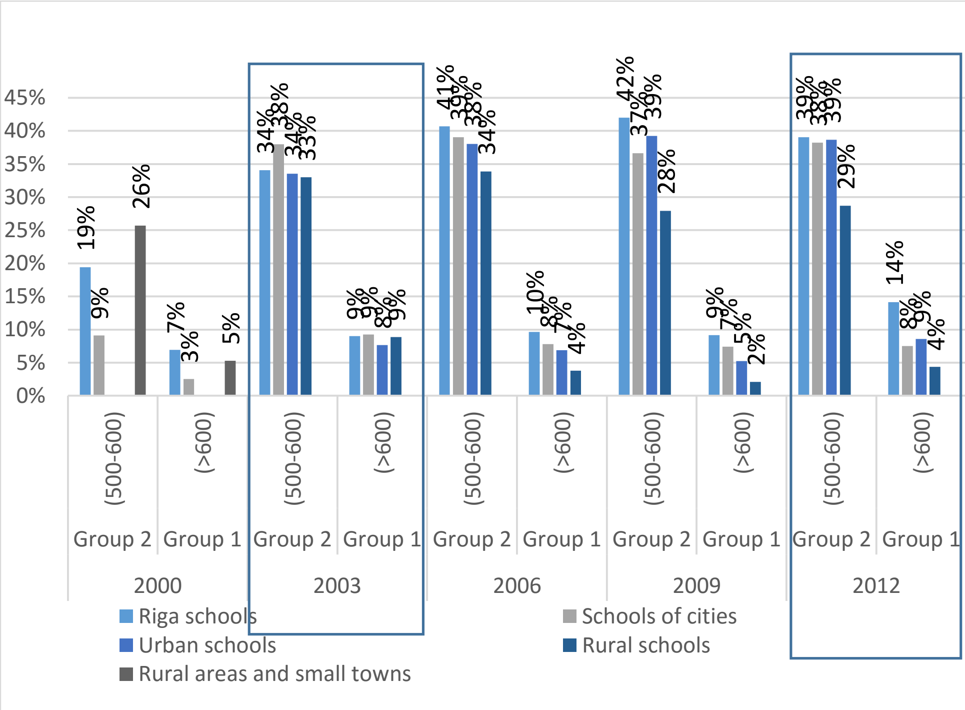


Figure 9.7

The proportion of students (%) in high achievement groups in mathematics, PISA cycles from 2000 to 2012, according to the type of school

Figure 9.7 shows that much higher performance in mathematics in 2012 was achieved by those students who were studying in state gymnasiums, and, as discussed previously, it was self-evident. Secondary school and gymnasium student percentage in Group 1 is very similar, but the greatest drop in the proportion of students in Group 1 has been observed particularly in basic schools. The comparison of all cycles shows that at secondary schools the situation is very stable, without dramatic falls or rises, yet it can also be a warning sign of stagnation, lack of striving for better results. The fall is observed in the gymnasiums, yet it can be explained by the fact that the state gymnasiums were separated from the gymnasiums.



In 2000 the data of rural areas and small towns were combined in one group

Figure 9.8

The proportion of students (%) in high achievement groups in mathematics, PISA cycles from 2000 to 2012, according to the location of school

Looking at the performance of students according to the school location, it can be observed that the percentage of students who are able to reach at least 600 points in Riga schools and other city schools is on the rise (see Figure 9.8). Comparing the cycles when mathematics was the main content area, it was evident that again the rural schools saw a significant decrease in the proportion of students both in Group 1 and Group 2, consequently, the number of students in rural schools who were able to achieve such high results continued to decline. Very rapid growth– from 9% to 14% - was observed in Riga schools in Group 1 At the same time, the proportion of students in t Group 2 at the schools of Riga and other cities is equal.

Opportunities of Latvia's students to achieve high results in mathematics in PISA

Mathematics was the main content area of PISA in 2003 and 2012. As shown in Table 9.6, the percentage of students in the highest achievement group in both cycles has been almost the same.

Table 9.6

The proportion of students (%) in different achievement groups in mathematics, PISA cycles from 2003 to 2012

Year	Top performing students according to OECD PISA classification	Top performing students, if the threshold is 600 points	Students achieving between 500 and 600 points
2003	7,9	8,7	34,4
2012	8,0	8,9	35,9

Just like in reading, a binomial logistic regression calculations were used to define the factors influencing the student achievement in the cycle, in which mathematics for the first time was the main content area – PISA 2003. Significant possible factors to gain high results in mathematics include the anxiety when solving mathematics tasks, higher parental education level, attitude to computers (Table 9.7).

Table 9.7

Student achievements in mathematics, PISA 2003: results of logistic regression

2003	B	Standard error	Significance	Exp(B)
Anxiety when solving mathematics tasks	0,197	0,029	<0,001	1,218
Higher parental education level	0,194	0,024	<0,001	1,214
Attitude to computers	-0,134	0,023	<0,001	0,875

Subsequently, these same factors – indices were examined also by the PISA 2012 data to see if changes had occurred since 2003 (Table 9.8).

As shown in Tables 9.7 and 9.8, parental education is an important factor affecting also the achievement of students in mathematics. According to PISA 2003 data analysis results, increasing this index by one unit, the likelihood of students to move from Group 2 to Group 1 would be 21%, while PISA 2012 data analysis results show that this likelihood would already be 35% , other indices remaining unchanged. The index "a higher parental education level" is created from student responses on parental education (OECD, 2005a), similarly to 2000 and 2009.

Table 9.8

Student achievements in mathematics (OECD PISA 2012), using the regression obtained in PISA 2003: results of logistic regression

2012	B	Standard error	Significance	Exp(B)
Highest parental education level	0,301	0,042	<0,001	1,351
Limitation of computer use in studies	-0,237	0,048	<0,001	0,789
Anxiety when solving mathematics tasks	-0,977	0,052	<0,001	0,376

The index "Anxiety when solving mathematics tasks" or "Mathematics anxiety" is built on the basis of affirmative students' responses to five items about learning mathematics (OECD, 2005a):

- I often worry that i may have difficulties in mathematics classes.
- I get very tense when I have to do mathematics homework.
- I get very nervous doing mathematics problems.
- I feel helpless when doing a mathematics problem.
- I worry that I will get poor marks in mathematics.

PISA 2003 data show that anxiety positively affects student achievement, whereas PISA 2012 data, on the contrary, testify to negative influence, respectively, the opportunity for a student to transfer from Group 2 to Group 1, would be increased by 22% (PISA 2003) with an increase in index value for one unit, provided that the values of the other indices remain unchanged, while the probability of a student from Group 2 to enter Group 1 would be reduced by 36% (PISA 2012).

PISA 2003 data analysis shows that the worries and anxiety about their success and failure are experienced a lot more by the students whose achievements are higher, while PISA 2012 data analysis shows that more concerned are those who are falling a little bit short of the high achievement threshold. The anxiety can create a certain pressure, which can improve the work and raise the creative activity. The mind works faster and perceptual abilities are boosted. Such positive stress is harmless, and even quite necessary (Geisselharts, Hofmane-Burkarta, 2000). Excessive stress may work in the opposite direction, this assertion supported by Yerkes and Dodson Law (1908): If the stress level is low, the achievements are low, too, however, as this level rises, the achievements will increase, but only up to a certain limit, beyond which the performance falls again (Miles, Shevlin, 2001). The student who knows what the or she is doing, does not feel so much stress and is able to do more. The fact that the students are anxious about their results is a sign of the sense of responsibility for their work.

The index "Attitudes toward computers" is built on the basis of affirmative students' responses to four items below (OECD, 2005a):

- It is very important for me to work with a computer.
- To play or work with a computer is fun.
- I use the computer because I am very interested in it.
- I lose track of time when I am working on the computer.

This index was not created for PISA 2012, but two other indices were made instead – the positive attitude index "using a computer for studies at school" and negative attitude index "limitation of computer use in studies". Therefore, these two indices were chosen for the comparison, and the positive attitude index had to be excluded because its significance was not confirmed. Negative attitude index "limitation of computer use in studies" was made up of students' answers as to whether they agree with the following statements (Bertling, Kyllonen, Hersbach, Lietz, Tobin, 2012):

- Using the computer for learning is troublesome.

- Since anyone can upload information to the Internet, it is in general not suitable to use it for schoolwork.
- Information obtained from the Internet is generally too unreliable to be used for school assignments.

In both years, these computer-related indices show a negative impact on student achievement. With the increase of the indices, the likelihood of students to reach high achievement would be reduced by 88%, according to PISA 2003, and by about 79% according to PISA 2012. It is not possible to compare these two indices, because they include different questions. PISA 2003 statements are about general computer usage, while PISA 2012 addresses the use of the computer, especially the Internet, particularly in studies. Since 2003, the data show that the use of computer for entertainment, games, leading to the loss of the sense of time, results in decreasing student achievement. By contrast, the impact of negative attitude explored in 2012 study means that the students with more positive attitude to the use of a computer and the Internet for studies show higher achievements.

Perhaps, a more negative attitude towards the use of a computer and the Internet for studies is expressed by those students who do not know how to use the opportunities of ICT in the learning process, or who have not learned to do it.

Table 9.9

Student achievements in mathematics (OECD PISA 2012): results of logistic regression

	B	Standard error	Significance	Exp(B)
Experience with applied mathematics tasks	0,303	0,079	<0,001	1,353
Higher parental education level	0,129	0,026	<0,001	1,138
ICT use at school	-0,276	0,061	<0,001	0,759
Anxiety when solving mathematics tasks	-0,994	0,073	<0,001	0,370

A new logistic regression model was created for PISA 2012 data, this time choosing for the raw data all available PISA 2012 indices, and as a result, among the most significant should be noted "Anxiety when solving mathematics tasks", "Higher parental educational level", " Experience with applied mathematics tasks " (Table 9.9).

This model also retains two indices from the model reviewed before – "Highest parental education level" and "Anxiety when solving mathematics tasks". Two new indices have been introduced – " ICT use at school" and "Experience with applied mathematics tasks". Obviously, if students were given increased opportunity to solve more applied mathematics tasks, then the probability to shift from Group 2 to Group 1 would rise by 35%. This index is formed of student responses to the question " How often have you encountered the following types of mathematics tasks during your time at school?" (OECD, 2014):

- solving an equation like $6x^2 + 5 = 29$
- solving an equation like $2 (x + 3) = (x + 3) (x – 3)$
- solving an equation like $3x + 5 = 17$

It relates to the discussion above, that the ability of students to solve the tasks for which a certain set algorithm should be used, develops their capacity to better solve also the other tasks because they have a more advanced algorithmic thinking – the ability to execute the instructions, to apply the knowledge gained.

The second index - "The use of ICT at school" would have a negative effect on the likelihood of students to gain high results, the probability to leave Group 2 to enter Group 1 would be reduced by 76%. This index was created from student responses to the question "How often do you use a computer for the following activities at school?" (OECD, 2014a):

- Chatting on line at school
- Using email at school
- Browsing the Internet for schoolwork
- Downloading, uploading or browsing materials from the school's website (e.g. Intranet)
- Posting my work on the school's website
- Playing simulations at school
- Practicing and drilling, such as for foreign languages or mathematics
- Doing homework on a school computer

- Using school computers for group work and communication with other students.

Students with top performance in mathematics

Table 9.10 summarizes the comparison of the proportion of students (as a percentage) in Latvia and the countries selected for comparison with regard to science proficiency at the highest levels from 2006 to 2012 cycle. The percentage of Latvia's students in these levels is twice as low as the OECD average. By contrast, Estonia's proportion of students at the highest levels is above the OECD average, and even three times higher than the proportion of Latvia's pupils at these levels. It should be emphasized that from the countries considered in Table 9.10, only in Latvia, Russia and Lithuania the students' top performance in science is below the OECD average. In Latvia and Russia the proportion of students who reach the highest levels of competency is almost two times smaller in comparison with the OECD average.

Table 9.10

The comparison of student proportion (%)in the highest levels of science competency in all cycles of the study

Year	2006	2009	2012
Finland	20,9	18,7	17,1
Hong Kong	16	16,2	16,7
New Zealand	17,6	17,6	13,4
Estonia	11,5	10,4	12,8
OECD country average	9	8,5	8,4
Lithuania	4,9	4,7	5,1
Latvia	4,1	3,1	4,3
Russia	4,2	4,3	4,2

The countries are arranged according to the proportion of students at the highest levels of competency in 2012
Data of the OECD PISA data base

The distribution of students in top performance groups in science

When comparing the achievements in science among girls and boys, Figure 9.9 shows that in the 2000 and 2003 cycles of the study the proportion of girls in Group 1 was higher than that of boys, in 2006 (science was the main content area) and 2009 cycles of the study the proportion of boys was higher in Group 1, but in 2012 the proportion of girls was slightly higher again. Although the proportion of boys and girls at the highest achievement group generally tends to increase with each cycle, , the proportion of boys is rapidly rising. In all study cycles, the proportion of girls who obtain more points than the OECD average is higher than the proportion of boys.

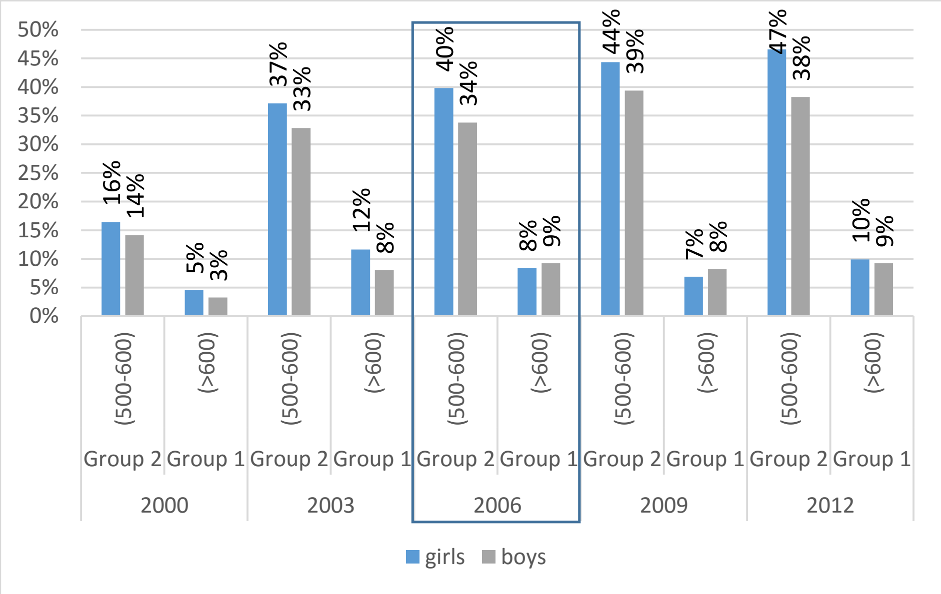


Figure 9.9

The proportion of students (%) in high achievement groups in science, PISA cycles from 2000 to 2012, according to gender

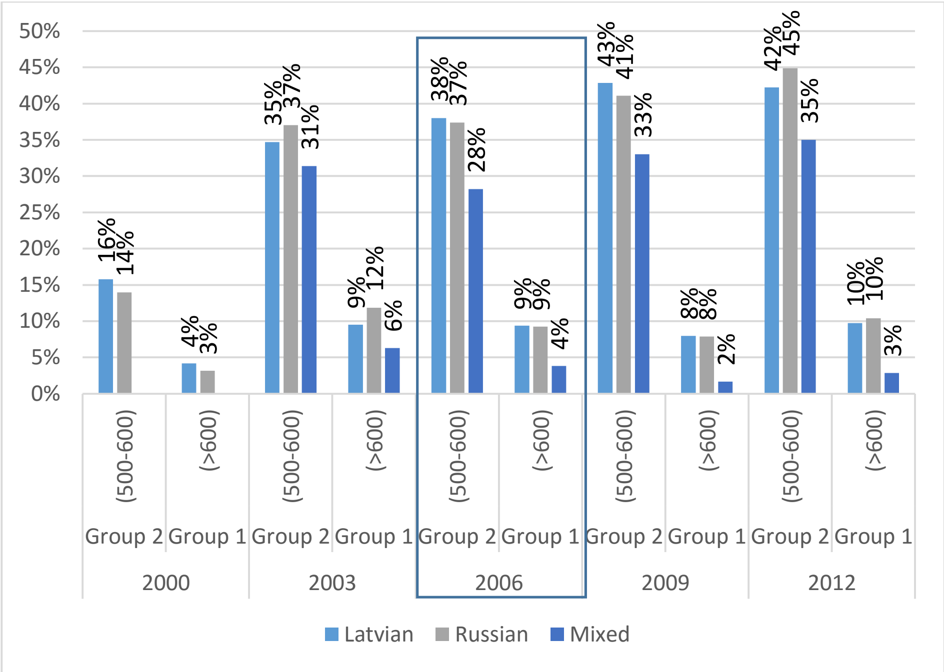


Figure 9.10

The proportion of students (%) in high achievement groups in science, PISA cycles from 2000 to 2012, according to language of instruction at school

The proportion of students in Group 1 with Latvian or Russian instruction language, starting from the cycle of 2006 onwards remains the same (Figure 9.10). In 2000, Group 1 had a higher proportion of students studying in Latvian, while in 2003 the percentage of students studying in Russian was higher. Although in the latest cycles the percentage of the students whose performance exceeds 600 points is observed to decline, in the last cycle a slight increase was seen; however, the number of students achieving more points than the OECD average, increases. As shown in Figure 9:10, in mixed schools the proportion of students in the high achievement groups is small, and the proportion of students who are able to exceed the OECD average is much lower in comparison with the students who study in schools with the Latvian or Russian language of instruction.

It is also evident that most of the students who are able to reach the highest level of competency in science, are studying in state gymnasiums. The least proportion of top-performing students attend primary schools, where there are no sharp declines, and the proportion of students at the highest achievement group has been constant since

2006 cycle, when science was the main content area of the study. Similarly to mathematics, a stable situation is observed in secondary schools (see Figure 9.11).

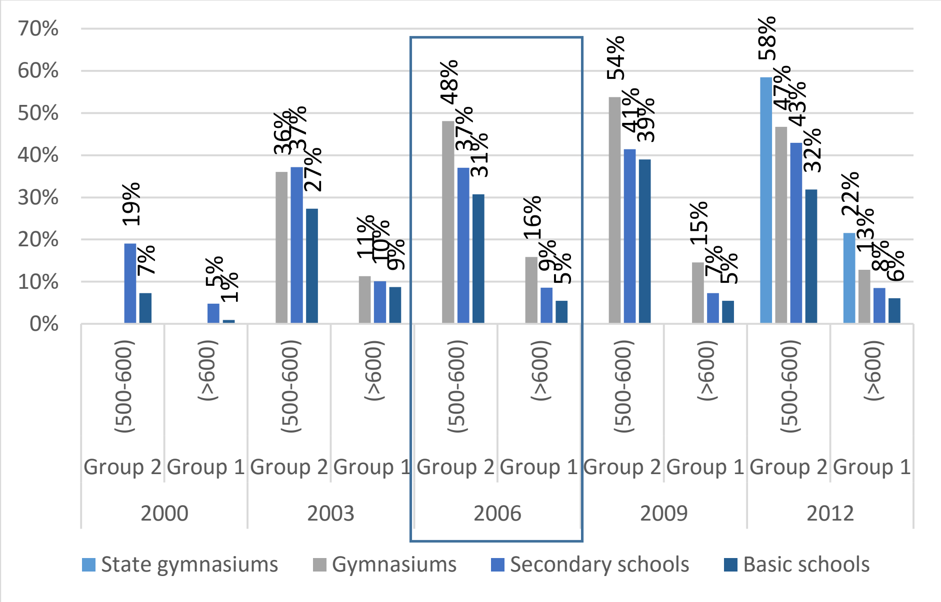
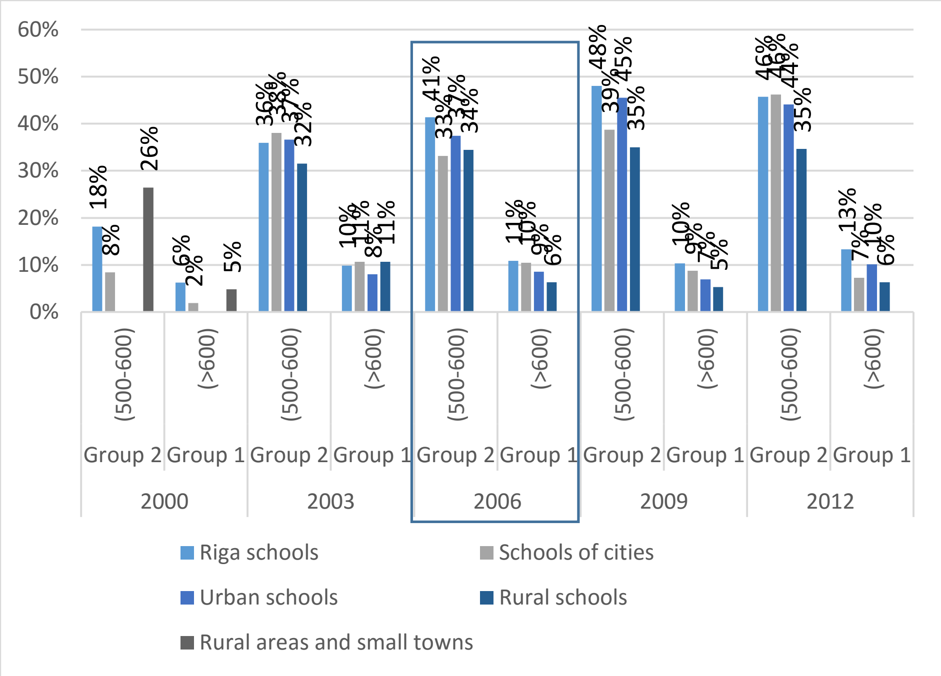


Figure 9.11

The proportion of students (%) in high achievement groups in science, PISA cycles from 2000 to 2012, according to the type of school

As seen in Figure 9.12, the performance in science in rural schools is characterised by stability. The greatest decline in the proportion of students in the highest achievement group is observed in the big cities, where, however an increase is seen in the proportion of the students, who are able to reach at least 500 points, yet do not exceed 600 points. After previous reductions, there is an increase in the proportion of students in Riga and other cities.



2000. gadā dati par laukiem un mazajām pilsētām tika apvienoti vienā grupā

Figure 9.12

The proportion of students (%) in high achievement groups in science, PISA cycles from 2000 to 2012, according to the location of school

Opportunities of Latvia's students to achieve high results in science in PISA

The main content area of PISA 2006 cycle was science. As seen in Table 9.11, the number of students who achieved high results according to the OECD classification , decreased, yet by changing the threshold, increased.

Table 9.11

The proportion of students (%) in different achievement groups in sciences, PISA cycle of 2006

Year	Top performing students according to OECD PISA classification	Top performing students, if the threshold is 600 points	Students achieving between 500 and 600 points
2006	6,6	6,8	37,6

The likelihood of Group 2 students to achieve higher results in science or to enter Group 1, according to binomial logistic regression calculations, is determined by the following factors: higher parental education level, future-oriented motivation to study science, confidence in the results in science, satisfaction with the results in science, general attitude towards science, awareness of environmental issues (see Table 9.12).

Table 9.12

Student achievements in science, PISA 2000: results of logistic regression

	B	Standard error	Significance	Exp(B)
Awareness of environmental issues	0,518	0,036	<0,001	1,679
Confidence in the results in science	0,416	0,034	<0,001	1,516
Satisfaction with the results in science	0,185	0,038	<0,001	1,203
General attitude towards science	0,152	0,030	<0,001	1,165
Future-oriented motivation to study science	0,101	0,030	0,001	1,106
Higher parental education level	0,084	0,010	<0,001	1,088

The index "Students' awareness of environmental issues" is made up of students' responses to five environment-related items. The goal was to observe the students' awareness about (OECD, 2009a):

- The increase of greenhouse gases in the atmosphere.
- Use of genetically modified organisms.
- Acid rain.
- Nuclear waste.

- The consequences of clearing forests (to use the land for other purposes).

With the increase of this index by a single unit, the likelihood of students to enter Group 1 would increase by 68%. Of the factors included in the equation, it is the most influential. The second most influential factor is the index "Confidence in the results in science". If this index increased by one unit, the likelihood of students to enter Group 1 would increase by 52%, if the values of other indices remained unchanged. The index is created of the students' answers to questions about the extent to which they are confident of being able to fulfil the science-related tasks (OECD, 2009a).

The increase of the rest of the indices by one unit would increase the likelihood of students to passing from Group 2 to Group 1 by 20% ("Satisfaction with the results in science "), 17% ("General value of science") and 10% ("Future-oriented science motivation"), if the values of other indices remain unchanged. The index "Satisfaction with the results in science" is formed by the students' responses as to the extent to which they agree with the following statements (OECD, 2009a):

- Learning advanced science topics would be easy for me.
- I can usually give good answers to test questions on science topics.
- I learn science topics quickly.
- Science topics are easy for me.
- When I am being taught science, I can understand the concepts very well.
- I can easily understand new ideas in science.

The index "General value of science" is created of the students' answers to what extent they agree with the following assertions (OECD, 2009a):

- Advances in science and technology usually improve people's living conditions.
- Science is important for helping us understand the surrounding world.
- Advances in science and technology usually help improve the economy.
- Science is valuable to society.
- Advances in science and technology usually bring social benefits.

The index "Future-oriented science motivation" is created of the students' answers to what extent they agree with the following assertions (OECD, 2009a):

- I would like to make a career ing science.
- I would like to study science after secondary school.
- I would like to spend my life doing advanced science.
- I would like to work on science projects as an adult.

Clearly, the students' knowledge about nature and the environment is associated with the students' performance in science. Consequently, raising public awareness of environmental matters is a topical issue. By promoting the public education in this area, the students' motivation to link their future with science will also increase, which is an essential development in the light of Latvia's National Guidelines.

5.3. Possible reasons for students' top performance in other countries in OECD PISA

This chapter reviews the possible reasons for the high achievements of such countries as Estonia, Finland, Hong Kong (China), and New Zealand. These countries are selected on the basis of their excellence in all content areas of OECD PISA, as well as the large proportion of students particularly in the highest achievement groups.

"Money alone can't buy a good education system. Strong performers in PISA are those countries and economies that believe – and act on the belief - that all children can succeed in school. Among wealthier economies, those that prioritise the quality of teachers over smaller classes tend to show better performance. When it comes to money and education, the question is not "how much?" but rather "for what?"" (OECD, 2012b).

Estonia

Maie Kitsing, External Evaluation Department consultant,Estonian Ministry of Education and Science, writes that the possible reasons why the Estonian students in the PISA study are top performers, are (Kitsing, 2011a):

1.Decentralised education system:

a) schools are autonomous, and the head of the school has the right to organize the daily school life,

b) teachers are free to choose the teaching methods and textbooks.

2.Clear qualification requirements for teachers:

a) education:

i) a master's degree,

ii) 160-hour practice within five years;

b) support:

i) to new teachers – a year to adjust to school,

ii) the state ensures 3% of the wagefund for professional courses,

iii) benefits to new teachers –.

3.Children's pre-school development :

a) requirement to teachers – higher education,

b) 93% of the children in the country attend pre-school, although it is not a mandatory requirement,

c) the state educational standard for pre-school has been developed,

d) pre-school education is state-funded.

Performance variations between Estonian schools in PISA are large. There are schools, where almost 50% of students do not reach the base level either in reading, or mathematics or science and where the school average in all content areas does not reach 440 points. This shows that the study activity of these schools is different from that of the schools where students achieve high results (Kitsing, 2011b). The best schools are those where the students' potential is used to the maximum (Toomela, Kikas, Mõttus, 2006).

Perhaps the reason for differences in results between those countries that have better social and political circumstances lies in the political and social situation in the country. . In such countries, the students have greater personal motivation to gain knowledge (Täht, Must, 2010).

It is possible that structured cognitive approach is the reason for the good results in science and reasoning abilities (Kask, 2009).

Finland

Finnish fifteen-year-old students in the OECD PISA are among the best in all content areas, although in 1970 the Finnish education system was not one of the most successful in the world, at that time USA being the leading country in education.

Pasi Sahlberg, a former Director General of CIMO (Centre for International Mobility and Cooperation) at the Finland's Ministry of Education and Culture, emphasises that a fundamental reasons of changes in education policy were geographical and historical –the geographical position between the great kingdom in the west and the great empire in the east – the national interests were set as the priority , not allowing education policy to become a victim of partisan policy:

"We are a small nation that the rest of the world sees as a strange place that speaks a language nobody else understands. Over the past half-century Finns have adopted an understanding that the only way to survive as a small, independent nation is by educating all people. This is the only hope amid the competition between bigger nations and all those who have other benefits Finns don't have" (OECD, 2010b).

In 1970s, the Finnish education policy makers decided that if the investment was made in skilful teachers, the local schools could be allowed a greater autonomy to decide what and how to teach (Darling-Hamond, 2010; Sahlberg, 2012).

Several main reasons of the Finnish students'high performance are named:

- Others have better experience.

The creators of the Finnish education system have learned from the experience of others in relation to education and have adopted the best ideas on how to most effectively improve the educational system. For example, the teaching methods borrowed from the USA – cooperative learning (Sahlberg, 2012).

- High qualification of teachers.

Teachers in Finland must necessarily have a master's degree. The Finnish schools recruit the best candidates who have obtained a master's degree in education in one or two subjects and completed a teacher training program, focussing on problem solving, research, development of standards, evaluation of results, methods, how to work with students who learn differently (Authors and Institute for Educational Research, 2007; Darling-Hamond, 2010; Haahr, 2005; Sahlberg, 2010; OECD, 2010b; Välijärvi, 2005).

- Autonomy of schools.

Investment in teacher education has enabled Finland to move from a centralized school system, based on external tests to many localized systems. Quality assurance is largely based on trust. There is a perception that the academically educated teacher is the best expert to freely operate in relation to the national standard, using it to develop his or her own standard. The national basic standard of education provides teachers with recommendations, evaluation criteria for each subject, each level and for the total final evaluation of each student's annual progress. In the light of these guidelines, each local school's teachers develop more detailed standards and deliverables for each school according to the students' needs. Once a week, the teachers in Finland come together to jointly plan and develop the standard, the schools within the same municipality are encouraged to share their materials (Darling-Hamond, 2010; Bjorkvist, 2005; Haahr, 2005; Välijärvi, 2005).

Olli Luukkainen, the President of the Trade Union of Education in Finland:

"Teachers in Finland are very independent. They can decide almost everything: how they will teach, what they will select from the basic (national) curriculum, when they will teach each particular topic. The fact that teachers have so much independence and respect influences young people as they are deciding what program they will follow in the university. If they choose teacher education, they know they will be entering a profession that enjoys broad trust and respect in the society, one that plays an important role in shaping the country's future" (OECD, 2010b)".

- Safety and welfare for all students.

Schools are more than educational institutions. They are full-service schools providing students not only with a hot lunch for everyone, but also with the health and dental services, as well as with a variety of mental health support services that may be needed by the students and parents (OECD, 2010b). Finland does not practice testing of students and school ranking. The teacher helps the student to be responsible for his or her own growth and learning, providing a psychologically and emotionally safe learning environment. Greater emphasis is placed on teachers' preparation and raising their qualification rather than on testing of students. Regardless of the school's location, it is staffed by highly qualified teachers, consequently, all Finnish schools provide equitable and positive learning opportunities for all Finnish students to obtain quality education (Authors and Institute for Educational Research, 2007; Sahlberg, 2012, OECD, 2010b).

- Size of schools.

Finland has relatively small schools, up to 300 students per school and 20 students per class, allowing teachers to know each student and in collaboration with colleagues to find the most suitable learning method for him or her in order to maximize their potential (Hancock, 2011). The teachers are qualified to work also with the students who have special needs. The teachers are qualified in special education. Students with special needs attend ordinary schools, being integrated among other students (Bjorkvist, 2005; Haahr, 2005; OECD, 2010).

- United and sustainable vision for education policy maintained by the society.

Active involvement of the general public in elaboration of education development plan is mentioned as another reason of success. Educational development plans are drawn up for the period of four years; it is a joint work of education authorities, municipalities supervising the schools, the teachers, drawing also on the opinions of business leaders, non-governmental organizations, researchers and parents. The broad based policy-making process ensures the sustainability of reforms and provides a shared vision of the ongoing reforms. Although since 1970 Finland has had more than 20 education ministers, the main principles of educational policy-making have changed only slightly (Sahlberg, 2006; Sahlberg, 2012).

- Teaching methods.

In Finland, the main focus in the learning process is laid on research, while evaluation is used to cultivate the students' active learning skills, ability to ask questions and find their own answers (Darling-Hamond, 2010).

- The simplicity of the Finnish language.

There are researchers who believe that the simplicity of the Finnish language is the reason for high achievements in OECD PISA. This does not mean that the language is easy to learn. The Finnish language that belongs to the Finno-Ugric language group, is sufficiently simple and makes it easy to understand instructions, as well as to comprehend the written material and to avoid misunderstandings. The Estonian language also is one of the Finno-Ugric languages, which may also be the reason o their high performance (Bjorkvist, 2005; Nuoret, 2010).

"Learning and studying as a lifelong process is the new way of thinking in education. Willingness and ability of flexibly restore one's competencies are necessary to adapt to labour market needs. Basic education is no longer able to provide students with the knowledge and skills appropriate throughout life. Instead, it is more important to develop students' learning skills and to promote a positive attitude toward learning and studying. All the traditional education systems is facing major challenges. A large proportion of students is bored and simply does not learn, hates learning. According to the OECD PISA results in Finland there is a similar situation, as well. Development of learning culture and climate in schools is a challenge for all education sector employees " (Välijärvi, 2005).

Hong Kong (China)

Given that Hong Kong is a Chinese city, which has long been a British colony, its education system is largely shaped like that of the United Kingdom (OECD, 2010c), however, the Hong Kong students have much better results in international studies.

In the Chinese culture and society, a great emphasis is placed on academic knowledge, which could be the reason why the students reach high results (Cheung, Rudowicz, 2003; Schlecher, 2012). Parental and family influence on student achievement is very significant, furthermore, in China the parents mostly use authoritarian parenting style in bringing up children (Wang, 2004; Sun, Bradley, 2010). This means that children should obey parents, their say is a rule. If parents should want to take the kids to after-school hobby groups in one of the scientific areas, the children will attend these hobby groups. Students in Hong Kong devote a lot less time to non-academic activities, instead they use a lot more time to attend the hobby groups, to do homework in mathematics, science or other subjects, as well as to read for pleasure (Wang, 2004).

Student achievements in Hong Kong are largely influenced by a teacher who is highly respected in China (Chen, 2005). According to the Guide of Hong Kong Basic Education Standards, schools and teachers in Hong Kong, as in Finland, are authorized to develop their own individual school educational standards, based on the national standard (The Curriculum Development Council, 2002).

New Zealand

Like Finland, the New Zealand education system quality is largely dependent on the teacher, where the government assigns a great importance to teacher education and qualification (Schleicher, 2007; Alton-Lee, 2003).

School autonomy is indicated as a reason for good performance, because teachers have the opportunity to adjust the standards to the needs of a particular school and students. The school board consisting of the school community is responsible for the supervision of the school. The board is responsible for the strategic management of the school, school inspection, evaluation of the staff and the principal. The board, together with the school principal and teachers, develop their own educational standard, since the national standard describes only the necessary key competencies and goals to be achieved in each of the eight areas of learning, not describing the content of the program. Schools have a broad discretion in drawing up their programs, taking into account the students' and local area's needs (Nusche, 2012).

A group of New Zealand researchers in a longitudinal study have found that those reading skills that students have obtained at a pre-school age have a decisive impact on student achievement in reading ability in school years (Blaiklock, 2011).

Summary

Top performing students achieve high results in a particular area because they are highly motivated, and have the appropriate skills and abilities to achieve their goals: problem solving, time management skills, creativity, information management skills and communication skills.

In the latest study cycle – PISA 2012, compared with the previous cycle, the proportion of the students who were able to achieve high results (above 600 points) had increased. However, the OECD average proportion of students in this achievement group still has not been reached in any content area.

The proportion of girls in high achievement group particularly in reading is much greater, in the latest cycles this difference has only increased. The proportion of boys in high achievement group of mathematics within the last cycles of the study has been slightly higher than that of the girls. However, in science the proportion of top-performing boys and girls in high achievement group is nearly equal. By contrast, the proportion of girls in the group achieving between 500 and 600 points is higher than the proportion of boys, with the exception of mathematics, where in this group there is an equal proportion of boys and girls.

The percentage of students who attend schools where the language of instruction is Russian, in high achievement group of mathematics and reading is much higher compared with students from schools with the Latvian language of instruction. In science, the percentage of students in high achievement group is nearly equal. A very small percentage in high achievement group is constituted by the students who study in the so-called mixed-language schools or bilingual schools.

Particular attention should be paid to rural schools, especially basic schools, because the situation there is the worst. Instead of closing these schools, it should be considered how to promote their development. The state must ensure quality education for students by providing equal educational opportunities to all its citizens, regardless of their economic status and place of residence. School development is not likely to contribute to rural prosperity, yet it will reduce rural deterioration. Parents are much more willing to leave the children to study at local schools, next to the place of residence, even though they work in one of the nearby towns. To take children to schools in cities and towns requires additional expenditure. However, if there is no local school, then the best solution is to move to cities.

The factors influencing student performance are divided into two groups – those that can and those that cannot be directly influenced. Parental education, as can be seen in all regression models discussed above, is one of the main factors influencing the students' achievements. Consequently, in order to achieve an improvement in student performance, it is necessary to attain the rise of overall quality and level of public education. The researcher Rita Geske in her thesis " National-level factors influencing the science achievements of primary school pupils in international comparative studies: educational management perspective"writes that the more educated is the society in general, the higher performance is shown by the students (Geske, 2013). Also, the information about such countries as Finland, Estonia and Hong Kong (China) confirms that the public attitude towards education has an important role in students' high achievements in PISA (Mihno, 2013).

Latvia has a relatively small number of students who reach the highest levels of competency, and Latvia's average result is below the OECD average, which shows that the Latvian basic education system does not provide adequate educational opportunities for the best students (Kiseļova, 2011).

It means that a greater emphasis should be placed by education policy-makers on higher education and lifelong learning, as the learning process cannot stop, it must continue throughout life. The country requires an offer of quality education, a greater financial support from the state for implementation of educational process both in general education, higher education as well as further education – teachers' salaries, state-funded study places, scholarships. The state should be interested that as many students as possible continue studies in higher education institutions, consequently, it must provide the education that caters to the society's expectations and needs. The country has a capacity to gain high achievements, if there is assuredness of the necessity for quality education among the public and the national policy-makers, and also if national education policy-makers and the general public have a common vision of the necessity of education and its development concept, the need for reforms and their direction (Mihno, 2013).

The education system quality is largely determined by the teachers working at school. Teachers have a daily contact with students, they know the students, both their weaknesses and strengths. The teachers should be the ones to inspire students, motivate them and help realize their abilities, to teach them how to learn. Consequently, the national education policy makers should ensure that most qualified teachers work at schools, those, who are the best of the best, taking the example of the countries like Hong Kong (China), Finland, New Zealand and Estonia, where the students achieve high levels of competence much more often than in Latvia. The education requirements for teachers are higher in Estonia and Finland, where the teachers must have a master's degree, but also in Hong Kong (China) and New Zealand to become a teacher with a bachelor's degree is not so simple. The prospective teacher has to meet sufficiently many and essential requirements (Mihno, 2013).

For the country to have as many educated people as possible, the state must ensure accessibility of quality education for all the population, including those who are socially disadvantaged, who have emotional, physical or mental health problems requiring a different study approach. Also, the state should take care of those students who are gifted and the regular school programme is not suitable for them to maximize the use of their abilities and potential. This is shown by the education systems recognised as successful, where a great deal of attention is paid to students' needs. These systems devote much greater care to the students who have special needs, usually associated with mental and physical learning restrictions, as well as to the gifted students and their need for studies with a special approach.

If teachers are highly qualified and are the best of the best in their field, then it is possible to consider the autonomy of schools. As concluded by the OECD education researchers, great school autonomy in the development of curricula, teaching content and the creation of the evaluation policy at school ensures top performance of schools. The autonomy means that the teachers can develop their own curricula, choose the teaching materials, books, the methods of work in a particular class and with a particular student, the teacher is free to choose the criteria for evaluation of students, evaluation methods and the need for evaluation. The school management, in turn, can decide on the organization of the daily school life and procedures. The autonomy has also a downside – if astudent changes school, the problems arise when the study programs do not match. Latvia had this problem in the period from 1991 to 2000 (Mihno, 2013). Therefore, it is essential that the teachers should focus on development of students' abilities and knowledge, rather than on simply fulfilling standards and execution of study programs that do not yield the desired results. It is desirable that the guidelines should be developed, instead of minutely described requirements that restrict the teachers, not allowing them to plan the work according to the needs of the class.

To improve the student performance in reading, the students' positive attitude towards reading should be promoted, the students encouraged to read more for pleasure, not just the literature mandatorily set down by the school, and electronic texts. Particular attention should be paid to the reading material that is meant particularly for boys in all age groups, because, looking at the library offers, it appears that much more literature is available for girls, especially in adolescence. A very valuable library activity for children encouraging them to read a book is "Children's Jury". Teenagers, young people and adults also need such activities. The teachers should impart to the children the truth that reading is an interesting and useful activity, allowing the children to choose the books according to their interests and abilities also during the lessons. The compulsory literature must also be compatible with age, students' interests and abilities.

In order to achieve high results in mathematics, students should be responsible for the learning process, and they should be motivated to gain knowledge, not only to get good grades. The education system must be geared to gaining an in-depth knowledge, and not targeted at demonstration of good grades, which do not necessarily mean high knowledge.

There is a general opinion that computer use improves the student performance particularly in mathematics just because the computer specialists are associated with high mathematical ability, but, unfortunately, regression equation reveals quite the opposite picture. Frequent use of computers does not improve student performance in mathematics, this suggests that students use computers mostly for entertainment. As mentioned above, studies have shown that intensive use of computer training does not yield higher achievements, therefore it is necessary to develop training methods for ICT use in lessons. The professional qualification development courses for teachers need to include more topics on ICT application opportunities and methods for the use of ICT in specific subjects to make ICT an asset, not an obstacle in mastering the curriculum. Also, students would need to learn the skills to use ICT for improvement of their learning capacities and facilitation of the learning process, making learning more interesting and rewarding.

Student performance in mathematics is also affected by how often students perform the so-called regular mathematical tasks, so that students learn to execute the instructions, developing the algorithmic thinking that helps achieve higher results o in other areas, too.

Student performance in science is significant impacted by students' knowledge of the natural sciences-related issues that contribute to the students' self-confidence and motivation to learn science, and the subsequent decision to have their future career in sience. This means that it is necessary to talk more about environmental issues not only in lessons, because it is still relatively little, but also outside the school. School teachers need a greater variety of methods to attract the students 'attention to the questions of science. Science is much more difficult to learn and understand just by reading books or listening to the teacher, the best are the visual examples – demonstrations, videos, photos, excursions and similar methods. In order to facilitate the work of science teachers through the diversification of lesson content, it is recommended to create a database containing a variety of informative material where teachers could select the materials according to the topic of the lesson and the corresponding to the abilities of the respective class and age group. However, it would help the teachers a lot if they could exchange materials and ideas how to build these materials, what methods to use for acquiring the specific themes. Therefore it is necessary to create virtual environment, where teachers could exchange ideas, as well as to conduct regular seminars and discussions.

Recommendations to educational policy makers:

- To develop a common and sustainable education development plan that would be acceptable to the public and which would be implemented irrespective of the change of ministers;
- To develop guidelines for determining the curriculum content direction, and targets to be achieved in a longer period of time;
- To establish a tailored educational policy catering to gifted students;
- To dedicate more attention to teacher training, qualification of teachers and the quality of their work. The teachers must be highly esteemed professionals in their field, as they educate children who are our future. The teachers must be responsible for their work. Consequently, the salary should be adequate, although the salary does not confer the quality upon the teacher's work, it is just one aspect that can affect it. Unfortunately, this is not seen inthe current processes in the Latvian education – the teachers' role, qualifications and values are undermined, minimizing the requirements set to the teachers' profession. Selection of future teachers must take place prior to studies, as well as after completing the studies at the recruitment of teachers for work;
- To improve public attitude towards education, creating a respectable, intelligent and positive image of the teacher. If teachers are the best of the best and value their own work, the others will also respect them;

- To ensure the access to quality education to all students regardless of their material situation, their place of residence, schools attended, their physical, mental or emotional capabilities;
- To establish a student assessment procedure, where in parallel to assessment with a grade there would be a descriptive assessment of a student's progress, as well as his or her behavioural evaluation;

Recommendations to school principals

- To employ only the best candidates as teachers;
- To grant teachers the maximum reasonable autonomy in development of study programmes;
- To ensure student-friendly environment at school;
- To organize student development-oriented interviews, which are also attended by the students' parents. The interviews should be aimed at promoting the pupils' development, not condemnation;
- To organise and involve the school in various events dedicated to environmental issues;
- To create closer cooperation with libraries, becoming involved in their events, and to organise different reading-related activities proactively, particularly considering the youth auditorium..

Recommendations to teachers:

- Within the framework of the Law on Education and Cabinet of Ministers Regulations to develop own curricula, based on the abilities and needs of specific classes and students;
- To encourage the students to study, learn and acquire education;
- To regularly involve students in self-assessment and evaluation;
- To take care of own qualification by attending various courses and seminars, to raise one's own education level by studying at higher education institutions and at further education levels.

Recommendations to parents:

- To choose for the children a school that is located close to their place of residence, and suitable to their physical, intellectual and emotional needs;

- To lead by example, showing the children that education matters, that education does not cease with obtaining a diploma, but continues throughout life and that the main benefit is knowledge;
- Never to criticise teachers in the presence of children, even if the parents do not agree with the teachers' opinion, thereby not diminishing the teacher's reputation and the children's respect toward the teacher. Never allow the students to speak badly about a teacher, but teach them to defend their opinion without losing composure and becoming disrespectful;
- To take an active part in the events organised by the school, showing the children that the parents are not indifferent to the school and events therein. To support teachers in order to help your children perform better, and to show interest about what goes on at the school not only in problem situations, but on everyday basis;
- To pay serious attention to reading in the family by reading yourselves, urging the children to read, choosing the literature together with the children that is suitable and interesting to them. To focus particularly on the boys' reading habits;
- Not to rebuke children for failures, but to support and help prevent repetition of failures;
- To control the time spent by the children at the computer, tablet or smart phone, using the Internet for entertainment, playing games and watching films. To make sure that the children do not stay up late and that they have completed their homework;
- All family to become involved in various environmental protection events and activities – recycling, joint work to clean the environment and surrounding areas, saving water, decreasing the electricity consumption, the action "Earth Hour", etc.

Recommendations to students:

- To become involved in the school life as much as possible. To learn to contribute one's maximum capacities and capabilities to fulfil the task as well as possible;

- In case of failures not to give up, but study harder, seeking support of teachers, parents and peers who are better at the respective subject;
- To try to understand one's own interests and choose appropriate literature by attending school and municipality libraries. Each day to read at least one page in a book that is not a school textbook;
- To limit computer time spent for entertainment, to complete the assignments and homework first, and only then turn to recreation, not forgetting about sleep and rest;
- Together with the family and school to take part in activities of environment protection and preservation;
- To try to comprehend the true meaning of education: that the main benefit is knowledge, not the mark or assessment. Knowledge is the only asset that nobody can take away, but which we can increase throughout our lifetime both formally and informally

Summary

A whole set of education quality evaluation activities are being developed and used globally to improve student learning and teaching and to achieve the planned results. That includes student, teacher, school principal, school and education system assessment and evaluation. Student assessment, which is also implemented in international comparison globally since 1958 and in Latvia – since 1991, is one of the major education quality assessment activities.

All the developed countries, including Latvia, invest a great effort in improvement and development of their education systems. Therefore, it is necessary to systematically and effectively ensure the participation of Latvia in the global education quality evaluation and advancement processes, maintaining and developing the research potential at an international level in our country, and involvement in relevant OECD, EU and IEA research and education development programmes. Thus, a comprehensive, reliable and internationally comparable information and new knowledge is obtained about Latvian education system and its development trends. It can significantly contribute to development and adopting evidence-based decisions in education management and policy.

"Quality of Education: International Comparison. Latvia in OECD Programme for International Student Assessment", the 7th monograph in the series "Educational Research in Latvia", is dedicated to analysis (using OECD PISA data) of the most recent Latvian education quality indicators and their contextual characteristics in international comparison, perform their secondary analysis to address relevant Latvian educational development issues.

The summary presents the main results of the analysis of Latvian student performance in mathematics, sciences, reading and financial literacy within international comparison, relation of our students' performance with students' socio-economic situation, education process at school (absences, use of ICT, student assessment results in school examinations, etc.), possibilities to increase the relative number of students with high performance in Latvia. The problem of improving the opportunities to obtain education of equally high quality in Latvia is touched upon in various aspects by analysing the quality of education in urban and rural areas, different

types of schools, for boys and girls, in small schools and classes, showing the need for optimizing the school network.

Student Performance in Mathematics, Reading and Science

OECD PISA defines the mathematics literacy as

- individual's capacity to formulate, employ, and interpret mathematical problems in a variety of contexts;
- individual's ability to detect causal links mathematically, use mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena;
- individual's ability to recognize the role that mathematics plays in the world and to take well-founded judgments and decisions needed by constructive, engaged and reflective citizens.

This definition emphasizes the role of mathematics as of a subject taught in school, where the processes related to problem-solving in real-life context, by using mathematical analysis, applying appropriate mathematical literacy and evaluating the solution in the context of the problem are particularly emphasized. Items of mathematics are composed pursuant to the knowledge and skills required to solve them, observing the particular context and content. Mathematical literacy, as well as science and reading proficiency is expressed in points or in six proficiency levels.

For OECD countries in PISA 2012 average student score in mathematics is 494 points with a standard deviation of 92 points. The highest average performers are the students of Shanghai (China) (613 points), followed by Singapore (573 points), Hong Kong (China) (561 points), Taiwan (China) (560 points) and Korea (554 points). From European countries the highest performers are the students of Liechtenstein (535 points), Switzerland (531 points) and the Netherlands (523 points).

The mean score of Latvia's students – 491 points – is not statistically significantly different from the OECD average, it is seen as a very good achievement of our education system. Latvia's student performance is on the same level as the average student performance in France, Great Britain, Iceland, Luxembourg, Norway, Portugal, Italy and Spain.

In comparison with the PISA 2003, PISA 2012 showed a decrease of the number of students in Latvia who did not reach the second proficiency level in mathematics, which is considered a basic level, where the students begin to demonstrate sufficient mathematical proficiency that allows to successfully apply mathematical knowledge and skills to achieve any objective and in the future to integrate into society and compete in the labour market. This decrease is statistically significant, and is the fifth largest among the European Union countries. By contrast, the percentage of Latvian students who are able to solve items of the highest difficulty level in 2012 remained at the level of 2003, and is one of the lowest among European Union countries (overall, 8% in proficiency level 5 and 6). Among the countries of European Union, invariably the highest performers are the students of Finland and the Netherlands, the lowest – Greek, Bulgarian and Romanian students. Latvia's student performance in 2012 has improved in comparison with the previous studies, reaching the average level of EU – the mean score of 492, surpassing countries like Sweden, Portugal, Luxembourg, Italy and Hungary.

Scientific literacy is defined as an individual's scientific knowledge and use of it to identify questions, acquire new knowledge, explain scientific phenomena, and draw evidence-based conclusions about science-related issues. Scientific literacy includes both scientific knowledge and knowledge about science as such. Science items are versatile, they include a variety of real-life and scientific aspects. Five different real-life situations related to health, natural resources, environmental quality, hazards, scientific and technological performance in personal, social and global settings are used in these items. Science content is divided into four categories of knowledge: Physical systems, Living systems, Earth and space systems and Technology systems. To solve the items in science, students must be able to identify scientific issues, explain phenomena scientifically, as well as use scientific evidence.

PISA 2012 average student performance in science in various countries ranges from 580 to 373 points. The performance of Shanghai (China) students (580 points) is statistically significantly higher than that of students from all other participating countries. With a relatively high performance difference follows Hong Kong (China) (555 points), Singapore (551 points) and Japan (547 points). The highest performance from European countries is demonstrated by the students from Finland (545 points), Estonia (541 points) and Poland (526 points). Statistically significantly above the OECD average (501 points) is the performance of the students from Liechtenstein (525 points), Germany (524 points), the Netherlands (522 points), Ireland (522 points), Switzerland (515 points), Slovenia (514 points), Great Britain

(514 points), the Czech Republic (508 points) and Belgium (505 points). Latvia (502 points) together with Austria (506 points), France (499 points), Denmark (498 points) and the USA (497 points) belongs to the group of five countries where the average performance does not statistically significantly differ from the OECD average student performance. Students of Peru, Indonesia, Qatar, Tunisia and Albania show a very low performance in science. The lowest performance among the European countries is achieved by the students from Albania and Montenegro. The students of Cyprus, Romania, Serbia and Bulgaria have a slightly better performance.

The average performance of Latvian students in science does not statistically significantly differ from the OECD average, and that can be perceived as a very good achievement of our education system. However, the comparison of proficiency groups shows that there are too few students in Latvia, whose literacy would correspond to the highest performance level (overall, 4.3% in the 5^{th} and 6^{th} level of proficiency), consequently, in this aspect our education system requires significant improvements.

The greatest increase in science literacy since 2006 PISA cycle is observed in Turkey, Qatar, Romania and Thailand, however, these countries still have a long way to go to reach the level of medium and high performance. Among the countries with relatively high performance a significant improvement has been noted in Poland (28 points), Italy (18 points), Korea (16 points), Japan (15 points) and also Latvia (13 points). A decline of performance is observed in European countries with a relatively high level of education – in Finland (-18 points), Hungary (-10 points), Sweden (-19 points), Slovakia (-17 points) and Iceland (-13 points). In 2006, the performance of Latvia's students in science was lower than that of Swedish students, in 2009 – the same, but in 2012 – statistically significantly higher.

While looking at the average performance of students from European Union in science in 2006, 2009 and 2012, invariably the highest performance is shown by the students from Finland and Estonia, the lowest – by Greek, Bulgarian and Romanian students. The performance of Latvia's students is on the increase, in 2012 it is already slightly (statistically insignificantly) above the EU average. Latvia has stepped up in ranking lists by three places and now outperforms France, Denmark, Hungary and Sweden, but not Austria.

PISA defines reading literacy as the capacity to understand, use, reflect on and engage with written texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society. Reading literacy includes reading of diverse types of coherent text (for example, description, narration, exposition, argumentation, transaction) and variously structured documents (for instance, forms, advertisements, announcements, tables, diagrams).

PISA reading literacy assessment items are developed, observing three main elements: the text (medium, environment, format, type), the aspect (to obtain the information, to interpret what has been read, link the information to one's past experience) and the situation (related to private sphere, public sphere, education, work). There are several different types of reading items in the test – items requiring open-constructed, short-constructed, multiple-choice and complex multiple-choice responses.

In PISA 2012, the highest reading literacy performance is demonstrated by the students of East Asian countries – Shanghai (China) (570 points), Hong Kong (China) (545 points), Singapore (542 points), Japan (538 points), Korea (536 points) and Taiwan (China) (523 points). The highest performance in the European countries was shown by the students of Finland (524 points), Ireland (523 points), Poland (518 points) and Estonia (516 points). The average performance of Latvia's students in reading (489 points) is slightly below the OECD average (496 points), however, this difference is statistically significant. The performance of our students statistically significantly does not differ from those of the Czech Republic (493 points), Italy (490 points), Austria (490 points), Hungary (488 points), Spain (488 points), Luxembourg (488 points), Portugal (488 points), Israel (486 points), Croatia (485 points) and Sweden (483 points). The performance of our students is higher than that of our neighbours – Lithuania (477 points) and Russia (475 points). The lowest performance in Europe was shown by the students of Bulgaria, Romania and Montenegro.

Similarly to mathematics and science, in 2012 the number of Latvia's students at the highest – sixth level of reading proficiency was very low (0.3%). By comparison, one can look at the following example: if in a big school there are 1000 students, only three of them will demonstrate the performance of the highest level. If one class group (for example, all the 9^{th} grades) in Latvia comprises 20 000 students, only 60 of them will have the performance of the highest level. This is much too little to provide the country with advanced doctors, scientists, politicians and entrepreneurs. However, it should be noted that the fifth level of proficiency also corresponds to the top level performers' group of OECD PISA, which in Latvia within PISA 2012 has been reached by 3.9% of the students in reading. Thus, in Latvia there are altogether 4.2% of the students representing the 5th and 6th proficiency level. The greatest increase in reading performance since 2000, excepting the countries with very low performance, was in Poland (39 points), Israel (34 points), Liechtenstein (33 points) and Latvia (31 points). In case of Israel and Latvia, the relatively low performance in 2000 should be noted. The greatest decline can be observed in the countries of Northern Europe – Sweden (-33 points), Iceland (-24 points) and the European leader in education – Finland (-22 points). Since 2009, the biggest performance increase was noted in Taiwan (China), Ireland, Macao (China), Thailand, Japan and Poland. The most significant performance decrease was in Iceland, Slovakia, Sweden and Finland. The international community comparatively early noted a decrease in Swedish students' average performance revealed by international comparative studies (not only PISA), however, insufficiently adequate attention yet has been paid to the fall in Finland's performance.

Overall, from 2006 to 2012 the average performance of the European Union students in reading has increased. The average performance of Latvian students has also been constantly increasing, yet in 2009 and 2012 only by two points (statistically insignificantly), falling behind the average performance of EU students (486 and 491 points, respectively). Over the past three years, Latvia has moved up one place in the ranking, surpassing Hungary, Portugal and Sweden, where the student performance has decreased. By contrast, Czech and Austrian student performance in 2009 was lower than that of Latvian students, but in 2012 – higher.

Latvian Student Performance in Relation to Different Contextual Factors

In long-term perspective – throughout the whole period since regaining of independence in 1991 – Latvian educational system has ensured a gradual increase in the quality of education, furthermore, the average quality increase is among the highest in comparison to other countries of the world. The level of education quality attained by our students places Latvia among 15–25% of the countries of the world with the highest quality of education.

The above conclusions are justified by the fact that we can assess the average education quality level in Latvia and its changes in international comparison over quite a long period of time, because Latvia was actively involving in international comparative education studies immediately after regaining its independence. International analysis shows that, as per Latvian results, not only in the OECD PISA since its first cycle – PISA 2000, but also in the cycles of TIMSS and PIRLS of IEA that were started earlier, the annual average increase of Latvian education quality in mathematics, science and reading is the greatest among 49 countries in the period from 1995 to 2009. We are followed by countries like Germany, Poland, Lithuania, Finland, Denmark, Hungary, USA, Russia, Austria etc., while the most notable decrease in the level of quality is found in Sweden, followed by the Czech Republic, Norway, etc.

According to PISA 2012 and TIMSS 2011 data, the education quality level attained in Latvia corresponds to the 24th position among 76 countries. According to the OECD PISA cycle results, the education quality level in Latvia corresponds or is close to the average performance of OECD and EU countries (except the considerably lower results obtained in PISA 2000). Nevertheless, the results of Latvia according to IEA TIMSS and PIRLS data until 2007 (since subsequently Latvia temporarily ceased to participate in IEA studies, remaining only in OECD PISA) were significantly above the average level of the participating countries of the studies and with a growing trend. The relative position of Latvia in countries' ranking in each of the OECD PISA cycle, taking into account the total number of participating countries, also has an overall tendency to rise. More and more new participating countries become involved in the research, but their education systems usually show the level of education quality that is lower than the OECD average, and thus also lower than the already achieved level of Latvia. Envisaging the continuation of this process and notionally composing a ranking chart containing the results demonstrated by students representing almost all the countries of the world, and the expected results in international comparative studies, we obtain the assessment that Latvia falls within the 15–25% of countries with the highest performance. Of course, all the countries of the world do not participate in international comparative assessment of education quality, thus, we can evaluate the their possible level of quality only approximately.

Educational reforms have also been summarised and analysed internationally – implementation of student and school assessment and evaluation (centralized examinations, international comparative studies, accreditation, licensing, etc.), arrangement of the fundamental organizational and financial issues related to education system (development of school management and financing mechanisms, and to a certain extent – their decentralization, etc.), systematising the pedagogical foundations of the education system (curriculum reforms, education standards and study programmes, textbooks, etc.), that have formed the basis of increasing the quality of education in Latvia and other countries (for example, in Poland, Lithuania, Hong Kong (China) and Singapore), in specific periods of national education system development in these countries generally achieving a good level of education quality according to internationally established criteria.

According to PISA 2012, Latvia has one of the smallest student performance variation in mathematics in comparison to the OECD countries, practically, it is the same only in Estonia and even smaller in Mexico, even Finland shows a greater performance variation than Latvia. Latvia has demonstrated a relatively small student performance variation also in other PISA cycles and other content areas. Furthermore, there has been an increase in performance, and simultaneously a reduction of its performance variation, indicating that the quality of education in Latvia has increased while the disparity in equity of education quality has decreased. One component of performance variation – the between-school variation – in Latvia is two times smaller than the average in OECD.

Overall, it certainly positively characterizes the education system of Latvia, since it indicates that the high proficiency level of our students does not have as great a difference from the low proficiency level in comparison with the average difference in OECD countries – consequently, the education system provides a relatively greater equity of education quality throughout the education system of the country. This also means that the relative number of students in Latvia in the lowest and highest proficiency levels, which are defined according to OECD countries' average distribution, will be below the average in OECD, as the average student performance in Latvia is close to the average score of OECD, but performance variation is smaller.

Although the performance variation in Latvia is relatively smaller than in many OECD countries, it certainly exists, and depends upon a number of factors – regional, school, family, and individual student's level. Analysis of PISA 2012 results shows that the degree, to which the performance of Latvia's fifteen-year old students in tests depend on the material welfare of the family, educational and cultural resources available at home, parental education and occupation (i.e., student SES), generally is consistent with the average level in OECD countries. However, in the last years the dependence of student performance on student SES in Latvia has recently slightly increased as previously it was lower than the average in OECD countries. Consequently, the situation in the field of education equity in Latvia has slightly deteriorated.

The average level of school's SES significantly influences student performance, when comparing various schools in Latvia and on the average in OECD countries. A more detailed analysis of school SES and average school performance shows that 21.3% of Latvia's students attain a high level of performance studying in schools with a high level of SES. These are joined by additional 3.8% of the students who attend schools with a high performance but average level of SES. On the other hand, 9% of Latvian students study in schools with a low school SES and a low performance level. Increasing the student performance in these schools is certainly not just a matter of education system, but mainly a topic of regional development, if these schools are located in the area where SES generally is low, and perhaps it is partly a matter of student selection in these schools. 11.5% of students attend schools with a low performance level, but an average level of SES. In such schools improvement of education should be the key factor in increasing learning outcomes. The international comparison of schools in respect to school performance levels and school SES is favourable to Latvia – in OECD countries, on the average, 18% of students learn in schools with low SES and low performance level, and 20% attend schools with a high SES and high performance levels. In Latvia, the relative number of such students is 9.0% and 21.3%, respectively. Thus, the number of students from schools with a low performance level and a low SES in Latvia is relatively small in comparison to the OECD average. The smallest number of students from schools with a low SES and a low level of performance is in Finland – only 4%. Finland is followed by Norway (4.1%), Iceland (7.1%), Estonia (7.8%), Sweden (8.1%), Latvia (9.0%), Canada (9.5%) and Denmark (10.1%).

The average performance of fifteen-year olds in mathematics, science and reading in rural schools of Latvia still lags behind the performance level of the students of similar age group in the schools of Riga and other Latvian cities and towns.

Difference in performance levels depending on urbanization does not significantly change over the period of time, it has been present in all studies, in all content areas and levels of education. The analysis shows that the difference in performance is not determined solely by objectively lower student SES in rural areas, but also by other factors.

Student SES in rural schools of Latvia is significantly lower than in Riga, the relative differences being much more pronounced than on the average in OECD countries, and these are considerably increasing. The relative number of rural students in Latvia is twice as large as on the average in OECD countries. Therefore, the role of regional development policy in providing support to rural development is very significant. Without development of the rural regions, the education system alone will not have a capacity to ensure equally qualitative education opportunities in the entire territory of the country.

At the same time, as the difference of performance levels in Riga and rural schools remains the same in a situation, when the relative differences of family SES between Riga and rural areas are visibly increasing, it is not a bad indicator regarding the rural schools. Besides, the achieved science literacy level in Latvian rural schools within PISA 2012 is close to the average level of students in Sweden and Russia (the entire countries), in reading – approaching Cyprus' level, and in mathematics – close to the level of Israel and Greece.

The PISA 2012 in Latvia shows that the performance level of girls is higher than the performance level of boys in all content areas. In reading and science this difference is statistically significant, but in mathematics it is statistically insignificant. In reading, the superiority of girls in Latvia in all PISA cycles since 2000 has been invariably high (it has been so also on the primary school education level, as shown by IEA PIRLS results in grade 4). The girls also show a higher performance in science in all cycles, although the performance difference in scores varies, and within the last cycles it has a tendency to increase. Until today, the performance difference in mathematics between our boys and girls has been statistically insignificant.

The average performance of Latvia's students in all content areas and all PISA cycles does not significantly differ in schools that teach in Latvian language and schools where minority education programmes are implemented in Russian language.

The average performance of Latvia's students differ in case of students who study in different types of education establishments. Gymnasium students have the highest performance, followed by secondary school students and then – by basic school students. An identical dependence of Latvia's student performance on the type of education establishment is observed in all PISA cycles since 2000 and in other international studies.

For example, PISA 2012 results show that the performance of students from Riga gymnasiums in mathematics almost reaches 570 points, just behind the average achievements of Shanghai (China) and Singapore, thus relatively ranking the 3rd in international performance. The average performance in mathematics of students from all the other PISA 2012 participating countries is lower. However, it should be understood that we are comparing only the single best, but relatively small education segment of Latvia to the average indicators of other countries (although it should be noted that Shanghai also is only one of China's cities).

We know that there is a student selection, often using entrance examinations, in gymnasiums, students do prepare beforehand (with private tutors and through enhanced lessons in extracurricular groups, etc.), in order to study in gymnasiums. The gymnasiums have a quite high student SES, the atmosphere strongly promotes focussing on high study performance, etc. At the same time, it clearly demonstrates that very high results like these are quite achievable in Latvia. However, in Latvian basic schools the student performance level is much lower, for example, in mathematics PISA 2012 reveal that they score between 480 and 455 points (depending on the location of the school), which is below the OECD average. Then again, it is the same range of average performance level in mathematics as achieved by the students of USA, Lithuania, Sweden, Hungary and Greece.

To contribute to the equity of education quality, one should pay attention also to the lower performance levels of Latvian students in basic schools in comparison to secondary schools, besides, this phenomenon is most pronounced in Riga, slightly less in other cities and rural areas of the country, but it is almost absent in the towns. Possibly, it is influenced by a certain selection of students, which, in turn, is related, among other factors, also to SES.

Comparing the performance levels in different types of schools, the data characterising student SES in different types of schools in Latvia should definitely be taken into account. Gymnasiums, particularly the state gymnasiums, have a very high level of SES. They are followed by secondary schools and basic schools, where this index is the lowest. Consequently, the variations in performance levels in different types of schools to a certain extent can be explained also by the different SES, which, in turn, depends on the location of the school, the student selection process, as well as other factors.

The survey of school principals in Latvia reflects that their resource management activities (responsibility on planning and spending the school budget, selection and recruitment of teachers, setting the initial salaries and bonuses for teachers) is significantly more autonomous as in OECD countries on the average. On the other hand, regarding curriculum and assessment management (choice of textbooks, study subjects and their content, choice of student assessment methods) the level of autonomy in Latvia is lower than on the average in OECD countries. The relative level of school autonomy in Latvia has a tendency to grow.

The principals of Riga schools see less autonomy in their activities with regard to resource and curriculum and assessment management in comparison to their colleagues in other Latvian schools. On the other hand, student – teacher relationship, discipline, provision with study materials and teachers, extracurricular activities are evaluated by school principals as equally good both in the city schools and rural schools of Latvia. Rural schools on average are smaller, they have less students per teacher and there are less students in the classrooms.

Competitiveness among schools with regard to attracting students from the same area is higher in Latvia than on the average in OECD countries, and it has definitely increased due to the reduced number of students. 74% of school principals think that the school is competing with two or more schools in attracting the students, 19.5% – with one school and only 6.5% state that they do not have a competition with other schools. Besides, only 20.5% of school principals think that living in the school area "Always" equals to admission of the student, 79.5% of the school principals have replied "Sometimes" or "Never". The relatively free choice of schools in Latvia foster the impact of family SES on the choice of school, the relative number of schools that are chosen by most socio-economically favourable families is rapidly decreasing (since

2006, the relative number of schools in Latvia that are being chosen by families with very high SES has decreased from 75–77 % to 55%).

There is a pronounced correlation in Latvia that higher performance in international studies is demonstrated by schools and classes with a bigger number of students. However, it should be noted that correlation between two variables does not signify a direct causal link. The situation is considerably influenced by other factors, for example, student SES, location of the school, student selection procedures (if such exist), striving for improved learning performance in school and in classroom, etc. As a result, the possible pedagogical advantages in small schools and classes in Latvia to be gained because of small number of students still cannot compensate for other negative factors, and student performance there, on the average, is lower (also after accounting for student SES).

The dramatic decrease of student numbers in Latvia calls for an optimization of school network. The number of 15-year old students in Latvia's education establishments in the period from 2003 to 2012 has decreased by 50.5%. This is the greatest decline among PISA participating countries. The number of students from general education day schools in Latvia has decreased by 42% since 1998, and the number of teachers and schools – by 25%. The relation between the numbers of students and teachers within this period has decreased from 11.7 to 8.9. The authors do not consider that the reduction in numbers of schools and teachers has to be relatively as big as the decrease in student number, however, a large disproportion instigates problems.

The greater school management autonomy in smaller municipalities could be a hindering factor for school optimization there. School principals and individual teachers quite often also are elected officials in these municipalities and they can possibly have a crucial vote in municipal decisions with regard to the field of education in the interests of their schools. As a result, school principals fight for retaining their own schools at any cost, and the local municipalities support them.

Undoubtedly, the issue of school network reform is closely linked to the state administrative and territorial division, possible changes thereof (continuation of the reform) and the regional development policy of the state in general. It is very complicated to ensure efficient education in regions that are not being developed. Likewise, regions cannot properly develop without schools. Thus, this is a matter of intersectoral policy and it can be solved more efficiently, if municipalities choose to cooperate.

If there is a clarity on state administrative territorial division and regional development, then it is possible to systematically implement the goal set in the current government's declaration of 2014: "We shall establish a strategic development model of school network, which will ensure a quality education for students of the first six grades as close as possible to students' homes, while preserving the rural schools of Latvia as important local community centres. Secondary education will be concentrated in schools with a well-developed pedagogical resources, as well as material and technical facilities." The declaration exactly corresponds to the recommendations the researchers have been publishing since 2000, based on the data of international comparative education studies implemented in Latvia in 1990s and later. Thus, essentially, one of the proposals arising from the results of all the current international comparative studies is the necessity to optimize school network in Latvia and to ensure the equity of education quality throughout the state.

Student performance is increased both by their positive interaction with the teacher (student feels the teacher's interest in each student's performance, the teacher provides additional assistance when necessary, and explains the topic until the students have understood it, teacher gives students an opportunity to express their opinion) and the discipline in the classroom (lack of noise and disorder, students listen to the teacher, they are not late arriving to school or do not skip the entire school days), as well as student interest in the respective study subject (i.e., mathematics). This was confirmed by student with high SES performance analysis in relation with various contextual factors of nine Baltic Sea Region states, using PISA 2012 data.

Overall, the analysis of truancy and disciplinary problems in classroom, using PISA 2012 student survey data, showed that our students have a relatively quite high truancy level. Skipped days in schools of Latvia are related to essential weakening of performance level, a less pronounced correlation was established between the decrease in performance and arriving late for school. However, skipped classes in case of Latvia's students in comparison to the OECD average, as well as Baltic Sea Region states, was related to a small decrease in performance level, thus raising considerations about significance of that particular lesson and its added value. The truancy trends of Latvia's students were not statistically significantly different in schools with different study languages, urban and rural schools, basic schools, secondary schools and gymnasiums. Both girls and boys have similar truancy habits. The schools with a better disciplinary climate index have a lower intensity of truancy. Latvia's students from the families with a higher SES on the whole are less prone to truancy than the students from families with a low SES.

Undoubtedly, the role of ICT is very important in all the areas of the contemporary life. However, the obtained results here in a way counter our expectations and hopes. OECD PISA participant performance analysis demonstrated that the highest average performance in all content areas was shown by the group of students, who indicated that in the respective study subject the computers were not used at all during the lessons within a week at school. On the other hand, with increasing of computer use time, the average performance of students in all content areas deteriorated. Not to deny the growing role of ICT in study process, the obtained research results signal that meaningful ICT use in Latvia's general education schools should be viewed as insufficient, as it is still impossible to identify the added value obtained through the use of ICT in the study process.

Students with a higher performance more often use Internet to search for the information about further career options, upper secondary school, college and university study programmes, as well as try to establish their interests and skills. Unfortunately, among these there are rather few rural basic school students (14%). Students' interest in future career can serve as a motivating factor for higher study performance, therefore career education has a particular role at schools. PISA data analysis demonstrates that students from families with a lower SES have mastered the skills related to future careers more at school than outside it. Consequently, schools have the possibilities as well as obligation to motivate students from less well-off families to choose to continue their education and think purposefully about their future career.

The above-mentioned results of analysis have contributed to the following recommendations:

- to continue increasing the overall quality of education in Latvia (student proficiency in mathematics, science and reading), enhancing the work with gifted students and simultaneously focusing on the less advanced ones. It will result in raising the average performance level, the relative number of top performing students will increase and the number of students showing a low performance will decrease;

- to define the situation and look for ways to help students from families with lower SES to achieve a higher performance, and particularly to assist schools with a relatively great number of these students. In this respect, a particular attention should be paid to the group of schools with low overall SES and low performance (approximately one tenth of 15-year old students study in this group of schools), although this is the matter of regional development as much as that of education ;
- to optimize school network in Latvia and develop state regions, ensuring the high equity of education quality throughout the country (in cities and rural areas, basic schools and secondary schools). In this process, the students from first six grades must be ensured with education of a good quality as close as possible to their homes, concentrating the secondary education in schools with teachers of a high professional level and well-developed infrastructure by improving the school network, schools should be merged or closed, secondary schools should be transformed into basic schools, basic schools – into primary schools, etc. The education quality factor should definitely be taken into account, during optimization, not basing the decisions only, for example, on infrastructure costs. As the resource economy through optimization of infrastructure appears, the funds must be directed towards improvement of education process and professional growth of teachers. Appropriate methods must be chosen for comparing the education quality levels of individual schools – centralized exams, international comparative studies of education, specialised quality monitoring activities – in order to determine both the level of student performance and, as much as possible, its growth, while taking into account also SES of student families and overall SES of the school;
- to reduce disparity between genders in reading literacy:
    - to use as many diverse study methodologies during study process as possible to ensure that different student groups would benefit as much

as possible during the study process and to meet the interests and needs of different students;

- to provide speech therapist free of charge to all the students at pre-school and basic school levels;
- to create a school environment where students would not abuse each other neither verbally, nor physically;
- to preserve the mandatory pre-school education and to ensure the required number of places in pre-schools for all age groups;
- to change the attitude toward truancy, which in Latvia is not usually considered as something out of the ordinary. On the state and municipal levels to meticulously comply with all the requirements established by the legislation with regard to absence recording, monitoring and reporting, to revise the registration system of truancy cases, to set a procedure of cooperation between schools and parents with regard to absences, to improve the definition of actions to be implemented in case of truancy, depending on its type and scale;
- to carry out extensive scientific and methodological work to study the opportunities for ICT use during lessons at school to achieve a positive impact of ICT integration on student performance. It is required that ICT industry supports this work
- to focus the work of teachers on creating a positive cooperation with students, a good disciplinary climate, to provide strong support for students during their learning. All stakeholders – parents, teachers, intellectuals, mass media – should try to increase the students' motivation to learn.

Latvian Students with a High Level of Performance

The proportion of top-performing students in mathematics, science and reading in Latvia in all PISA cycles is lower than on the average in OECD countries. PISA 2012 results show a very small tendency to increase in comparison with PISA 2009, however, the relative number of such students in Latvia has not statistically significantly changed in any cycle and content area. In comparison to the neighbouring countries we are behind Estonia, in Lithuania and Russia the proportion of such students is similar to our country. The number of girls in the top-performing group in Latvia is higher particularly in reading, in the last PISA cycles this difference is increasing. In mathematics, in the last cycles the number of boys in the top-performing group is slightly bigger than that of girls. On the other hand, in the area of science the number of boys and girls in the top-performing group is nearly the same. A particular attention should be devoted to rural schools, especially basic schools, since they show the poorest results with regard to achieving top-performance.

The strategic state development and education policy documents of Latvia envisages an increase in the number of students achieving high performance and that undoubtedly is crucial for successful development of our country, therefore the secondary analysis using the data of PISA cycles aims to define the factors that could contribute to increasing the number of such students in Latvia. It resulted in identification of general factors, like higher parental education level, which is positively related to a higher student performance in all the content areas, as well as a number of factors specific to each content area.

Accordingly, by constantly increasing the level of education among the public and particularly young families in Latvia, we can expect a rise in student performance. In this respect, our country has good prospects, as the relative number of inhabitants who have obtained higher education in Latvia is rapidly increasing, for example, our country belongs to those EU countries that have already exceeded the EU indicator for 2020 – 40% of young people in the age group from 30 to 34 have obtained a higher education. The forecast provided in OECD *Education at a Glance* (2014) testifies that almost 85% of young people in Latvia will start studies in tertiary education during their lifetime, and this is the second greatest indicator value after Australia (the average indicator of OECD countries is close to 60%).

A high student performance in mathematics is positively affected, if the students experience adequate anxiety when responsibly solving mathematical tasks, at the same time overcoming the excessive anxiety and insecurity in this subject. The performance is positively influenced also if the students often solve the so-called formal mathematics tasks. Thereby, they learn how to act upon instructions and develop algorithmic thinking, which, in turn, also helps to achieve a higher performance in other areas, for example, reading. The frequent use of computers does not improve students' results in mathematics, while a positive student opinion regarding the use of computer and Internet information for the purposes of learning and solving school exercises, is related to a higher performance in mathematics.

To improve student reading literacy, a positive attitude towards reading must be promoted, students should be encouraged to read for their own pleasure, not only the mandatory literature at school, including electronic texts. Particular attention should be paid to literature intended to boys in all age groups. A more correct learning strategy should be shaped for the students in order to understand and remember texts or write text summary.

High achievements in science are promoted by a number of specific factors, such as students being well-informed about environmental issues, confidence and satisfaction with their performance in science, positive attitude towards the role of science in people's lives and in development of society, and the possibility of developing their careers in the field of science.

PISA data analysis and study of foreign experience allows to offer a number of recommendations to education policy makers, school principals, teachers, parents and students.

Recommendations to education policy makers:

- create exact and detailed education policy with respect to gifted students;
- devote more attention to education of teachers, their qualification and work quality;
- improve public opinion regarding education by creating respectable, intelligent and positive image of the teacher. If the teachers will be the best of the best and if they will respect their own work, then the others will also respect them;
- ensure a higher state financial support to implementation of education process both in general education and higher education, as well as further education – teacher salaries, state-funded study places, grants and scholarships;
- devote more attention to higher education and lifelong learning, since the learning process should not stop, it must continue throughout the lifetime;
- create a student assessment procedure, which, in parallel to assessment with a mark, would provide a descriptive evaluation of student's progress as well as assessment of behaviour.

Recommendations to school principals:

- recruit only the best candidates as teachers;
- give teachers the maximum allowed autonomy in developing the study programme;
- ensure student-friendly environment at school;
- organize student-development related interviews with participation of student's parents. The aim of the interviews: to promote student's development instead of reprimand;
- organize various events related to environmental issues and involve the school thereof;
- build a closer cooperation with libraries, participate in their events, as well as proactively organise different activities related to reading, paying a special attention to youth attendees.

Recommendations to teachers:

- develop your own study programmes according to education standard and based on the needs and skills of the particular class and students;
- encourage student motivation to learn, read and educate themselves;
- regularly involve students in self-evaluation;
- raise your qualifications, attend courses, seminars or increase the level of education by enrolling into higher study levels at the university.

Recommendations to parents:

- choose a school that is close to home and adapted to child's physical, intellectual and emotional needs;
- set an example that education matters, that education does not end with obtaining a diploma and continues throughout one's lifetime, and that the main benefit from the education is knowledge and competencies;
- never speak bad about a teacher in the presence of a child, even when parents disagree with teacher's opinion. It will help to maintain the status of the teacher and child's respect to him or her. Never let students speak bad about the teacher, instead teach them how to defend one's opinion by maintaining a calm and respectful attitude;

- become actively involved in events organized by the school, thus demonstrating to children that school and the things happening in it do matter to parents. Support teachers to help your child to achieve a better performance, show the interest about events at the school – not only in problem situations but also in everyday life;
- devote a particular attention to reading in family, by reading yourself and encouraging children to read, by choosing relevant and interesting literature together with children. Concentrate particularly on the boys' reading habits;
- do not punish children for failure, rather support and help to overcome errors;
- control the time the children spend with computer, tablet or smart phone, using Internet for leisure, playing games or watching films. Make sure that children go to bed early and have done their homework;
- together as a family participate in different events related to environment protection – sorting waste, taking care of environment, reducing water and electricity consumption by participating in "Earth Hour", etc.

Recommendations to students:

- as much as possible participate in the events organised by the school. Try to do your best, giving the maximum of your capacity to complete the task as well as possible;
- in case of failure don't give up, rather study more efficiently, ask help from teachers, parents and fellow students who are more advanced in the subject;
- try to understand your own interests and choose appropriate literature by visiting school and municipal libraries. Each day read at least a page of a book which is not a textbook;
- limit the use of computer for leisure, first of all complete your homework and then think about the entertainment, not forgetting the sleep;
- together with family and school actively participate in environment protection events;
- try to understand the real meaning of education, – the main benefit is knowledge and competencies and not the assessment or mark. Knowledge and competencies is the only thing that nobody can take away and which we can supplement throughout our lifetime both in formal and informal ways.

Analyses of Latvia`s Mathematics Curriculum and Student Assessment in Comparison with PISA results

Commencing another PISA cycle, all participating countries evaluate suitability of the new items to the students of respective country, taking into account the content and context of each item. In Latvia, the skills and knowledge required for solving PISA mathematics items correspond to Regulations on the State Standard in Basic Education and on Basic Education Study Subjects' Standards.

Comparing student performance in mathematic link items in both PISA study cycles with mathematics as the main content area – PISA 2003 and PISA 2012, it was established that the results differ only in some items. Overall, Latvia's students in PISA 2012 were better at solving the items involving numbers and measurements, but less successful concerning the items involving shapes and spatial reasoning. The items concerning space and shape (geometry) have traditionally been the field in which Latvia's students have shown the highest performance, however, decreasing performance in mathematic link items may indicate negative trends in teaching geometry at school.

In comparison to the OECD countries, Latvia's students have been statistically significantly better at solving 12, but less successful – at solving 27 out of 109 mathematics items included in PISA 2012. Other items were solved according to OECD average level. Students in Latvia have a greater difficulty with open-constructed response items requiring logical justification of the judgments and making conclusions. Items, where students must be able to use mathematical knowledge correctly to find the right solution in equal number of items (11 items), are both among the best and worst-solved. Most of the items showing worse results in PISA 2012 in comparison with PISA 2003 are also the open-constructed response items, where students must transform formulas or apply the respective formulas to a specific situation. Among the best-solved items there are less open-constructed response items, and these items do not require transformation of formulas. As to the content areas in comparison with the students from OECD countries, Latvia's students faced the greatest difficulties with the items involving probability and statistics. Although both themes are included in the Regulations on the State Standard in Basic Education and on Basic Education Study

Subjects' Standards, interpreting data tables and diagram content still proves to be complicated for our students. Latvian students faced problems also with items involving numbers and measurements. Although students in solving PISA items can use calculators, numerical calculations, proportions and percentages present difficulties to our students.

When composing programmes for the subject of mathematics, the question arises, as to what extent mathematics associated with real-life issues should be included in school mathematics curricula. PISA 2012 data analysis showed that the correlation between student performance and frequency of solving applied mathematics tasks is not linear. If such tasks are solved sometimes, student performance is increasing, but a frequent solving of such tasks does not guarantee a higher performance by students. On the other hand, a frequent simple formal mathematical task solving during the lessons, in addition to knowledge, as well as understanding of mathematics' concepts, can be associated with a higher student performance. In OECD countries the increase of index value by a single unit, which characterises the frequency of solving simple formal mathematical tasks items in lessons, the performance would increase by 50 points, and the performance of Latvia's students would increase by 62 points. In East Asian countries (Shanghai (China), Singapore, Hong Kong (China), Taiwan (China), Korea, Macao (China), and Japan), where students demonstrate a high performance level, students have indicated that simple formal mathematic tasks are solved during lessons more often than in other participating countries. PISA results indicate the need for a balance among the different kinds of tasks. High performance in PISA is not related only to providing students with opportunities to often solve simple formal mathematics items – it is necessary, but not sufficient. The learning opportunities of applied mathematics are also related to high performance, although only to a certain limit.

In Latvia, the basic education study results are evaluated both according to student's final assessment (the average mark calculated from the results throughout the final year) upon graduating from the 9th grade and the examination results graduating the 9th grade. The examination in mathematics at the end of the 9th grade mainly tests students' knowledge and skills, and their application in standard tasks in mathematics. Tasks, where mathematical knowledge and skills should be applied to real-life situations make up 20–29% from the total number of examination tasks. By contrast, the main goal of OECD PISA is to examine the proficiency of students to apply their mathematical knowledge and skills to real-life situations. Between the 9th grade student achievement in mathematics examination and PISA 2012 score there is a statistically significant correlation 0.656.

The distribution of student achievement in mathematics at the end of the 9th school year, in exam at the end of the 9th school year and PISA 2012 differs – only PISA 2012 performance distribution is close to normal. At the end of the 9th grade, the most commonly received score is 4 points, in the examination – 5 and 6 points (according 10-point grading scheme for students` assessment in Latvia). Comparing the performance distribution according to school types, it can be concluded that PISA 2012 performance distribution is close to normal in basic and secondary schools, gymnasiums and state gymnasiums. Thus, it can be affirmed that the items of PISA mathematics test were appropriate for Latvia's students, regardless of the school in which they were studying. The 9th grade examination assessment distribution is close to normal in case of secondary school and gymnasium students. Examination tasks were easy for state gymnasium students, but more difficult for basic school students. Distribution of performance in examination and at the end of the school year casts doubts on the objectivity of assessment.

Upon comparing PISA 2012 and the examination performance distribution, it is evident that among the students who have received a relatively low score in the examination (4, 5 and 6 points), there are the students who reached both high and low results in PISA. By contrast, virtually in all PISA mathematics proficiency levels there are students who have received the highest score in the examination. Students with high results in examination and simultaneously low performance in PISA have mastered the school programme well, but lack the capacity to apply that knowledge in real-life situations.

OECD PISA student knowledge and skills are considered to be sufficient for successful continuation of education, if a student's performance corresponds to at least the second proficiency level. Only 17% of the students whose performance in PISA 2012 is lower than the proficiency level 2, have obtained unsatisfactory score (lower than 4 points) in examination, all the other students who have showed a low performance in PISA test, scored a sufficiently the examination – most often they received 4 (almost satisfactory), 5 (satisfactory)and 6 points (almost good).

Student achievement both in examination and PISA has a statistically significant correlation with student SES. In comparison, SES influence on examination results is less pronounced. Student achievement in examination and in PISA 2012 is most closely related to occupation of student's parents. The more prestigious is the profession of student's parents, the higher achievement is shown by the student both in examination and PISA 2012. A higher performance in PISA 2012 is demonstrated by those students, who have more household items and education and culture-related items at home. Examination score is less influenced by these factors.

In order to analyse the further achievement of PISA participants, upon graduating from the upper secondary school the students, who participated in PISA 2009 and in 2012 took centralized examination in mathematics – a total of 1,410 students or 31% of PISA 2009 participants – were selected. Between the performance of these students in mathematics in PISA 2009 and in the centralized examination in 2012 there is a statistically significant correlation of 0.561. Both students with a high performance in PISA 2009 and those with a very low performance – from 240 to 725 points continued their studies in upper secondary school. Students with top-level performance in mathematics in PISA 2009 obtained a high assessment score also in the centralized examination (90% of these students achieved A, B and C level).

The correlation between performance of all PISA 2009 participants in mathematics and their family SES is 0.355, which is statistically significant. For those PISA 2009 participants who in 2012 took the centralized examination in mathematics, this correlation is weaker – the correlation coefficient is 0.109, although it is statistically significant. SES impact on the level of secondary education is weaker because secondary school and gymnasium students have a higher SES and it is less diverse. Those PISA 2009 basic school students, who continued to study in upper secondary school, have the average SES of 0.014, while all PISA 2009 participants who attended basic school, have the average SES of -0.429. Consequently, the education in upper secondary schools or gymnasiums is continued by those students of basic schools (and basic schools mainly are rural schools), whose family's socio-economic status is higher.

Student performance in both PISA 2009 and centralized mathematics examination in 2012 is closely related to students' further education plans after graduating from basic school. Students who responded in PISA 2009 that they are planning to obtain a higher professional education or a bachelor's or master's degree, showed a higher performance.

On the level of school, one can also observe a statistically significant correlation between the student performance in mathematics in PISA 2009 and in centralized examination in 2012 (correlation coefficient 0.502), as well as between the student performance in mathematics in PISA 2012 and the centralized examination in 2015 (correlation coefficient 0.528). Thus, in secondary schools and gymnasiums, where students achieve high results in PISA tests, high results can be expected also in centralized examinations.

The following recommendations have been developed as a result of the analysis.

Education policy-makers should introduce a centralized assessment and marking of the 9th grade mathematics examination, which would ensure a more objective comparison of education quality provided by different schools. It is necessary to prepare an adequate analysis and reviews to be submitted to the local municipality leaders of the 12th grade compulsory centralized examination results, that would provide municipalities with a better understanding of the education quality achieved by schools (comparable indicators, relative quality level of each secondary school in relation to other schools and its changes over the years, the number of students, etc.).

Mathematics teachers should concentrate a particular attention to the tasks representing probability, statistics and geometry spheres, interpretation of data tables and content of diagrams, formula transformations, proportion and percentage calculations.

Organizers of further education for teachers and methodological associations of mathematics teachers should include in their operational programmes the topics referred to in the recommendation above.

Student Performance in Financial Literacy

The fifteen-year old Latvia's students' financial literacy in OECD PISA 2012 (501 score points) fully corresponds to the average level of students from OECD countries. The performance of Latvia's students does not statistically significantly differ from Polish (510 points) and USA student performance (492 points). Estonian student performance (529 points) is higher than the average score of OECD countries, Russia's (486 points) – lower. The relationship of Latvia's student performance and SES index, as it changes by an unit, is lower than the OECD average, and performance standard deviation in case of Latvia is the smallest of all 18 countries participating in PISA financial literacy module. The smallest performance variation in Latvia suggests more equity in education quality in our country, and at the same time it influences the relative number of students with low and high performance, in comparison to the average values of OECD countries – Latvia has relatively less students with a low performance and, unfortunately, that also is the case with the high achievements.

Of course, a significant specifics of financial sector also emerges in the analysis of various contextual factors. The volume and place of financial education in basic school curriculum in Latvia is not sufficiently expressed and defined, an important role in performance of students in the field of finance is played by knowledge and skills obtained informally, for example, using the bank account and debit card, conversations with parents about money issues, family budget, joint planning of family recreational travel expenses, saving and spending habits of their own.

The framework and respective items included in OECD PISA 2012 financial literacy module framework are also incorporated in the curriculum of other countries participating in the research, although in a less regular and consistent manner than, for example, in mathematics. This is demonstrated by surveys of school principals, as well as students. To the question regarding availability of financial education in basic schools a negative response was given even by 84% of school principals in Spain, the least often the answer "financial education is not available" was provided in Slovakia (16%). Even in the countries with a high student performance there is a great relative number of school principals who believe that the financial education in basic schools is not available– Estonia 78%, Shanghai (China) 51% , in Latvia, it is an opinion expressed by 28% of school principals.

Not more than 40–50% of the students confirm that they have learned how to manage money at school, or in various events and projects outside. There are even less affirmative answers to the question, whether students have learned it in a special school subject or classes dedicated to management of one's own finances. 19% of Latvia's students claim that they have not learned how to manage money in any of the ways listed above. It is surprising that these are exactly the students who show a high performance in the financial test (573 points), second only to the average performance of students from Shanghai (China). However, it should be noted that these students have a good performance in mathematics (518 points), reading (513 points) and they have a relatively high SES.

Consequently, we can conclude that the overall student performance in the finance test has no relation to the amount of financial education at school. In our opinion, these facts attest to the fact that the nature of the financial field in the school curriculum is integrated, i.e., cross-subject. In the financial sphere the knowledge and skills obtained informally are also of a great importance. Perhaps these results reflect the change in the teaching and learning in the modern world – in many cases, specific knowledge and skills can be acquired outside the school, through information and communication technologies, informally, however, that requires a high level of key competencies, for example, in mathematics, reading comprehension, critical thinking, etc.

Therefore, we recommend to develop the key competencies of students, to analyse and improve curriculum and teaching and learning methods, integrate financial themes in different school subjects (social studies, mathematics, home economics, etc.), to develop appropriate training materials, to organize teachers' methodological seminars, to include the respective topics to a greater extent in teacher training and professional development, to involve experts from financial institutions and NGO's in educational process..

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