LATVIJAS UNIVERSITĀTE
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KVALITATĪVAS SĀKUMIZGLĪTĪBAS IESPĒJU VIENLĪDZĪBA LATVIJĀ

EQUITY AND QUALITY IN PRIMARY EDUCATION OF LATVIA

Promocijas darbs
Promotion Paper

Vadības doktora zinātniskā grāda iegūšanai
for the degree of Doctor in Management

Nozare (Branch) – **vadībzinātne (Management)**
Apakšnozare (Sub-branch) – **izglītības vadība (Educational Management)**

Zinātniskais vadītājs (advisor):
Prof. **Andris Kangro**

Rīga - 2009

ANOTĀCIJA

Promocijas darbā galvenā uzmanība tika pievērsta vienlīdzīgi augstas kvalitātes izglītības nodrošināšanas visām skolēnu grupām iespēju izpētei Latvijas sākumskolas izglītības pakāpē. Pētījums balstījās uz sākumskolas un dažos gadījumos pat pirmsskolas izglītības analīzi, jo izglītības problēmu saknes meklējamas jau pirmajos skolas gados – gan tāpēc, ka veiksmīga izglītības sākuma fāze ir priekšnoteikums veiksmīgām mācībām vēlāk, gan tāpēc, ka dinamiskas strukturālās izmaiņas mūsdienu globālajā ekonomikā prasa izveidot stabilu vispārējās izglītības pamatu.

Analizējot izglītības sistēmas kvalitāti, skolēnu sasniegumi tiek uzskatīti par svarīgiem indikatoriem. Izglītības kvalitāti skolā nav iespējams izvērtēt efektīvi, ja neņem vērā dažādus konteksta faktorus (O'Sullivan, 2006). Konteksta faktori apraksta tos ekonomiskos un sociālos spēkus, kas ietekmē izglītības sistēmu, lai gan neatrodas šīs sistēmas tiešas ietekmes un kontroles sfērā. Lai papildinātu plašo teorētisko literatūras analīzi, tika izmantoti divu jaunāko Starptautiskās izglītības novērtēšanas asociācijas (International Association for the Evaluation of Educational Achievement – IEA) pētījumu, Starptatiskā lasītprasmes novērtēšanas pētījuma - PIRLS 2006 un Matemātikas un dabaszinātņu izglītības attīstības tendenču pētījuma - TIMSS 2007, dati. Lai gan Latvijas sākumskolu skolēnu sasniegumi kopumā bija visai atzīstami, ievērojami pārsniedzot starptautiskos vidējos rezultātus lasītprasmē, matemātikā un dabaszinātnēs, svarīgi noskaidrot šo rezultātu sadalījuma īpašības Latvijas izglītības sistēmā dažādos aspektos. Būtisks izglītības kvalitātes aspekts Latvijā ir saistīts ar pilsētu un lauku skolēnu sasniegumu atšķirībām. Šīs atšķirības saglabājas ilgstoši, un tām ir tendence palielināties. Latvija ir maza valsts, kurā šāda tendence ir visai nepatīkama. Atšķirības pilsētas un lauku skolēnu sasniegumos parāda ne tikai izglītības sistēmas nevienlīdzību, bet ir uzskatāmas arī par negatīvu parādību sabiedrībā kopumā.

Šī pētījuma mērķis bija izpētīt Latvijas sākumizglītības kvalitātes uzlabošanas iespējas, samazinot atšķirības pilsētu un lauku skolēnu vidējos sasniegumos. Darba autori vienmēr mulsinājis, ka vienīgie skaidri konstatētie skolēnu sasniegumus ietekmējošie līdz šim bijuši ģimeņu sociālie un ekonomiskie faktori. Autore, protams, nenoliedz šo faktoru nozīmīgumu, tomēr uzskata, ka šādi secinājumi var izrādīties ierobežojoši izglītības sistēmas izaugsmes iespēju noteikšanas kontekstā.

Būtiska pētījuma daļa bija saistīta ar tādu skolēnus raksturojošo pazīmju noteikšanu, kuras varētu izmantot labākai skolēnu sasniegumu atšķirību izpratnei. Katrai potenciāli

nozīmīgai pazīmei tika veikta aprakstošā statistiskā analīze (procentu tabulas, centrālās tendences parametri, korelācijas). Daļa pazīmju tika apvienotas, veidojot indeksus, lai uzskatāmāk demonstrētu tādu sarežģītu faktoru kā sociāli-ekonomiskais statuss izpausmi un ietekmi uz skolēnu sasniegumiem. Pēc tam tika veikta salīdzinošā Latvijas un sešu Eiropas valstu datu analīze, kļūdu aprēķinos izmantojot atkārtoto replikāciju algoritmu, kā arī lineārās regresijas un variances analīzes metodes un hierarhisko lineāro modelēšanu.

Sākot datu analīzi, nevarēja pārliecinoši konstatēt vai lauku skolas būtiski atšķiras organizāciju līmenī. Izglītības kvalitāti potenciāli var ietekmēt valdība. Vēl vairāk, kopumā iejaukšanas izglītības sistēmā tiek uzskatīta par pieņemamāku un veiksmīgāku, nekā, piemēram, tieša iejaukšanās ģimenēs. Analizējot situāciju Latvijas skolās kopumā, netika konstatēta būtiska skolas resursu faktora ietekme.

Tomēr, vai patiešām var uzskatīt, ka tikai ģimeņu sociāli ekonomiskajam statusam ir nozīme sasniegumu atšķirību izskaidrošanā? Pētījuma ietvaros tika konstatētas vairākas pietiekami viegli manipulējamas pazīmes, kas ietekmēja skolēnu sasniegumus. Līdz ar sociāli ekonomiskā statusa atšķirībām īpaši nozīmīgu ietekmi uz sasniegumiem skolā atstāj vairākas pirmsskolas aktivitātes, piemēram, lasītprasmes nodarbības ģimenē, lasīšanas iemaņu attīstīšana un bērna agrīna iesaistīšana mācību aktivitātēs. Savukārt, neadekvāta iejaukšanās bērna izglītošanā pirmsskolas vecumā, kas notiek ģimenē un/vai pirmsskolas izglītības iestādē, var radīt vēlāk grūti labojamus negatīvus efektus. Kvalitatīva izglītība pirmsskolas iestādēs īpaši pozitīvi ietekmē bērnus no ģimenēm ar nelabvēlīgiem sociāli ekonomiskiem apstākļiem. Sabiedrības nevērība pret šādiem bērniem pirmsskolas izglītībā rada īpaši nelabvēlīgu ietekmi, turpinot vispārējo izglītību.

Jau pētījuma sākuma stadijā kļuva skaidrs, ka lai gan ģimeņu sociāli ekonomiskais statuss ir vissvarīgākais skolēnu sasniegumus ietekmējošais faktors, tomēr ar atšķirībām skolēnu sociāli ekonomiskajā statusā vien nevar izskaidrot skolēnu sasniegumu atšķirības pilsētās un laukos. Turpinot pētījumu autore guva aizvien noteiktāku pārliecību par to, ka Latvijas sākumskolas izglītības sasniegumu nepietiekamā vienlīdzība ir saistīta ar sociāli ekonomiskā statusa atšķirībām skolu līmenī un urbanizācijas efekta ietekmi, jo laukos sociāli ekonomiskā statusa atšķirības izpaužas krasāk. Tātad sociālā nevienlīdzība ir valsts administratīvi teritoriālā sistēmā. Latvija ir neliela valsts ar mazu iedzīvotāju skaitu, tāpēc šādu izglītības nevienlīdzību veicinošu faktoru ietekme ir ļoti nevēlama. Gandrīz pusi no konstatētajiem urbanizācijas efektiem var izskaidrot ar salīdzinoši zemākā sociāli ekonomiskā statusā esošu skolēnu daudzumu dažādās skolās.

ABSTRACT

The research of this promotion paper focused on equity of achievement in primary education in Latvia. The research was based on the primary, and in some respects even preprimary, education because the roots of the education quandary lie in the early years of schooling – both because early learning is a pre-requisite for successful later learning, and because rapid structural changes in modern global economies may require a solid foundation of general knowledge as distinct from specific knowledge.

When analyzing the quality of an educational system, student achievement results are considered key indicators. However, one cannot effectively judge the quality of education in a school without reference to contextual factors (O'Sullivan, 2006). Contextual factors describe the economic and social forces that have an effect on the educational system, but are beyond the direct control of the system. To support the extensive research of the literature, data from the two most recent IEA[1] studies, Progress in Reading Literacy Study - PIRLS 2006 and Trends in International Mathematics and Science Study - TIMSS 2007, were used. Even if Latvia's overall results in the international arena at the primary school level look rather good, with the achievement levels being well above the international average in reading literacy, mathematics, and science, how these scores are distributed across the Latvian population is very important. An important dimension of educational equity in Latvia is rural-urban disparities in student achievement. Moreover, this is a persisting trend and the gap has kept increasing over time. For a small country like Latvia, this situation is devastating. The rural-urban achievement gap represents not only a threat to the quality of the educational system in Latvia, but also to its society as a whole.

The goal of this research is to find solutions for improving quality of the primary education in Latvia by minimizing the student achievement gap between the rural and urban communities. The author has always found it frustrating that so far the only well established determinants of student achievement has been of socio-economic origin. The author does not deny that such findings are true. However, such a conclusion can be rather limiting in terms of possibilities to improve the situation.

The selection of the background variables that would be used to better understand student achievement was a crucial step in this research. Descriptive statistics were computed for each variable of interest (percentages, means, and correlations). Some variables were combined to form indices to better represent complex constructs, such as socio-economic

[1] International Association for the Evaluation of Educational Achievement.

background. Then, comparative analysis were computed for Latvia and six other European countries relying on statistical methods such as univariate analyses using the jackknife repeated replication (JRR) algorithm, regression analyses, analyses of variance (ANOVA), and Hierarchical Linear Modeling (HLM).

At first, it was not obvious whether there were any crucial differences in the rural schools as organizations. Quality of schooling can potentially be influenced by the government. Moreover, interventions in the educational system are generally viewed as both more acceptable and more likely to succeed than, for example, direct interventions in the families. Whether fortunate or unfortunate, when analyzed for Latvia overall, the determinant of school resources did not show any significant effect at all.

However, is it true that nothing other than the socio-economic background matters? The research did identify some influential determinants of student achievement that can very well be manipulated externally. Apart from socio-economic inequalities, such input factors as early literacy activities, early childhood exposure to education, and early literacy skills proved to be extremely important determinants of later achievement in school. Inadequate early interventions, whether invested by the family, preschool, or a combination of both, are difficult to remedy later on. Returns of qualitative preschool education are particularly high for children from disadvantaged backgrounds. Lack of public intervention for children from lower socio-economic backgrounds has especially harmful effects on later stages of schooling.

It became clear early in the research that, even though socio-economic status is the most important determinant of student achievement, differing socio-economic backgrounds of individual students cannot explain the urbanization effect. Later on in her research, the author became more and more convinced that poor equity of achievement in Latvia's primary education is a problem of segregation by socio-economic status, and the urbanization effect is significant mostly because the segregation is more obvious in the rural areas of the country. The state administrative-territorial system seems to be segregated. Although this is not unique to Latvia, the size of the country and its population are too small to allow for this level of segregation. Almost half of the originally stated urbanization effect was explained by controlling for the proportions of disadvantaged students in different schools.

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INTRODUCTION

"The potential of our people, in combination with a concerted State policy, need to be used to achieve meaningful results in the development of Latvia's economy, at a time of increasing global competition. The investment, the knowledge, the successes, and the achievements of each and every inhabitant of Latvia are crucial for maintaining Latvia's successful national development."

Vaira Vīķe-Freiberga

1. Defining the Problem

Throughout Western countries, education has been re-theorized under Human Capital Theory as primarily an economic device. Human Capital Theory is the most influential economic theory of Western education, setting the framework of government policies since the early 1960's (Fitzsimons, 1999). However, Human Capital Theory takes for granted that an individual's demand of education will automatically be transformed into real human capital: there is no supply constraint. This optimistic view of human capital production seems less and less relevant. Similarly, education policy can no longer be reduced to the question of choosing the educational budget size on the basis of an underlying rate of return on educational public investment. We need to analyze the production process of educational services and study how educational inputs are transformed into outputs. Benefits of education are not only individual ones. They are also benefits to society. Education develops productive resources beyond what an individual expects in financial return on his investment during the rest of his life cycle, and even beyond what his employer captures (Vandenberghe, 1996).

Most likely there is no extensive need to prove the importance and influence of education as such. However, the author feels that there is some building frustration about education policy; educational inputs and outcomes, including the cost, effectiveness, fairness, and student achievement. Although the educational process has been extensively researched; clear policy prescriptions have been difficult to derive (Hanushek, 2003). Also, education is a relatively recent subject of economists' attention, which adds to the frustration by introducing a much wider perspective on education production process as a crucial part of society's development. Even if there are very important points of overlap in measuring scholastic performance, in analyzing the educational production process, and in formulating educational policy, it has been analyzed more extensively by researchers in other fields (i.e. psychology, sociology, and political science), having different priorities of

their research. There exists however a consistency to the research findings that does have an immediate application to educational policy: Schools differ dramatically in "quality" (Hanushek, 2003).

Back in 1988, professor of educational leadership and policy studies, Leonard A. Valverde, claimed that the general public and many educators believe that it is extremely difficult if not impossible to provide excellent education and equality of opportunity to everyone. It has become a paradox that schools should promote both equality and quality but cannot foster both goals at once. Canadian researchers, Smith and Lusthaus (1995), however, argue that the apparent antithesis of equality and quality results from mutually exclusive definitions obscuring the true relationship between the two constructs. They offer a model demonstrating that equality and quality are not only compatible but mutually supportive and enhancing (Smith, Lusthaus, 1995). Thus the struggle for school systems which are both equal and excellent becomes one of the major challenges facing politicians and educators in many Western countries.

The social inequalities in relation to school are so obvious that we must criticize their scale or be pleased when they are at all reduced. Unfortunately, the inequality is a favorite argument of the defenders of not taking action. International comparisons here become very important. If the inequality is reduced by one or more countries, then the others must countenance some blame for not doing likewise. It is a different question, however, whether fairness requires, whatever the cost in the other dimensions, exact equality of school careers between social groups. Equal citizenship assumes that although people may possess different qualities, and therefore be unequal in terms of merit, they are all of equal worth.

European Union heads of state have agreed on the so called "Lisbon strategy" with its goal to become "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". European Group for Research on Equity in Educational Systems claims to go beyond formal equality[2]. In the second edition of "Equity in European Educational Systems" (2005), it is clearly pointed out that in Europe equity[3] in education is rapidly becoming a major political issue and is a more difficult concept than equality. "In fact, a strictly egalitarian vision, which would aim to give everyone the same treatment, while ignoring the characteristics of each individual at the outset, or even the results in terms of

[2] Equality in the school setting is often termed "equal educational opportunity" (EEO).
[3] Equity in education means that a baseline student should be able to have the same level of achievement attending any school in the school system (Chamberlain, 1987).

reproduction of the initial inequalities, would force us to question its very foundations, precisely for reasons of equality since, in this case, a strict equality of treatment would ignore other kinds of inequality" (Equity in European Educational Systems, a set of indicators, 2005). European citizens are becoming more demanding in relation to educational systems, they are no longer prepared to settle for speeches merely explaining existing inequalities. People also are interested in the efficiency of their educational system, including its costs, its internal and external efficiency.

Quality, equality, and equity of outcomes being at the heart of education satisfy basic learning needs, and enrich the lives of learners. An education system that has a strong, clear respect for human rights and equity is clearly moving in the right direction towards improving its quality. "What the best and wisest parent wants for his own child, that must the community want for all its children" (Dewey, 1900).

If Dewey had a conclusion like this back in 1900, why, more than a hundred years later, are we still so frustrated looking for policies and practices to achieve quality, equality, and equity in our educational systems? Luckily, the society we are living in is constantly moving up the ladder of expectation. We have to overcome obstacles, which are not constant either and create themselves almost as fast as computer viruses are created. Political systems change, hopefully for the greater good, but they do throw educational systems out of some already achieved balance because the whole purpose they have been serving changes. Also, obviously it is not easy to measure quality in education where it is still argued whether excellence, equality, or equity of outcomes is more important. In this research, the author's argument is that neither of these qualities achieved separately provides the best for the community. Only achieving a balance in all three of them can be considered a success.

In today's global economy, concerns about international competitiveness have intensified the discussion as to whether and to what extent the one educational objective must be sacrificed in order to achieve the other. While the focus of the debate in the early 1970's was on higher education, the roots of the education quandary lie in the early years of schooling – both because early learning is a pre-requisite for successful later learning, and because rapid structural changes in modern global economies may require a solid foundation of general knowledge as distinct from specific knowledge. The author believes that qualitative early childhood education and the possibility of lowering the school starting age in some countries, including Latvia, can be very influential factors on later educational performance and the effects seem to be able to persist through adulthood.

2. Significance of the Research

Ever since the collapse of the Union of Soviet Socialist Republics and the dominating socialist regime in 1990, Central and Eastern European countries, including Latvia, have faced a double challenge; protecting the public education achievements of the past while reforming the system to the new rules and goals of society. Any assessment of the changes in education across the region must be seen in terms of both the opportunities and the constraints accompanying these truly historic developments. The legacy of the socialist educational system included notable achievements: wide access to basic education, a high degree of gender equity, high literacy rates and positive results in certain aspects of learning achievement. However, adapting to truly democratic societies, market-oriented economies and closer economic and social integration into European structures, the potential contributions of education, using the term in its broadest sense, are indeed great. Equitable educational systems and good learning outcomes can play a central role in building human capital and thus to rebuild the economies shattered by the shift from a planned system and provide the relevant skills needed to support national and European competitiveness in a period of rapid technological change and globalization of markets.

In the past, compulsory school enrolment was practically universal, and it was taken for granted that schools were easily accessible and all children were in school. Now it seems that maintaining wide access to basic education has come at the expense of educational quality. Central governments had devolved responsibilities to local authorities without allocating control over adequate resources. This only contributed to widening regional differentiation in per student expenditures. Thus local governments were given increasing responsibilities for education provision from preprimary to secondary schooling. However, in many instances local authorities, particularly in rural areas, were not allocated the financial resources to meet the new responsibilities and have few means to raise additional funds. The still huge differences in the levels of per capita household income and greater inequality in how income is distributed means that parents have fewer financial resources for their children's education. Urban/rural disparities were reflected among school graduates. For example, a study conducted in 1997/98 in Romania showed significant differences in test scores at the end of compulsory schooling. Eighty-three percent of urban children passed the exam compared to only 68 percent of rural children. Also, widespread use of extra-curricular private tutoring financed by parents was considered an important source of social inequity (World Education Forum, 2000). The opportunity costs of

education, as opposed to contributing to household income via the informal sector became very high, particularly among rural populations. Finally, changes in access and quality had important implications for equity. The increasing reliance on the contribution of the community and family to support educational expenses was bound to discriminate children from poorer regions, communities, and families. Socio-economic disparities between households and regions widened dramatically during the 1990s and were reflected in the growing polarization across the educational system. At the level of basic schooling, fiscal adjustment forced by declines in public expenditure and decentralization had influenced education quality. In fact, changes in equality of opportunity in basic education appeared rather within the system than entering the system. That is, most children were in school, but only some had access to a better quality education: better teachers, better school conditions, and very importantly – more relevant classes. Thus, it is not only a matter of greater deterioration in the rural areas, but also of greater gains in the urban areas.

The Synthesis Report of the World Education Forum back in 2000 also stated that the economic impact of transition was most dramatically reflected by large falls in production. In terms of measured output, real GDP fell sharply during the 1990s, especially in the former USSR which includes Latvia. Most countries hit the bottom in the mid 1990s and by 1998 Latvia was one of the countries that had not reached higher levels of GDP than in 1990. Thus, by the year 2000, while more stable economic conditions helped to facilitate educational reform, economic recovery was still not a reality.

However, according to the long-term economic strategy of Latvia, the plan is to change the dominant model of the Latvian economy which is mostly based on the use of cheap labor and production with low value-added. Instead, it is proposed to use knowledge and high technologies to bring about a transition from a labor-intensive economy to a knowledge-intensive economy (The Information Database on Education Systems in Europe, The Education System in Latvia, 2006/07, P.9). Many positive changes already have happened in the new millennium. Latvia has joined the family of European Union member States, entered the NATO alliance and achieved indicators of economic growth that are among the highest in Europe. The strongest indicator that Latvia has finally reached a point of development above basic economic recovery is the recently adopted National Development Plan 2007 -2013 (2006). It is a national mid-term planning document conveying the main directions of development and the main tasks of the state and society. Education and knowledge for the growth of economics and technological distinction is defined as the main strategic aim with the following priorities: a well-educated and creative

individual, technological distinction, flexibility of enterprises, and research and development. The next years will certainly be decisive ones for raising the quality of education and scientific research in Latvia, as well as for the further development of the economy. “We need to create a stable intellectual and material foundation for ensuring a gradual rise in Latvia’s overall welfare” (Vaira Vīķe-Freiberga, 2006).

The implementation of Latvia’s planned territorial reform is expected to influence management and administration of education. However, the reform and possible models are still subjects of discussion. Currently, there are two opinions in society that reflects on its influence on education, both related to the state’s obligation to provide compulsory education and funding for education – the one showing fear of closing small schools in the countryside, and the other pointing out the need to improve education quality (The Information Database on Education Systems in Europe, The Education System in Latvia, 2007, P.18).

Reliable methods of assessing learning achievement are an important part of an educational system that seeks to meet the needs of all children. Measuring learning achievement is an essential step towards evaluating the overall quality and efficiency of the educational system.

In most Central and Eastern European countries, the assessment of learning achievement used to be limited to ongoing monitoring that is predominantly school-based. The member states of the USSR were not permitted to establish and develop their own educational systems. They all had to operate under the auspices of the Soviet educational system, where all strategic decisions were taken in Moscow. The USSR participated in virtually no international comparative studies of educational systems.

Educational policy is difficult or even impossible to establish if the process is based only on data obtained only from one individual country. As the educational process is very complicated, it is difficult to estimate the influence of separate factors on the development of education. Many of the influencing factors in one individual country are almost permanent and it is difficult to determine the influence of them only from national studies. International studies overcome these restrictions. For example, it is possible to estimate the influence of the school starting age, the number of students in class, curriculum, etc. on student achievement (Geske, 2001).

In the late 1990s, most of these countries had started to pay greater attention to measuring learning achievement. Large-scale comparative studies of achievements in reading, mathematics, and science have been the main source of data on learning

achievement. Right after regaining its independence, Latvia established initial contacts with the International Association for the Evaluation of Educational Achievement (IEA) and since then has participated in several comparative studies (Geske, Grīnfelds, Kangro, 1997). Since 1999, Latvia has also been participating in the Programme for International Student Achievement (PISA) organized by the Organisation for Economic Cooperation and Development (OECD). A significant number of extremely valuable results has been published based on these studies in Latvia. The Ministry of Education and Science claims that the role of comparative research is increasing. A more efficient application of results, which would help developing policies in the field of education, is crucial (the minister of education and science, Baiba Rivža, 2007). With all of this importance being stated by the ministry, the author would expect speedier participation and financing decisions, since at this point Latvia's participation in the biggest and the most influential international comparative study, Trends in International Mathematics and Science Study (TIMSS) is in grave danger. The author also believes that the more researchers analyze and publish results of the studies already conducted in Latvia, the more politicians will recognize the significance and necessity of this, so far underestimated, input in developing educational policies in Latvia.

Even if Latvia's overall results in the international arena at the primary school level (results of the PIRLS 2006 and TIMSS 2007 studies) are looking rather good (Latvia scores well above the international average in reading literacy, mathematics, and science), how these scores are distributed across the population is very important. An important dimension of educational equity in Latvia is about rural/urban disparities in student achievement. Moreover, this is a lasting trend and the gap has kept increasing over time (Johansone, Preuschoff 2008).

The Review of National Policies for Education in Latvia (OECD, 2001) found that urbanization is one major factor influencing the quality of education in Latvia. One of the review's conclusions was that the differences between urban and rural areas in the quality and cost effectiveness of schools was a serious problem in Latvia's educational system. Over time, data from international studies (IEA TIMSS, PIRLS, and OECD PISA) assert that there are huge differences in student achievement by community in Latvia. For a small country like Latvia, this difference is devastating. The achievement gap represents not only a threat to the quality of the education system in Latvia but also to its society as a whole. Rural schools are producing low achievers, which might not be able to contribute to the

economy and society. This is especially problematic since Latvia is in need of sustainable economic growth to keep up with its neighbors.

Many European countries are practicing, or are heading towards, educational quasi-markets, which mean public funding on a per-pupil basis and free school choice. In Latvia, the government gives only partial funding (only the wages for pedagogical staff are allocated from state budget) for the public basic and secondary schools. Most expenses are covered by the district governments, similarly to the USA, where schools are financed from local district taxes. That way, in districts with more business activities and thus wealthier, more educated families have more taxes to be raised for their schools. Besides, in Latvia the wealth of districts have a lot to do with urbanization.

The socio-economic status and urbanization are the most important determinants of student achievement in Latvia (Mullis, Martin, Gonzalez, & Kennedy, 2003). Since educational policy can do very little or nothing at all to change the socio-economic status of individual families in a short period of time, it is important to identify determinants of student achievement that can be manipulated externally. It is important to explore possible reasons for the performance between school communities and bring up possible ways to create greater equitable learning opportunities.

Human capital production inevitably takes place in classrooms where students are together and interact. These classrooms are part of a school, and school is a part of a community. Thus achievement is most likely not entirely determined by the number of teachers, their experience, or the presence of labs and sport facilities. It also is influenced by the characteristics of students. First, educational attainment of a student is influenced by his or her parents' contribution to education. Many empirical studies (Glennester, 1991; Donni & Lejeune, 1994), just like PIRLS and TIMSS results, suggest that low achievers generally originate from poorer socio-economic backgrounds. However, child's attainment also can be influenced by the characteristics or behavior of his or her classmates and schoolmates. Already back in 1987, Jay Douglas Chamberlain stated that public finance literature had begun to realize the importance of the quality of community composition in the production of many publicly provided goods, including education. The author's argument here is that the school and money cannot accomplish everything regarding education. A large body of research (Coleman, 1966; Summers & Wolfe, 1977; Jencks & Meyer, 1987; Dynarski, Schwab, & Zampelli, 1989; Corcoran, Gordon, Laren, & Solon, 1990; Evans, Oates, & Schwab, 1992; Vandenberghe, 2002; Schuemer, 2004, and many others) stresses the importance of non-monetary inputs: social interactions. These social inputs, if properly

mobilized, can considerably buttress human capital production and usefully complement what monetary input and organization can do (Vandenberghe, 1996).

3. Predicted Outcomes

To support the extensive research of literature, the two most recent IEA studies, PIRLS 2006 and TIMSS 2007 provide a huge source of data with considerable opportunities for research. "The considerable investment in research made by funding organizations, participating countries, and IEA itself should be justified by the reassurance that such research makes a difference, ultimately in terms of the improvement of education systems and, equally importantly, in the life chances of individuals" (executive director of the IEA, Hans Wagemaker, in Loveless Ed. 2007). We can and should go beyond the international student-achievement horse race and see what works in and out of the classroom to improve student learning (Talbott, in Loveless Ed. 2007).

In a relatively short period of time, since regaining its independence in 1990, quite a lot of research has been done in Latvia indicating student achievement in the national and international context. However, the author's argument here is going beyond just stating inequalities and their impact on student achievement. So far there is no clear and undeniable relation between the expenditure per student with the specific resources they can buy (for example, teachers' education and experience, class size, schools labs etc.) and student achievement. Although, such monetary inputs as teachers' education and pay are important for student learning, the only well established result is that socio-economic origin is crucial (Glennerster, 1991; Donni, Lejeune, 1994; Geske, Grīnfelds, Dedze, Zhang, 2006).

Subject of the Research

Determinants of student achievement among different groups in primary education.

The Goal and Objectives

The goal of the research is to find solutions for improving quality of the primary education in Latvia by minimizing the student achievement gap between the rural and urban communities.

The author had set the following objectives to guide the analyses:

1. To study and analyze the relevant literature and research done in different countries.
2. To evaluate and compare student achievement in reading literacy, mathematics, and science at the primary school level in an international context.

3. To analyze how the student achievement scores are distributed across the population in Latvia and compare the results to Denmark, Germany, Lithuania, the Slovak Republic, Slovenia, and Sweden.
4. To explore how similar or different are the school starting age and exposure to early childhood education in Latvia and the countries mentioned above.
5. To analyze the rural/urban disparities in student learning outcomes in Latvia.
6. To analyze background determinants of student achievement in Latvia, including the rural/urban comparison.
7. To evaluate the extent of community composition/peer effects on student achievement in Latvia.

The Research Question

Analyzing differences in student achievement by urbanization in Latvia and determining the most influential factors of the rural-urban achievement gap.

Research Basis

The research is based on the IEA international comparative studies in education – PIRLS 2006 and TIMSS 2007.

The PIRLS 2006 study involved 40 countries around the world. That includes separate entries treated as countries for England, Scotland, and Hong Kong because of their distinct educational systems. Also, the two major geographic and cultural regions of Belgium, the French-speaking part and the Dutch-speaking part, have separate educational systems and participated separately. Five Canadian provinces are reported separately for the same reason (Mullis, Martin, Kennedy, Foy, 2007). Latvia participated with 147 schools, 211 reading (language) teachers, 4162 fourth-grade students, and 3974 parents.

The TIMSS 2007 study involved 36 countries and 7 benchmarking participants at the fourth-grade population.[4] The benchmarking participants are regional entities that follow all of the rigorous quality standards established by TIMSS. Their data are comparable to the countries' data, and they can use the TIMSS results as a benchmark (Mullis, Martin, Foy, 2008). Latvia participated with 146 schools, 339 mathematics and science teachers, and 3908 fourth-grade students.

Development of the Research

In order to analyze and appropriately apply data from an international study, one has to understand the study, its framework, development of the survey instruments, survey

[4] TIMSS 2007 involved two populations – fourth grade and eighth grade. This research is focused on the fourth-grade population only.

operations and procedures, data, etc. The author of this promotion paper was the Latvian National Research Coordinator for the previous cycle of the PIRLS study (PIRLS 2001) and the author of the PIRLS 2001 national report ("Starptautiskais lasītprasmes novērtēšanas pētījums 2000 – 2003", 2003). After gaining national experience, the author worked as a researcher at the IEA Data Processing and Research Center in Hamburg, Germany. During that time (2002 – 2005), she was a researcher for both, the TIMSS 2003 and the PIRLS 2006 studies. The experience involved creating the codebooks for the data entry and testing the programs for data processing. She also managed the documentation of national adaptations of the test instruments, and evaluated the quality of national data sets by implementing corrections required to meet international quality standards. This work required working with the participating countries to communicate results of the evaluations and assisting them in improving their national procedures, as well as organizing the second International Data Base (IDB) seminar for the PIRLS 2001 study. Since March 2005, the author is a researcher at the TIMSS & PIRLS International Study Center at Boston College, USA. The responsibilities there have involved contribution to the TIMSS 2003 User Guide for the International Database, the PIRLS 2006 and TIMSS 2007 Technical Reports, and development of the survey operations and procedures for both studies. To evaluate the quality on implementation of the studies in all the participating countries, the author has been responsible for the International Quality Control Program for both studies.

Because such large scale research was a completely new experience in Latvia at the time, none of the work mentioned above could have been done without an extensive and constant self development in the field and studying of relevant scientific literature. On the basis of the theoretical research and acquired experience, the author has become confident of her research topic and the thesis for the defense.

Finally, during the past two years, the author has worked on the practical research and preparation for the defense.

Publications and Reports on the Research Results so Far

1. Johansone, I. (2002). *Lasītprasme starptautiskajos salīdzinošajos izglītības pētījumos*. Izglītības zinātnes un pedagogija mūsdienu pasaulē. Latvijas Universitātes Raksti. (649). Rīga: Latvijas Universitāte. lpp. 45-54.
2. Johansone, I. (2002). *IEA starptautiskā lasītprasmes novērtēšanas pētījuma pirmie rezultāti Latvijā*. Izglītības zinātnes un pedagogija mūsdienu pasaulē. Latvijas Universitātes Raksti. (655). Rīga: Latvijas Universitāte. p. 47-62.

3. Johansone, I. (2002). *Latvia*. In Mullis, I.V., Martin, M.O., Kennedy, A.M., Flaherty, C.L. (Eds.). PIRLS 2001 Encyclopedia. A reference guide to reading education in the countries participating in IEA's PIRLS 2001 study. Chestnut Hill, MA: Boston College. p. 163-169.
4. Johansone, I. (2003). *Starptautiskais lasītprasmes novērtēšanas pētījums 2000-2003*. Latvijas Universitātes Pedagoģijas un Psiholoģijas fakultātes Izglītības pētniecības institūts. Rīga: Mācību grāmata. 144 lpp.
5. Johansone, I., Foy, P. (2004). *PIRLS 2001 results in the context of the European Union expansion*. Proceedings of the IEA International Research Conference 2004 PIRLS, Volume 3. Lefkosia. Cyprus: Cyprus University Press p. 36-45.
6. Johansone, I. (2006). *Sākumskolas izglītības kvalitātes rādītāji Latvijas laukos un pilsētās IEA PIRLS 2001 un TIMSS 2003 pētijumos*. Izglītības vadība. Latvijas Universitātes Raksti. (697). Rīga: Latvijas Universitāte. lpp. 64-76.
7. Johansone, I., Kennedy, A. (2007). *Quality assurance in the PIRLS 2006 data collection*. In Martin, M.O., Mullis, I.V.S., Kennedy, A. (Eds.). PIRLS 2006 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 73-91.
8. Johansone, I., Preuschoff, A.C. (2008). *Izglītības kvalitāte Latvijas laukos un pilsētās ar ieskatu IEA PIRLS 2006 pētījuma rezultātos.* Latvijas Universitātes Raksti. Izglītības vadība. (749). Rīga: LU Akadēmiskais apgāds.
9. Johansone, I., Malak, B. (2008). *Translation and national adaptations of the TIMSS 2007 assessment and questionnaires*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 63-75.
10. Johansone, I., Neuschmidt, O. (2008). *TIMSS 2007 survey operations procedures*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 93-112.
11. Johansone, I. (2008). *Quality assurance in the TIMSS 2007 data collection*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 113-140.

Additionally, the research theoretical and practical operations and results have been discussed at the following research conferences and seminars:

- February, 2001: Rīga, Latvia. The 59th conference of University of Latvia. *Reading Literacy in the Context of the International Comparative Assessments in Education* (*Lasītprasme starptautiskajos salīdzinošajos izglītības pētījumos)*.
- February, 2002: Rīga, Latvia. The 60th conference of University of Latvia. *First National Results of the IEA's Progress in International Reading Literacy Study in Latvia* (*IEA starptautiskā lasītprasmes novērtēšanas pētījuma pirmie rezultāti Latvijā).*
- December 2003: Rīga, Latvia. University of Latvia. *Presentation of the Results of the Progress in International Reading Literacy Study, PIRLS 2001 (Starptautiskā lasītprasmes novērtēšanas pētījuma PIRLS 2001 rezultātu prezentācija).*
- May, 2004: Lefkosia, Cyprus. University of Cyprus. The 1st IEA International Research Conference. *PIRLS 2001 results in the context of the European Union expansion.*
- August, 2006: Rīga, Latvia. The TIMSS 2007 fifth National Research Coordinator meeting. *TIMSS 2007 survey operations procedures and quality control programs.*
- December, 2007: Salzburg, Austria. The TIMSS 2007 seventh National Research Coordinator meeting. *TIMSS 2007 national adaptations.*

Research Methods

- Theoretical analyses of relevant scientific literature.
- Exploratory analyses of the data. Selection of the background variables that would be used to better understand student achievement was a crucial step in this research. Descriptive statistics were computed for each variable of interest (percentages, means, and regression coefficients). Some questions were combined to form indices to better represent complex constructs, such as socio-economic background.
- Comparative analyses for Latvia and six other European countries. This included such statistical methods as univariate analyses using jackknife repeated replication (JRR) method, regression analyses, analyses of variance (ANOVA), and Hierarchical Linear Modeling (HLM).

Novelty and Practical Value of the Research

- The most recent international data available are analyzed. These are one of the first published results of secondary analysis of the PIRLS 2006 and TIMSS 2007 data

in Latvia. The PIRLS 2006 data has been released to general public in February, 2008. The TIMSS 2007 data has been released to general public in February, 2009.

- For the first time Latvia's results in the IEA PIRLS and TIMSS studies are analyzed together, covering all major subjects (reading, mathematics, and science) at the primary school level. The population tested is the fourth grade, which is the final year of primary schooling in most countries participating in the two studies, including Latvia.
- For the first time in Latvia urbanization effects, community composition effects, and early childhood education effects on student achievement at the primary school level have been analyzed to this extent.
- For the first time group of factors have been recognized and multilevel models (individual student and school levels) have been built to explain the rural-urban achievement gap in Latvia's primary education based on internationally recognized and reliable data.
- Interactions of the most influential factors and student achievement have been revealed, and suggestions for externally manipulating such factors have been elaborated.

Structure and Volume of the Promotion Paper

The promotion paper has 177 pages and consists of an introduction, three parts, conclusions, references, and an appendix. The paper includes 10 figures, 27 exhibits, and 4 graphs.

The first part is a review of the literature and research from Latvia and around the world. It gives a deep insight in the theoretical bases for the research and explanation of the terminology used. The author also describes primary and basic education in Latvia and compares it to six other European countries. Finally, the author discusses the necessity and importance of international comparative assessments in education, in particular the IEA's PIRLS and TIMSS studies.

The second part is devoted to the methodology on how the data for this research was collected and what kinds of data analysis were done. It describes assessment specifications for the PIRLS 2006 and TIMSS 2007 studies. It also describes specifics of the PIRLS and TIMSS databases and has a brief description of the analysis methods used.

The third part reflects the results of the research and initiates the discussion on how student achievement might improve after considering the most influential determinants revealed by this research.

Thesis to be Defended

1. The variations between the achievement levels by school community in Latvia are significant, especially when groups are defined by urbanization. Children in rural communities are at a distinct disadvantage. Children attending rural schools do not achieve comparable educational outcomes as their urban counterparts.
2. Even though children from socially privileged families achieve higher performance in school than children from socially disadvantaged families, the urbanization effect cannot be fully explained by socioeconomic differences on individual student level.
3. Improving quality of community composition (peer effects) has an important effect on improving achievement of individual students. To minimize the negative effect, student segregation should be minimized to the greatest possible extent. The revealed interactions of the most influential factors and student achievement support the idea of organizing bigger schools in centers of the rural communities.
4. Early childhood exposure to education and early literacy skills are crucial factors influencing the later achievement in school. Also, the earlier in child's life the exposure to educational activities begins, the greater the benefits will be.
5. In addition to the previous statement, students in Latvia are some of the oldest ones among the fourth-graders in many developed countries. Lowering the school starting age with emphasis on early childhood education, especially for disadvantaged children and their communities, will have a positive impact on overall student achievement in Latvia.
6. Student attitudes towards learning are significantly declining in Latvia. Students also have wrong perception of their own abilities, because they judge their own achievement relative to their peers. Positive student attitudes towards learning and healthy self-concept, regardless whether it is reading, mathematics, or science, should be added as an important goal to the basic education standard of Latvia.

Limitations of the Research

- Student achievement is students' knowledge and abilities in reading, mathematics, and science that have been measured in IEA's international comparative assessments – PIRLS and TIMSS.
- Thinking of education as an input-process-output system, student achievement results have been analyzed as an indicator of output quality.
- Achievement equity in this promotion paper means that a baseline student should be able to have the same level of achievement attending any school in the school system.

LITERATURE REVIEW

"Quality in education is somewhat problematical: like beauty, it lies in the eye – or rather the mind – of the beholder."

Cliff, Nuttall, and McCormick, 1987

4. Quality, Equality, and Equity in Education

In a knowledge-based society, quality basic and secondary education is the minimum starting capital without which a person's full and successful inclusion in the labor market and everyday life is not possible (Latvian National Development Plan, 2006). At the same time, leading European economic advisors (e.g., Sapir et al. 2003, Calmfors et al. 2006) stress that education and training systems that create efficient and equitable outcomes are key to economic prosperity and social cohesion (Woessmann, 2006).Given the effects of education on individual and society's well-being, the distribution of education is also crucial. But what can we consider a quality education? How can we measure it? How can we achieve and improve it? What is the role of equality and equity in achieving quality? What have we learned about the relationship between education and economic growth? What determines economic growth across nations? It is human capital, but it is hard to measure. School attainment and number of years of schooling are not very good measures of human capital, particularly in an international context (Hanushek, 2007).

In the management literature, the term quality has different meanings and has been variously defined as value by Feigenbaum in 1951, as conformance to specifications by Gilmore in 1974, as defect avoidance by Crosby in 1979, as excellence by Peters and Waterman in 1982, as conformance to requirement and, as meeting and/or exceeding customer's expectations by Parasuraman et.al. in 1985, as fitness for use by Juran and Gryna in 1988, etc. There seems to be no consensus definition even though most of these definitions are closely related. Similarly, education quality is a rather broad and controversial concept in research and policy discussion. The definitions vary and so do the indicators used to describe quality in education. Some may emphasize the quality of inputs to the educational systems whereas others emphasize the quality of process and outcomes (Cheng and Tam, 1997).

Borrowing the ideas from total quality management (Tenner and Detoro, 1992) and system approach, Cheng (1995) defined education quality as follows: "Education quality is the character of the set of elements in the input, process, and output of the education system that provides services that completely satisfy both internal and external strategic

constituencies by meeting their explicit and implicit expectations." Thus, education quality is a multi-dimensional concept and cannot be easily assessed by only one indicator. For assessing school education quality, different indicators may be developed to give information about the performance of an education institution in different aspects of input, process, and outcome. Based on different conceptions of education quality and different concerns about achievement of education quality, different people may use different indicators to assess education quality and different strategies to achieve education quality (Cheng and Tam, 1997).

Bergman (1996), later subscribed by Chapman and Adams (2002), argued that there are different types of quality. Bergman used three studies to show how parents use different types of quality when demanding education for their children. Four types of inter-related educational qualities are postulated – value quality, input quality, process quality, and output quality. Value quality is about how values shape what is considered quality, for example, when parents choose religious schools.

Input quality includes resources, the curriculum, and the child's preparedness upon entering school. Input factors describe the resources that go into the system. They include educational opportunity and student attendance, support personnel, teachers' qualifications and experience, accessibility and use of instructional materials in selected subjects.

Process quality is the quality of the teacher-student interaction in the teaching-learning process. Process factors describe the activities resulting from the use and management of the input indicators within the school. Among these process factors are teachers' professional development, planning, and collaboration.

Finally, output quality is the quality of student achievement. Output factors describe students' development while they are still in school, including students' attitudes. Student achievement results have always been considered key indicators of educational quality, and student scores on large-scale assessments are the subject of public interest. However, test scores can be interpreted meaningfully only in the context of the system that produced them. Understanding and evaluating the quality of education requires not just numerical values or quantitative result measures such as achievement, but a more comprehensive picture of the unique and complex characters of communities, schools, student background, etc. One cannot effectively judge the quality of education in a school without reference to contextual factors (O'Sullivan, 2006). Contextual factors describe the economic and social forces that have an effect on the education system, but are beyond the direct control of the system.

If we think of education as an input-process-output system, how do we measure quality? Does quality mean having superior resources (e.g., teachers), superior processes (e.g., curriculum, instruction), and superior products (e.g., student achievement)? If so, where are the criteria of comparison in relation to what or to whom we can consider something or someone superior? While norm-referenced measures (relation to a normalized distribution of performance) are concerned with a relative standard (dependent benchmark), criterion-referenced measures (comparison to some previously set criteria) are concerned with meeting some absolute standard (independent benchmark). Another way of thinking about educational quality emphasizes the process occurring in schools, considering the student as both a consumer and a producer benefiting from and contributing to his or her own intellectual, personal, and social development (Bonstingl, 1992). This approach recognizes that the potential for success or failure is quite closely associated with process and continuous improvement is considered a quality education.

Education is more important than ever for economic development and is being discussed more and more by economists. Looking at the educational quality in the eyes of economists, such terms as efficiency and equality are being found as measures describing quality. With efficiency economists usually mean its cost, internal and external efficiency, and its capacity to pass on skills that are useful to society. Equality on the other hand denotes fairness or justice and subsumes the notions of procedural and substantive equality. Equality means sameness, uniformity, and equivalence. In the context of education, equality is most often referred to as "equal educational opportunities" (EEO) (Smith, Lusthaus, 1995). It is an easy concept to discuss because the notion of equality is as old as human thought and most people would generally support its importance. Everyone would agree that education can reduce income inequality; education opens new opportunities for the poor and increases social mobility. Since not all groups of society can afford investing in education, it is the state's role to promote equality of opportunity. However, it is a widely held view among economists that economic efficiency and social equality are incompatible, if not outright mutually exclusive (Gylfason and Zoega, 2003). The topic of equality of educational opportunity is indeed broadly discussed and also controversial. Some authors discuss equality as "fair play". In other words, disadvantaged individuals will still finish last, if they finish this "race" at all (Vickers, 1983). Bayefsky (1985) defines equality as "free to try, born to lose". In the second edition of "Equity in European Educational Systems" (2005) the equality of opportunities is characterized as hypothetical equality only. It claims that quantitative democratization in terms of access to education and wealth across

Europe has helped to hide less obvious inequalities. On the other hand, equal citizenship assumes that although people may possess different qualities, and therefore be unequal in terms of merit, they are all of equal worth. Equality of opportunity thus refers to the freedom to exercise one's natural abilities and the redistribution of social or economic benefits (Smith, Lusthaus, 1995). The two authors suggest that according to how one promotes equality and quality, educational policies can be characterized as one of the four following types.

- Low equality and low quality: This approach uses student segregation, separating students into streams or programs and virtually denying various students access to certain types of learning experiences. In this case, policy makers would believe they are offering quality services to one or all of these streams, while in reality that is not likely to happen.
- Low equality and high quality: This type of policy pursues quality at the expense of equality. It excludes those who do not achieve the standards used to define quality. This includes creating especially desirable schools, providing these schools with superior resources, and then restricting access to them to those students who meet some predetermined academic prerequisites.
- High equality and low quality: In this case, the aim is to achieve equality at the expense of quality. It includes all students without regard for any standards of quality and without providing appropriate support.
- High equality and high quality: In this case the policy seeks to provide a quality educational experience to all students. If quality is defined by high achievement scores on normalized tests, it is impossible to provide EEO (Equal Educational Opportunity) to all students.

Neither excellence alone, with its policy of exclusion, nor equality alone with its policy of inclusion, is sufficient for the attainment of educational eminence. Excellence without a commitment to equality could result in arrogance, and equality without a commitment to excellence could result in mediocrity (Willie, 1987). Years of schooling without quality education are a waste of resources. Cognitive ability is correlated with growth rates.

This is where the term "equity" comes in. The terms equity and equality in education are often mixed together or used to describe each others' properties. With equity, the author means when all groups of students master the goals of the curriculum to approximately the

same degree. The emphasis here is on “all groups”, not “all students”. The equalization of educational outcome between all individuals is an unobtainable goal. While the principle of equality assumes fairness by the uniform application of the same expectation, standard, or treatment, the principle of equity, on the other hand, acknowledges that applying the same treatment to everyone without regard to individual differences does not have an equitable impact on all members of the population. Hamilton (1983) argued that equity will be realized only when student achievement outcomes are equalized. It is obvious however that equal outcome for all students is unrealistic. It is impossible to bring every individual to the same level of educational achievement because individuals are unique and have different innate abilities. Even if all students went to the same school and had the same teachers and educational supplies, some would still score higher than others. Equity in education means that a baseline student should be able to have the same level of achievement attending any school in the school system (Chamberlain, 1987).

While providing universal primary education in developing countries remains a great challenge and a great opportunity (educational success would give millions more the skills to rise out of poverty), most European countries achieve virtually universal enrolment in terms of the quantity of primary and lower secondary (basic) education. Thus quality and equity in education is rapidly becoming a major political issue in Europe and in most other developed countries. It is also true that, in this context, equity is currently a more difficult concept than just equality. Quality and equity in education are proven to be very effective factors in overall economic growth. “There is strong evidence that the cognitive skills of the population – rather than mere school attainment – are powerfully related to individual earnings, to the distribution of income, and to economic growth” (Hanushek, 2007).

However, the inevitability of economic and social inequalities is a very common argument of not taking any action. Improvement in an educational system comes from making things happen, not letting things happen. Education just might be the most powerful way to actually reduce economic, social, gender, and other inequalities. Education must be viewed as an integrated system within society rather than a separate organization. When quality begins as an isolated project in one school, it is not likely to influence the overall quality of education. Politicians, economists, government and education professionals must learn to work together (Arcaro, 1995).

4.1. Political, Economic, and Social Inequalities

Most people would agree that a year of schooling in a school in, lets say, Peru, is not the same as a year of schooling in a school in Sweden. Most people would also agree that there are many other factors, such as urbanization, family, and peers, that contribute to educational outcomes. At the same time, research on the economic impact of schools ignores these factors. It is convenient in policy discussions to concentrate on such things as years of school attainment, which is observed and measured readily and published on a consistent basis. Obviously, there are a lot of factors that have an important impact on economic growth. For example, well-defined economic institutions, openness of the economy, open trade, security of property rights, and security of the nation are preconditions to economic development. However, even if the effect of educational quality on economic growth may differ depending on the economic institutions of a country, educational quality, measured by knowledge and cognitive skills, does have a strong and robust influence. Discussions of quality however inevitably lead to questions about whether it can be affected by policy. One consistent finding is that just equality or simply putting more resources into schools, reducing class sizes, increasing teacher training, will not reliably lead to improvements in student outcomes. Building new schools is helpful, but will not change the teachers in the schools. That is not to say that spending and resources never matter. They are especially important in developing countries, as well as in some poorer regions and schools of any developed country. However, resources may not have any consistent effects without putting them into the context of alternative structures and institutions of schools (Hanushek, 2007).

Many research studies conclude that despite the increase in number of years of schooling for all children, outcome inequities continue to grow and the gap between the most advantaged and most disadvantaged is actually getting bigger (Duru-Bellat, 2002). Not only high average achievement is important but how the achievement is distributed across the population. However, is this discussion about different schools or different backgrounds of the students attending them? What belongs to the school and what pertains to society? It is true that different schools and different teachers can get different learning out of students. However, families and their socio-economic status have a lot to do with educational outcomes. Family background matters regardless of the country we are looking at. Quality of schooling is something that can potentially be influenced by the government. Moreover,

interventions in the educational system are generally viewed as both more acceptable and more likely to succeed than, for example, direct interventions in the families.

It is more difficult, however, to introduce effective changes that would overcome the effect of the families in developed countries. We may note a shift from the concept of poverty to social inequality. Social inequality refers to the ways in which socially-defined categories of individuals are differently positioned with regard to access to social goods, including education, moreover quality education. Social exclusion is the lack of resources of an individual household, inadequate social participation, lack of knowledge, and lack of power. Social exclusion can be a vicious circle. It can repeat itself for generations. School is only a part of a wide educational community. Students in difficulty are coming, in most cases, from social groups which are themselves disadvantaged.

Educational inequalities are greatly based on social stratification and people's views towards the costs and benefits of education differ between social strata. Educational disadvantage usually stems from more general social and economic disadvantage (Smith, Lusthaus, 1995).

Raymond Boudon (1974) distinguished between the primary and secondary effects of social class in education. The primary effects are the different academic abilities of children, while the secondary effects are the varying educational choices made by children and their families among different social classes. By considering the secondary effects of social class, the organization of an education system comes in place. Social selection is not only caused by institutional selection mechanisms, but also by mechanisms by social self-selection. Thus the different educational opportunities provided by the educational system are highly dependenr on the social class. Boudon's approach goes beyond the human capital approache which is commonly used at the time and tended to view educational outputs as being rated equally among all social classes. He characterizes educational choices as being made relatively within social stratification by taking into consideration the costs and benefits in the course of life. Educational choices that are normally based on a personal point of view, where students and their families take into account personal experiences and their own knowledge of the education system and the function of educational advantages in the course of life, lead to their educational pathway decisions. Because of their different positions in social stratification, the experiences and expectations among people differ. Consequently, their educational pathway decisions differ as well (Pietsch, Stubbe, 2007).

Professor Basil Bernstein (1924 – 2000) was one of the leading sociologists in the world whose work over four decades illuminated the understanding of the relationship

among political economy, family, language and schooling (Sadovnik, 2001). From his first works on language, communication codes and schooling, to his later works on pedagogic discourse, practice and educational transmissions, Bernstein produced a theory of social and educational codes and their effect on social reproduction. He introduced the construct of elaborated and restricted language codes as a way of accounting for the relatively poor performance of working-class students, especially on language-based subjects. While the restricted code works for situations in which there is a great deal of shared knowledge in the group of speakers (slang), the elaborated code spells everything out for everyone to understand. Bernstein argued that restricted language codes are functionally related to the social class, where context dependent language is necessary. Because schools require an elaborated language code for success, this means that working class children are disadvantaged. Bernstein's research argued that working-class students have access to their restricted code(s) – but middle-class students have access to both restricted and elaborated codes, because the middle class is more geographically, socially and culturally mobile. His suggestion is that restricted codes cannot deal effectively with new knowledge and ideas and one who can't handle elaborated code will not succeed in the educational system (Bernstein, 1970).

Additionally, there are more and more new contexts for inclusions and exclusions for different social groups. For example, globalization can be seen as an opportunity for the upper classes to consolidate and increase their positional advantage in relation to the middle or lower classes. International connections are already much more developed between prestigious institutions possessing important economic, cultural, and social resources. In most countries, the lower classes are nationally and even locally oriented in matters of work, culture, and education and thus are more likely to be disconnected from globalization and might be even afraid of it.

Another aspect of concerning constraints and opportunities for parents of different social groups has to do with living environment and its impact on education. In many European countries, most of the population lives in cities that have undergone profound changes affecting the social environment in the neighborhoods themselves and schools children grow up in. This social environment can be considered as a form of individual and collective social capital (Bourdieu, 1980; Coleman, 1988; Lin, 2001; van Zanten, 2005). The geographical location of the neighborhood is important because, even if there is good public transportation, parents generally prefer children to go to a school near their home. In most cases, social groups are not distributed evenly across neighborhoods and segregation is

conceived as an involuntary process associated with various forms of societal inequality and exclusion. This socialization is characterized by externally-imposed social closure, limited economic and cultural resources, and therefore scarce social capital in terms of aspirations and values, as well as social networks.

With the ever growing pressure to succeed, parents must make increasing use of extra-educational resources, such as private tutoring and various learning aids, in order to help children remain engaged in their studies and improve their performance in a more competitive school and job market. Also, television and the internet present new challenges to school culture. From one perspective, these changes create more opportunities for culturally endowed parents to use those cultural resources and influence their children's leisure activities in certain cultural directions that would increase their educational advantages. Form another perspective, it gives more power to parents who have the financial resources to pay for more expensive technology and more expensive tutoring and leisure activities. Although lower-class children are very influenced by television and new technologies, their parents frequently lack the cultural and financial resources to fully use these media as educational resources (van Zanten, 2005).

School choice is becoming more common trend. Choice and competition, along with decentralization and autonomy of school, are considered as institutional features that might be part of a successful educational system (Hanushek, 2007). Research on choice, however, shows that because these strategies suppose parents' economic, cultural, and social resources, they tend to be used more frequently by upper and middle-class parents and thus increase the advantages of the already advantaged (Walford, 1992). Upper-class groups have always used elite schools extensively and had access to the most reputable schools through residential segregation. Parents who want to gain access to the best schools must spend more time choosing schools and developing successful strategies to get their children into them and more money on private lessons for their children to meet the school requirements and get by in competitive environments. Choice also gives different advantages to different middle-class groups. Those who have more financial assets can use the private sector and provide more extra-school support. Those who have more cultural capital, like teachers, can get more information about schools and better prepare their children to get into them. Lower-class families are at a disadvantage in the choice game, not only because they lack the financial, cultural, and capital resources to make the best choices, but also because, in many cases, they do not want to choose. Additionally, lower-class

children are victims of middle-class choices that increase the already high levels of academic and social segregation in the schools they are enrolled in (van Zanten, 2005).

4.2. Community Composition Effects

Society has attempted to offer opportunities to individuals without realizing that people live, move, and altogether exist within the context of groups. According to the wisdom of sociology, effective individuals drive their effectiveness from the groups with which they affiliate and in which they participate. Likewise, effective groups derive their effectiveness from the skills and performance of their members. Individuals operate within the context of social organization (Willie, Alves, 1996).

The level of safety from criminal activity in a community depends not only on the factors used to equip the police department. It depends on the proclivity of residents to commit crimes. Likewise, the quality of education for a particular student depends on the quality of students with which the student associates. Equalizing expenditure levels in different districts will not lead to equity if there are student composition disparities between districts. Each student in a school has a part in determining the quality of education for his fellow students by his impact on peer group quality. Student composition, or peer group effects, refer to the impact that all students in a school have on the quality of educational outcomes. Since the production of educational services requires purchased inputs and a student peer group, additional purchased inputs for a district which has a more disadvantaged peer group might help in order to provide more equity. The quality, not necessarily the cost, of teachers and students, both the individual and his peer group, are the two primary factors that affect the level of educational achievement. Maximization of the average student achievement level among students calls for complete mixing of students from affluent homes and students from disadvantaged homes (Chamberlain, 1987).

Education is one of those numerous human activities characterized by social spillovers. The spillover argument is particularly easy to understand when social circumstances become extreme. For example, in schools with severe drug addiction, parental violence or other serious problems, the learning and teaching activities are constantly compromised, no matter the individual's ability (Vandenberghe, 1996). Clearly the experience of going to school, as opposed to not going to school, tends to make a considerable difference. However, in a developed country with free and compulsory schooling, how much difference does the school a child attends make (Gorard, Sundaram, Smith, 2006)?

Coleman (1966) was the first to claim that a student's achievement is highly dependent on the characteristics of his or her classmates. Compositional, or peer effects, assume that if two students from the same socioeconomic background are placed in two schools with different peer compositions, the student placed in the school with more students from a low socioeconomic background is likely to score lower than the student placed in the school with more students from a high socioeconomic background. Coleman (1966) also provided the first evidence that low-achieving students are more affected by the abilities of their peers than high-achieving students. The Coleman report, also known as Equality of Educational Opportunity, was especially influential in the United States due to its implications for school desegregation (Arnott & Rowse, 1986).

Peer effects have been widely researched in the United States. Summers and Wolfe (1977) found significant peer effects for 6th–grade and 8th-grade students in Philadelphia. The authors concluded that more able students are less affected by the characteristics of their peers than less able students. In earlier studies, Hanushek (1970, 1971) was unable to find peer effects at the classroom level. However, in a later attempt to measure peer effects, Hanushek, Kain, Markman, and Rivkin (2001) found that black elementary school students in Texas scored 0.024 standard deviations higher when placed in a class with 10% less black students. This difference was statistically significant. The comparable estimate for white students was insignificant – .003 standard deviations. White students are not negatively affected by being placed in a school with 10% more black students.

There also is evidence for significant peer effects from outside of the United States. Henderson, Mieskowski, and Sauvageau (1978) found that in Canada (sample drawn from the French part of the Montreal school district), the characteristics of the average students in a class have a strong impact on the achievement of individual students. The peer group effect is measured by the mean IQ of the students in the class in which the student is placed. A major finding of Henderson, Mieskowski, and Sauvageau (1978) is that the peer group effect is nonlinear. The achievement of an individual student increases when the average achievement in the classroom improves, but the increment in achievement decreases with the level of average class ability. The authors concluded that mixing low-performing and high-performing students will have a positive impact on the achievement in the overall student population because the gains of the low-performing students will offset the losses of the high-performing students: "So, if the objective of society is to maximize the overall achievement level of its students, or mean achievement, a uniform mixing of students by achievement will be optimal" (Henderson, Mieskowski, & Sauvageau, 1978, p. 105). The

school-mix matters because it provides the context for creating student's awareness of equity and so acts as a determinant of their lifelong aspirations. People growing up in segregated settings receive poorer instruction, fewer local services, substandard materials, less able teachers, face higher crime, and greater poverty. Thus, they grow up less prepared for academic challenges, and less prepared to face diversity (Gorard, Sundaram, Smith, 2006).

Vandenberghe (2002) has analyzed peer effects using the TIMSS 1995 data for OECD countries. The author concluded that if two students from the same socioeconomic background are placed in two schools with different peer compositions, the student placed in the school with more students from a low socioeconomic background is likely to achieve less than the student placed in the school with more students from a high socioeconomic background. His research supports the finding that students from high socioeconomic backgrounds are less affected by the characteristics of their classmates than students from low socioeconomic backgrounds.

Schuemer (2004) concluded from an analysis of German PISA-E data that the relationship between student composition in a school and the individual student's performance is not linear. She identifies significant threshold effects along the continuum. Whenever the percentage of students from low socioeconomic backgrounds falls below a particular level, the individual student's performance decreases significantly. Further analysis with this dataset has shown that despite a high self-concept of their achievement, students in schools with a high density of disadvantaged peers still are low performers. Students judge their own abilities relative to their classmates. If all peers are low achieving, a student who outperforms his classmates has a high self-concept of his or her own abilities. This also is known as the "big fish little pond effect" (Marsh, Koeller, & Baumert, 1999).

Conceptual and political challenges caused by the proof of existing peer effects should not be underestimated. Social interaction of better educated individuals produces collective benefits of various kinds. Education has long been considered by economists as a source of positive externality[5]. However, social interaction is a local phenomenon and takes place in bounded entities that are separated from each other. When individuals are grouped in a particular neighborhood, school, or classroom, what level of externality do they benefit

[5] Externality is a side-effect on others following from the actions of an individual or group. This effect often is unwished for. For example, while the acquisition of a car may benefit one household by improving mobility, it generates pollution and creates congestion for others. Two types of externality are recognized: public behavior externalities covering property, maintenance, crime, and public behavior, and status externalities resulting from the social and ethnic standing of the household (www.answers.com).

from? Allocation of heterogeneous individuals in strictly delimited entities thus becomes a critical issue. Being in different neighborhoods, schools, or with individuals with different characteristics is considered a social choice problem reflecting individual or collective preferences. Human capital theory puts forward the idea that the major coordination problem is to convince each individual to choose the right level of human capital investment. However, the problem is probably more complex than simply making sure that each individual decides to accumulate the right level of human capital. Education lies at the intersection of two sets of competing rights. The first is the right for parents to choose the experiences, influences, and values to which they expose their children. The other is the right of a democratic society to use the educational system as a way of reproducing its most essential political, economic, and social institutions through a common schooling experience. The second objective is greatly compromised if individuals are inappropriately allocated among schools. Some coordination mechanism must exist to ensure minimal compatibility between conflicting individual and social preferences (Vandenberghe, 1996).

4.3. Parent Involvement

Parent involvement is defined by American National Middle School Association as having an awareness of and involvement in schoolwork, understanding of the interaction between parenting skills and student success in schooling, and a commitment to consistent communication with educators about child's progress (NMSA, 2006). Parental involvement is another form of social interaction significantly influencing educational outcomes. When families are involved in their children's education, children earn higher grades, attend school more regularly, complete more homework, demonstrate more positive attitudes, and are more likely to enroll in higher education than students with less involved families. This holds true for all ages of students. However, the earlier in a child's educational process parent involvement begins, the more powerful the effects will be (Cotton & Wikelund, 1989).

The importance parents place on education is positively related to academic outcomes (Weiss, 1990). Parents influence their child's learning through transmitting norms and some specific behaviors which contribute directly to learning. Even if the control of education remains with professionals, a certain mismatch between home and school priorities is inevitable. Such school-family ties as classroom visits, consultation with teachers and organization of parent-school activities is an influential form of parental involvement (Vandenberghe, 1996).

Joyce Epstein (1995) identified and studied multiple measures of parent involvement. As a result of her research, Epstein and her colleagues developed a framework of the following six types of involvement.

- Parenting (understanding child's development, developmentally appropriate parenting, set home conditions to support learning at each grade level)
- Communicating (home-school)
- Volunteering
- Learning at home
- Decision making
- Collaborating with the community

Similarly, researchers Fan and Chen (2001) examined multiple measures of parent involvement. They identified three constructs of parent involvement:

- Communication
- Supervision
- Parental expectations and parenting style

Moreover, Fan and Chen concluded that parental expectations and parenting style, the manner and extent to which parents communicate their academic aspirations to their children, are the most critical involvements in regard to student performance. Authoritative parenting style, that includes parental warmth, inductive discipline, no-punitive punishment practices, consistency in child rearing, and a clear communication of interest in the day-to-day lives of children, is identified as the preferred style (Pate & Andrews, 2006).

Changes in schools seem to be lagging far behind though. There does not seem to be too many schools that have moved beyond traditional forms of parent involvement. If families are to work with schools as partners in the education of their children, schools must provide them with the opportunities and support they need to become involved. Too often schools expect families to do it all alone. What about orientation and training for parents to become more involved in their children's learning? Research in this area indicates that parents generally want and need direction to participate. Orientation or training can take many forms, from providing written directions with a send-home instructional packet, to providing workshops where parents construct, see demonstrations of, and practice using instructional games. Researchers have also found that the schools with the most successful parent involvement programs are those which offer a variety of ways parents can participate. Recognizing that parents differ greatly in their willingness, ability, and available

time for involvement in school activities, these schools provide a continuum of options for parent participation (Cotton & Wikelund, 1989).

Parental participation in their child's learning is however positively related to parental social class. Low-income parents are often underrepresented among the ranks of parents involved with the school. There can be several reasons for that: lack of time or energy, embarrassment or shyness about one's own educational level or linguistic abilities, lack of understanding or information about the structure of the school and accepted communication channels, perceived lack of welcome by teachers and administrators, and teachers and administrator's assumptions of parents' disinterest or inability to help with children's schooling. Perhaps one of the most important findings of the research, however, is that parents of disadvantaged children can and do make a positive contribution to their children's achievement in school if they receive adequate training and encouragement to do so (Cotton & Wikelund, 1989). The issue is how we can provide for kids who live in abominable situations. We need to focus on the children that need the most and reach out to parents who do not understand how to access the system. Moreover, we need to have public engagement conversations. We also need to influence politicians and to ensure that they understand the importance of parental involvement in education. There is an urgency for action, and the need to build relationships at the local community level (NCPIE, 2000).

4.4. Early Childhood Interventions and School Enrollment Age

The early years of a child's development are critical to establishing a foundation for success in school. Recent research into brain development has revealed the importance of early relationships and experiences to building social, emotional, intellectual, and academic skills that individuals rely on throughout their lives. As discussed before, educational disparities start before school – children from low-income families are found disproportionately in the less formal, less enriched settings, which have been found by research to yield lower school readiness and lower achievement throughout the school years (Brandon, Maher, Joesch, 2003). Early exposure to literacy activities, for example, is a key element of later reading achievement (Mullis, Martin, Kennedy, Foy, 2007).

There are high returns to early investments, whereas of inadequate early interventions, whether invested by the family, preschool, or in the best of circumstances by the combination of both, are difficult and costly to remedy later on. Education learned at one stage is an input into the learning process of the next stage. Returns on educational investment are highest in early childhood because of their compounding effects on

facilitating later learning. Returns of qualitative preschool education are particularly high for children from disadvantaged backgrounds whose homes do not provide them with the foundation of skills necessary to prosper at later educational stages. Lack of public intervention for children from low socio-economic backgrounds has especially harmful effects on further stages of schooling. This perspective, however, requires a particularly long time horizon, which may run against the political self-interest of many policymakers, because the positive returns to early childhood investments may not be fully visible for quite a few years (Woessmann, 2006).

An especially effective approach of early childhood interventions for disadvantaged children is involving them in an intensive preschool setup at very early ages, involving parents to any extent possible, and home visits by such professionals as social workers and early childhood educators (Cunha et al., 2006). Participation in high-quality early childhood education and care programs is positively associated with the cognitive, social, and emotional development of children, their school readiness and achievement for all children, but with associations being especially strong for children from disadvantaged backgrounds (Fuchs & Woessmann, 2004; Kamerman et al., 2006). Thus, early childhood education programs that are particularly targeted at disadvantaged children seem to have strong potential for raising equity (Woessmann, 2006).

Investment in early childhood education has been shown to be an effective strategy for closing the academic achievement gap for low-income children. In the United States, there is a national program, called “Head Start” that promotes school readiness by enhancing the social and cognitive development of children through the provision of educational, health, nutritional, social, and other services. The “Head Start” program provides grants to local public and private agencies to provide comprehensive child development services to economically disadvantaged children and families, with a special focus on helping preschoolers develop the early reading and math skills they need to be successful in school. The “Head Start” program serves children from birth to three years of age in recognition of the mounting evidence that the earliest years matter a great deal to children’s growth and development. The program engages parents in their children’s learning and help them making progress toward their educational, literacy, and emotional goals. “Head Start” offers parents opportunities and support for growth, so that they can identify their own strength, needs, and interests. “Head Start” serves families within the context of the community, and recognizes that many other agencies and groups work with the same families. It advocates for a community that shares responsibility for the healthy

development of all children and families. “Head Start” has already produced dramatic, long-term impacts on the lives of children from disadvantaged families. The program significantly raised the performance scores of all children, with the largest gains being made by the lower-performing children. The program helps narrowing the gap between Head Start children and other American children. Families are served at special centers and/or by home visits. Families receiving the service are 62 percent more likely to read to their children daily than the families that did not receive the program. To achieve lasting impacts and good return on investments, preschool programs must provide quality services. Research based on “Head Start” and other early childhood settings shows that the education level of the preschool teachers is a key factor to quality services (Barnett, 1993, 1995, 2002, 2003; Love et al., 2002).

An alternative to these targeted early childhood programs can be found in regular education as well. Starting primary school at a younger age is another form of early childhood intervention. There is, however, continuing controversy about the optimal or appropriate age at which children should start school. Much research has shown that older children do better on tests, but this is because they are older at the time of testing and, in fact, the results are unrelated to the age they started school (Black, Devereux, Salvanes, 2008).

For most OECD countries, including Canada, Belgium, France, Germany, Italy, Spain, and a majority of states in the US, education is compulsory at age six. In Sweden, Norway, Finland, and Denmark education is compulsory from age seven onwards, whereas for the United Kingdom it is at age five. Most countries give the option for children to start school one year before the compulsory schooling age. In France for example, parents have the possibility to send their children to school starting from the age of 3. In the UK some schools have two or three intakes during the school year, determined by the birth date. Germany is currently discussing multiple intakes during the school year. The Netherlands and New Zealand children can enroll at any time during the school year. In the Netherlands, children are permitted to attend primary school the first day after their fourth birthday, and are required to attend school at the age of five. In New Zealand, both thresholds are set for one year later (Lauven, Lindahl, Oosterbeek, Webbink, 2004).

Some of the former socialist countries have introduced changes in the age children start school during the past ten years. In Slovenia, children now start school at the age of six instead of seven. In the Slovak Republic, primary school begins when the child reaches the age of six, with the possibility of adding a “zero” grade for children aged six who come

from socially disadvantaged backgrounds and have not reached the maturity level necessary for schooling. In Lithuania, however, compulsory education starts either at the age of six or seven. Although age six is the suggested age for starting primary education, there is an increasing tendency for parents to wait until their child is seven years old before beginning school. The author thinks there is a very positive change in Latvia in this regard. Even though primary education starts at the age of seven (the calendar year a child turns seven years old), Latvia has introduced one year of compulsory preprimary education for five and six year old children (the calendar year a child turns six years old). Preprimary education in Latvia focuses on comprehensive child development, health education, and preparation for basic education (PIRLS 2006 Encyclopedia, 2007). The author generally agrees that this innovation should be a very good investment in improving equity in student achievement. However, she is convinced that some special attention should be brought to the disadvantaged regions and families in regard of the quality and intensity of this preprimary education.

Cahan and Cohen (1989) estimated the effect of extra time in school on early test scores in Israel. Overall, the findings indicate that the effect of an additional year of schooling on test scores is about twice the effect of being one year older. Mayer and Knutson (1999) studied the effect of being exposed to school at an earlier age for children in US. They find that starting school a year earlier and having the same amount of schooling results in a reading score increase of 0.403 of standard deviation and a math score increase of 0.261 of standard deviation. Lauven, Lindahl, Oosterbeek, and Webbink (2004) studied the effect of expanding enrollment possibilities in early education on achievement of young children in Netherlands. They find that for disadvantaged children increasing potential school enrollment by one month increases their test scores on average by 0.06 of a standard deviation. This effect is similar for both language and math tests, and it similarly affects children with lower educated parents and minority children. They also find that non-disadvantaged Dutch children do not benefit in test scores from expanded enrollment opportunities. The authors of this research conclude that the 0.06 standard deviation increases in test scores come at a cost of about 354 to 541 Euros per student, per year. This, they stress, compares favorably to the costs and effects of the “Head Start” program in the United States. The effect of “Head Start” participation on early test scores is 0.203 of a standard deviation for disadvantaged children and costs are estimated at approximately 3500 US Dollars per child per year.

With evidence that suggests that early investments have important and long-lasting effects on children's future schooling and lives altogether, politicians must now decide on the most affordable and effective interventions. There certainly is a wide choice of institutional arrangements with regard to school starting age and opportunities for disadvantaged children, publicly provided early education, and targeted early childhood interventions to be considered and adjusted to meet the needs of Latvia.

5. International Comparative Assessments in Education

Meaning often emerges through contrast. We do not know what it means to work hard until we see how hard others work. We do not understand what children can accomplish until we have seen what other children the same age do. So it is with cultures and so it is with educational systems. Cross-country comparisons can help us discover characteristics of our own country that we fail to notice because we are too familiar with them. How do we explain to parents, teachers, administrators, and the general public the student achievement gap, the achievement level it takes to be competitive in the world community (Stevenson, Stigler, 1992)? Generally, people compare against the local benchmarks which either indicate no big problem, our students are doing quite well, or find inequalities that are considered very difficult or even impossible to be influenced by the education system.

It is true that the educational process is very complicated and dynamic. Thus, it is difficult to estimate the influence of separate factors, or factor groups, on development of education. Many of the influencing factors in one individual country are almost permanent and it is difficult to determine their influence only in national studies. International studies can overcome these restrictions. For example, it is possible to estimate the influence of the school starting age, the number of students in class, curriculum, etc. on student achievement. Also, to adopt decisions adequate to the current political and economical situation, politicians, education experts, and administrators of educational institutions need comprehensive and reliable information concerning the current state of affairs in their national educational system when compared to international progress. Again, comparative educational studies are the only way to obtain such information. There are no absolute units or standards to measure the quality of education in different countries as it could be evaluated only in comparative international studies. No country should invest huge resources in education without validation of comparative international results (Geske, 2001).

About 2000 years ago, in the fourth century B.C., Greek philosopher Xenophon already compared educational institutions in Persia and Greece. However, a French researcher, Marc-Antoine Jullien (1775-1848), is historically considered to be “the father” of comparative research in education. He was one of the first to formulate an approach which utilized comparative analysis for the study of education systems. Jullien proposed a systematic and comprehensive study of education throughout Europe and, for the first time, used a questionnaire as the basic instrument (Fraser, 1965). More systematic and

comprehensive evaluation of educational systems started only at the beginning of the 19th century. Michael Sadler (1900) first gave prominence to the need for systematic study of other countries' entire context of educational influences, as an aid to understanding and reforming one's own matrix of learning (King, 2000). The first studies, however, dealt only with descriptions of educational systems, institutions, and programs with no systematic and precise research methods allowing for quantitative comparisons (Geske, 2001). Much information was compiled and disseminated by early comparative education scholars intending on getting "the facts", which in those pre-computer and pre-internet days were far more difficult to ascertain (King, 2000).

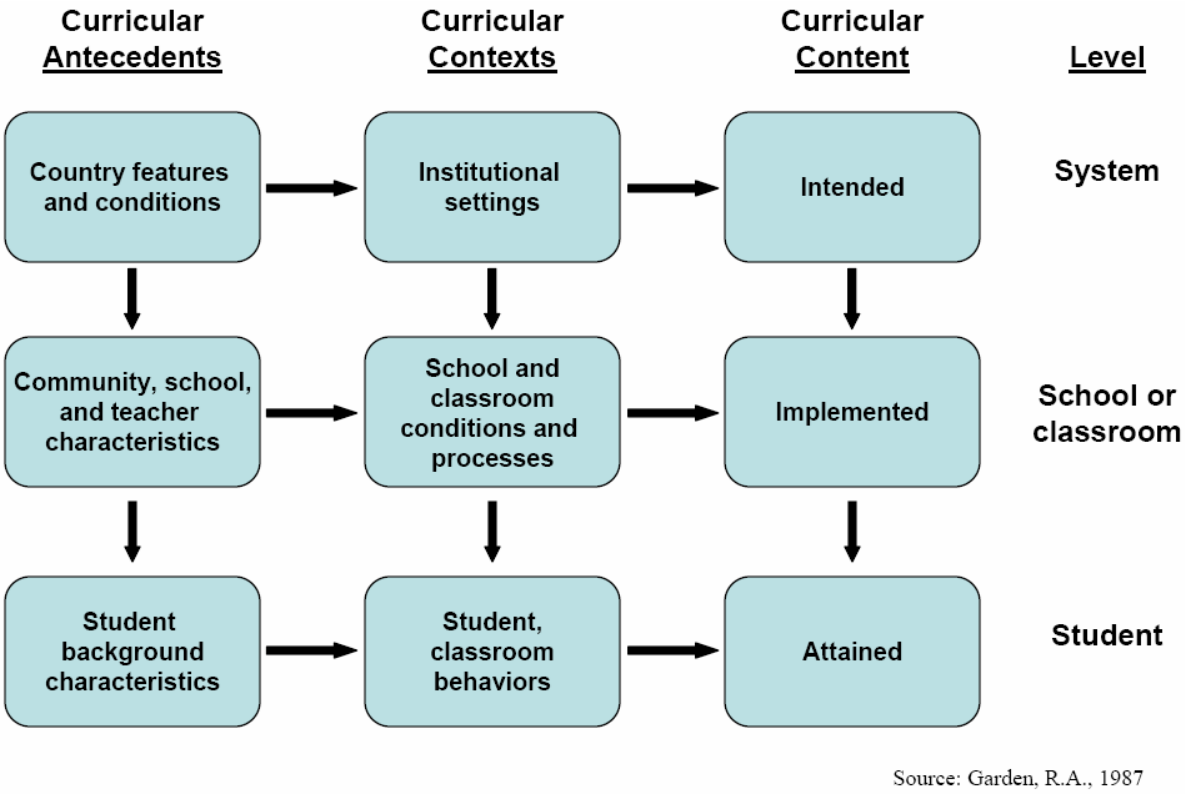
In the 1950s, many countries experienced great educational development and expansion. Many countries, under the auspices of either UNESCO or the OECD, conducted excellent descriptive studies of their education systems. However, more and more educational policymakers felt the lack of comparisons of the productivity or outputs of education systems (Mullis, Martin, 2007).

In 1959, a small group of educational and social science researchers founded the International Association for the Evaluation of Educational Achievement (IEA), the organization that pioneered international assessments of student achievement. At first, the researchers' aim was to understand the great complexity of factors influencing student achievement in different subject fields. "They used the popular metaphor that they wanted to use the world as an educational laboratory to investigate effects of school, home, student, and societal factors, arguing that an international comparative approach was necessary to investigate effects of many of these factors" (Gustafsson, 2008). Even if the IEA became a legal entity only in 1967, the first study "Pilot Study of School Achievement" was conducted already in 1959-1961. The First International Mathematics Study (FIMS) was conducted between 1961 and 1965. In 1970-1971, it was followed by the very large and complex Six Subject Survey that comprised reading comprehension, literature, civic education, French as a foreign language, English as a foreign language, and science. During the 1980s, the studies in mathematics (SIMS) and science (SISS) were repeated and some new studies were introduced.

In IEA studies, participating systems are challenged to review their own structures, practices, and curricula through comparison and contrast with those of other participants. During the second mathematics study, the IEA framework was developed, and with some adaptations, it has been used until today (Figure 5.1). In this model, curricula are examined

at three levels – system, school, and student level and curricular antecedents can be correlated with curriculum contexts to predict curricular content outcomes (Dedze, 1999).

Figure 5.1: A research model for IEA studies (first developed for the SIMS study)



Starting in the 1990s, a new phase in international comparative research in education began. The goal of international comparative studies was reformulated to focus on the outcomes of education, thus essentially limiting the task to being one of describing outcomes, along with some background and process variables. Thus, international studies were transformed to serve the purpose of educational evaluation. More and more educators were interested in the consequences of changes in educational governance and processes of decentralization. Also, great methodological advances had been made in the technology for large-scale assessment of knowledge and skills (item-response theory and matrix-sampling designs). This methodology was well suited for efficient and reliable estimation of system-level performance, and it was skillfully implemented to support the international studies. The IEA's Third International Mathematics and Science Study (TIMSS 1995) was the first study to take full advantage of the new technologies. When the OECD Programme for International Student Assessment (PISA) started in 2000, similar techniques were adopted and the emphasis of the international comparative studies on evaluation of educational

quality in the service of educational policy became even more emphasized (Gustafsson, 2008).

In most Central and Eastern European countries, the assessment of learning achievement used to be limited to ongoing monitoring that is predominantly school-based. The member states of the USSR were not permitted to establish and develop their own educational system. They all had to operate under the auspices of the Soviet educational system, where all strategic decisions were taken in Moscow. The USSR participated in virtually no international comparative studies of educational systems.

For many years Latvia was a part of the USSR, and research in its education system was most often done in order to "prove" the orders given from above were correct (Dedze, 1999). After Latvia regained its independence in 1990, the Ministry of Education and the University of Latvia took the first steps to obtain valid and internationally comparable information about the country's education system. In 1991, the ministry authorized researchers from the University of Latvia (Broks, Grīnfelds, and Kangro) to establish initial contacts with the IEA. Latvia became a member country of the IEA in 1993, and the Senate of the University of Latvia established the IEA National Research Center of Latvia (Geske, Grīnfelds, Kangro, 1997). Since then, Latvia has participated in many studies conducted by the IEA, as well as in the OECD PISA study. The results can be found in numerous publications by Dedze, Geske, Grīnfelds, Johansone, Kangro, Kiseļova, Ozola etc.

The role of forecast and comparative research in educational research is increasing, with a more efficient application of results in the process of developing policies in the field of education. The Ministry of Education and Science of the Republic of Latvia is currently ordering research in the following areas: bilingual education and minority languages; pre-school, basic and secondary, professional, and higher education; youth activities in leisure time; sports education; teachers; education and labor market (The Information Database on Education Systems in Europe, The Education System in Latvia, 2007).

In the following sections the author has summarized information on the IEA reading literacy, mathematics, and science studies. Latvia has participated in these studies since 1992 and many answers could be found using the information gathered during this time. There is information to be found concerning basic and secondary education, teachers, and bilingual education (in most studies Latvian and Russian speaking students were tested). For the purpose of this particular research, the author is using information gathered from the IEA's PIRLS 2006 and TIMSS 2007 (fourth grade) studies. The two studies offer a huge data base on all the major subjects taught through the primary education and accesses

students at the end of the primary education level in the case of Latvia and many other participating countries. As far as the reading literacy that is assessed, this is a very important age, when most children are moving from learning to read to reading to learn. "Students who fail to achieve to learn to read let alone read to learn face enormous problems in coping with the demands of school and society. Only by reading to learn can children become autonomous learners. This literacy helps them become independent thinkers and educated members of society" (Schwippert, Goy, in Schwippert Ed. 2007).

5.1. Reading Literacy and IEA's Progress in International Reading Literacy Study

Reading Literacy

Reading is a process of constructing meaning from written texts. Reading involves a transaction between a reader and a text during which the reader creates purposeful meaning. To date, however, the term "literate" has no universally accepted definition. One of the most significant contributions in the efforts to clarify and to awaken interest in the need for literacy was the UNESCO monograph "The teaching of reading and writing" by Gray in 1956 (Hillerich, 1976). Fifty years ago, Gray pointed out the lack of agreement on a definition of literacy. Even today it seems that unless one is to construe his own original definition, the term literacy is mostly used in order to describe a person's ability to read and write. To acquire the ability to read and write is a fundamental human right and a basic requirement for individual and national development.

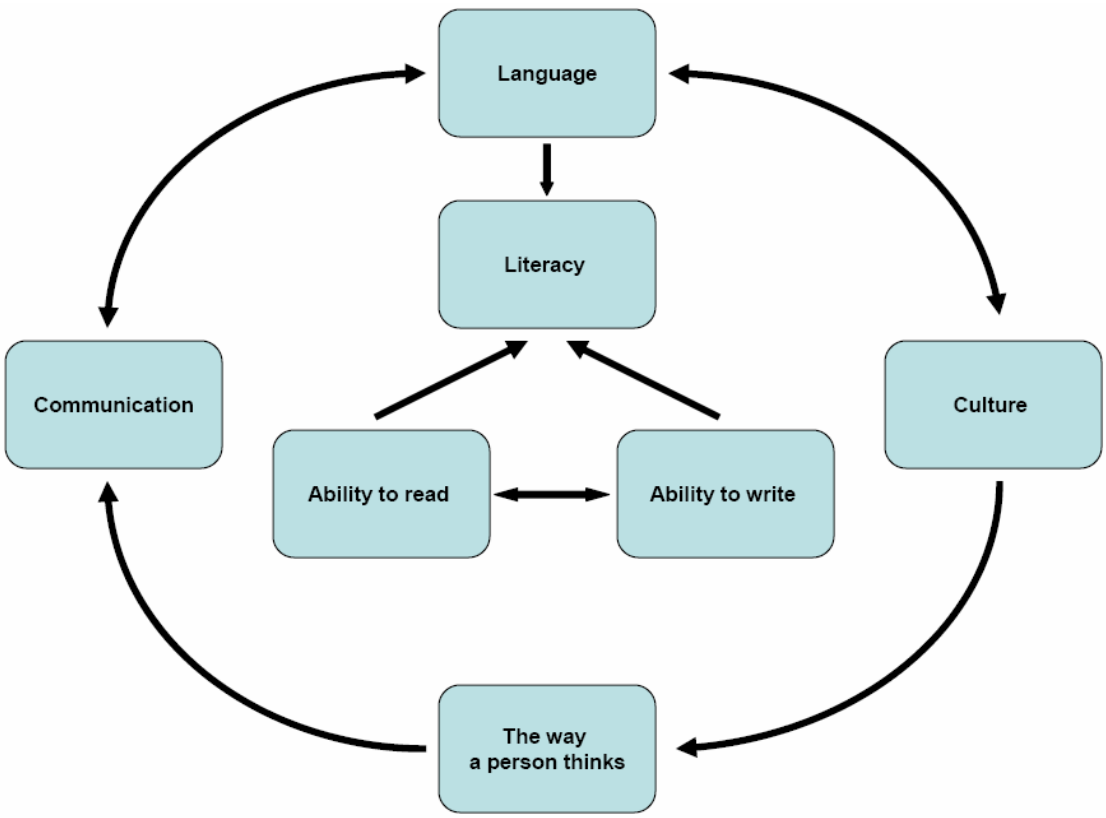
Hillerich (1976) was questioning such a basic definition asking: reading and writing to what extent? With what quality? In his view, this meant that a person either has the ability or does not have it and thus either is literate or illiterate. His argument was that one cannot suddenly move from illiteracy to literacy and any definition of literacy must recognize this quality as a continuum, representing all degrees of development. It also must recognize a three-year old, for example, as he functions at the level of oral communication appropriate to him on the continuum. A person is functionally literate when he has acquired the knowledge and skills in reading and writing which enable him to engage effectively in all those activities in which literacy is normally assumed in his culture and group (Gray, 1956).

Goody (1977) pointed out the effects of literacy on the modes of communication, how changes in modes of communication promote the development of cognitive process by assisting developments in the growth of human knowledge and in the growth of one's capacity to store and to augment that knowledge (Akinnaso, 1981). Written language is a

tool for recording, storing and retrieving information. Literacy is the human capacity to use that tool in the reciprocal activities of storing and recovering information (Dedze, 1999).

The PIRLS 2006 national research coordinator for Latvia, Antra Ozola (2007), illustrates literacy in relation to culture, the way a person thinks, communication and language that lead to the ability to read and write (Figure 5.2).

Figure 5.2: Graphical interpretation of the way to literacy



Source: Adapted from Ozola, A., 2007

"The ability to read is universally regarded as fundamental to all forms of personal learning and intellectual growth. In the modern world, a literate population is essential for a nation's social and economic development" (Campbell, Kelly, Mullis, Martin, Sainsbury, 2001). Research shows that writing leads to improved reading achievement, reading leads to better writing performance and combined instruction leads to a higher level of thinking than when either process is taught alone (Braunger & Lewis, 1998).

"Reading literacy is one of the most important abilities students acquire as they progress through their early school years. It is the foundation for learning across all subjects, it can be used for recreation and for personal growth, and it equips young children

with the ability to participate fully in their communities and the larger society" (Mullis, Kennedy, Martin, Sainsbury, 2006).

Reading Literacy Study (RLS)

In 1988, the IEA General Assembly, composed of research institutes participating in IEA projects, decided to undertake a study of Reading Literacy (RLS). The data collection took place in the period of October 1990 to April 1991 depending on the school year in each country. Research institutes from thirty-two countries participated in the study. Latvia conducted the study one year later than the other countries and therefore its data are not part of the international report. However, it was the first comparative study carried out in Latvia after regaining its independence (Dedze, 1999).

For the purposes of the Reading Literacy Study, reading literacy was defined as: "…the ability to understand and use those written language forms required by society and/or valued by the individual." The major aim of the RLS was to determine the average levels of reading literacy of representative samples of all students in the grades where most nine and fourteen-year olds were to be found. Among other aims reported, the following ones were mentioned by National Research Coordinators (NRCs) in later publications:

- To describe the voluntary reading activities of nine and fourteen-year olds;
- To identify differences in policies and instructional practices in reading, and to study the ways in which they relate to students achievement and voluntary reading;
- To produce valid international tests and questionnaires which could be used to investigate reading literacy development in other countries;
- To provide national baseline data suitable for monitoring changes in reading literacy levels and patterns over time.

The major domains or types of reading literacy materials included in the RLS tests of both age levels were as follows:

- Narrative prose;
- Expository prose;
- Documents.

Here are some findings of the RLS:

- Finland showed the highest reading literacy levels at both age levels in almost all domains.
- The levels of reading literacy were highly correlated across all three domains and across both age groups in all the participating countries.

- The levels of reading literacy were closely related to countries' national indices of economic development, health, and adult literacy.
- Formal instruction did not begin until age seven in four of the ten highest scoring countries at each age level. A late start was not found to be a serious handicap in reading literacy, when judged at age nine. However, when achievement scores were adjusted for economic and social circumstances across all countries, an earlier start was generally found to be an advantage.
- Girls achieved at higher levels than boys in all countries among the nine-year olds and in most countries among fourteen-year olds.
- Children whose home language was different from that of the school showed lower literacy levels in all countries at both age levels.
- Urban children achieved at higher levels than rural children in most education systems. In a few highly developed countries, rural students showed literacy levels as good as, or better than, their city age mates (Elley, 1992).

It can be said that the RLS study paved the way for a further development of the IEA. The study provided researchers with valuable information and data about the teaching and learning of reading, reading practices at school and everyday life, and the importance given to reading by teachers, parents and society (Tiana, 2002).

Descriptive information from the univariate analysis of the findings may be found in Elley (1992, 1994) and Postelethwaite & Ross (1992). More elaborate techniques were used to find differences in teaching strategies by controlling external conditions in Lundberg & Linnakyla (1993). Detailed findings may be found in National Reports produced by individual countries. The results of Latvia can be found in the research results published by Indra Dedze (1999).

Progress in International Reading Literacy Study (PIRLS)

Ten years after the Reading Literacy Study and two years before the United Nations declared the beginning of the "Decade of Literacy" (2003-2012), the IEA launched the Progress in International Reading Literacy Study (PIRLS). The 1991 Reading Literacy Study served as a foundation for PIRLS. PIRLS focuses on the achievement of young children in their fourth year of schooling and the experiences they have at home and at school in learning to read. PIRLS is also designed to measure trends in reading literacy achievement, and thus is conducted every five years. The first PIRLS assessment took place in 2001, which was followed in 2006, and the next assessment is planned for 2011.

Although the 1991 study provided the groundwork for PIRLS, the new framework and specifications were developed for the first assessment in 2001 by Campbell, Kelly, Mullis, Martin, Sainsbury and updated for the 2006 assessment by Mullis, Kennedy, Martin, and Sainsbury.

For PIRLS, reading literacy is defined as: "…the ability to understand and use those written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment" (PIRLS 2006 Assessment Framework, 2006).

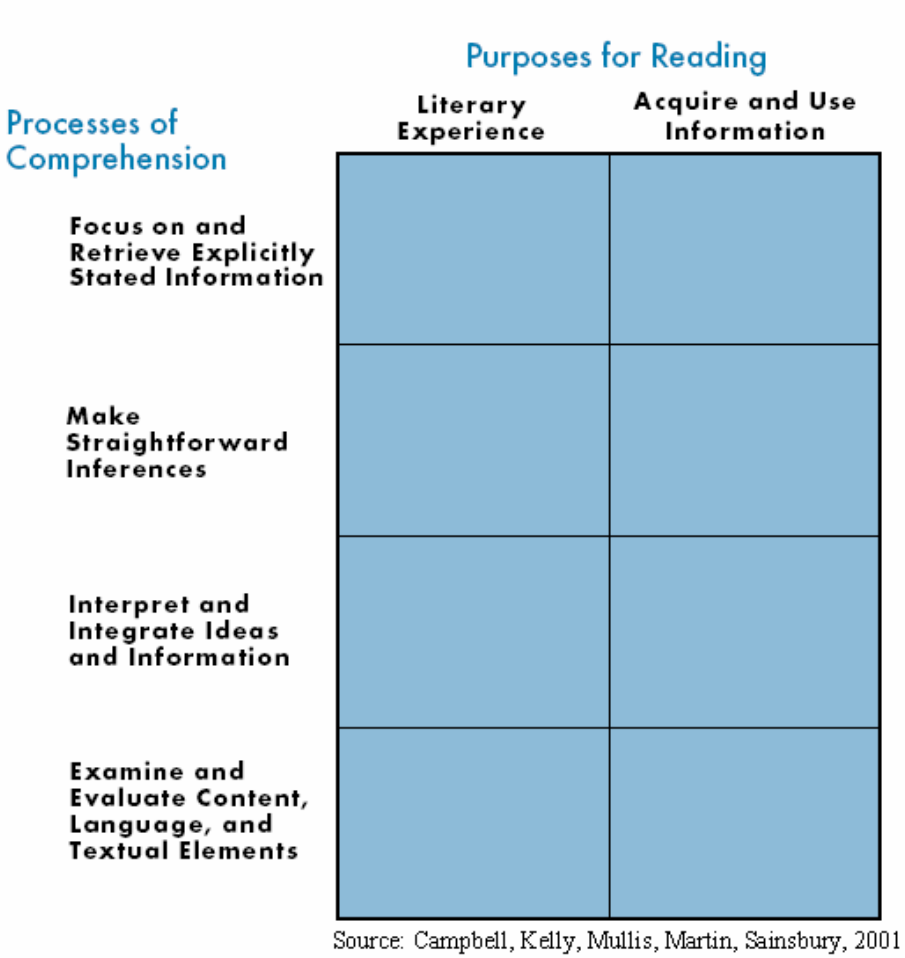
Reading ability develops through extensive reading for a variety of individual purposes. Children who read for meaning monitor their achievement and gain control over the process over time (Association for Supervision and Curriculum Development (ASCD), 1997).

PIRLS focuses on three aspects of student's reading literacy:

- purposes for reading;
- processes of comprehension; and
- reading behaviors and attitudes.

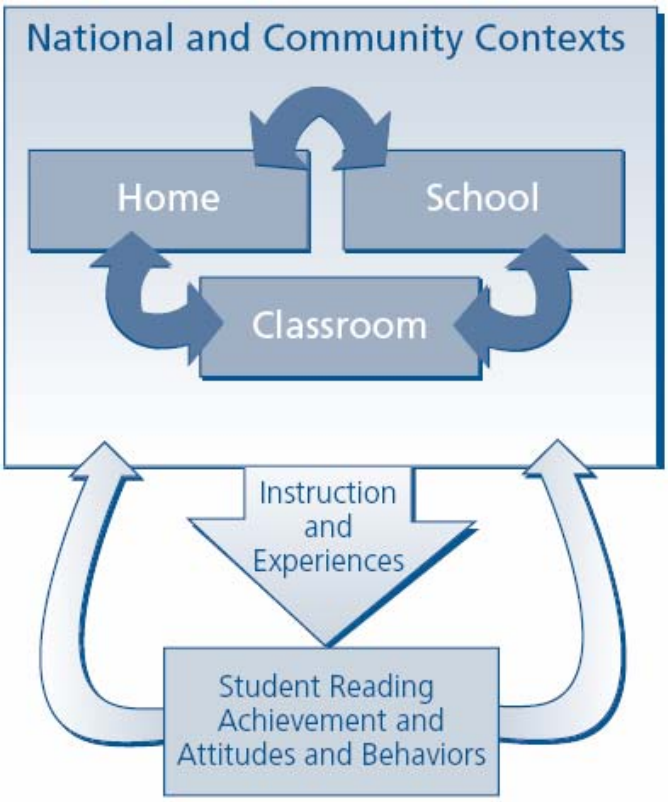
The first two aspects formed the basis for the assessment test. However, reading literacy is directly related to the reasons why people read. For young readers, emphasis is placed on reading for interest or pleasure and reading to learn. Figure 5.3 illustrates the interaction of processes of comprehension and purposes for reading. The two purposes of reading relate to the two types of reading that students engage in both inside and outside school. The processes of comprehension concern how readers construct meaning from the text they have read. Readers construct meaning in different ways. They focus on and retrieve specific information; they make inferences, and finally also evaluate features of the text. Learners have to take responsibility for their own comprehension, asking themselves what prior knowledge they have that fits the approaching topic, adjust their strategies to make the information meaningful, apply the ideas in their own words, and give some personal value (ASCD, 1997).

Figure 5.3: PIRLS reading purposes and processes



Background knowledge and prior experience are critical to the reading process. Reading comprehension is enhanced when readers extend their experiences and background knowledge to increasingly difficult concepts and complex patterns of language. In addition to collecting data on student achievement in reading literacy, PIRLS collects information relating to the context within which students learn to read. Questionnaires addressed the third aspect mentioned above collecting information on home and school factors known to be associated with the development of reading literacy. Figure 5.4 illustrates the relationships among the home, school, and classroom influences on children's reading development and how this interaction is situated within, and shaped by, the community and country. Student achievement and attitudes are products of instruction and experiences gained in a variety of contexts. The model can be viewed as a system of reciprocal influences as student outcomes also feed back into the homes, school, and classroom environments (Mullis, Kennedy, Martin, Sainsbury, 2006).

Figure 5.4: Contexts within which students develop reading literacy



Source: Mullis, Kennedy, Martin, Sainsbury, 2006

For detailed information on contexts for learning to read and their incorporation in the PIRLS study, please refer to the PIRLS 2006 Assessment Framework and Specifications available at http://pirls.bc.edu/PIRLS2006/framework.html. For the PIRLS assessment design and methodological specifications, please consult Section 7.

5.2. IEA's Trends in International Mathematics and Science Study

"Mathematics is a creation of the mind and is not due to the generalization of experiences or to their analysis; nor is it due to an innate form or mold which the mind compels experience to assume, but is the outcome of an evolution, the determining factors of which are the creative ability of the mind and the environment in which it finds the problems which it has to solve in some manner and to some degree" (Shaw, 1918). For more than two thousand years, mathematics has been a part of human search for understanding. Mathematical discoveries have come from the attempt to describe the natural world and from the desire to arrive at a form of inescapable truth from careful reasoning. These remain important motivations for mathematical thinking, but nowadays mathematics has been successfully applied to many other aspects of the human world. Today

mathematics as a mode of thought and expression is more valuable than ever before. Learning to think in mathematical terms is an essential part of becoming an educated person (Lewis, 2008). Thus, prime reasons for having mathematics as a fundamental part of schooling include the increasing awareness that effectiveness as a citizen and success in a workplace are greatly enhanced by knowing and, more important, being able to use mathematics (TIMSS 2007 Assessment Frameworks, 2005).

Science is reasoned-based analysis of sensation upon our awareness. When a manifestation of our reality previously considered supernatural is understood in terms of causes and consequences, it acquires a scientific explanation (http://en.wikipedia.org). Science extends and enriches our lives, expands our imagination and liberates us from the bonds of ignorance and superstition. Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena. What is the purpose of science? Perhaps the most general description is that the purpose of science is to produce useful models of reality. Knowledge in science is gained through research (http://www.sciencemadesimple.com/science-definition.html).

Mathematics is essential to many sciences and behaves like "a language of science". Observing and collecting measurements, as well as hypothesizing and predicting, often require extensive use of mathematics and mathematical models. Virtually every branch of mathematics has applications in science. Mathematics is fundamental to the understanding of the natural sciences and the social sciences, many of which also rely heavily on statistics. Whether mathematics itself can be classified as science has been a matter of some debate. Mathematical theorems and formulas are obtained by logical derivations which presume axiomatic systems, rather than a combination of empirical observation and method of reasoning that has come to be known as scientific method. In general, mathematics is classified as formal science, while natural and social sciences are classified as empirical sciences (http://en.wikipedia.org).

The Third International Mathematics and Science Study (TIMSS 1995) was the first assessment to bring together mathematics and natural science in a single study. TIMSS 1995 assessed student achievement in mathematics and science at three levels of the education system – grades three and four (the end of primary schooling), grades seven and eight (basic education level, middle school, or lower secondary), and twelfth grade (the end of secondary schooling). Already then, additional to the student achievement test, TIMSS included an in-depth analysis of mathematics and science curricula and an extensive investigation into home, school, and classroom contexts for learning.

In the 1990s, there was a growing interest in international studies and a growing acceptance that effective mathematics and science education would be a crucial ingredient of economic development in the increasingly knowledge-based and technological world of the future. Also, at that time, the Soviet Union fell apart and many of the countries regaining their independence (including Latvia) were eager to participate in studies that would provide data to guide the revitalization of their educational systems. Thus, TIMSS 1995 involved almost fifty different countries and became the largest study of its kind at that time. TIMSS 1995 was successful in providing valuable information that could be revealed only from an international study. For example, in several participating countries student achievement in mathematics and science dropped significantly across the grades, where students were doing well in the primary grades, but the longer they stayed in school, the more they fell behind their peers in other countries (Mullis, Martin, 2007).

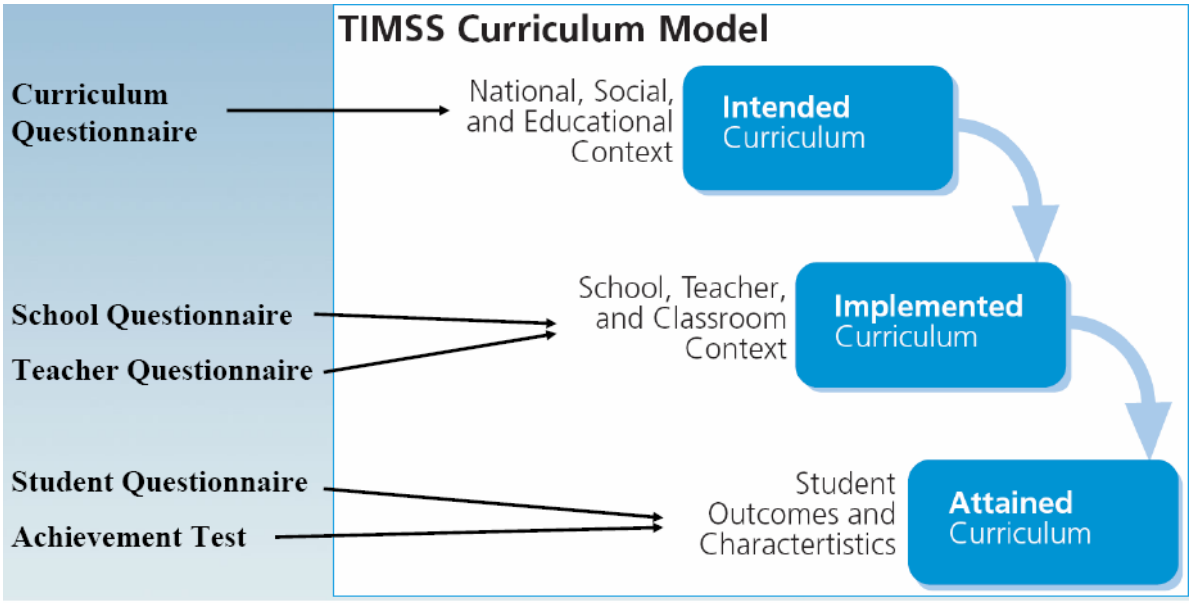
As a result, the IEA decided to administer TIMSS at the eighth grade four years later, in 1999. TIMSS 1999 (at the time known as TIMSS-Repeat) for the first time in an international study provided a solid measurement of trends in student achievement from two points in time – eighth-grade students in 1995 compared with eighth-grade students in 1999 (For the methodological specifications, please consult Section 7). The results provided countries that participated in both assessments with information on changes in their eighth-grade student average achievement in mathematics and science, as well as changes in the social and educational context for learning.

TIMSS results were widely disseminated across participating countries, and the impact on educational systems has been considerable. TIMSS, now renamed the Trends in International Mathematics and Science Study, has become a major component of the IEA's core cycle studies. TIMSS is dedicated to providing a solid measurement of trends in student achievement in mathematics and science at fourth and eighth grades every four years. TIMSS 2003 reported achievement at both grades, extending the trend line from 1995 through 1999 to 2003 for eighth-grade students and from 1995 to 2003 for fourth-grade students (Mullis, Martin, 2007). TIMSS 2007 is currently in its final phase and this dissertation reveals one of the first published results of this assessment. The next TIMSS assessment will take place in 2011, at the same time as PIRLS.

Building on earlier IEA studies of mathematics and science achievement, TIMSS uses the curriculum as the major organizing concept in considering how educational opportunities are provided to students, and the factors that influence how students use these

opportunities. The TIMSS curriculum model (Figure 5.5) has three aspects: the intended curriculum, the implemented curriculum, and the achieved curriculum.

Figure 5.5: TIMSS Curriculum Model



Source: Adapted from Mullis, Martin, Ruddock, O'Sullivan, Arora, Erberber, 2005

"This represents, respectively, the mathematics and science that society intends for students to learn and how the education system should be organized to facilitate this learning; what is actually taught in classrooms, who teaches it, and how it is taught; and, finally, what it is that students have learned, and what they think about these subjects" (TIMSS 2007 Assessment Frameworks, 2005).

TIMSS 2007 is organized around two dimensions, a content dimension specifying the domains or subject matter to be assessed and a cognitive dimension specifying the domains of thinking process to be assessed (Figure 5.6). For the mathematics assessment at the fourth grade[6], the domains assessed focus on geometric shapes, measures, and introductory algebra concepts that are included in the test as part of number. For the science assessment at the fourth grade, the emphasis is on life science instead of biology, physics and chemistry are assessed as one content domain – physical science, and earth science.

[6] For this research, the author is not using the TIMSS 2007 eighth-grade data. Thus, all emphasis are on the fourth-grade only. For detailed information concerning the eighth-grade assessment, and additional information on the fourth-grade assessment, please refer to the TIMSS 2007 Assessment Frameworks available at http://pirls.bc.edu/TIMSS2007/frameworks.html

Figure 5.6: TIMSS 2007 Content and Cognitive Domains at Fourth Grade

Domains	Percentages	
Content	Mathematics Assessment	Science Assessment
Number	50%	
Geometric Shapes and Measures	35%	
Data Display	15%	
Life Science		45%
Physical Science		35%
Earth Science		20%
Cognitive		
Knowing	40%	40%
Applying	40%	35%
Reasoning	20%	25%

Because there are numerous contextual factors that effect students' learning, TIMSS collects a range of information about such contexts together with assessing students' performance in mathematics and science. The TIMSS 2007 Contextual Framework encompasses five broad areas on which information is collected: Curriculum, schools, teachers and their preparation, classroom activities and characteristics, and students. "In particular, TIMSS examines the curricular goals of the education system and how the system is organized to attain these goals; the educational resources and facilities provided; the teaching force and how it is educated, equipped, and supported; classroom activities and characteristics; home support and involvement; and the knowledge and attitudes that students and teachers themselves bring to the educational enterprise" (TIMSS 2007 Assessment Frameworks, 2005).

6. Preprimary and Primary/Basic Education in Latvia

In comparative education, the classic debate focuses on the extent to which educational systems become more similar or retain distinctive structural differences over the course of modernization and globalization. However, modern education was not created overnight in similar contexts but rather emerged over an extended historical period in highly diverse ideological, political, and economic contexts (Cummings, 2008).

Europe is characterized by a very wide variety of education and training systems. To better explore the educational system, particularly specifications of the preprimary and primary/basic education in Latvia, the author has drawn comparisons with six other

European countries. Some of these countries, like Lithuania, the Slovak Republic, and, to some extent, Slovenia share similar experiences in their recent past, while Denmark, Germany, and Sweden have had rather different paths in their development. It is quite obvious that there are more rapid differences among educational systems in later stages of schooling, while the preprimary, primary, and elementary stages are rather similarly organized. At this point, many European countries are even sharing similar reforms in terms of preprimary and primary education, and practically all of the EU countries are placing preprimary and primary education as high priorities for their current reforms. There is a trend towards requiring children to start education at a younger age, with several countries having lowered their school starting ages recently and others making pre-school attendance compulsory (EURYDICE, NFER, 2007).

In Latvia, preprimary education for children less than seven years of age is a part of general education. Preprimary education of five and six year olds is compulsory since the 2002/03school year. However, the reform was not completed overnight and only since 2004/05 did most five and six year olds attend preschool. Unfortunately, this means that the author cannot study any results or effects of this reform using the data from the PIRLS 2006 and TIMSS 2007 studies. There are public and private preprimary education institutions in Latvia. Public sector institutions require that parents make a financial contribution to cover the cost of meals and administrative expenses, but access to educational activities is free of charge. The fee in private sector institutions covers the full costs of the program, except for the salaries of teachers teaching five and six year olds.

Similarly, Denmark has made a year of preprimary schooling compulsory since 2008 and children are enrolled at the age of six. In Germany, the Slovak Republic, and Slovenia children start primary school at the age of six. The Slovak Republic and Slovenia have lowered the school starting age just recently. In most states (Lander) of Germany, responsibility for preprimary education lies with the social ministries and such institutions are mainly run by non-public bodies (primarily churches and welfare associations). In Slovenia, pre-school institutions are set up by municipalities and, even if attendance is optional, more and more children between the ages three and six are participating. In the Slovak Republic however, preprimary education is considered to be the first level of the education system and caters to children from three to six years of age. Attendance is not compulsory, but the strategy is to increase the participation rate of pre-school children by exempting parents from paying the fees for the second child (starting from the 2008/09 school year), and funding pre-school institutions should be set up on more a stable and solid

ground by additional financial support from the State starting 2010. In Lithuania and Sweden, preprimary schooling is not compulsory and children start primary school at the age of seven. However, in Sweden, the municipalities are required to provide early childhood education for all children aged one to five whose parents work or study. Universal preschool gives all four and five year olds the right to preprimary education for at least three hours a day free of charge. The preprimary schooling from the age of six is part of the public school system in Sweden, but attendance is voluntary. In Lithuania, the improvement of preschool availability, quality, and effectiveness is a very high priority. In September 2007, the Lithuanian government approved a "Program for the Development of Preschool and Preprimary Preparatory Education for 2007-2012" developed by the Ministry of Education and Science. The program sets out measures for increasing availability of preschool and the provision of preprimary education, particularly in rural areas, the introduction of more flexible working hours at preschool educational institutions, a greater variety of curricula, improving competencies of the teaching staff and the material facilities of pre-school educational institutions.

In Latvia and the Slovak Republic, preprimary education is mostly organized in accordance of a school-based model, where the children are grouped according to age, just like the organization of classes in primary schools. In Denmark, Germany, and Sweden however, the non-school education-oriented settings for children under 6 years of age, children of different ages are grouped together in accordance with the family model. Furthermore, in Sweden, there is a tendency to group together children of the same family. In Lithuania and Slovenia, both models commonly exist alongside each other (EURYDICE, 2007-2008).

In all countries, official documents state educational objectives for preprimary provision. Generally, they are very similar in all countries: development, autonomy, responsibility, self-confidence, well-being, citizenship, preparation for school life and future education.

Basic or elementary education is compulsory in Latvia until the age of 18. It is organized as a single structure; of primary (ISCED 1) and lower secondary (ISCED 2) education. The first stage of basic education is the primary school (grades 1-4 / age 7-11). Basic education is completed by the end of the ninth grade and usually at the age of 16. When children reach the age of seven, their parents must enroll them in the school of their choice. However, everyone has the right to attend the school closest to home. None of the

public sector education institutions implementing compulsory education may administer admission tests (EURYDICE, 2007-2008).

In the other six countries, the basic education is compulsory until the age of 16. In Germany, the Slovak Republic, and Slovenia, compulsory schooling starts at the age of six with the first grade, while in Latvia and Denmark it starts with the preprimary year for the six year olds. In Lithuania and Sweden, basic or elementary education starts from the age of seven.

The school year in Latvia is from September to the end of May and consists of two semesters. The length of the school year in grade 1 is 34 weeks and in grades 2 through 8, it is 35 weeks. In grades 1 through 9, lessons are 40-45 minutes each, with the maximum weekly study load ranging from 22 to 26 lessons, depending on the grade. The maximum number of lessons in grades 1 through 3 is five per day; in grades 4 and 5, it is six lessons.

To ensure a high quality education, specific requirements have been stipulated by the state for teacher training and teacher qualifications. Since 2004, a teacher must have a university education degree and relevant qualifications in compliance with the procedure set by the Ministry of Education and Science. Thirty-six hours of in-service training are required for a three-year period. There are nine state-run higher education institutions that provide full-time professional teacher-training programs (Ozola, 2007).

Basic education is the core foundation. Education experts agree that the development of higher competences requires at least five to six years of learning the basic cultural techniques of reading, writing and arithmetic (the World Education Forum in Dakar, 2000).

The basic education (grades 1 through 9) standard of Latvia determines the main aims and tasks, the mandatory content, the main criteria, and the arrangement for the evaluation of student achievement in basic education. Subject standards, part of the basic education standard, determine the main aims and tasks of each subject, the mandatory content of the subject, and the forms and order of the evaluation of achievement. The first version of the current primary education standard of Latvia was developed and approved in 1998. Recent changes and developments are reflected in the Regulations Nr. 1027 of the Cabinet of Ministers of Latvia, “About state standard of primary education and subject standards of primary education” (December 19, 2006). In 2007 and 2008, changes were enacted to these regulations.

The compulsory content of basic education should cover the following domains (Geske, Grīnfelds, Ozola, 2008).

- Technology and the basics of science (mathematics, informatics, science, physics, chemistry, biology, and geography)
- Language
- The arts
- People and society

6.1. Reading Curriculum and Instruction in Primary Grades in Latvia

On average, children entering the first grade usually begin reading simple words (1 or 2 syllables). There is no formal requirement for children to be able to read or write before entering school, although an interest in books, printed text, and letters is expected.

The language domain is formed by three main subjects: the Latvian language, a minority language (in minority programs of education), and literature. Reading instruction in the primary grades mainly takes place in Latvian. For grades 1 through 9, the goal is to develop a student's competence in the language of instruction, self-expression skills, communication in the language, understanding of the role of language in his or her personal development, retention of national identity, and development of intercultural dialogue.

The objectives of the language of instruction are to provide each student with the opportunity to:

- Develop language communication skills;
- Acquire the rules and specifics of language function;
- Develop an understanding of the language as a part of the nation's culture and national identity;
- Apply language skills in the learning process and self-expression; and
- Develop skills to improve his or her speech culture, rhetoric, and etiquette.

The language competencies do not explicitly include reading but do contain basic elements such as issues of general linguistics, texts, and sentences. Within the text competency, students are expected to learn about the characteristics of texts (e.g., purposefulness, entirety, coherency, and completeness), themes, main ideas, titles, paragraphs, text types, language styles, and text editing (Ozola, 2007).

Comparing Latvia's reading policy and its national curriculum with the policy and curriculum of neighboring country Lithuania, the author has noticed that actually stressing

the notion of reading being fun and guiding young children into enjoying reading is missing in Latvia, as well as in Denmark, the Slovak Republic, Slovenia, and Sweden. The author thinks that for children of primary school age, learning to enjoy reading should be a primary objective. It is troubling to see that the fourth-grade students in Latvia are one of the least likely to be reading for fun in the world and are significantly less likely to read for fun in 2006 than they reported back in 2001. The situation is similar in Slovenia and Sweden, while, interestingly enough, more than 50% of the fourth graders in Lithuania, are reading for fun every day or almost every day (PIRLS 2006 International Report). Modern child psychology emphasizes that children learn better if they are having fun along the way (Blatz, 1938; Lee, 2005).

The reading requirements that students should achieve by the end of grade 3 in Latvia include the following:

- Read correctly and with understanding a text that is appropriate to his or her learning needs and interests;
- Comprehend the idea expressed in a given text, identify the theme, and understand the connection between the title and theme;
- Recognize lines and paragraphs in a given text;
- Find concrete information in a text, and use it in his or her activities; and
- Recognize the significance of word choice, sentence types, and the use of punctuation marks in the comprehension and creation of a text.

The reading requirements that students should achieve by the end of grade 6 in Latvia include the following:

- Read correctly, consciously, fast, and with expression;
- Identify the theme, main idea, and parts (e.g., introduction, conclusion) of a given text, and understand their roles;
- Understand the systematic character of a given text and the meaning of paragraphs in the creation of a text;
- Evaluate the information given in a text, and use it in his or her activities;
- Develop his or her reading skill purposefully;
- Know the features of the functional styles of a language; and
- Recognize the role of the use of words, syntactic constructions, and punctuation marks in the comprehension and creation of a text.

In grade 4, six native language lessons per week are recommended. There are several textbooks, workbooks, and other instructional materials developed for language instruction in Latvian and minority languages. There is a list of recommended instructional literature for general education institutions prepared by the Center for Curriculum Development and Examinations and distributed to all schools. The list includes experimental books, textbooks, teaching aids, workbooks, and methods handbooks (Ozola, 2007).

6.2. Mathematics Curriculum and Instruction in Primary Grades in Latvia

There are two parts to the mathematics standards for primary grades in Latvia. The first part describes objective and tasks of the subject and is common for all standards. The second part describes the mandatory contents of the subject and it includes all content topics that students should learn in mathematics during basic schooling. The standards also include three sets of requirements that students should achieve by graduating from grades 3, 6, and 9, respectively.

The objective of mathematics is to help students understand mathematical methods and develop their skills to learn about the world, other academic subjects, and multiform activities. The school, in its teaching of mathematics, should aim to ensure that students learn to:

- master the skills to deal with real numbers, using relationships and analytical methods,
- study the geometric figures of planes and their properties,
- develop dimensional perceptions,
- master the skills to research and solve practical tasks by using mathematical models and obtaining, arranging, analyzing data, and forecasting the expected result, and
- promote the development of thinking by forming the ability to express mathematically grounded decisions and improving problem-solving skills.

The mandatory domains of the subject and their related subtopics include the following.

- Formation of mathematical sets of instruments. Number and computations: natural numbers, regular fractions, decimal numbers, rational numbers, and real numbers; algebraic expressions and computations: algebraic expressions, equations with a single variable and systems, single variable inequalities and systems, single argument functions, and strings of numbers; geometric shapes and their study:

basic geometric elements, triangles, quadrangles, circumference and circle, polygons with varied number of sides, regular polygons, symmetry of planar shapes, and geometric figures.

- Use of mathematics in the analysis of natural and social processes. Measurements and their metering, including correlation; elements of information processing, statistics, and the theory of probability; collecting, processing, and analyzing information and groups of elements, as well as the concept of probability.
- Formation of mathematical models and the study of methods characteristic of mathematics. Mathematical language; formation and analysis of mathematical models: specification of a problem, formulating it mathematically, using a mathematical model, solving a mathematical model, and interpreting the solution.

Each teacher in Latvia can use the mathematics standards to make his or her own program for each grade or use an example program that is approved by The Center for Curriculum Development and Examinations. This program and sets of books (student textbooks, workbooks, and the teacher book), approved by the center, are additional information for teachers. For mathematics, the number of lessons per week is four in grades 1 to 4, five in grades 4 to 6, six in grade 7, and five in grades 8 and 9. In grades 1 to 4, there is one teacher for all subjects (with the exception of music, sports, etc.). In grades 5 to 9, there are separate subject teachers (Geske, Grīnfelds, Ozola, 2008).

It is interesting to compare the policy and standards with the ones in Sweden. Surprisingly enough, it is quite rare to see that a country's policy for teaching mathematics to young children would stress the importance of helping children understand the usefulness of mathematics in everyday life. Most countries have standards that list a variety of numerical concepts, mathematical models, statistical methods etc. Sweden, on the other hand, states that the main role of mathematics in compulsory school is to provide students with the knowledge in mathematics needed to make well-founded decisions when making choices in everyday life. Their list of goals for teaching mathematics to young children does not start with mastering the skills to deal with numbers, analytical methods, mathematical models and so forth. They are aiming to ensure that students first develop an interest in mathematics, as well as confidence in their own thinking and their own ability to learn and use mathematics in different situations. Sweden also stresses the importance to help children appreciate the important role of mathematics and the value of using mathematical forms of expression. They mention teaching students to develop their ability to understand, carry out

and use logical reasoning, as well as orally and in writing to explain and provide the arguments for their thinking. The knowledge and understanding of numerical concepts, calculations, mathematical methods, and basic concepts of geometry, statistics, and algebra are listed as abilities students should develop in order to achieve the goals listed above (Fjellstrom, Ramstedt, 2008).

The author has always had a great interest in how to avoid the question asked by so many students, and unfortunately adults as well: "What is the use of mathematics? I'll never use it…" What is wrong with our standards, curriculum, or possibly the way teachers teach mathematics, for students to develop such dislike of mathematics? The author is convinced that the roots could be found in how mathematics is introduced and taught to very young children. Professor of mathematics, Robert H. Lewis (Fordham University, 2008) has put the problem in writing. Mathematics is not about answers, it's about processes. He mentions, as an example, that when a new building is made; a skeleton of steel struts called the scaffolding is put up first. The workers walk on the scaffolding and use it to hold equipment as they begin the real task of constructing the building. The scaffolding has no use by itself and just building it and then walking away, thinking that something of value has been accomplished, would be absurd. Unfortunately, this seems to be happening too often when teaching mathematics. Students learn formulas and how to "plug into them". They learn mechanical techniques for solving certain equations, but all of these things are just scaffolding. They are necessary and useful, but by themselves they are useless. Another example, given by Dr. Lewis, was about an athlete spending hours and hours running on a treadmill. If the treadmill is not seen during the actual competition, was it just a waste to use it? Something of value, namely stamina and aerobic capacity in this case, was produced and is of enormous value even if it is not seen in any immediate sense. So it should be with mathematics education, to produce something of value, true mental capacity and the ability to think. Teaching is not a matter of pouring knowledge from one mind into another as one pours water from one glass into another. It is more like one candle lighting another. Each candle burns with its own fuel. Mathematics education should awaken a love for truth and beauty in the heart of a student after which the student moves forward with powerful interest under the gentle guidance of teachers. Only this kind of approach would inspire love of mathematics instead of diffusing distaste (Lewis, 2008).

6.3. Science Curriculum and Instruction in Primary Grades in Latvia

Just like for mathematics standards, there are two parts (objective and tasks; mandatory domains of the subject) of the science standards for primary grades in Latvia. The standards also include three sets of requirements that students should achieve by the end of grades 3, 6, and 9, respectively. There are more than 100 required items in each of these sets of standards.

The goal of the science curriculum is to create an opportunity for the student to accomplish the following.

- Learn the basics of research work in science
- Study nature's systems and processes by learning to understand the diversity and unity of nature
- Understand the importance of achievements in the natural sciences in the daily lives of humans and understand the necessity of preserving the environment and health by obtaining practical experience in preserving and improving the quality of the environment

In the science standards, the following themes are used as the basis for structuring subject content.

- Basics of research work
- Nature's systems and processes
- Interaction between humans and the environment
- Basics of research activities

The science standards in Latvia are not structured by grade. The sequence of particular topics can be found in the subject syllabus. Taking into account the fact that this syllabus is only a guide, teachers have the opportunity to develop their own syllabi, taking into account the general requirements of the science standards and the general purposes of primary education.

Regulation Nr. 1027 of the Cabinet of Ministers of Latvia, "About state standard of primary education and subject standards of primary education" define two lessons per grade per week in technology and fundamentals of sciences for grades 1 to 6. The number of lessons per week is mandatory. Content coverage is not mandatory, but different subject syllabi are available for all teachers who are not able or do not want to develop their own syllabus. In science, beginning in grade 7, the different subjects (biology, physics,

chemistry, and geography) have their own subject standards (Geske, Grīnfelds, Ozola, 2008).

7. Main Findings and Conclusions of the Theoretical Research

To summarize the review of the literature and findings of research from around the world, the author claims that there is no doubt about the importance and influence of education as such. However, there is plenty of frustration about education policy; educational inputs and outcomes, including the cost, effectiveness, fairness, and student achievement. Although the educational process has been extensively researched; clear policy prescriptions have been difficult to derive. Also, obviously it is not easy to measure quality in education where it is still argued whether excellence, equality, or equity of outcomes is more important. The following findings have grounded the author's research and support the conclusions drawn from it.

- In a knowledge-based society, quality basic and secondary education is the minimum starting capital without which a person's full and successful inclusion in the labor market and everyday life is not possible (Latvian National Development Plan, 2006). At the same time, leading European economic advisors (e.g., Sapir et al. 2003, Calmfors et al. 2006) stress that education and training systems that create efficient and equitable outcomes are key to economic prosperity and social cohesion (Woessmann, 2006).Given the effects of education on individual and society's well-being, the distribution of education is also crucial. Neither excellence alone, with its policy of exclusion, nor equality alone with its policy of inclusion, is sufficient for the attainment of educational eminence. Excellence without a commitment to equality could result in arrogance, and equality without a commitment to excellence could result in mediocrity (Willie, 1987). Years of schooling without quality education are a waste of resources.

The author's argument is that neither of these qualities achieved separately provides the best for the community. Only achieving a balance in all three quality, equality, and equity can be considered a success. Since several IEA's studies have shown that Latvia's overall results in the international arena look rather good, achievement equity across the population becomes one of the most important indicators of the overall quality.

- The early years of a child's development are critical to establishing a foundation for success in school. Recent research into brain development has revealed the importance of early relationships and experiences to building social, emotional,

intellectual, and academic skills that individuals rely on throughout their lives. Educational disparities start before school – children from low-income families are found disproportionately in the less formal, less enriched settings, which have been found by research to yield lower school readiness and lower achievement throughout the school years (Brandon, Maher, Joesch, 2003). Early exposure to literacy activities, for example, is a key element of later reading achievement (Mullis, Martin, Kennedy, Foy, 2007).

Thus, the author is confident of her choice to focus on equity of achievement in primary education in Latvia. The research is based on the primary, and in some respects even preprimary, education because the roots of the education quandary lie in the early years of schooling – both because early learning is a pre-requisite for successful later learning, and because rapid structural changes in modern global economies may require a solid foundation of general knowledge as distinct from specific knowledge.

- While providing universal primary education in developing countries remains a great challenge and a great opportunity (educational success would give millions more the skills to rise out of poverty), most European countries achieve virtually universal enrolment in terms of the quantity of primary and lower secondary (basic) education. Thus quality and equity in education is rapidly becoming a major political issue in Europe and in most other developed countries. It is also true that, in this context, equity is currently a more difficult concept than just equality. Quality and equity in education are proven to be very effective factors in overall economic growth. "There is strong evidence that the cognitive skills of the population – rather than mere school attainment – are powerfully related to individual earnings, to the distribution of income, and to economic growth" (Hanushek, 2007).

An important dimension of educational equity in Latvia is rural/urban disparities in student achievement. Moreover, this is a persisting trend and the gap has kept increasing over time (Johansone, Preuschoff, 2008). For a small country like Latvia, this situation is devastating. The rural-urban achievement gap represents not only a threat to the quality of the educational system in Latvia, but also to its society as a whole. This becomes the major point of investigation within this research.

- Human capital production inevitably takes place in classrooms where students are together and interact. These classrooms are part of a school, and school is a part of

a community. Individuals operate within the context of social organization (Willie, Alves, 1996). Education is one of those numerous human activities characterized by social spillovers (Vandenberghe, 1996). Clearly the experience of going to school, as opposed to not going to school, tends to make a considerable difference. However, in a developed country with free and compulsory schooling, how much difference does the school a child attends make (Gorard, Sundaram, Smith, 2006)? Many empirical studies (Glennester, 1991; Donni & Lejeune, 1994), suggest that low achievers generally originate from poorer socio-economic backgrounds. Already back in 1987, Jay Douglas Chamberlain stated that public finance literature had begun to realize the importance of the quality of community composition in the production of many publicly provided goods, including education.

Further research is driven by the finding that the school and money cannot accomplish everything with respect to education. A large body of research (Coleman, 1966; Summers & Wolfe, 1977; Jencks & Meyer, 1987; Dynarski, Schwab, & Zampelli, 1989; Corcoran, Gordon, Laren, & Solon, 1990; Evans, Oates, & Schwab, 1992; Vandenberghe, 2002; Schuemer, 2004, and many others) has already stressed the importance of non-monetary inputs: social interactions. These social inputs, if properly mobilized, can considerably buttress human capital production and usefully complement what monetary input and organization can do (Vandenberghe, 1996).

- The social inequalities in relation to school are so obvious that we must criticize their scale or be pleased when they are at all reduced. Unfortunately, the inequality is a favorite argument of the defenders of not taking action. International comparisons here become very important. If the inequality is reduced by one or more countries, then the others must countenance some blame for not doing likewise. Also, reliable methods of assessing learning achievement are an important part of an educational system that seeks to meet the needs of all children. Educational policy is difficult or even impossible to establish if the process is based only on data obtained only from one individual country. Many of the influencing factors in one individual country are almost permanent and it is difficult to determine the influence of them only from national studies. International studies overcome these restrictions. For example, it is possible to

estimate the influence of the school starting age, the number of students in class, curriculum, etc. on student achievement (Geske, 2001).

The author believes that meaning in achievement or background characteristics often emerges through contrast. Cross-country comparisons can help us discover characteristics of our own country that we fail to notice because we are too familiar with them. How do we explain to parents, teachers, administrators, and the general public the student achievement gap, the achievement level it takes to be competitive in the world community (Stevenson, Stigler, 1992)? Generally, people compare against the local benchmarks which either indicate no big problem, our students are doing quite well, or find inequalities that are considered very difficult or even impossible to be influenced by the education system. Thus, supported by findings of the literature review, the two most recent IEA studies, PIRLS 2006 and TIMSS 2007 provide a huge source of data with considerable opportunities for research.

- In comparative education, the classic debate focuses on the extent to which educational systems become more similar or retain distinctive structural differences over the course of modernization and globalization. However, modern education was not created overnight in similar contexts but rather emerged over an extended historical period in highly diverse ideological, political, and economic contexts (Cummings, 2008).

To better explore the educational system, particularly specifications of the preprimary and primary/basic education in Latvia, the author is drawing comparisons with six other European countries. Some of these countries, like Lithuania, the Slovak Republic, and, to some extent, Slovenia share similar experiences in their recent past, while Denmark, Germany, and Sweden have had rather different paths in their development. Comparisons are focusing on school starting age and organization of preprimary education, curricula related issues, and equity in student achievement outcomes in each of the comparison countries.

METHODOLOGY

In undertaking a piece of research, inevitably the researcher must choose among different approaches in making an area of interest researchable. The nature and content of the "problem", as well as the extent of the available resources, clearly influence the choice. It is also important to be aware that the different methods available have differing inherent strengths and weaknesses, which need to be taken into account in relation to the goals of the research when an approach is selected (Gill, Johnson, 1988).

Scientific research need not be exclusively equated with the collection and analysis of original data. Some research topics can be examined through analysis of data already collected and compiled. The analysis of existing aggregated data has the great advantage of economy. The researcher does not have to pay the costs of sampling, producing survey instruments, coding, and so forth (Babbie, 1990). Also, just like using existing scientific literature for theoretical analyses of any research topic, previously applied research using the same data can be an extremely valuable input.

The author of this research has been very privileged to have "both" - the opportunity to use the data form well-known large scale international assessments, PIRLS and TIMSS, and at the same time, has taken an extensive part in almost every step of the development and implementation of both studies in Latvia and internationally.

The IEA's PIRLS and TIMSS studies are descriptive surveys based on cross-sectional survey research designs. The qualities displayed in survey research give it much strength in population validity and reliability. Since they entail careful selection of samples, the descriptive and explanatory conclusions reached by this analysis can be generalized to the population from which the samples have been selected. Surveys and censuses differ primarily in that a survey typically examines a sample of a population, while a census generally implies the enumeration of an entire population. A large number of instruments have been designed to capture not only student outcomes, but also many categories of background and explanatory variables. Compared to other methods for causal inference, such as randomized experiments, the data from international studies offer great advantages. They involve large samples collected with sophisticated sampling designs from a large number of school systems, and they are generated with careful attention to quality in every step of the data generation process. However, the studies do not test theories or provide explanations, but rather provide an infrastructure for research through generating data that may be used to investigate a wide range of research questions (Gustafsson, 2008).

8. Assessment Specifications of the PIRLS 2006 and TIMSS 2007 Studies

8.1. Target Population

PIRLS assesses reading literacy at the fourth grade and TIMSS assesses mathematics and science of children in their fourth year of formal schooling. "The target grade should be the grade that represents four years of schooling, counting from the first year of ISCED[7] Level 1, provided that the mean age at the time of testing is at least 9.5 years" (Joncas, 2008). The target population is an important transition point in children's development, when most children have learned how to read and are now reading to learn. Also, this is generally the last year of primary or the first year of basic (lower secondary) education in most countries.

8.2. Sampling and Sampling Weights

As mentioned before, the sample design has to ensure that the survey data provide accurate and efficient estimates of national student populations. All participating countries were expected to ensure that the national defined populations included at least 95 percent of the national desired populations of students. If combined school-level and within-school exclusions exceeded 5 percent of the national desired target population, results were annotated in the international reports (Martin, Mullis, & Foy, 2008). For example, due to financial reasons, Latvia only included schools with Latvian being the language of instruction in their TIMSS 2007 sample.

The basic PIRLS and TIMSS sample design has two stages: schools are sampled with probabilities proportional to size at the first stage, and one or more intact classes of students from the target grade are sampled at the second stage. The method is referred to as a stratified, systematic, two-stage probability proportional-to-size (PPS) sampling technique, where schools are first sampled and then classes within sampled (and participating) schools (Joncas, 2008).

Stratification at the school level was used to complete this technique. School stratification is the grouping of schools into smaller sampling frames according to information found on the initial sampling frame prior to sampling (i.e., students in certain regions or types of schools are represented in the sample in proportion to their distribution in the population) and may be employed to improve the efficiency of the sample design, to sample sections of the population at different rates, or to ensure adequate representation of

[7] ISCED stands for the International Standard Classification of Education Development by the UNESCO Institute for Statistics.

specific groups in the sample (Joncas, 2008). For Latvia, schools were stratified by urbanization as follows.

- Rīga
- Large cities (Rēzekne, Daugavpils, Jelgava, Jūrmala, Ventspils, and Liepāja)
- Small towns
- Rural

For PIRLS 2006, schools also were stratified by region (Kurzeme, Zemgale, Latgale, Vidzeme, Rīga), by language of instruction (Latvian, Russian, and mixed), and by school type (primary, basic, secondary).

Ideally, response rates to study samples should be 100 percent. However, this goal is very difficult, if not impossible, to achieve in many participating countries. To avoid sample size losses, the sampling plan identified replacement schools for cases when a sampled school refused to participate in the study. Replacement schools usually belonged to the same stratum and had other characteristics comparable to the originally sampled school (e.g., school size, language).

The two-stage stratified cluster PPS design generally results in differential probabilities of selection of the students, requiring a unique sampling weight for each participating classroom in the study. Sampling weights were calculated according to a three-step procedure involving selection probabilities for schools, classrooms, and students. The first step consisted of calculating a school weight, which also incorporated weighting factors from any additional front-end sampling stages such as urbanization for Latvia. A school-level participation adjustment was then made to the school weight to compensate for any sampled schools that did not participate and were not replaced. In the second step, a classroom weight reflecting the probability of the sampled classroom(s) being selected from among all the classrooms in the school at the target grade level was calculated. This classroom weight was calculated independently for each participating school. The final step consisted of calculating a student weight. Because intact classrooms were sampled, each student in the sampled classrooms was certain of selection, and so the student weight was 1.0. A non-participation adjustment was then made to adjust for sampled students who did not take part in the testing. This adjustment was calculated independently for each sampled classroom. Thus, the sampling weight is attached to each student record as the product of the three intermediate weights: the first stage (school) weight, the second stage (classroom)

weight, and the third stage (student) weight, including non-participation adjustments (Joncas, 2008).

For detailed information on sampling and sampling weights, please refer to the PIRLS 2006 Technical Report and the TIMSS 2007 Technical Report available at http://timssandpirls.bc.edu

PIRLS 2006 Sample and Participation Rates for Latvia

The sample was selected under the supervision of the TIMSS & PIRLS International Study Center and Statistics Canada. Out of 150 sampled schools, Latvia participated with 147 schools, 211 reading (language) teachers, 4162 fourth-grade students, and 3974 parents.

Overall, 4.7 % of Latvia's fourth-grade students were excluded from the general population because of such reasons as language of instruction, proficiency in the testing language, special needs, etc. (Figure 8.1).

Figure 8.1: PIRLS 2006 General population, Excluded Students, and Participation Rates for Latvia

Number of eligible schools (with Latvian and Russian language of instruction) for PIRLS 2006 target population	825
Number of eligible 4th grade students in Latvia (with Latvian and Russian language of instruction)	20 575
Number of schools with the language of instruction other than Latvian or Russian	6
Number of schools with special needs students	80
Number of very small schools (with less than 4 students in 4th grade)	38
Number of sampled schools	150
Number of sampled students	4 469
Percentage of students excluded at the school level	4.3%
Percentage of students excluded at the student level	0.5%
Number of students participated	4 162
School participation rate (without replacement schools)	97%
School participation rate (with replacement schools)	98%
Student participation rate	94%

According to the IEA rules of exclusion and participation rates, Latvia had a representative sample of its target population (all fourth-grade students in the country). The overall exclusion did not exceed 5% and the participation rates were higher than 85% at all levels.

TIMSS 2007 Sample and Participation Rates for Latvia

Just like for PIRLS 2006, the sample was selected under the supervision of the TIMSS & PIRLS International Study Center and Statistics Canada. Out of 150 sampled schools, Latvia participated with 146 schools, 339 mathematics and science teachers, and 3908 fourth-grade students.

Overall, 4.6% of Latvia's fourth-grade students were excluded from the national desired population because of such reasons as language of instruction, proficiency in the testing language, special needs, etc. (Figure 8.2).

Figure 8.2: TIMSS 2007 General Population, Excluded Students, and Participation Rates for Latvia

Number of eligible schools (with Latvian language of instruction) for TIMSS 2007 target population	647
Number of eligible 4th grade students in Latvia (with Latvian language of instruction)	13 448
Number of schools with Russian language of instruction (including mixed language schools)	193
Number of schools with the language of instruction other than Latvian or Russian	7
Number of schools with special needs students	89
Number of very small schools (with less than 4 students in 4th grade)	35
Number of sampled schools	150
Number of sampled students	4 188
Percentage of students excluded at the school level	4.2%
Percentage of students excluded at the student level	0.4%
Number of students participated	3 908
School participation rate (without replacement schools)	93%
School participation rate (with replacement schools)	97%
Student participation rate	95%

The overall exclusion for Latvia did not exceed 5% and the participation rates were higher than 85% at all levels. According to the IEA rules of exclusion and participation rates, Latvia had a representative sample of all fourth-grade students with Latvian language of instruction, which corresponds to 72% of all the fourth-grade population. Unfortunately, students with Russian as the language of instruction were excluded because of financial reasons. The author has to admit that the participation of Latvia in TIMSS 2007 was in great danger because of financial problems that were resolved only at the last minute. The author is relieved to state however that several previous IEA studies have proven that overall there

is no statistically significant difference in student achievement by language of instruction in Latvia (Geske, 2005; Johansone, 2003).

8.3. Assessment Design

Both assessments comprise written tests together with a set of questionnaires that gather information on the educational and social contexts for achievement. For PIRLS, these are five questionnaires – Curriculum Questionnaire, School Questionnaire, Teacher Questionnaire, Learning to Read Survey (Home Questionnaire), and Student Questionnaire. For TIMSS at the fourth grade, these were four questionnaires – Curriculum Questionnaire, School Questionnaire, Teacher Questionnaire, and Student Questionnaire.

Achievement Tests

Because of the broad coverage and ambitious assessment goals resulting in a large number of items that would require extensive testing time, both studies use a matrix-sampling approach that involves packaging the entire assessment pool of items into a set of achievement booklets, with each student completing just one booklet. For TIMSS, items are organized into item blocks (14 for mathematics and 14 for science with 10 to 15 items per block). Each item block appears in two booklets (14 booklets altogether), providing a mechanism for linking together the student responses from the various booklets. Booklets are distributed among students in participating classrooms so that the groups of students completing each booklet are approximately equivalent in terms of representing the general population. Similarly for PIRLS, blocks (reading passages accompanied by items) must be paired with others. However, if each block is to be paired with all other blocks, the number of booklets would become very large. Thus, for PIRLS 2006, 12 test booklets are derived by combining four literary (L1 to L4) and four informational (I1 to I4) blocks. Each of these blocks appears in three different booklets. Additionally, a 13th booklet, called the "Reader", consists of one literary block (L5) and one informational block (I5) and is not directly linked to any other blocks. However, booklets are assigned to students in such a way that the same proportion of students responds to blocks L5 and I5 as to each of the other blocks. Using Item-Response Theory (IRT) scaling techniques, a comprehensive picture of the achievement of the entire student population is assembled from the combined responses of individual students to the booklets there are assigned.

In order to measure trends for both studies, a portion of the blocks were secured from the previous cycles (2001 for PIRLS and 2003 for TIMSS) to be used again in 2006 and 2007 respectively. For PIRLS 2006, three new literary and three new informational blocks

were used along with the two literary and two informational blocks which were secured from the 2001 cycle. For TIMSS 2007, half of the mathematics and half of the science blocks were the secured ones from the 2003 cycle.

Two item formats are used for both studies – multiple-choice and constructed response. Multiple-choice items provide students with four response options, of which only one is correct. For constructed-response items, students are required to construct a written response, rather than select a response from a set of options. Constructed-response items are particularly well-suited for assessing aspects of knowledge and skills that require students to explain phenomena, interpret data, provide support, or that result in interpretations depending upon students' background knowledge and experiences. About half of the total number of points represented by all items comes from multiple-choice items. Each multiple-choice item is worth one point. For PIRLS, constructed-response items are worth one, two, or three points, depending on the depth of understanding required. For TIMSS, constructed-response items are worth one or two score points, depending on the nature of the task and the skills required. However, TIMSS also uses extended reasoning item sets addressing thinking skills necessary to complete the task. For the reasoning tasks, the number of possible points, typically three to six points, depends on the requirements for students to successfully complete the task. The scoring guides, provided by the TIMSS and PIRLS International Study Center, describe the essential features of appropriate and complete responses for each constructed-response item. They describe evidence of partially correct and completely correct responses and provide a sample of student responses at each level of understanding to help those who will rate the actual students' responses. For more information on specifications of scoring the constructed-response items, please refer to the PIRLS 2006 Technical Report and the TIMSS 2007 Technical Report available at http://timssandpirls.bc.edu. The operational aspects of the scoring procedures is described in the next section of this promotion paper.

The reliability of the reading, mathematics, and science tests was estimated using the internal consistency (consistency over items) approach. The Cronbach's alpha test reliability coefficient for each country is the median Kuder-Richardson Formula (KR20) across the 12 achievement booklets and the reader for PIRLS 2006 and across the 14 achievement booklets for TIMSS 2007. The median of the reading test reliability coefficients across all countries for PIRLS 2006 was 0.88. For Latvia, the median of the reading test reliability coefficients was 0.86 (Mullis, Martin, Kennedy, Foy, 2007). The median of the fourth-grade mathematics test reliability coefficients across all countries for TIMSS 2007 was 0.83. For

Latvia, the median of the fourth-grade mathematics reliability coefficients also was 0.83. The median of the fourth-grade science test reliability coefficients across all countries for TIMSS 2007 was 0.80 For Latvia, the median of the fourth-grade mathematics reliability coefficients was 0.76 (Olson, Martin, Mullis, Foy, Erberber, Preuschoff, 2008).

Curriculum Questionnaire

The National Research Coordinators were responsible for completing the Curriculum Questionnaire(s), drawing upon the knowledge and expertise of curriculum specialists and educators as necessary. The questionnaires are primarily centered on collecting basic information about the organization of the national or regional curriculum, about the content intended to be covered up to the fourth grade and what it prescribed and how it is disseminated.

School Questionnaire

The principal of each sampled school completed a School Questionnaire. Principals answered questions about the emphasis on the curriculum in the school, about enrollment and staffing, resources available to teach reading, mathematics, and science, school goals, instructional time, home-school connections, and school climate.

Teacher Questionnaire

Teachers of the assessed classes responded to a Teacher Questionnaire. The Teacher Questionnaire included questions about the teacher's background, and professional preparation and experience for both studies. For PIRLS, the questionnaire asked about reading activities and materials used for reading instruction and the assessment of students' performance in reading. For TIMSS, teachers were asked about mathematics and science instruction. Teachers were asked to refer specifically to the class of students participating in the study.

Student Questionnaire

Each participating student completed a Student Questionnaire. The questionnaire included questions about such aspects as students' home and school lives, home resources, classroom experiences, self-perception and attitudes about each of the subjects, homework, out-of-school activities, languages spoken in the home, and school safety.

Learning to Read Survey (PIRLS Only)

The parents or guardians of each student, participating in the PIRLS study, completed the Learning to Read Survey. This questionnaire asked about preparations for primary schooling, including attendance in preschool and literacy-centered activities in the home before the child began school, such as reading books, singing songs, or writing letters or

words. Parents answered questions about home resources in addition to information about their highest level of education and employment situations.

8.4. Survey Operations Procedures

Operationally, large scale international studies such as PIRLS and TIMSS represent a considerable challenge. To ensure that the data are internationally comparable, it is essential that all countries complete the procedures specified by the TIMSS & PIRLS International Study Center, and all the activities are carried out in accordance with the international schedule. This was achieved by providing detailed directions and procedural manuals, presenting and explaining all the standardized procedures during the meetings for the National Research Coordinators (even on an individual basis when necessary), and an extensive quality control program implemented internationally and nationally. The author of this promotion paper currently is the coordinator of survey operations and quality control for both PIRLS and TIMSS projects at the PIRLS & TIMSS International Study Center at Boston College.

For more information on survey operations, please refer to the PIRLS 2006 Technical Report and the TIMSS 2007 Technical Report available at http://timssandpirls.bc.edu

National Research Coordinators

PIRLS and TIMSS are cooperative ventures among independent research centers in the participating countries. In each participating country, the national center is responsible for the implementation of the study in that country. The National Research Coordinator is the contact person for all those involved in the study within the country, and is the representative of the country at the international level. The National Research Coordinator ultimately made all of the national decisions regarding the study and, if necessary, implemented and adapted all the internationally agreed-upon procedures for the national context, with guidance from the organizations directing the study and experts from within the country. The author of this promotion paper represented Latvia as a National Research Coordinator for PIRLS 2001.

Field Test

Both studies administered a field test, which was a smaller administration of the PIRLS and TIMSS assessments. The field test was crucial to the development of the instruments, particularly the achievement tests. The newly developed PIRLS reading passages and items for both PIRLS and TIMSS were tried out in a field test in order to investigate the psychometric characteristics of the achievement items and make well-

informed decisions about the best ones. For PIRLS 2006, the field test involved 12 newly developed blocks (6 for each reading purpose). For TIMSS 2007, the field test involved 14 newly developed item blocks (7 for science and 7 for mathematics).

The field test also served to test the survey operations procedures in order to avoid any possible problems during the data collection. An essential step towards achieving this goal was to conduct a full-scale field test of all instruments and operational procedures under conditions approximating, as closely as possible, those of the data collection. Additionally, this allowed the countries to become acquainted with the activities and refine their national operations and provide feedback that was used to improve the procedures for the data collection.

Contacting Schools and Sampling Classes

One of the essential, first steps in the survey activities of both studies was to establish good working relationships with the schools sampled to participate in the study. National Research Coordinators were responsible for contacting these schools and encouraging them to take part in the assessment, which often involved obtaining support from national or regional educational authorities, depending on the national context.

Each participating school provided information on all the eligible fourth grade classes in the school, ensuring that every fourth-grade student in the school was in only one of the listed classes (courses). Using this information, the national centers sampled classes within the schools. Intact classes had to be sampled. These procedures were necessary for a random sample of classes to result in a representative sample of students.

Although all students enrolled in the sampled classes were part of the target population, both studies recognized that some student exclusions were necessary because of either some functional or intellectual disability, or in cases where there were non-native language speakers. Accordingly, the sampling procedures provided for the exclusion of students. It was important that the conditions under which students could be excluded be carefully delineated, because the definition of students with "disabilities" varied considerably from country to country.

Preparing the Test Instruments for Data Collection

The TIMSS & PIRLS International Study Center provided participating countries with the necessary instrument production files, including fonts, style guides, graphic files, and explicit instructions on how to use the materials in order to produce quality test instruments. The achievement booklets and questionnaires were developed using the Adobe®InDesign® layout program.

The overarching goal of the test instrument preparation was to create internationally comparable assessment booklets and background questionnaires that were appropriately adapted for the national context. This began with translating the test instruments from English into the language(s) used in the participating countries. All the translations were verified by independent international verifiers, who provided suggested changes in the texts when appropriate.

Before the test booklets and questionnaires could be printed and administered to students, the NRCs were required to submit a print-ready copy of all the test instruments to the TIMSS & PIRLS International Study Center for layout verification and review of national adaptations.

This whole procedure ensured that students experienced the test instruments in the same way across all participating countries, apart from the translation and national adaptation of text.

Administering the Assessment

The administration of both assessments consisted of two parts. The first part concerned the achievement booklets, which consisted of two testing sessions. This was followed by the completion of the Student Questionnaire. The time allotted for each test session was standardized across countries. To complete each test session for the PIRLS assessment, students were allowed 40 minutes, for a total of 80 minutes, and 36 minutes, for a total of 72 minutes, for the TIMSS study. There was a required break between the two sessions not exceeding 30 minutes. If a student completed session 1 or session 2 of the assessment before the allotted time was over, he or she was allowed to review his or her answers or read quietly, but was not allowed to leave the testing room. To complete the Student Questionnaire, students were given at least 20 minutes for PIRLS and at least 30 minutes for TIMSS.

Considerable effort was expended in developing standardized materials and procedures so that the data collected in each country would be comparable to the greatest possible extent. In order to further ensure the quality of the data, an international quality control program was developed to document data collection activities around the world (Johansone, Kennedy, 2007; Johansone, 2008).

Scoring the Constructed-response Items

The success of assessments containing constructed-response questions depends on the degree to which student responses are scored reliably. This was accomplished through the provision of explicit scoring guides and extensive training in their use, as well as continuous

monitoring of the quality of the work. Two international scoring training sessions were held, where national representatives were trained to score each of the constructed-response items.

In order to demonstrate the quality of the data, it was important to document the reliability of the scoring process within countries, across countries, and across survey cycles. To establish the reliability of the scoring within each country, two different scorers independently scored a random sample of the same student responses. The degree of agreement between the scores assigned by the two scorers is a measure of the reliability of the scoring process. In order to measure the reliability of the scoring process across countries, each country scored the same set of student responses written in English. Computing the level of agreement across countries provided information about how consistently the scoring guides were applied from one country to the next. To measure the reliability of the scoring process over time, a trend reliability scoring activity has been introduced. Using this approach, scorers for the PIRLS 2006 and the TIMSS 2007 assessments scored student responses from 2001 and 2003 respectively. The results were used also as a diagnostic tool to indicate the need for further training of scorers. If agreement on any comparison was below 85 percent, retraining of the scorers was required (Johansone, Neuschmidt, 2008).

For PIRLS 2006, scoring reliability within countries was very high – the percentage of exact agreement, on average, across countries, was 93%. For Latvia, the exact agreement was 90% (Mullis, Martin, Kennedy, Foy, 2007). For the TIMSS 2007 mathematics assessment, scoring reliability within countries was even higher – the percentage of exact agreement, on average, across all the fourth-grade participants was 98%. For Latvia, the exact agreement was 95%. For the science assessment, the percentage of exact agreement, on average, across all the fourth-grade participants was 96%. For Latvia, the exact agreement was 85% (Olson, Martin, Mullis, Foy, Erberber, Preuschoff, 2008).

Creating the PIRLS and TIMSS Data Files

The IEA Data Processing and Research Center provided software to accommodate data entry and data verification. This was crucial in order to incorporate the international codebooks describing all variables and their characteristics. There was one codebook for each of the background questionnaires, one for the test booklets, and one for the Reliability Scoring Sheets. Data files for entering the PIRLS and TIMSS data were created based on these codebooks. The software also offered data and file management capabilities, convenient checking and editing mechanisms, interactive error detection, and reporting and quality-control procedures.

When all data files had passed the national quality control checks, they were submitted to the IEA Data Processing and Research Center, along with data documentation for further processing, input into the international database, and adding sampling weights and achievement scores.

As a result, each participating country received their national data files and documentation to be used for any within-country secondary analyses. For the international database, data for questions that were not internationally comparable, including any added national questions, were removed (Barth, Neuschmidt, 2007). All the data files were provided in SAS and SPSS software systems.

9. Data Analyses

Both studies were very ambitious and demanding, involving complex procedures for drawing student samples, assessing students' achievement, and analyzing and reporting the data. Thus, in order to work effectively with the PIRLS and TIMSS data, it is necessary to have an understanding of the characteristics of the studies. Apart form the general description in this dissertation, all crucial details can be found in the technical reports of both studies, as well as in the user guides for the international databases of both studies.[8]

9.1. The International Database

The international databases for PIRLS (2001 and 2006) and TIMSS (1995, 2003, and 2007) are unique resources for primary education policy makers and analysts. They contain a huge amount of data on student achievement and background variables from countries all over the world. For example, the PIRLS 2006 international database includes data from over 210 000 students and their parents, about 6 750 teachers and school principals. The international databases support and promote secondary analyses aimed at improving primary education by providing the data colleted and processed by the IEA's PIRLS and TIMSS projects. In the international databases (PIRLS and TIMSS), data files are provided for each country that participated in the study and for which internationally comparable data are available (Foy, Kennedy, 2008).

Sampling Weights in the PIRLS and TIMSS Data

The sum of the weights for each national sample estimates the size of the national target population. The student sampling weight, known as TOTWGT in the international database, is used whenever student population estimates are required. The use of TOTWGT

[8] Available at http://timssandpirls.bc.edu

ensures that the various subgroups that constitute the sample are properly and proportionally represented in the computation of population estimates, and that the sample size is inflated to approximate the size of the population (Foy, Kennedy, 2008). For cross-country analyses however, using TOTWGT might not be desirable because larger countries would contribute more than smaller countries. Thus, PIRLS and TIMSS data provides SENWGT, which is a transformation of TOTWGT that results in a weighted sample size of 500 in each country. HOUWGT, on the other hand, ensures that the weighted sample corresponds to the actual sample size in each country and may be used when the actual sample size is required for performing significance tests.

Because some students might have more than one teacher, PIRLS and TIMSS provide a teacher weight – TCHWGT. This weight is used to analyze student and teacher data together.

Finally, the school sampling weight, called SCHWGT, is the inverse of the probability of selection of the school, multiplied by its corresponding non-participation adjustment factor. Although schools generally were sampled with probabilities proportional to size, it is possible to conduct analyses at the school level by using SCHWGT.

Student Achievement Scores and their Sampling and Imputation Variance

Because the test booklet completed by each student contained only a subset of the items in the whole assessment item pool, each student essentially responded to just a part of the assessment, which posed a challenge in terms of determining individual student achievement scores. Thus, PIRLS and TIMSS use a sophisticated psychometric scaling technique (known as item response theory scaling with conditioning and multiple imputation) to derive estimates of the scores the students would have received had they completed the entire assessment. These imputed student achievement scores are appropriate for making inferences about the student population (Yamamoto, Kulick, 2000), but not as reliable measures of individual students' scores.

Because each imputed score is a prediction based on limited information, it almost certainly includes some small amount of error. So that analysts may judge the effect of the imputation on their analyses, the database provides five separate imputed estimates (known as plausible values) for each score. The plausible values are the best measures of student achievement in the international database, and should be used as the outcome measure in any study of student achievement.

Also, because statistics generated from the international database are estimates of national performance based on complex sampling and assessment designs, rather than

simple random sampling and every student in every country answering every item, it is important to have a way of quantifying the uncertainty associated with these statistics.

The international databases also include software (a set of program macros described in Section 9.3) using the jackknife repeated replication technique (JRR) that enables analysts using the SAS or SPSS software systems to combine the results of the five plausible values into a single result and to compute standard errors that incorporate both sampling and imputation errors. The standard errors may be used to create confidence intervals for statistics computed from the TIMSS and PIRLS data.

For international comparisons, the TIMSS and PIRLS scale were to have an average of 500 and a standard deviation of 100. The TIMSS scale metric was established in 1995 and, to enable comparisons across TIMSS assessments, the data from 1999, 2003, and 2007 also were placed on this metric. The same approach is used for the PIRLS study, with the scale metric having been set in 2001. The scale average remains at 500 with each study cycle and provides a fixed point of comparison through time. This is necessary because the international average is obtained by averaging across the mean scores for each of the participating countries, and changes from cycle to cycle based on the set of countries taking part. Using a point of reference that can change substantially from cycle to cycle creates the possibility for misinterpretations, particularly if countries gauge their progress in terms of how far they are above or below this moving target. The fixed average approach by using the scale average as the point of reference avoids misinterpretations based on movement of the international average between cycles.

9.2. Comparative Analyses

Some overall international results are presented in this promotion paper in order for the reader to have an overview of where Latvia's results in the two studies stand internationally. The results from the PIRLS 2006 and TIMSS 2007 international reports were used to give this insight. The reports are available at http://timssandpirls.bc.edu.

The author uses comparisons throughout this research with the results for Sweden, Germany, Denmark, Slovenia, Lithuania, and Slovak Republic. The six countries were chosen based on participation in both studies and being members of the European Union (EU). Four countries joined the EU recently, in 2004. The overall results for these countries vary by up to 27 points for reading literacy achievement, by up to 41 points for mathematics achievement, and by up to 28 points for science achievement. Meaning often emerges

through contrast. The author used cross-country comparisons whenever she recognized they would better explain the meaning of the results.

9.3. Exploratory Analyses

A very important part of this research was selecting background variables (questions) to understand the achievement gap between urban and rural communities in Latvia.

As the first step of this exploratory analysis, the author very thoroughly reviewed the international reports of both studies to find background characteristics that are associated with student achievement, and thus can be used to describe this achievement gap. To no big surprise, there is apparently no clear relationship in Latvia between teacher characteristics, including teachers' education, experience, and age on one hand, and student achievement on the other. In TIMSS 2007 for example, 100% of the fourth-grade students in Latvia were taught by female teachers and 98% of them reported having a university degree but not a postgraduate degree. Other teacher background variables, such as teachers' career satisfaction, were also not associated with students' reading achievement in Latvia (Mullis, Martin, Kennedy, Foy, 2007).

It has been known for a long time that the socio-economic status and urbanization are the most important determinants of student achievement in Latvia (Mullis, O'Martin, Gonzales, Kennedy, 2001). Factors such as teachers' education, teachers' age, homework, or teaching policies are not strong enough to compensate for the socio-economic status and community effect (Johansone, Preuschoff, 2008).

The author reviewed the PIRLS 2006 and TIMSS 2007 background questionnaires and chose questions that could be used to describe the achievement differences between urban and rural communities. Unfortunately, this time around, the content of the PIRLS and TIMSS background questionnaires still differed substantially. Thus, it was not possible to explore the population distribution and relationship with student achievement in reading, mathematics and science based on the same indicators. The author also acknowledges that different background indicators are not equally influential in regards to reading, mathematics or science achievement. Thus, generally it makes perfect sense to choose different background indicators when analyzing student achievement in different subjects. For this particular research, the PIRLS background questionnaires seem to be better suited, especially having the Learning to Read Survey completed by parents. The age of the respondents limits the questions that they can answer accurately. Parents' reports on their educational levels, employment situation, their child's preschool experience, and

educational activities during preschool years are extremely valuable and, unfortunately, missing for the TIMSS study.

Background Variables

This section presents the background variables, including single-item and multiple-item indicators (indices), selected for this research. The variables were grouped into conceptual categories described by single questionnaire items or constructs measured by sets of items, also known as scales. The blocks were:

- Community contexts;
- School resources and school climate;
- Early childhood education (PIRLS only);
- Students' family background; and
- Students' attitudes and self-concept.

Even if the conceptual categories were set the same (except for the early childhood education) for both studies, the indicators used to describe these varied across studies.

Since one of the main objectives of this research was to explore the achievement gap in student achievement in Latvia associated with differences between schools and school location in particular, community contexts became an important aspect to explore. To describe community contexts, and to provide information on the demographics of schools attended by fourth-grade students, the author chose to use data on school location, principals' reports on enrollment figures and the percentage of students from economically disadvantaged homes. In Latvia, schools were stratified by urbanization during the school sampling process. This information was used in this research to determine the urbanization of a community. It was generally used with two categories - "Rural" and "Urban". The communities characterized as urban, included Riga, other cities, and towns. In some analyses "Riga" and "Cities/Towns" were divided into separate categories.

School resources are a factor that can be manipulated externally. Thus its efficiency is evaluated as part of this research. To provide information on school resources, answers of school principals to such questions as availability of enrichment or remedial mathematics and/or science instruction, availability of adult literacy programs, difficulty to fill vacancies (if any), shortages or inadequacy of particular school resources (e.g., instructional materials, budget for supplies, school buildings and grounds, heating/cooling, lighting systems, instructional space, etc.) were included. Also, teachers' responses to questions such as if

reading specialists were available in schools or if they felt prepared to teach different mathematics or science topics.

School climate is supportive for learning. In the PIRLS 2006 results, students at the high level of the Principal's Perception of School Climate (PPSC) index had , on average, higher reading achievement than those at the medium level (Mullis, Martin, Kennedy, Foy, 2007). To explore the school climate in the PIRLS and TIMSS results for Latvia, principals' perception of school climate, including teachers' job satisfaction, teachers' expectations for student achievement, parental support, students' attitudes regards school property and each others welfare, etc., were used.

"Abundant research evidence has established that early exposure to literacy activities is a key element of later reading achievement" (Mullis, Martin, Kennedy, Foy, 2007). To explore the relation of early childhood education and student reading achievement, the author used information collected from parents on their child's experiences in learning to read and exposure to preschool education. Also, it has long been proven that family background has a strong influence on student achievement (please refer to Section 4.1). Literacy resources in students' homes, including socio-economic and cultural capital, such as parental education, parental occupation, and number of books at home, etc. should be strongly influential and, thus, were explored in this research. As mentioned before, it is unfortunate that data on early childhood education, as well as parents' educational and occupational background are not available in relation of mathematics and science achievement. In TIMSS, only eighth-graders were asked about their parents' education and occupation. That is because the majority of fourth-graders would most likely not have given accurate answers on their parents' education and occupation. Also, fourth-graders themselves would most likely not remember much of their preschool experience, or would have difficulty understanding such questions. Thus, this information is not available for the fourth-grade student population in TIMSS. Instead, the author used data available from students' reports on home possessions (e.g., books in the home, computer in the home, internet in the home, own room, etc.) as indicators for the socio-economic background of their families.

The author believes that positive student attitude towards learning and a healthy self-concept, regardless whether it is toward reading, mathematics, and/or science, should be an important goal especially in primary school curricula. To explore the relationship between students' attitudes toward learning and achievement, the author used students' agreement with statements about reading, mathematics, and/or science (Figures 9.1 – 9.2). To explore

the relationship between student self-concept and achievement, the author used students' agreement with several statements regarding their self-confidence in reading, mathematics, and/or science.

Some variables were recoded for better overseeing the distribution of responses. For example, the original non-categorical variable, containing school principals' answers on enrollment of students in the school, was split into four categories.

Some variables were reverse coded in order to match the scale direction. For example, there are questions using a four-point Likert scale format (e.g., strongly agree, agree, disagree, and strongly disagree) with some positive statements (e.g., I enjoy learning mathematics) and some negative statements (e.g., Mathematics is boring). One of these statements, usually the negative one, was reverse coded in order to make sense conceptually.

The background questionnaires within each of the two studies included sets of questions that relate to the same underlying construct. These questions were combined to form indices (multiple-item indicators) to better represent constructs that cannot be or are difficult to capture with a single question. Some indices were already calculated for the international database while others were created specifically for this research.

Computing Questionnaire Indices (Multiple-item Indicators)

Indices are a special type of derived variable that assigns students to one of three levels – high, medium, and low – on the bases of responses to the questions chosen for an index. The high category of an index includes the responses that are expected to represent aspects of a supportive learning environment, and the low category includes those responses that are expected to represent the least supportive learning environment (Martin, Preuschoff, 2008). For example, students at the high level of the PIRLS 2006 index on students' reading attitudes (SATR) (described in Figure 9.1) reported that they agree on statements: I read only if I have to (reverse coded); I like talking about books with other people; I would be happy if someone gave me a book as a present; I think reading is boring (reverse coded); and I enjoy reading. In contrast, students at the low level of this index disagreed on the same statements, except for the negative statements which were reverse coded.

There were five internationally created and one author created PIRLS 2006 index included in this research. There were seven internationally created and one author created TIMSS 2007 index included in this research. For the internationally created indices used in this research, the scales were created by calculating averages of the responses and assigning students to the three levels based on cutoff points. For the indices created by the author, the

scales were created by combining the responses and directly classifying cases into the high, medium, and low level of an index depending on combination of responses to the source questions.

For PIRLS 2006, such an index of students' socio-economic background (SEB) was created. Students were assigned to the low index level if:

- their parents reported to have 100 or less books in the home,
- both parents' highest level of education was some secondary or less, or both parents' highest level of education was post-secondary but not university, and
- either parent or both parents worked less than full-time for pay.

Students were assigned to the high index level if:

- their parents reported to have more than 100 books in the home, and
- either parent's highest level of education was finished university or higher.

All other combinations were assigned to the medium category.

For TIMSS 2007, an index of students' socio-economic background (SEB) also was created. Based on students' responses to two questions in the Student Questionnaire about possessions students have in their homes. These possessions included the number of books in the home (0-10 Books;11-25 Books; 26-100 Books; 101-200 Books; More than 200 Books) and a list of six home possessions (Computer; Internet Connection; Own room; Encyclopedia; DVD Player; CD player). Students were assigned to the low index level if they reported to have:

- 100 or less books in the home and two or less of the six home possessions.

Students were assigned to the high index level if they reported to have:

- more than 100 books in the home and at least four out of the six home possessions.

All other combinations were assigned to the medium category.

In constructing an index, it was important that the component variables were intercorelated so that together they formed a reliable scale and also that they were correlated with student achievement. Responses were included in an index variable calculation only if there were data available for two thirds of the component variables (Martin, Preuschoff, 2008).

Figures 9.1 and 9.2 provide information on the variables used in this research from the PIRLS 2006 and TIMSS 2007 data respectively.

The corresponding questions from the background questionnaires for PIRLS 2006 and TIMSS 2007 are available at http://timssandpirls.bc.edu/pirls2006/context_quest.html and http://timssandpirls.bc.edu/timss2007/context_quest.html respectively.

Figure 9.1: Description of the PIRLS 2006 Variables

Variable	Description
Community Contexts	
IDSTRATE and IDSTRATI	Sampling stratification variables Urban / Rural
ACBGENR	School Questionnaire: What is the total enrollment of students in your school as of <first day of month PIRLS testing begins, 2005/2006>? Response options recoded by author: 1 = Less than 70 2 = 71 – 100 3 = 101 – 500 4 = More than 500
ACBG4ENR	School Questionnaire: What is the total enrollment of <fourth-grade> students in your school as of <first day of month PIRLS testing begins, 2005/2006>? Response options recoded by author: 1 = Less than 8 2 = 9 - 25 3 = 26 - 50 4 = More than 50
ACBGPST1	School Questionnaire: Approximately what percentage of students in your school come from economically disadvantaged homes? 0 – 10% 11 – 25% 26 – 50% More than 50%
School Resources and Climate	
ACDGASR	Internationally created index availability of school resources (ASR). Based on School Questionnaire: How much is your school's capacity to provide instruction affected by a shortage or inadequacy of any of the following? Qualified teaching staff. Teachers with a specialization in reading. Second language teachers. Instructional materials (e.g., textbooks). Supplies (e.g., papers, pencils). School building and grounds. Heating/cooling and lighting systems. Instructional space (e.g., classrooms). Special equipment for physically disabled students. Computers for instructional purposes. Computer software for instructional purposes. Computer support staff. Library books. Audio-visual resources. Response options: 1 = Not at all; 2 = A little; 3 = Some; 4 = A lot Responses for each category were averaged across each principal. High level corresponding to an average of 1 to less than 2; Medium level corresponding to an average of 2 through 3; and Low level corresponding to an average greater than 3 through 4.

Variable	Description
ACBIDIS1	The authors created derived variable on programs available in school. Based on School Questionnaire: Are any of the following programs and services available at your school site for the children and families in your school? Adult literacy program for <language of test> speakers (ACBGPRS1). Adult literacy program for non <language of test> speakers (ACBGPRS2). Parent education programs (e.g., classes on child development, education on being a parent) (ACBGPRS3). Health or social services (ACBGPRS4). Response options: Yes; No 1 = Responded “No” to all four categories 0 = Responded “Yes” to any of the four categories.
ACDGPPSC	Internationally created index on principals’ perception on school climate. Based on School Questionnaire: How would you characterize each of the following within your school? Teachers’ job satisfaction. Teachers’ expectations for student achievement. Parental support for student achievement. Students’ regard for school property. Students’ regard for each other’s welfare. Response options: 1 = Very high; 2 = High; 3 = Medium; 4 = Low; 5 = Very low Responses for each category were averaged across each principal. High level corresponding to an average of 1 to less than 2.33; Medium level corresponding to an average of 2.33 through 3.67; and Low level corresponding to an average greater than 3.67 through 5.
Early childhood education	
ASDHEHLA	Internationally created index on early home literacy activities. Based on Learning to Read Survey: Before your child began <ISCED Level 1>, how often did you or someone else in your home do the following activities with him or her? Read books. Tell stories. Sing songs. Play with alphabet toys. Play word games. Read aloud signs and labels. Response options: 1 = Often; 2 = Sometimes; 3 = Never or almost never Average was computed across the 6 categories. High level indicates an average of 1 to less than 1.67; Medium level indicates an average of 1.67 through 2.33; and Low level indicates an average greater than 2.33 through 3.
ASDHAIB	Internationally created index on early literacy skills. Based on Learning to Read Survey: How well could your child do the following when he/she began <ISCED Level 1>? Recognize most of the letters of the alphabet. Read some words. Read sentences. Write letters of the alphabet. Write some words. Response options: 1 = Very well; 2 = Moderately well; 3 = Not very well; 4 = Not at all Average was computed across the 5 categories. Very well indicates an average of 1 to less than 1.75; Moderately well indicates an average of 1.75 through 2.5; Not very well indicates an average of greater than 2.5 through 3.25; and Not at all indicates an average of greater than 3.25.

Variable	Description
ACDHDIS1	Learning to Read Survey: The authors created variable, containing information from the international variables ASBHOATT and ASBHOHLO. How long your child attended <ISCED Level 0>? 1 = Not at all 2 = Up to and including 2 years 3 = More than 2 years
Students' family background	
ASDHDIS2	The authors created index on socio-economic background. Based on Student Questionnaire and Learning to Read Survey. Books at home (ASBGBOOK). Parents' education (ASBHLEDF; ASBHLEDM). Parents' employment (ASBHEMPF; ASBHEMPM). For calculation of the index, refer to page 84.
Students' attitudes and self-concept	
ASDGSATR	Internationally created index on students' reading attitudes. Based on Student Questionnaire: I read only if I have to (reverse coded). I like talking about books with other people. I would be happy if someone gave me a book as a present. I think reading is boring (reverse coded). I enjoy reading. Response options: Agree a lot = 1; Agree a little = 2; Disagree a little = 3; Disagree a lot = 4 Average was computed across the five questions. High level indicates an average of 1 to less than 2; Medium level indicates an average of 2 through 3; and Low level indicates an average of greater than 3 through 4.
ASDGSRSC	Internationally created index on students' reading self concept. Based on Student Questionnaire: Reading is very easy for me. I do not read as well as other students in my class (reverse coded). When I am reading by myself, I understand almost everything I read. I read slower than other students in my class (reverse coded). Response options: Agree a lot = 1; Agree a little = 2; Disagree a little = 3; Disagree a lot = 4 Average was computed across the five questions. High level indicates an average of 1 to less than 2; Medium level indicates an average of 2 through 3; and Low level indicates an average greater than 3 through 4.

Figure 9.2: Description of the TIMSS 2007 Variables

Variable	Description
Community Contexts	
IDSTRATE and IDSTRATI	Sampling stratification variables Urban / Rural
AC4GTENR	School Questionnaire: What is the total enrollment (number of students) in all grades? Response options recoded by author: 1 = Less than 70 2 = 71 – 100 3 = 101 – 500 4 = More than 500
AC4GEENR	School Questionnaire: What is the total enrollment in the fourth-grade? Response options recoded by author: 1 = Less than 8 2 = 9 - 25 3 = 26 - 50 4 = More than 50
AC4GSBED	School Questionnaire: Approximately what percentage of students in your school come from economically disadvantaged homes? 0 – 10% 11 – 25% 26 – 50% More than 50%
School Resources and Climate	
AC4NMAT1 AC4NSCI1	The authors created derived variables on programs available in school. Based on School Questionnaire: Does your school do any of the following for students in the fourth-grade? Offer enrichment mathematics (AC4MSOEM). Offer remedial mathematics. (AC4MSORM) Offer enrichment science (AC4SSOES). Offer remedial science (AC4SSORS). Response options: Yes; No 1 = Responded “No” both categories 0 = Responded “Yes” to any of the two categories.
AC4GFTVY	School Questionnaire: How difficult was it to fill fourth-grade teaching vacancies for this school year? Were no vacancies. Easy to fill vacancies. Somewhat difficult. Very difficult.

Variable	Description
ACDMSRMI ACDSSRSI	Internationally created index availability of school resources for mathematics (ASRMI) / science instruction (ASRSI). Based on School Questionnaire: Is your school's capacity to provide instruction affected by a shortage or inadequacy of any of the following? Instructional materials (e.g., textbook). Budget for supplies (e.g., paper, pencils). School buildings and grounds. Heating/cooling and lightening systems. Instructional space (e.g., classrooms). Computers for mathematics instruction. Computer software for mathematics instruction. Calculators for mathematics instruction. Library materials relevant to mathematics instruction. Audio-visual resources for mathematics instruction. Response options: 1 = None; 2 = A little; 3 = Some; 4 = A lot Responses for each category were averaged across each principal. High level corresponding to an average of a-e is less than 2 and the average value of g-k is less than 2; Low level corresponding to an average of a-e is greater than or equal to 3 and the average value of g-k is greater than or equal to 3; Medium level corresponds to all other answer combinations.
ATDMTTOV ATDSPTOV	Internationally created derived variable on teacher being prepared to teach all the mathematics / science topics. Based on Teacher Questionnaire: How well prepared do you feel to teach the following mathematics (20 topics listed) / science (22 topics listed) topics? Response options: Not applicable = 1; Very well prepared = 2; Somewhat prepared = 3; Not well prepared = 4 Computed percent of students whose teachers indicate “Very well prepared” for each of the topics.
ACDGPPSC	Internationally created index on principals’ perception on school climate. Based on School Questionnaire: How would you characterize each of the following within your school? Teachers’ job satisfaction. Teachers' understanding of the school's curricular goals. Teachers' degree of success in implementing the school's curriculum. Teachers' expectations for student achievement. Parental support for student achievement. Parental involvement in school activities. Students' regard for school property. Students' desire to do well in school. Response options: 1 = Very high; 2 = High; 3 = Medium; 4 = Low; 5 = Very low Responses for each category were averaged across each principal. High level corresponding to an average of less than or equal to 2; Medium level corresponding to an average of greater than 2 and less than or equal to 3; and Low level corresponding to an average greater than 3.

Variable	Description
Students' family background	
ASDHDIS2	The authors created index on socio-economic background. Based on Student Questionnaire. Books at home (AS4GBOOK). Computer at home (AS4GTH02). Internet at home (AS4GTH05). Study desk at home (AS4GTH03). Dictionary at home (AS4GTH04). The four <country-specifics> at home (for Latvia those were – own room; encyclopedia; DVD player; and own CD player (AS4GTH06; AS4GTH07; AS4GTH08; AS4GTH09). For calculation of the index, refer to page 84.
Students' attitudes and self-concept	
ASDMPATM ASDSPATS	Internationally created index on students' positive affect toward mathematics / science. Based on Student Questionnaire: How much do you agree with these statements about learning mathematics / science? I enjoy learning mathematics / science. Mathematics / science is boring (reverse coded). I like mathematics / science. Response options: Agree a lot = 1; Agree a little = 2; Disagree a little = 3; Disagree a lot = 4 Average was computed across the five questions. High level indicates an average of less than or equal to 2; Medium level indicates an average of greater than 2 and less than 3; and Low level indicates an average of greater than or equal to 3.
ASDMSCM ASDSSCS	Internationally created index on students' self concept in learning mathematics and science. Based on Student Questionnaire: How much do you agree with these statements about learning mathematics / science? I usually do well in mathematics / science. Mathematics / science is harder for me than for many of my classmates (reverse coded). I'm just not good at mathematics / science (reverse coded). I learn things quickly in mathematics / science. Response options: Agree a lot = 1; Agree a little = 2; Disagree a little = 3; Disagree a lot = 4 Average was computed across the four options. High level indicates an average is less than or equal to 2; Medium level indicates an average is greater than 2 and less than 3; and Low level indicates an average is greater than or equal to 3.

Once the set of variables was chosen for each of the two studies, univariate statistics and bivariate associations between the variables (percentages, means, and regression coefficients) were computed for all variables of interest.

The JACKGEN, JACKPV, JACKREG, and JACKREGP macros, provided with each of the international databases, were used for these calculations. The JACKGEN macro is used to compute percentages and means of continuous variables (percentages of students within specified subgroups and their mean on a variable of choice) with their JRR standard

errors. The JACKPV macro computes percentages and mean achievement scores (percentages of students within specified subgroups and their mean achievement scores) based on plausible values with their JRR standard errors. The JACKREG macro is used to perform a multiple linear regression between a dependent variable and a set of independent variables. It computes the regression coefficients and their JRR standard errors. The JACKREGP macro is used to perform a multiple linear regression between a set of plausible values as the dependent variable and a set of independent variables. It computes the regression coefficients and their JRR standard errors (Foy, Kennedy, 2008).

9.4. Modeling Student Achievement in Latvia

Relying solely on univeriate and bivariate statistics can easily lead a researcher to reach overly simplistic and sometimes misleading conclusions. That is because a host of other factors, besides the one independent variable, most likely had some influence on students' scores. By using multivariate statistics, it is possible to control for other influences. Any multivariate analyses can tell the researcher how well each independent or control variable predicts scores on the dependent variable (Buddenbaum, Novak, 2001).

Additionally, in the case of multistage sampling designs like in PIRLS and TIMSS, the lower level units (classrooms, students) are not selected independently: "…having selected a primary unit (a school, for example) increases the chance of selection of secondary units (students, for example) from that primary unit" (Snijders, Bosker, 1999). Also, students within schools and classrooms share the same context (e.g., teacher, peers) and are more similar to each other than students randomly drawn from different classes and schools. Thus the PIRLS and TIMSS data are hierarchical in nature, with students within classes and classes within schools.

Consequently, a multilevel approach was adopted for this research. Multilevel modeling explicitly models the nested structure of the data using separate regression equations at each level describing how variables at one level influence variables at the other level. In other words, multilevel modeling summarizes evidence across all groups while keeping in mind that each school may have its own regression line. Also, group characteristics can be used to model individual outcomes. (Harrison, Raudenbush, 2006).

"Hierarchical linear models (HLM) explicitly recognize the presence of hierarchical units of analysis and allow modeling them simultaneously, in interrelated sub-models" (Ramirez, 2004).

Intraclass Correlation

Before modeling student achievement, it was important to know the extent of achievement variance at the level of school/class and at the level of students within those schools/classes. The purpose of a one-way Analysis of Variance (ANOVA) is to determine whether the differences among 2 or more means are greater than would be expected from sampling error alone (Glass, Hopkins, 1996). It also provides a measure of the proportion of variance at the school level (intraclass correlation).

Moreover, the intraclass correlation offers a measure of equity, or disparity, of learning opportunity (equity of student achievement outcomes). Systems with a low intraclass correlation have achieved a measure of equity whereby all schools perform at roughly equivalent levels. The intraclass correlation coefficient, a correlation coefficient which varies between 0 and 1, is the correlation between the micro-units belonging to the same macro unit. The coefficient is defined as the proportion of total variance accounted for by between group variance.

$$\mathrm{I}CC = \frac{\tau_{00}}{\tau_{00} + \sigma^2}$$

τ_{00} = variance between groups (schools/classes)

σ^2 = variance within groups (students within schools/classes)

First, the ratio of school and class mean variance to the total achievement variance was estimated. In this model, the variation in the dependent variable (reading, mathematics, and science achievement respectively) is partitioned into three components – between schools, classes, and students within those classes. No predictors were used at this point. The results provide an estimate of the variation in group means relative to the population grand mean. The results for Latvia were compared to the ones for Sweden, Germany, Denmark, Slovenia, Lithuania, and the Slovak Republic. In a scenario whereby only one classroom per school is sampled, we can claim only to have a sample of classrooms, as opposed to a sample of schools, from the whole population. Thus, the intraclass correlation becomes more a measure of the disparity between classrooms in the population than between schools (Foy, 2004). This was the case for Denmark and Germany in PIRLS 2006 and for Germany in TIMSS 2007. Thus there is no coefficient estimated for between-school variance in Denmark and Germany respectively.

As the next step, the author explored the variance structure using a three-level analysis of variance model (Foy, 2004). Three variance components, schools, classrooms, and students, were estimated. The Mean Square Total, or an estimate of the total variance, is

presented along with the variance components. The total variance is the sum of the four variance components.

Finally, a fourth level, variance explained by urbanization at the school level, was added for Latvia.

Hierarchical Linear Models

The community composition/peer effect was analyzed using multilevel analysis. Multilevel analysis was performed based using Hierarchical Linear Model (Raudenbush, Bryk, 2002). Multilevel analysis is a special form of regression analysis, which takes into account nesting in the data.

In large-scale assessment studies such as TIMSS or PIRLS multistage sampling designs are more practical and cost-efficient than simple random sampling designs. Also, such designs allow addressing policy relevant questions about relationships between macrolevel characteristics, such as peer composition, and microlevel characteristics, such as student achievement. In multistage sampling designs students are not selected independently like in simple random sampling designs. In other words students don't have the same probability of being selected. Having selected a primary unit (school) increases the probability of selecting a secondary unit (student) within that school. Students within schools share the same context (e.g., teachers, peers) and are more similar to each other. The nested structure of the data has to be taken into account when analyzing TIMSS or PIRLS data.

The advantage of multilevel modeling is that the nested structure of the data is explicitly modeled using separate regression equations at each level. These separate regression equations describe how variables at one level influence variables at the other level. Multilevel modeling is an efficient way of summarizing evidence across all groups while keeping in mind that each school has its own regression line (Harrison, D.M. & Raudenbush, S.W., 2006).

Multilevel modeling allows variables to be included in the model at different levels of the hierarchy. Group characteristics can be used to model individual outcomes. Also, multilevel models are a tool to test cross-level interactions. Multilevel modeling can be used to partition variance into its components at different levels. This information is useful to describe the impact of certain policies or organizational characteristics (e.g., tracking).

Multilevel analysis also allows to control for individual students' socioeconomic background and for the aggregated socioeconomic background simultaneously. This analysis was performed at the student and school levels. An indicator of students'

socioeconomic background was computed for each study. The descriptions on how the indices were derived can be found earlier in this section.

The models first take into account only the students' individual socioeconomic background and early childhood education (PIRLS only). Further school level (Level-2), variables such as urbanization and the aggregate socioeconomic background at schools, are added.

The adjusted reading achievement score represents the achievement of an average student for continuous variables and a student in the reference categories for dummy variables. The reference category is, for example, a student at the low socio-economic background (SEB) index level, whose school is in a rural community and is in a school with 50% or less fourth-grade students at the at the medium or high SEB index level.

The adjusted mathematics and science achievement score represents the achievement of an average student for continuous variables and a student in the zero categories for dummy variables. For example a student at the low SEB index level whose school is in a rural community and has an average percentage of students at the medium or high SEB index level. The adjusted mathematics and science achievement score represents the achievement of an average student in the zero categories or reference category (low SEB index level in a rural school with 10% or less students at the high SEB index level).

The peer effect is conceptualized as a threshold effect. The peer effect is not expected to be constant anywhere along the continuum of students' aggregated socioeconomic background. Instead of estimating a linear effect, cutscores or thresholds were selected at which peer composition appeared most influential.

RESULTS AND DISCUSSION

Since the author believes finding meaning in achievement or background characteristics emerges through contrast, the discussion of the results is presented through comparisons whenever possible. First the overall international results are presented, followed by the estimation of variance components in reading, mathematics, and science achievement for Latvia in relation to Denmark, Germany, Lithuania, the Slovak Republic, Slovenia, and Sweden. Further, the discussion continues with the distribution of student achievement in Latvia and the most influential background determinants of the achievement results by urbanization. Finally, the author presents models on how different characteristics of community or peer composition (threshold effects for community composition) can affect the achievement of individual students.

10. Overview of the PIRLS 2006 and TIMSS 2007 International Results and Latvia's Achievement in Them

The author first reflects on some of the main international results and important comparisons concerning Latvia in particular from both PIRLS 2006 and TIMSS 2007 studies. The international reports for both studies are available at http://timssandpirls.bc.edu.

Latvia can be proud of its overall results. In both studies, Latvia's average achievement was well above the scale average. However, this overall success should not lead to ignoring some of the problems within the educational system. In addition to the analysis of the achievement gap by urbanization and achievement variance among schools, this research presents other results from the international reports that deserve closer attention from researchers and policy makers as they reveal possibly serious concerns. For example, Latvia had the lowest percentage of students with positive attitudes towards reading and one of the highest percentages of students with negative attitudes towards reading among all participating countries. Additionally, students' attitudes towards reading and mathematics are significantly dropping over time. Since correlation between students' attitudes and student achievement tends to be very strong, policymakers should be concerned that such a trend might eventually negatively influence student achievement. On the other hand, the percentage of students with high self-concept in reading has significantly improved since 2001. The author believes that students' high self-concept is a very positive characteristic, because students in Latvia did have relatively high overall reading

achievement. However, the author would be concerned to see the country developing a downward trend in achievement and attitudes while self-concept is getting higher.

The author thinks that there are some valuable lessons to be learned from the education policies of the Asian countries (in this research they are Hong Kong and Singapore in particular). Back in 2001, international results showed that most of the European countries participating in PIRLS had significantly higher reading achievement than the participating Asian countries. In mathematics and science, however, the participating Asian countries demonstrated higher results than the rest of the participating countries also back in 2003. Thus one could easily think that their educational systems put more emphasis on these subjects. Looking at the latest international results in 2006 and 2007, that is not the case anymore. These Asian countries are the world's leaders in all major primary school subjects, leaving all European countries and the United States well behind. Research on possible effective policy changes in the countries achieving such remarkable improvements might be very valuable.

Achievement in Reading Literacy

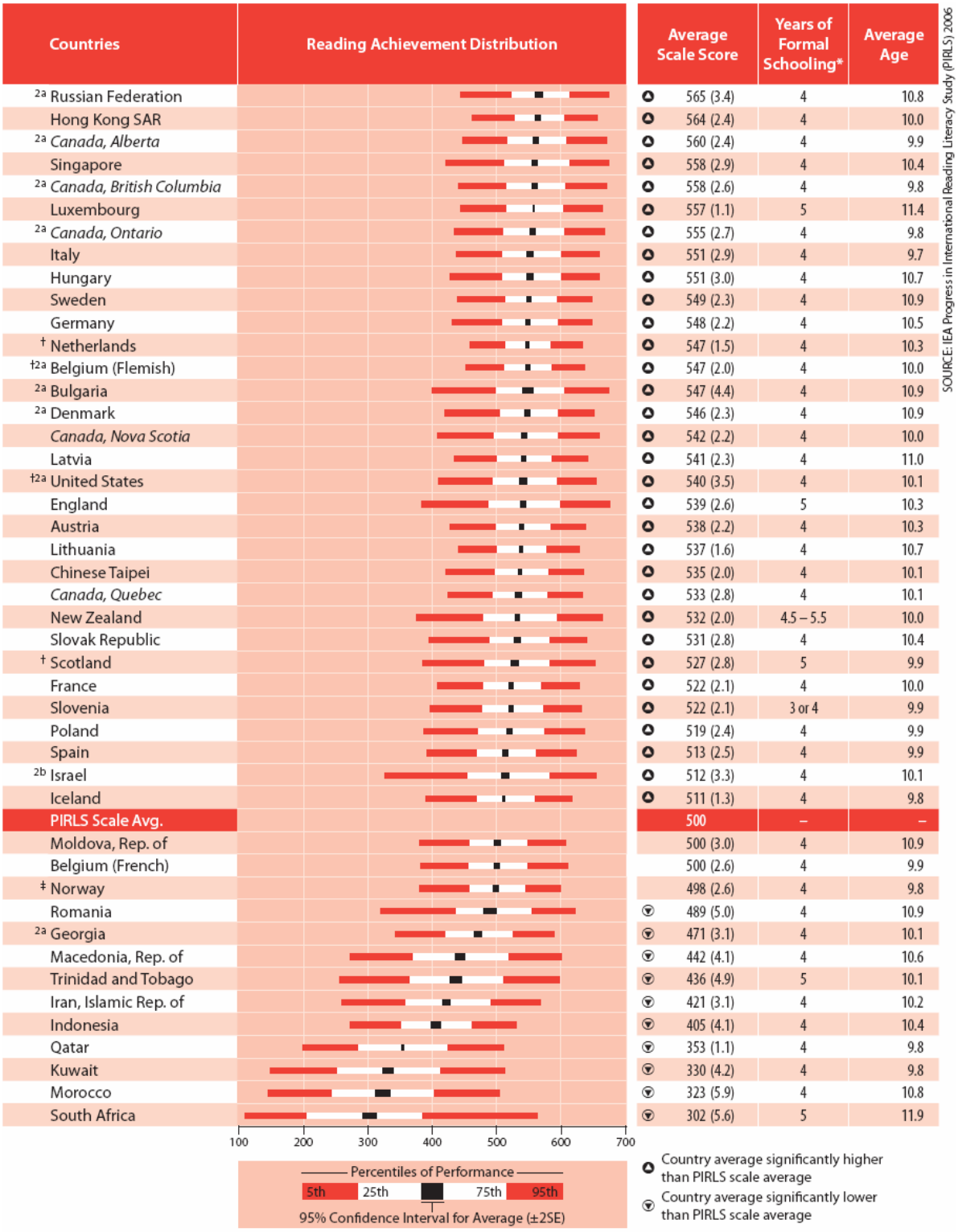
The overall reading achievement results for all participating countries are shown in Exhibit 10.1 (Source: Mullis, Martin, Kennedy, Foy, 2007). The exhibit also shows the distribution of the results and the 95% confidence interval of the achievement means for each country. The average achievement for Latvia was 541 scale points with a standard error 2.3. The exhibit also shows that most countries assessed students in their fourth year of formal schooling. Six countries tested students in their fifth grade, either because children start school at the age of five, or there have been special interests as in the case of Luxembourg and South Africa. Slovenia included some students in third grade because the country is in transition toward having students start school at a younger age to have four years of primary schooling instead of three, but the transition is not yet complete. The highest average age of fourth graders among all countries was in Latvia, 11.0 years. The youngest children assessed for PIRLS 2006 were in Italy, 9.7 years old on average.

In order to see if the differences in average achievement among the participating countries were statistically significant, the author presents Exhibit 9.2 (Source: Mullis, Martin, Kennedy, Foy, 2007). To read the exhibit, select a country of interest and read across the table. A circle with a triangle pointing up indicates significantly higher performance than the comparison country listed across the top. The absence of a symbol indicates no significant difference in performance, and a circle with a triangle pointing down indicates significantly lower performance than the comparison country. Latvia had a

significantly lower average reading achievement than in 13 other participating countries. They include Sweden and Germany. At the same time, Latvia's average achievement was comparable to 8 other countries, including Denmark and Lithuania. And finally, Latvia significantly outperformed 23 countries, including the Slovak Republic and Slovenia.

It is important to mention that back in 2001 Latvia's overall results in the PIRLS study were higher (Exhibit 10.3). Even if the difference was not statistically significant, there is a reason to be cautious of such a trend, especially since most other international studies to date have shown a rapid growth in Latvia's achievement since regaining its independence (Geske, 2000; Kangro, Geske, 2001; Geske 2002; Geske, Grīnfelds, Kangro, Kiseļova, 2004; Geske, Kangro, 2004; Geske 2005). Also, countries like the Russian Federation, Hong Kong, Singapore, and Slovenia have shown amazing improvements since 2001, and it is worth looking into their latest educational policies that have been so successful. Sweden, however, has experienced an unexpected drop in their students' reading literacy achievement since 2001. Lithuania, the Netherlands, England, and Romania also have experienced significant negative trends in reading achievement since 2001.

Exhibit 10.1: Distribution of PIRLS 2006 Reading Achievement.



* Represents years of schooling counting from the first yearof ISCED level 1.

** Taken from United Nations Development Programme's Human Development Report 2006, p. 283–286, except for Chinese Taipei taken from Directorate General of Budget, Accounting and Statistics, Executive Yuan, R.O.C. Statistical Yearbook 2005. Data for Belgium (Flemish) and Belgium (French) are for the entire country of Belgium. Data for England and Scotland are for the United Kingdom.

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included.

2a National Defined Population covers less than 95% of National Desired Population.

2b National Defined Population covers less than 80% of National Desired Population.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit 10.2: Multiple Comparisons of PIRLS 2006 Average Reading Achievement.

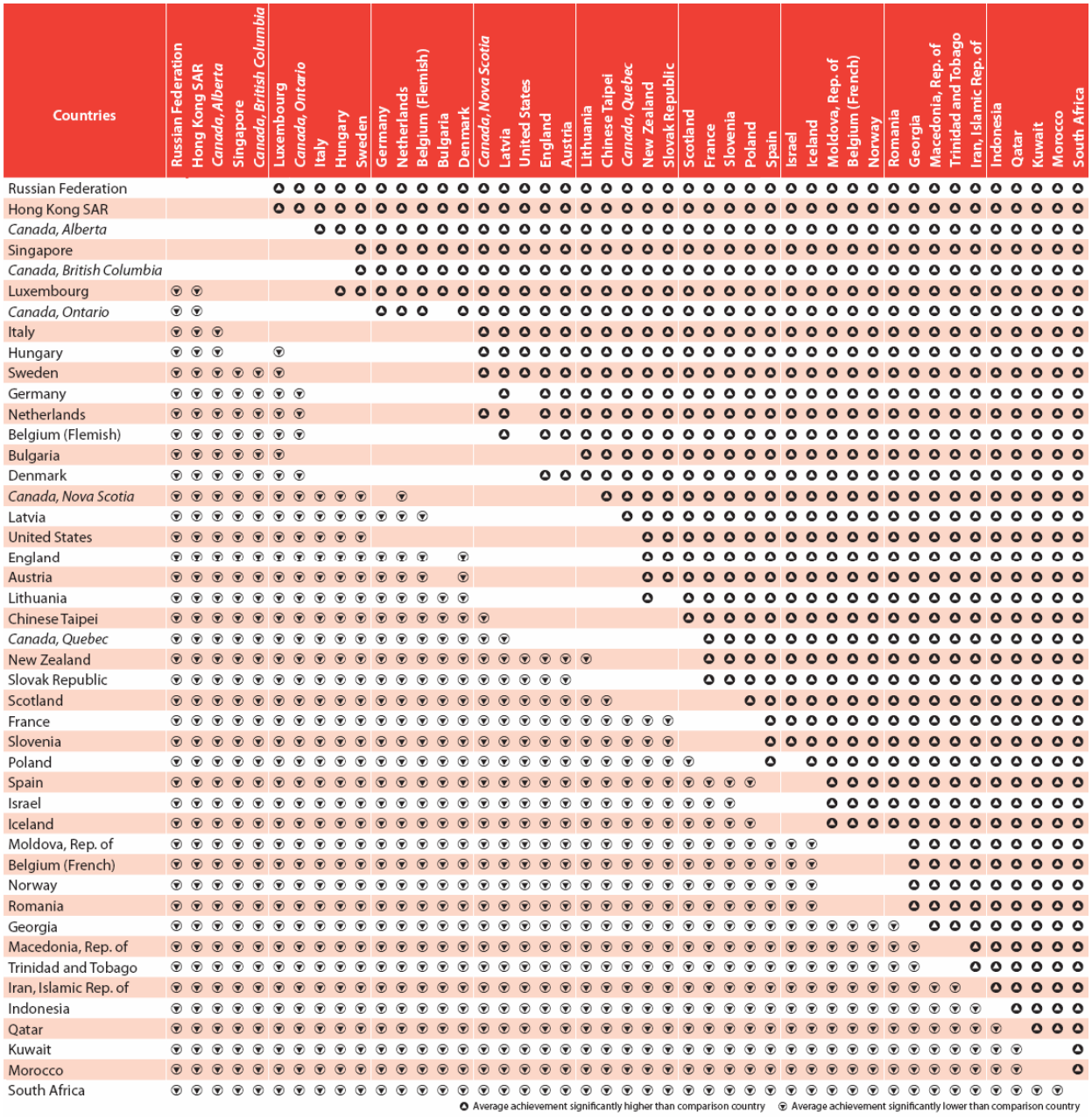


Exhibit 10.3: Trends in Reading Achievement.

PIRLS 2001	Average Scale Score	PIRLS 2006	Average Scale Score	Difference
Sweden	561 (2.2)	Russian Federation	565 (3.4)	+ 37 (5.6)
Netherlands	554 (2.5)	Hong Kong, SAR	564 (2.4)	+ 36 (3.9)
England	553 (3.4)	Singapore	558 (2.9)	+ 30 (5.9)
Bulgaria	550 (3.8)	Italy	551 (2.9)	+ 11 (3.8)
Latvia	545 (2.3)	Hungary	551 (3.0)	+ 8 (3.7)
Lithuania	543 (2.6)	Sweden	549 (2.3)	- 12 (3.2)
Hungary	543 (2.2)	Germany	548 (2.2)	+ 9 (2.9)
Unated States	542 (3.8)	Netherlands	547 (1.5)	- 7 (2.9)
Italy	541 (2.4)	Bulgaria	547 (4.4)	- 3 (5.8)
Germany	539 (1.9)	Latvia	541 (2.3)	- 4 (3.3)
New Zealand	529 (3.6)	United States	540 (3.5)	- 2 (5.2)
Scotland	528 (3.6)	England	539 (2.6)	- 13 (4.3)
Singapore	528 (5.2)	Lithuania	537 (1.6)	- 6 (3.1)
Russian Federation	528 (4.4)	New Zealand	532 (2.0)	+ 3 (4.1)
Hong Kong, SAR	528 (3.1)	Slovak Republic	531 (2.8)	+ 13 (4.0)
France	525 (2.4)	Scotland	527 (2.8)	- 1 (4.6)
Slovak Republic	518 (2.8)	France	522 (2.1)	- 4 (3.1)
Iceland	512 (1.2)	Slovenia	522 (2.1)	+ 20 (2.9)
Romania	512 (4.6)	Israel	512 (3.3)	+ 4 (4.4)
Israel	509 (2.8)	Iceland	511 (1.3)	- 2 (1.8)
Slovenia	502 (2.0)	Moldova, Rep. of	500 (3.0)	+ 8 (5.0)
Norway	499 (2.9)	Norway	498 (2.6)	- 1 (3.9)
Moldova, Rep. of	492 (4.0)	Romania	489 (5.0)	- 22 (6.8)
Macedonia, Rep. of	442 (4.6)	Macedonia, Rep. of	442 (4.1)	+ 1 (6.2)
Iran, Islamic Rep. of	414 (4.2)	Iran, Islamic Rep. of	421 (3.1)	+ 7 (5.2)
Morocco	350 (9.6)	Morocco	323 (5.9)	- 27 (11.3)

Achievement in Mathematics and Science

The overall mathematics and science achievement results for all participating countries are shown in Exhibits 10.4 and 10.5 respectively (Source: Mullis, Martin, Foy, 2008). The exhibits also show the distribution of the results and the 95% confidence interval of the achievement means for each country. The average mathematics achievement for Latvia was 537 scale points with a standard error 2.3, and the average science achievement for Latvia was 542 scale points with a standard error 2.3. Just as for the PIRLS 2006 study, most countries that participated in the TIMSS 2007 fourth-grade assessment assessed students in their fourth year of formal schooling. Three countries tested students in their fifth grade because children start school at the age of five. The highest average age of fourth graders among all countries was in Latvia, Denmark, El Salvador, and Yemen. The

youngest children, under 10 years of age were in Australia, Italy, Norway, Scotland, Slovenia, and Qatar.

Exhibits 10.6 and 10.7 show where the differences in average mathematics and science achievement, respectively, are statistically significant between pairs of countries (Source: Mullis, Martin, Foy, 2008). To read the exhibit, select a country of your interest and read across the table. A circle with a triangle pointing up indicates significantly higher performance than the comparison country listed across the top. The absence of a symbol indicates no significant difference in performance, and a circle with a triangle pointing down indicates significantly lower performance than the comparison country. In mathematics, Latvia had significantly lower average achievement than Hong Kong, Singapore, Chinese Taipei, and Japan. At the same time, Latvia's average achievement was comparable to Kazakhstan, the Russian Federation, England, and the Netherlands. Finally, in mathematics, Latvia significantly outperformed 27 countries. In science, Latvia had significantly lower average achievement than Singapore, Chinese Taipei, and Hong Kong. Latvia's average achievement was comparable to 7 countries – Japan, the Russian Federation, England, the United States, Hungary, Italy, and Kazakhstan. Finally, in science, Latvia significantly outperformed 25 countries.

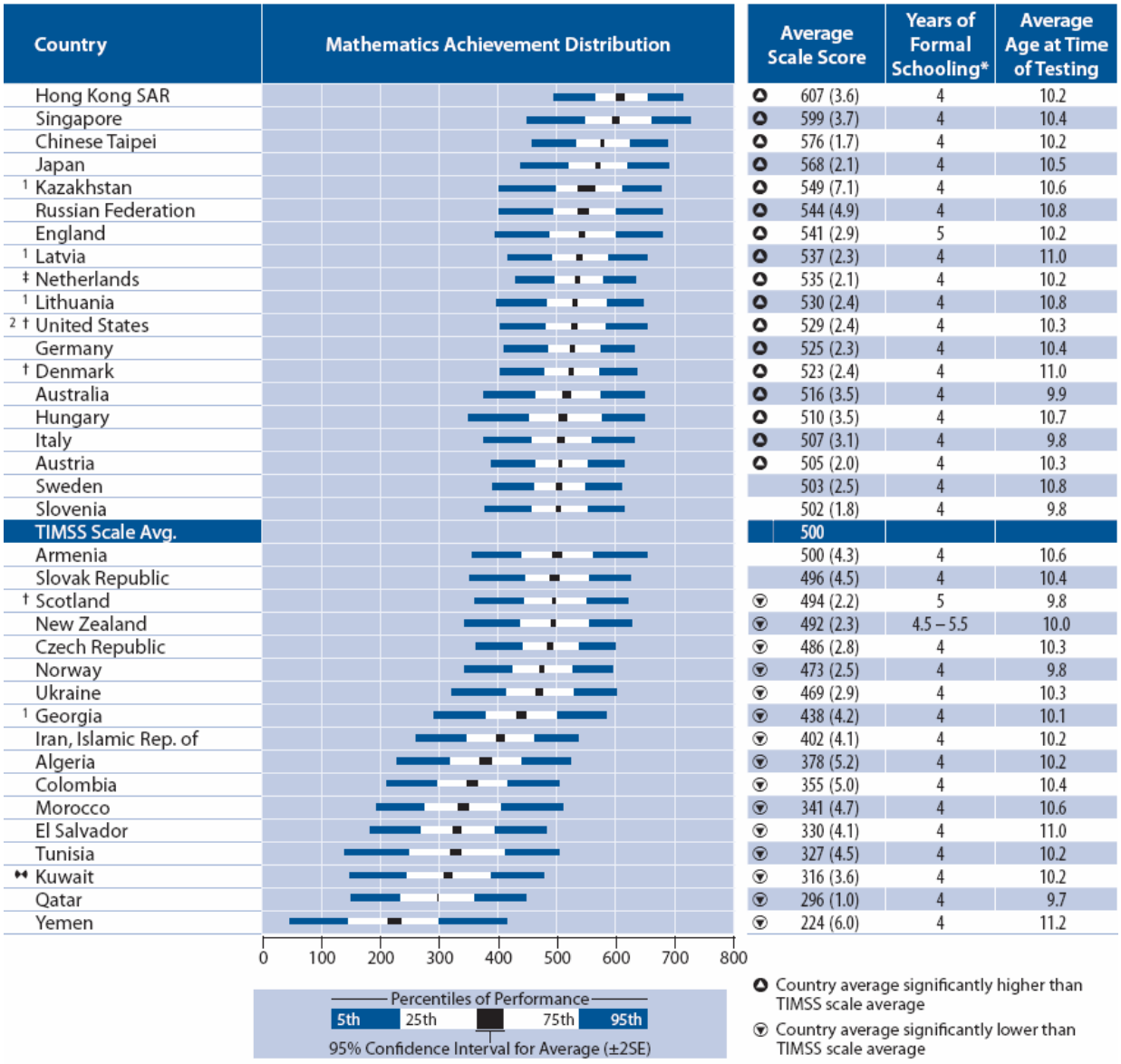
Over time, Latvia has kept improving its average achievement in both mathematics and science. The improvement in mathematics, however, has been minimal and not statistically significant since TIMSS 2003. Unfortunately, in 1995 and 2007, Latvia could not afford translating the survey instruments in any of the minority languages and thus only tested students with Latvian as the language of instruction. This influenced the availability of trend results. In order to reflect the trend results, it was necessary to remove the students tested in Russian from the 2003 sample. Thus, the trend results for Latvia are available for the population with Latvian as the language of instruction.

Exhibits 10.8 and 10.9 show the trends in mathematics and science achievement over time. In mathematics, Armenia has the biggest improvement (44 scale points) in their fourth-grade achievement results since 2003. Hong Kong, Slovenia, and Norway also achieved remarkable improvement, over 20 scale points. At the same time, Hungary has experienced a substantial drop in their mathematics results since 2003, 19 scale points. If we look at the trend results for the time period from 1995 to 2007, England and Hong Kong have managed an improvement of more than 45 scale points. In the Czech Republic, however, mathematics achievement has dropped 54 scale points since 1995. Armenia also achieved a big improvement in their science achievement since 2003, 48 scale points.

Latvia's improvement in fourth-grade science achievement also has been significant. Moreover, in the time period from 1995 to 2007, only Singapore has improved more than Latvia. The improvement for Singapore is 63 scale points, for Latvia the improvement is 56 scale points. For Norway the change has been the most disappointing with their average science achievement dropping by 27 scale points since 1995.

Unfortunately, the other four countries (Denmark, Germany, the Slovak Republic, and Sweden) the author is using for comparisons with Latvia throughout her research, have participated only in the 2007 cycle of TIMSS and thus there are no trend data available for them.

Exhibit 10.4: Distribution of TIMSS 2007 Mathematics Achievement.



* Represents years of schooling counting from the first year of ISCED Level 1.

** Taken from United Nations Development Programme's *Human Development Report 2007/2008*, p.229–232, except for Chinese Taipei taken from Directorate-General of Budget, Accounting and Statistics, Executive Yuan, *R.O.C. Statistical Yearbook 2007*. Data for England and Scotland are for the United Kingdom.

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.

1 National Target Population does not include all of the International Target Population defined by TIMSS.

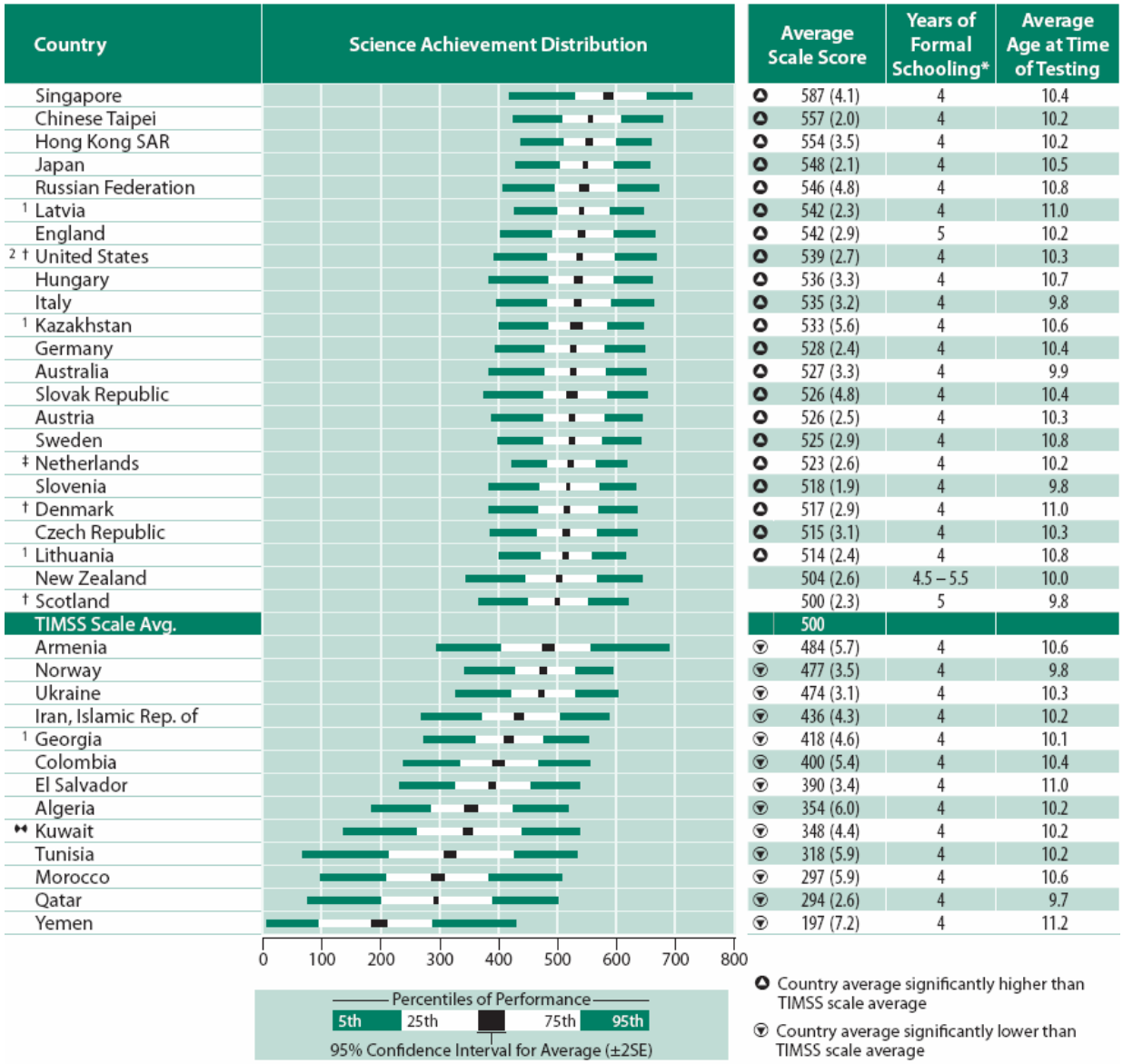
2 National Defined Population covers 90% to 95% of National Target Population.

** Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates comparable data are not available.

Exhibit 10.5: Distribution of TIMSS 2007 Science Achievement.



* Represents years of schooling counting from the first year of ISCED Level 1.

** Taken from United Nations Development Programme's *Human Development Report 2007/2008*, p.229–232, except for Chinese Taipei taken from Directorate-General of Budget, Accounting and Statistics, Executive Yuan, *R.O.C. Statistical Yearbook 2007*. Data for England and Scotland are for the United Kingdom.

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.

1 National Target Population does not include all of the International Target Population defined by TIMSS.

2 National Defined Population covers 90% to 95% of National Target Population.

** Kuwait and Dubai, UAE tested the same cohort of students as other countries, but later in 2007, at the beginning of the next school year.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates comparable data are not available.

Exhibit 10.6: Multiple Comparisons of TIMSS 2007 Average Mathematics Achievement.

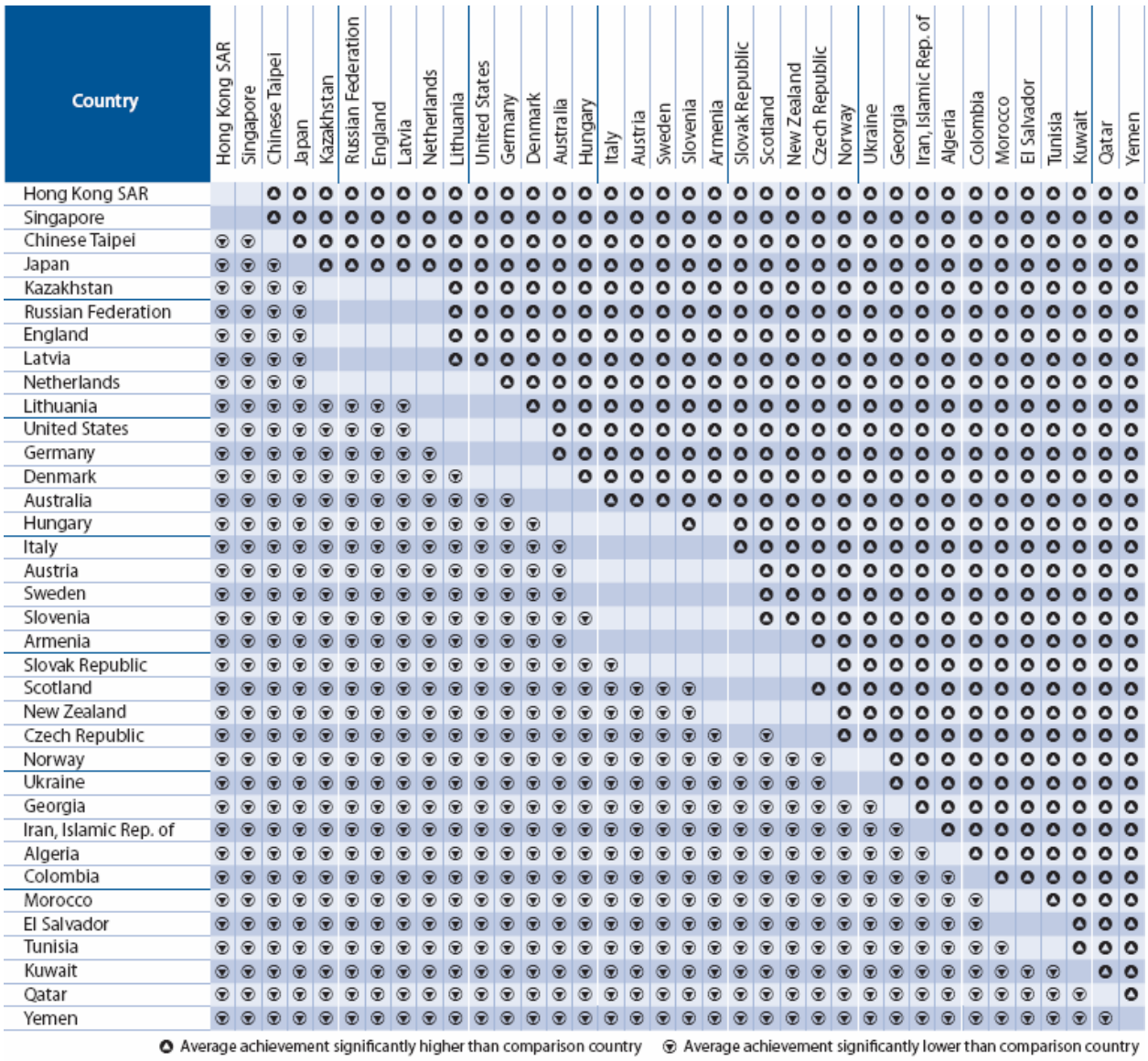


Exhibit 10.7: Multiple Comparisons of TIMSS 2007 Average Science Achievement.

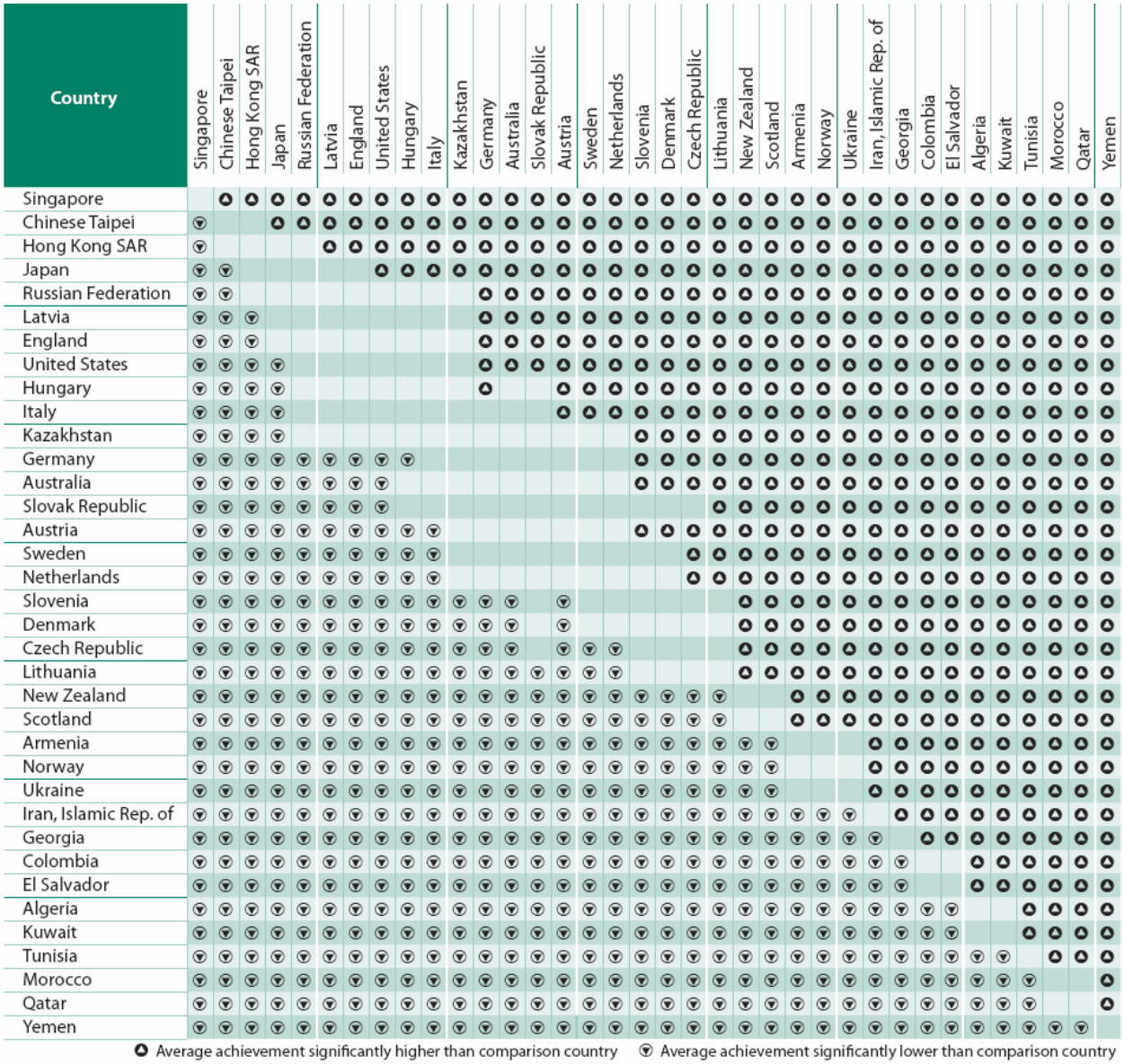


Exhibit 10.8: Trends in Mathematics Achievement.

Country		Average Scale Score	2003 to 2007 Difference	1995 to 2007 Difference
Hong Kong SAR	2007	607 (3.6)		
†	2003	575 (3.2)	32 (4.8) ▲	
	1995	557 (4.0)		50 (5.4) ▲
Singapore	2007	599 (3.7)		
	2003	594 (5.6)	5 (6.7)	
	1995	590 (4.5)		9 (5.9)
Chinese Taipei	2007	576 (1.7)		
	2003	564 (1.8)	12 (2.5) ▲	
Japan	2007	568 (2.1)		
	2003	565 (1.6)	4 (2.6)	
	1995	567 (1.9)		1 (2.8)
Russian Federation	2007	544 (4.9)		
2	2003	532 (4.7)	12 (6.8)	
England	2007	541 (2.9)		
†	2003	531 (3.7)	10 (4.7) ▲	
3 †	1995	484 (3.3)		57 (4.4) ▲
1 Latvia	2007	537 (2.3)		
1	2003	533 (3.1)	4 (3.8)	
1 ‡	1995	499 (4.6)		38 (5.1) ▲
‡ Netherlands	2007	535 (2.1)		
†	2003	540 (2.1)	−5 (3.0)	
‡	1995	549 (3.0)		−14 (3.7) ▼
1 Lithuania	2007	530 (2.4)		
1	2003	534 (2.8)	−4 (3.7)	
2 † United States	2007	529 (2.4)		
†	2003	518 (2.4)	11 (3.4) ▲	
	1995	518 (2.9)		11 (3.8) ▲
Australia	2007	516 (3.5)		
†	2003	499 (3.9)	17 (5.3) ▲	
‡	1995	495 (3.4)		22 (4.9) ▲
Hungary	2007	510 (3.5)		
2	2003	529 (3.1)	−19 (4.8) ▼	
	1995	521 (3.6)		−12 (5.1) ▼
Italy	2007	507 (3.1)		
	2003	503 (3.7)	4 (4.8)	
Austria	2007	505 (2.0)		
‡	1995	531 (2.9)		−25 (3.5) ▼
Slovenia	2007	502 (1.8)		
	2003	479 (2.6)	23 (3.2) ▲	
	1995	462 (3.1)		40 (3.6) ▲
Armenia	2007	500 (4.3)		
	2003	456 (3.5)	44 (5.5) ▲	
† Scotland	2007	494 (2.2)		
†	2003	490 (3.3)	4 (3.9)	
2 †	1995	493 (4.2)		1 (4.7)
New Zealand	2007	492 (2.3)		
	2003	496 (2.1)	−3 (3.2)	
	1995	469 (4.4)		23 (5.0) ▲
Czech Republic	2007	486 (2.8)		
	1995	541 (3.1)		−54 (4.0) ▼
Norway	2007	473 (2.5)		
	2003	451 (2.3)	22 (3.5) ▲	
	1995	476 (3.0)		−3 (4.1)
Iran, Islamic Rep. of	2007	402 (4.1)		
2	2003	389 (4.2)	13 (5.7) ▲	
	1995	387 (5.0)		15 (6.6) ▲
Morocco	2007	341 (4.7)		
	2003	347 (5.1)	−6 (6.7)	
Tunisia	2007	326 (4.5)		
	2003	339 (4.7)	−13 (6.5) ▼	

▼ 2007 average significantly higher
▲ 2007 average significantly lower

† Met guidelines for sample participation rates only after replacement schools were included.
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.
‡ Did not satisfy guidelines for sample participation rates.
1 National Target Population does not include all of the International Target Population defined by TIMSS.
2 National Defined Population covers 90% to 95% of National Target Population.
3 National Defined Population covers less than 90% of National Target Population (but at least 77%).

Trend notes: Data are not shown for Kuwait, because comparable data from previous cycles are not available. Data for Tunisia do not include private schools.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit 10.9: Trends in Science Achievement.

Country		Average Scale Score	2003 to 2007 Difference	1995 to 2007 Difference
Singapore	2007	587 (4.1)		
	2003	565 (5.5)	22 (6.8) ▲	
	1995	523 (4.8)		63 (6.4) ▲
Chinese Taipei	2007	557 (2.0)		
	2003	551 (1.7)	5 (2.6) ▲	
Hong Kong SAR	2007	554 (3.5)		
†	2003	542 (3.1)	12 (4.6) ▲	
	1995	508 (3.3)		46 (4.8) ▲
Japan	2007	548 (2.1)		
	2003	543 (1.5)	4 (2.5)	
	1995	553 (1.8)		−5 (2.6) ▼
Russian Federation	2007	546 (4.8)		
2	2003	526 (5.2)	20 (7.0) ▲	
1 Latvia	2007	542 (2.3)		
1	2003	530 (2.8)	12 (3.5) ▲	
1 ‡	1995	486 (4.9)		56 (5.4) ▲
England	2007	542 (2.9)		
†	2003	540 (3.6)	1 (4.4)	
3 †	1995	528 (3.1)		14 (4.2) ▲
2 † United States	2007	539 (2.7)		
†	2003	536 (2.5)	3 (3.5)	
	1995	542 (3.3)		−3 (4.3)
Hungary	2007	536 (3.3)		
2	2003	530 (3.0)	6 (4.5)	
	1995	508 (3.4)		28 (4.8) ▲
Italy	2007	535 (3.2)		
	2003	516 (3.8)	20 (4.9) ▲	
Australia	2007	527 (3.3)		
†	2003	521 (4.2)	7 (5.3)	
‡	1995	521 (3.8)		6 (4.9)
Austria	2007	526 (2.5)		
‡	1995	538 (3.6)		−12 (4.4) ▼
‡ Netherlands	2007	523 (2.6)		
†	2003	525 (2.0)	−2 (3.1)	
‡	1995	530 (3.2)		−7 (4.0)
Slovenia	2007	518 (1.9)		
	2003	490 (2.5)	28 (3.2) ▲	
	1995	464 (3.1)		54 (3.6) ▲
Czech Republic	2007	515 (3.1)		
	1995	532 (3.0)		−17 (4.3) ▼
1 Lithuania	2007	514 (2.4)		
1	2003	512 (2.6)	2 (3.7)	
New Zealand	2007	504 (2.6)		
	2003	523 (2.3)	−19 (3.5) ▼	
	1995	505 (5.3)		−1 (5.9)
† Scotland	2007	500 (2.3)		
†	2003	502 (2.9)	−2 (3.6)	
2 †	1995	514 (4.5)		−14 (5.0) ▼
Armenia	2007	484 (5.7)		
	2003	437 (4.3)	48 (7.1) ▲	
Norway	2007	477 (3.5)		
	2003	466 (2.6)	10 (3.5) ▲	
	1995	504 (3.7)		−27 (5.2) ▼
Iran, Islamic Rep. of	2007	436 (4.3)		
2	2003	414 (4.1)	22 (5.9) ▲	
	1995	380 (4.6)		55 (6.3) ▲
Tunisia	2007	317 (6.0)		
	2003	314 (5.7)	3 (8.1)	
Morocco	2007	297 (5.9)		
	2003	304 (6.7)	−7 (9.0)	

▼ 2007 average significantly lower
▲ 2007 average significantly higher

† Met guidelines for sample participation rates only after replacement schools were included.
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included.
‡ Did not satisfy guidelines for sample participation rates.
1 National Target Population does not include all of the International Target Population defined by TIMSS.
2 National Defined Population covers 90% to 95% of National Target Population.
3 National Defined Population covers less than 90% of National Target Population (but at least 77%).
Trend notes: Data are not shown for Kuwait, because comparable data from previous cycles are not available. Data for Tunisia do not include private schools.
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

11. Intraclass Correlation and Variance Components within the PIRLS 2006 and TIMSS 2007 Results in Latvia

Intraclass correlation and variance components alone do not provide more than a measure of equity, or disparity, in student achievement, and contextual information is necessary to explain these results. However, this information can be valuable either as confirmation of equity, or realizing the disparity and the need to look for ways to minimize it. Once again, meaning emerges through contrast and the author compares variance in student achievement in Latvia with the results from Denmark, Germany, Lithuania, the Slovak Republic, and Sweden. The results are presented in exhibits 11.1 and 11.2.

Exhibit 11.1: Intraclass Correlation for PIRLS 2006 and TIMSS 2007 data

Country	Reading		Mathematics		Science	
	Class-Level	School-Level	Class-Level	School-Level	Class-Level	School-Level
Denmark	0.128	—	0.118	0.117	0.131	0.128
Germany	0.298	—	0.275	—	0.256	—
Latvia	0.213	0.198	0.179	0.165	0.197	0.180
Lithuania	0.202	0.151	0.207	0.174	0.155	0.132
Slovakia	0.322	0.269	0.354	0.321	0.369	0.344
Slovenia	0.122	0.102	0.094	0.075	0.116	0.092
Sweden	0.133	0.111	0.156	0.148	0.176	0.165

The consideration of whether the intraclass correlation is particularly high or low in any of these countries is to some extent arbitrary. International comparisons here become very important. If the degree of equity is higher in some countries, it is a good reason for future research on how it has been achieved, and whether such policies would be worth trying in Latvia. For example, Latvia's intraclass correlation at the school level for student reading achievement was estimated at 0.198 and for mathematics and science achievement at 0.165 and 0.180 respectively. At the same time, for Slovenia the estimates were 0.122 for reading, 0.094 for mathematics, and 0.116 for science. Moreover, taking into account that the educational system in Latvia is greatly centralized (curriculum standards, availability of different textbooks, centralized examinations), the interclass correlation for Latvia can be considered high (Geske, Grīnfelds, 2006). The lowest level of equity in student achievement demonstrated in the seven comparison jurisdictions was in the Slovak Republic, followed by Germany. If we compare the level of equity in Latvia with the situation in Lithuania, the intraclass correlation coefficient for student achievement in reading literacy and science was

higher for Latvia, while for student achievement in mathematics it was higher for Lithuania. The highest level of equity in student achievement was in Slovenia, Denmark, and Sweden.

When compared to results from PIRLS 2001 and TIMSS 2003 data (Johansone, 2006), the school level intraclass correlation in Latvia was smaller in PIRLS 2006 and TIMSS 2007 data. The intraclass correlation was estimated at 0.218 for reading achievement in PIRLS 2001, and at 0.247 for mathematics achievement and at 0.244 for science achievement in TIMSS 2003. Since the difference for TIMSS might have been influenced by the fact that students with Russian as the language of instruction were excluded for TIMSS 2007, the author calculated the intraclass correlation for the 2003 data excluding the Russian speaking students. The results (0.204 for mathematics and 0.194 for science) showed that the language did have an effect on the trend narrowing the difference. Even though additional research would be necessary to fully explain these results, the author can conclude that, back in 2003, there was a little less variance among the Latvian schools than among the Russian schools.

It must be said, however, that having achieved a low intraclass correlation with equity in educational achievement does not necessarily entail high achievement. For example, Slovenia with the lowest estimated coefficient has lower overall student achievement than Latvia in all three subjects. In fact, Latvia outperforms all six countries in mathematics and science, and the Slovak Republic and Slovenia in reading literacy as well. Moreover, the results in Exhibit 11.2 show that the total variance or difference between the very best and the weakest results in Latvia is one of the smallest among the seven countries. In Slovenia, on the contrary, the difference between the highest and the lowest achievement is higher (except for mathematics achievement), but there is hardly any difference explained at the school level. At the same time for the Slovak Republic and Latvia, the between-school variance explains a relatively high percentage of the total variance.

Exhibit 11.2: Variance Decomposition Data for PIRLS 2006 and TIMSS 2007

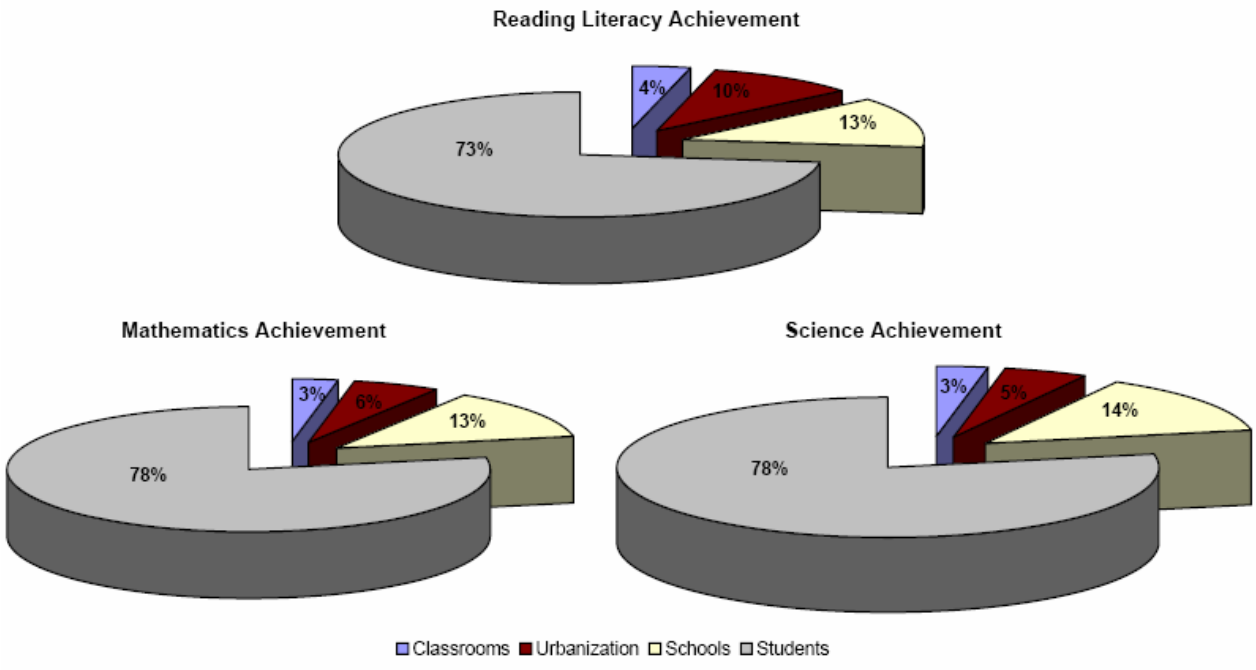
Country	Reading				Mathematics				Science			
	MST	Students	Classes	Schools	MST	Students	Classes	Schools	MST	Students	Classes	Schools
Denmark	4,861	87.0%	13.0%	—	5,019	88.2%	0.5%	11.3%	5,922	86.9%	1.0%	12.1%
Germany	4,487	70.2%	29.8%	—	4,645	72.5%	27.5%	—	6,261	74.4%	25.6%	—
Latvia	3,924	78.6%	4.1%	17.3%	5,172	82.0%	3.0%	15.0%	4,472	80.2%	3.6%	16.2%
Lithuania	3,238	79.8%	11.1%	9.1%	5,742	79.3%	7.1%	13.6%	4,252	84.5%	5.0%	10.5%
Slovakia	5,502	67.7%	13.3%	19.0%	7,216	64.5%	11.6%	23.8%	7,614	63.0%	9.2%	27.8%
Slovenia	5,003	87.8%	3.9%	8.3%	5,099	90.6%	3.6%	5.8%	5,804	88.4%	4.5%	7.2%
Sweden	4,051	86.7%	6.0%	7.3%	4,421	84.3%	2.2%	13.4%	5,414	82.3%	2.9%	14.8%

MST – Mean Square Total

Investigating potential means for improving Latvia's overall performance levels in primary education is not the main concern of this research. Moreover, Latvia's overall achievement might be quite blinding when judging quality of primary education. Investigating what else explains the total variance and at the same time reduces the effect blamed on the difference between schools is the next step.

Equity in performance outcomes between schools in Latvia is not self-explanatory at all. As mentioned before, the educational system in Latvia is greatly centralized. Parents are free to choose the school their child will attend, even though everyone has the right to attend the school closest to his/her place of living. Schools providing basic education may not organize admission tests, and in public schools, education is free (Eurybase, 2007). So, what does cause segregation and different achievement levels between schools? Is it mostly the lasting achievement gap between the rural and urban communities (Johansone, Preuschoff, 2008)? The results of exploring the variance structure for Latvia (Graph 11.1) show that 10% of the mean square total (total variance) in reading literacy, 6% in mathematics, and 5% in science can be explained by location of the school (rural versus urban). There still remains an unexplained 13%, 13%, and 14% of between-school variance. It has been concluded previously that the urbanization and socio-economic status are the most important determinants of student achievement in Latvia (Mullis, Martin, Gonzalez, & Kennedy, 2001). A very small variance exists between classes within schools, which even further show some segregation between schools or communities these schools belong to.

Graph 11.1: Variance Decomposition Data for PIRLS 2006 and TIMSS 2007 in Latvia



At this point, contextual information is necessary to interpret the variance components described above. Extending variance analyses by simply adding more levels would contain too much error to be of any further help.

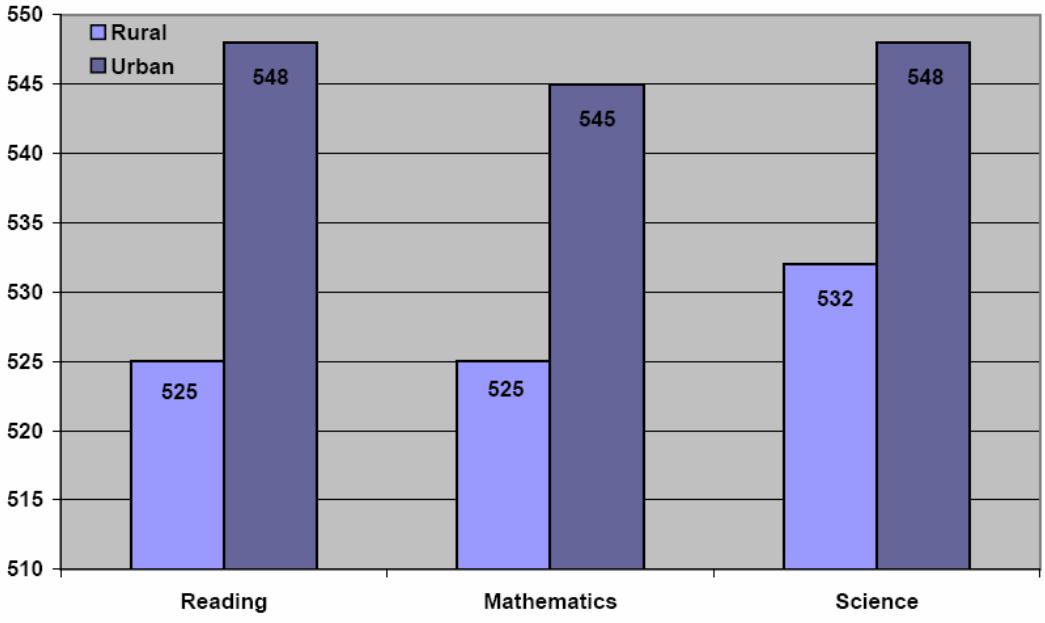
12. Rural-urban Achievement Gap and Background Determinants of Student Achievement by Urbanization in Latvia

In this section, the author adds achievement scores and some influential background determinants to the investigation. This helps to visualize the variance in student achievement. As the first step, the rural-urban achievement gap is described. Then the international benchmarks and the results of each of them by the urbanization factor in Latvia are presented. Some comparisons to the other six comparison countries also are included. These results are followed by analyses of community, school, and student background determinants in relation to student achievement by urbanization.

Rural-urban Achievement Gap in Latvia

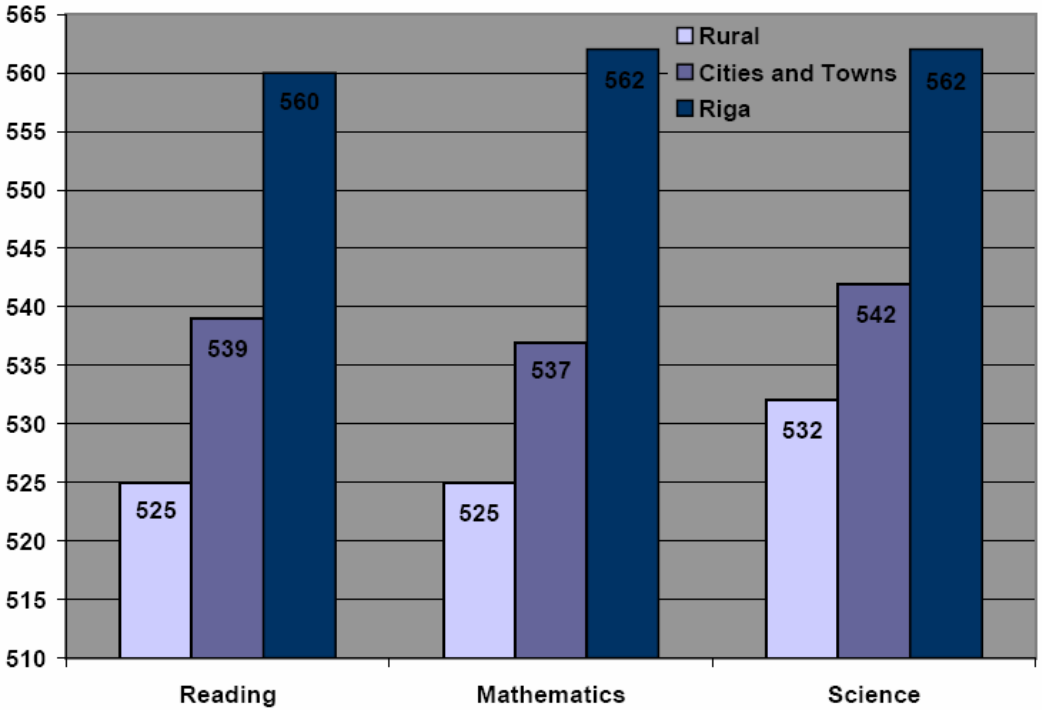
The variations between the achievement levels by school community (Graph 12.1) put children in rural communities at a distinct disadvantage. Children attending rural schools do not achieve comparable educational outcomes as their urban counterparts. The results are especially shocking when communities are stratified further by "Riga", "cities and towns", and "rural" (Graph 12.2).

Graph 12.1: Rural-urban Achievement Gap in Reading, Mathematics, and Science in Latvia



When “Riga” and other cities/towns are stratified together, the gap is considerably smaller. Riga outperformed other cities and towns by more than 20 scale points and rural parts of the country by more than 30 points.

Graph 12.2: Rural-cities/towns-Riga Achievement Gap in Reading, Mathematics, and Science in Latvia



Back in TIMSS 1995, students were administered the same test at the third- and the fourth-grades. Back then, the difference between achievement at the two grade levels for Latvia was 62 (SE 6.4) scale points for mathematics and 47 (SE 6.7) scale points for science. Unfortunately, this kind of measurement is not available for the later results. However, if the author speculates that the difference measured in one year of schooling would be comparable to the results found in this previous research, the Riga-rural achievement gap of 37 scale points for mathematics and 30 scale points for science could be characterized as at least half a year of schooling.

Referring back to Section 10, it is interesting to see that the average achievement in cities and towns in Latvia corresponds to the overall achievement of the whole country in all three subject areas. The average reading achievement of students in Riga could compete with the results of Hong Kong and Singapore. Also, the average science achievement in Riga was just as high as, and even higher than, in Chinese Taipei, Hong Kong, and Japan. In mathematics, however, Hong Kong, Singapore, and Chinese Taipei significantly

outperformed even the average of Riga's achievement. Students in Riga had comparable average achievement in mathematics as their Japanese counterparts. The average reading achievement for students from the rural parts of Latvia was comparable to the average reading achievement in France and Slovenia (27^{th} and 28^{th} in the distribution of reading achievement for PIRLS 2006), taking into account that Slovenia had their third graders as a part of their sample with one of the lowest average age from all participating countries. In science and mathematics, Latvia's rural students achieved comparable results as their counterparts in Germany, which is quite surprising. Germany showed relatively high achievement in reading literacy.

Even though achievement differences by gender are not a closely researched topic for this promotion paper, it is important to note that boys from rural schools had the lowest reading achievement with just 510 (SE 5.9) scale points, which was a significantly lower score than the average score for girls from rural schools. In fact, girls from rural schools even outperformed boys from urban schools, except for Riga, and girls outperformed boys by 19, 20, and 30 scale points in all three urbanization levels (Riga, cities/towns, rural) respectively. At the same time, there was no significant difference by gender for mathematics and science achievement. In reading, the gender influence seemed to be very strong, while in mathematics and science it was insignificant. Obviously, some circumstances and social stereotypes are influencing the boys' motivation to read and appreciate the value of reading. For example, reading is considered a feminized activity in many cultures, which might contribute to boys' disassociation from reading in an attempt to avoid feminine activity (Trong, Kennedy, 2006). This is a phenomenon that should be further researched in order to find the most influential determinants for gender difference in students reading achievement in Latvia.

The International Benchmarks

To further interpret the achievement results meaningfully, PIRLS and TIMSS use four points on the scale as international benchmarks, that provide descriptions of achievement on the scale in relation to performance on the assessment items,. The Advanced International Benchmark is set at 625 scale points, the High International Benchmark is set at 550 scale points, the Intermediate International Benchmark is set at 475 scale points, and the Low International Benchmark at 400 scale points. Exhibits 12.1 through 12.3 present percentages of students reaching the international benchmarks of reading, mathematics, and science achievement in Latvia and the six comparison countries.

Exhibit 12.1: Percentage of Students Reaching the International Benchmarks of Reading Achievement in Latvia, Denmark, Germany, Lithuania, the Slovak Republic, Slovenia, and Sweden

Countries	Advanced (625)	High (550)	Intermediate (475)	Low (400)
[2a] Denmark	11 (0.8)	52 (1.4)	85 (1.0)	97 (0.4)
Germany	11 (0.9)	52 (1.6)	87 (0.8)	97 (0.3)
Sweden	11 (0.9)	53 (1.5)	88 (1.0)	98 (0.4)
Latvia	8 (0.8)	46 (1.5)	86 (1.2)	98 (0.4)
Slovak Republic	8 (0.6)	43 (1.5)	80 (1.3)	94 (0.9)
Slovenia	6 (0.6)	37 (1.2)	76 (1.1)	94 (0.5)
Lithuania	5 (0.8)	43 (1.3)	86 (0.9)	99 (0.3)

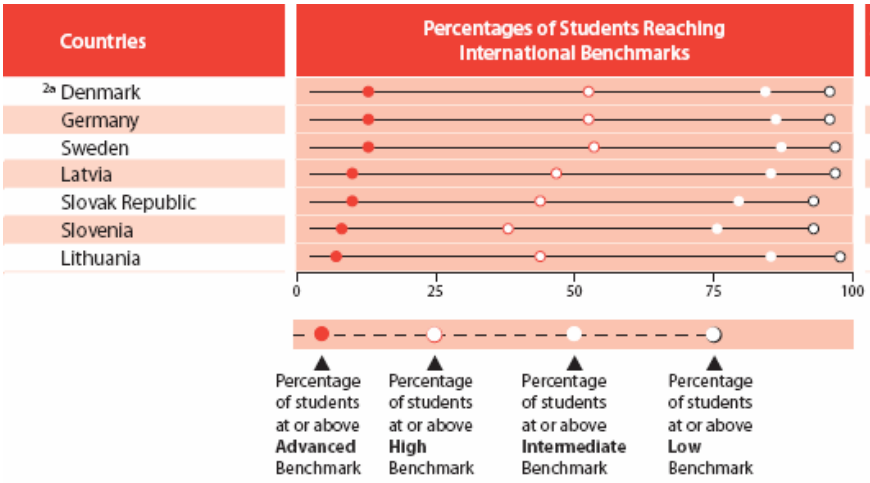


Exhibit 12.2: Percentage of Students Reaching the International Benchmarks of Mathematics Achievement in Latvia, Denmark, Germany, Lithuania, the Slovak Republic, Slovenia, and Sweden

Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
Latvia	11 (0.8)	44 (1.5)	81 (1.2)	97 (0.5)
Lithuania	10 (0.7)	42 (1.4)	77 (1.4)	94 (0.7)
Denmark	7 (0.7)	36 (1.5)	76 (1.2)	95 (0.8)
Germany	6 (0.5)	37 (1.3)	78 (1.2)	96 (0.5)
Slovak Republic	5 (0.7)	26 (1.4)	63 (1.8)	88 (1.5)
Slovenia	3 (0.4)	25 (1.1)	67 (0.9)	92 (0.6)
Sweden	3 (0.3)	24 (1.4)	68 (1.4)	93 (0.7)

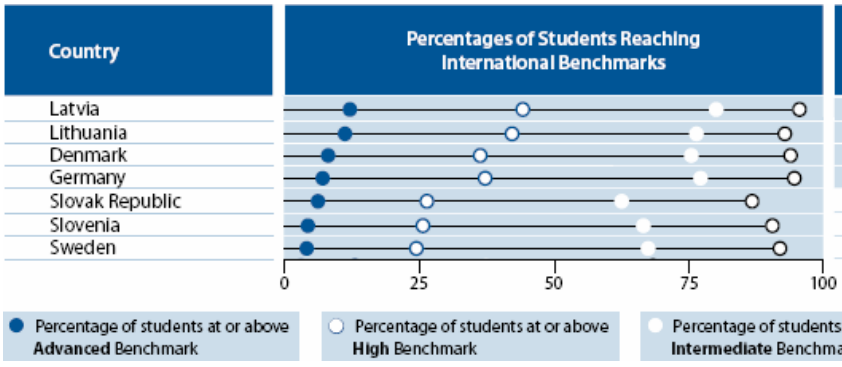
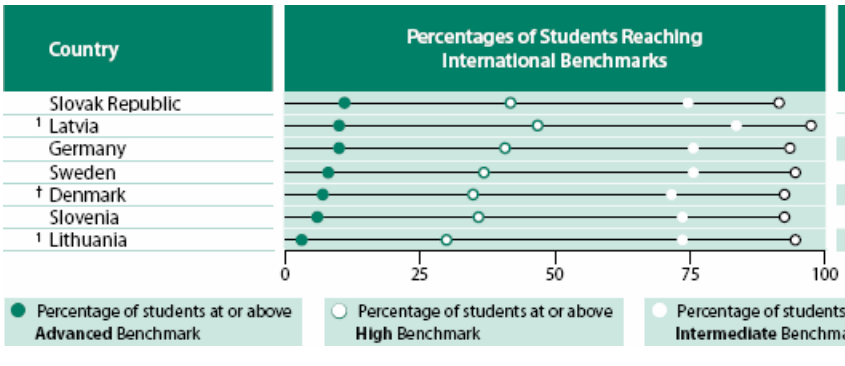


Exhibit 12.3: Percentage of Students Reaching the International Benchmarks of Science Achievement in Latvia, Denmark, Germany, Lithuania, the Slovak Republic, Slovenia, and Sweden

Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
Slovak Republic	11 (0.8)	42 (2.0)	75 (1.8)	92 (1.3)
[1] Latvia	10 (1.1)	47 (1.7)	84 (1.3)	98 (0.4)
Germany	10 (0.7)	41 (1.3)	76 (1.2)	94 (0.6)
Sweden	8 (0.6)	37 (1.6)	76 (1.5)	95 (0.6)
[†] Denmark	7 (0.8)	35 (1.5)	72 (1.5)	93 (0.8)
Slovenia	6 (0.6)	36 (1.3)	74 (1.0)	93 (0.6)
[1] Lithuania	3 (0.4)	30 (1.4)	74 (1.4)	95 (0.6)



At the Advanced International Benchmark (625 scale points or higher) in reading literacy, students responded fully to the PIRLS 2006 assessment. They could make interpretations of figurative language and demonstrated that they understood the function of organizational features. They could integrate information across the texts, and provide full text-based support. In mathematics at this level, students could apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning. They demonstrated a developing understanding of fractions and decimals. They could select appropriate information to solve multi-step problems, and they could formulate or select a rule for a relationship. Students at this level could apply geometric knowledge of a range of two- and three-dimensional shapes in a variety of situations, and they could organize, interpret, and represent data to solve problems. In science, students reaching the Advanced International Benchmark could apply knowledge and understanding of scientific processes and relationships in beginning scientific inquiry. Students communicated their understanding of characteristics and life processes of organisms as well as of factors relating to human health. At this level, students demonstrated understanding of relationships among various physical properties of common materials and had some practical knowledge of electricity. Students demonstrated some understanding of the solar system and Earth's physical features and processes, and they showed developing ability to interpret the results of investigations and draw conclusions as well as beginning ability to evaluate and support an argument.

Overall in Latvia, 8% of students reached the Advanced International Benchmark in reading. Within Latvia (Graph 12.3), 5% of rural students and 10% of urban students reached the advanced benchmark in reading. When separating Riga from other cities and towns, 13% of students in Riga and 7% of students in other cities and towns reached the advanced benchmark in reading. In mathematics, 11% of students in Latvia reached the Advanced International Benchmark. Within Latvia, 10% of rural students and 11% of urban students reached the advanced benchmark in mathematics. When separating Riga from other cities and towns, 16% of students in Riga and 9% of students in other cities and towns reached the advanced benchmark in mathematics. In science, 10% of students in Latvia reached the Advanced International Benchmark. Within Latvia, 10% of rural students and also 10% of urban students reached the advanced benchmark in science. When separating Riga from other cities and towns, 14% of students in Riga and 9% of students in other cities and towns reached the advanced benchmark in science.

At the High International Benchmark (550 scale points) in reading, students were characterized as competent readers. Based on the literary texts, they could retrieve significant details embedded across the text and provide text-based support for inferences. They could use organizational features to navigate through the international texts and make interferences and connections. At this level, students recognized main ideas, some textual features and elements, and were beginning to integrate ideas and information across texts. In mathematics, students could apply their knowledge and understanding to solve problems. Students could solve multi-step problems involving operations with whole numbers and use division in a variety of problem situations. They demonstrated understanding of place value and simple fractions. Students could extend patterns to find a later specified term and identify the relationship between ordered pairs. Students showed basic geometric knowledge and could interpret and use data in tables and graphs to solve problems. In science, students could apply knowledge and understanding to explain everyday phenomena. Students demonstrated understanding of plant and animal structure, life processes, and the environment and some knowledge of properties of matter and physical phenomena. They showed some knowledge of the solar system, and of Earth's structure, processes and resources. Students demonstrated beginning scientific inquiry knowledge and skills, and provided brief descriptive responses combining knowledge of science concepts with information from everyday experience of physical and life processes.

Overall in Latvia, 46% of students reached at least the High International Benchmark in reading. Within Latvia (Graph 12.3) the achievement gap appears quite clearly at this level. While 50% of urban students reached the high benchmark in reading, only 36% of rural students were able to reach this level. When separating Riga from other cities and towns, 60% of students in Riga and 43% of students in other cities and towns reached the high benchmark in reading. In mathematics, 44% of students in Latvia reached the High International Benchmark. Within Latvia, 38% of rural students and 49% of urban students were at or above the high benchmark in mathematics. When separating Riga from other cities and towns, 60% of students in Riga and 44% of students in other cities and towns reached the high benchmark in mathematics. In science, 47% of students in Latvia were at or above the High International Benchmark. Within Latvia, 42% of rural students and 50% of urban students reached the high benchmark in science. When separating Riga from other cities and towns, 60% of students in Riga and 46% of students in other cities and towns were at or above the high benchmark in science.

At the Intermediate International Benchmark (475 scale points) in reading literacy, students demonstrated some proficiency, especially with the stories (literary texts). Students were able to understand the plots at a literal level, and also to make some inferences and connections across the texts. In the informational texts, they were able to use the available organizers to find information beyond the initial parts of the texts, and to provide two pieces of information in answering a question. In mathematics, students could apply basic mathematics knowledge in straightforward situations. Students at this level demonstrated an understanding of whole numbers; they could extend simple numeric and geometric patterns. Students were familiar with a range of two-dimensional shapes. They could read and interpret different representations of the same data. In science, students at this level could apply basic knowledge and understanding to practical situations in the sciences. Students recognized some basic information related to characteristics of living things and their interaction with the environment, and showed some understanding of human biology and health. They also showed some understanding of familiar physical phenomena. At this level, students knew some basic facts about the solar system and had developing understanding of Earth's resources. They also demonstrated some ability to interpret information in pictorial diagrams and applied factual knowledge to practical situations.

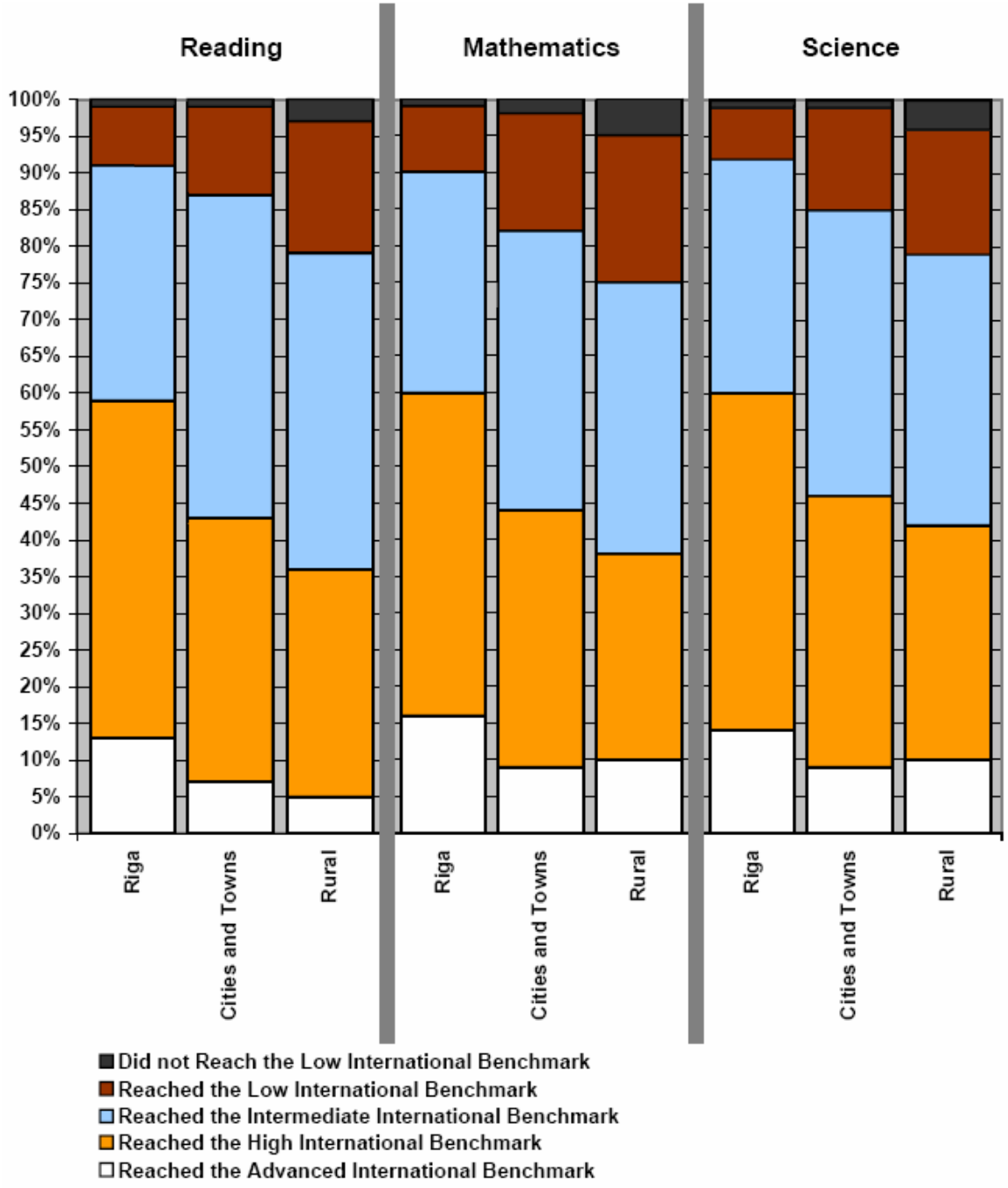
Overall in Latvia, 86% of students were at or above the Intermediate International Benchmark in reading. Within Latvia (Graph 12.3), 79% of rural students and 89% of urban students reached the intermediate benchmark in reading. When separating Riga from other cities and towns, 91% of students in Riga and 87% of students in other cities and towns reached the intermediate benchmark in reading. In mathematics, 81% of students in Latvia reached the Intermediate International Benchmark. Within Latvia, 75% of rural students and 84% of urban students reached the high benchmark in mathematics. When separating Riga from other cities and towns, 90% of students in Riga and 82% of students in other cities and towns reached the intermediate benchmark in mathematics. In science, 84% of students in Latvia reached the Intermediate International Benchmark. Within Latvia, 79% of rural students and 87% of urban students reached the intermediate benchmark in science. When separating Riga from other cities and towns, 92% of students in Riga and 85% of students in other cities and towns were at or above the intermediate benchmark in science.

At the Low International Benchmark (400 scale points), students displayed basic reading skills. They were able to recognize, locate, and reproduce explicitly stated details from the informational texts, particularly if the details were close to the beginning of the text. Students also demonstrated success with some items requiring straightforward

inferences. In mathematics, students demonstrated some basic knowledge and understanding of adding and subtracting with whole numbers. They were familiar with triangles and informal coordinate systems. Students at this level could read information from simple bar graphs and tables. Finally in science, students at this level had some elementary knowledge of life science and physical science. Students demonstrated some knowledge of simple facts related to human health and the behavioral and physical characteristics of animals. They recognized some properties of matter, and demonstrated a beginning understanding of forces. Students could interpret labels of pictures and simple diagrams, complete simple tables, and provide short written responses to questions requiring factual information.

The author characterizes the low benchmark as a breaking point and an especially useful measure in recognizing the proportion of students that have a minimum level of knowledge and understanding adequate to allow them to progress through their early school years. The highest percentage of students reaching at least the low reading benchmark was in Lithuania, with 99%. In Latvia and Sweden 98% of students reached the low benchmark in reading. Within Latvia (Graph 12.3), 97% of rural students and 99% of urban students reached the low benchmark in reading. When separating Riga from other cities and towns, less than 1% of students in Riga and 1% of students in other cities and towns did not reached the low benchmark in reading. In mathematics, 97% of students in Latvia reached the Low International Benchmark. Within Latvia, 95% of rural students and 98% of urban students reached the low benchmark in mathematics. When separating Riga from other cities and towns, 1% of students in Riga and 2% of students in other cities and towns did not reach the low benchmark in mathematics. In science, 98% of students in Latvia reached at least the Low International Benchmark. Within Latvia, 96% of rural students and 99% of urban students reached the low benchmark in science. When separating Riga from other cities and towns, only 1% of students in Riga and only 1% of students in other cities and towns did not reach the low benchmark in science.

Graph 12.3: Percentage of Students Reaching the International Benchmarks of Reading, Mathematics, and Science Achievement by Urbanization in Latvia



Having verbalized the meaning of the scale in relation to different levels of knowledge and understanding in all three major primary school subjects, it is possible to describe the rural-urban achievement gap in terms of student achievement levels. The average achievement of students in the rural parts of Latvia can be characterized at the level of the Intermediate International Benchmark. However, there were more than 20% of rural

students who did not even reach this level. What does this mean? The author speculates that students reaching only the Low International Benchmark have results lower than the average of third-graders in Latvia would have. Unfortunately, there were more than 20% of such students in Latvia's rural schools. Moreover, 3% or rural students did not reach even the Low International Benchmark in reading, 5% in mathematics, and 4% in science. At the end of their primary education, these students did not demonstrate even the very basic knowledge and understanding in the major subjects of the primary schooling. At the same time, the average achievement for students in Riga is at the level of the High International Benchmark, with more than 10% (16% for mathematics) reaching the Advanced International Benchmark and less than 10% of students not reaching the intermediate benchmark. The author speculates that students reaching the Advanced International Benchmark have results higher than the average of fifth-graders in Latvia would have. There were virtually no urban students who did not reach the low benchmark.

Despite the differences in mean scores by urbanization, there was an overlap among achievement levels of students from rural and urban schools. Obviously, the significant differences in average achievement cannot be explained by the urbanization factor alone. As revealed during the extensive review of the literature and conclusions of other researchers around the world, such factors as family background, community and school resources, early childhood exposure to education, as well as students' attitudes and self-confidence are of great influence to student achievement. The distribution of students with different background characteristics within rural and urban communities might shed some light.

Background Determinants of Student Achievement by Urbanization

The state administrative-territorial system in Latvia has shaped its system of education and has both directly and indirectly influenced student achievement (Geske, Grīnfelds, Dedze, Zhang, 2006). In spite of its relatively small size with just 64 000 square kilometers and the distance from the remotest villages in any direction to the capital city, Riga, not exceeding 300 kilometers, Latvia is divided into twenty-six administrative districts. Economically, differences among the various districts are quite remarkable with the wealthiest district (Riga district) having a per capita GDP of approximately 9 000 USD and the poorest (Rezekne district) having only approximately 2 400 USD. It is worth mentioning that at the same time (2006 data), Riga city had a per capita GDP of approximately 17 660 $. Because some districts are small, neighbouring districts may have different community composition. Also, the total populationof Latvia is only 2.3 million and about one third lives in Riga (Central Statistical Bureau of Latvia, 2006). As for student

population for this research, about 30% of students in 2006 and 39% in 2007 attended rural schools. When separating Riga from other cities and towns, the percentages were as follows – Riga, 28% in 2006 and 19% in 2007 and other cities and towns 42% and 43% respectively.

School and class sizes have long been an important subject discussed among educators and the general public as well. Unfortunately, it is a difficult concept to explore, because, once again, there are too many factors with a stronger influence on student achievement than the size of a school or a class. Moreover, one such factor is urbanization. In theory, we could speculate that when excluding the most influential factors and given the best student composition, smaller schools and/or classes would do better. However, that is unrealistic and, in fact, in all seven countries, for which data were explored in this research, bigger schools showed better results. Compared to Latvia, where 4.5% of children attended schools with less than eight forth-graders[9], such schools did not exist in Slovenia, there were almost none in Denmark and Germany (with 0.1% and 0.3% of students attending such schools respectively), 1% in Sweden, 2% in the Slovak Republic, and 4% in Lithuania. Schools with less than four fourth-graders were excluded from the sample. Thus, it is likely there were slightly more schools with less than eight fourth-graders altogether. From the results for Latvia (Exhibit 12.4), the more fourth-graders in a school, the better was student achievement in all three subjects, with one, yet unexplained, outlier – within urban schools the highest average reading achievement was for students from schools with 8-25 fourth-graders. This might be explained by the relatively small subgroup in this category and likely some specific urban schools, even though this effect did not appear in mathematics and science achievement, where the effect was not significant for the urban students. The positive correlation, however, was very obvious within Latvia's rural schools.

[9] Regulations on the Minimum and Maximum Number of Educatees, in general education in Educational Institutions Established by State and Local Government (Ministry of Education and Science of the Republic of Latvia), require that there is a minimum of 8 students for the classes in the countryside. Maximum 30 students are permitted in a class.

Exhibit 12.4: Student Distribution and Achievement by Urbanization and Number of Fourth-graders in the School in Latvia

Urbanization	Number of Fourth-graders in the School	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	Less than 8	13 (3.0)	516 (13.6)	12 (2.2)	507 (17.6)	12 (2.2)	509 (13.9)
	8 – 25	64 (5.3)	522 (8.0)	75 (3.1)	527 (4.9)	75 (3.1)	535 (4.6)
	26 – 50	16 (4.0)	539 (7.0)	11 (2.7)	547 (5.9)	11 (2.7)	548 (6.6)
	More than 50	7 (2.3)	544 (3.5)	2 (1.9)	563 (5.0)	2 (1.9)	561 (1.7)
Urban	Less than 8	1 (0.1)	500 (10.2)	-	-	-	-
	8 – 25	8 (1.4)	562 (7.9)	13 (3.3)	541 (6.2)	13 (3.3)	541 (6.3)
	26 – 50	32 (3.0)	539 (5.3)	31 (3.6)	540 (4.1)	31 (3.6)	544 (4.5)
	More than 50	59 (2.7)	551 (2.9)	56 (2.7)	548 (3.0)	56 (2.7)	552 (3.1)

( ) Standard errors appear in parentheses.

These results lead the author to think that apart from many other factors, community composition is more important than the number of students attending the school. For example, both PIRLS 2006 and TIMSS 2007 asked school principals the approximate percentage of students coming from economically disadvantaged homes. As expected, there are quite a lot more schools with more than 50% of children coming from economically disadvantaged families in the rural parts of Latvia – 18% versus 3 % in urban schools (Exhibit 12.5). Achievement obviously improves when comparing the lowest and highest categories, but it is not clear what happens among the middle categories. The author speculates that when answering the question, some school principals might have considered the whole country while others only their particular community.

Exhibit 12.5: Student Distribution and Achievement by Urbanization and Percentage of Students from Economically Disadvantaged Homes in the School in Latvia

Urbanization	% of Students from Economically Disadvantaged Homes in the School	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	0 – 10%	10 (4.9)	532 (40.4)	16 (4.4)	548 (10.1)	16 (4.4)	554 (11.3)
	11 – 25%	43 (7.8)	519 (6.3)	46 (6.8)	522 (5.4)	46 (6.8)	529 (4.3)
	26 – 50%	30 (7.5)	538 (6.6)	20 (6.4)	528 (8.5)	20 (6.4)	543 (8.5)
	More than 50%	17 (5.6)	514 (8.2)	18 (4.3)	517 (9.8)	18 (4.3)	519 (9.7)
Urban	0 – 10%	44 (4.7)	557 (3.8)	51 (4.8)	552 (3.7)	51 (4.8)	555 (3.7)
	11 – 25%	42 (4.6)	543 (3.5)	33 (5.2)	538 (3.6)	33 (5.2)	541 (3.8)
	26 – 50%	11 (3.3)	530 (7.4)	13 (3.1)	540 (6.9)	13 (3.1)	543 (8.2)
	More than 50%	3 (1.7)	539 (21.1)	3 (1.9)	515 (19.6)	3 (1.9)	527 (14.4)

( ) Standard errors appear in parentheses.

When student achievement by socio-economic background was compared using the author's created index (SEB), the results were more obvious (Exhibit 12.6). There was a higher concentration of well-off families in the urban parts of Latvia and the socio-economic background of families was highly correlated with student achievement. In reading, urban student achievement was markedly much higher than rural student achievement at all levels of socio-economic background. The author is convinced that the stronger relation of the rural-urban factor with the SEB index in the PIRLS 2006 arises from a better measurement of SEB. In TIMSS, only home possessions characterized socio-economic background, and information on such crucial determinants as parents' education and occupation were missing. Working class families with less educated parents might easily earn the same amount of money and have the same level of home possessions, but they most likely could not compensate for the missing cultural capital and parents' involvement in their child's education.

Exhibit 12.6: Student Distribution and Achievement by Urbanization and Socio-economic Background (SEB) in Latvia

Urbanization	Level of the SEB Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	10 (1.2)	555 (10.3)	12 (1.2)	558 (10.2)	12 (1.2)	559 (9.4)
	Medium	77 (1.8)	529 (6.0)	60 (2.1)	527 (5.1)	60 (2.1)	532 (4.7)
	Low	13 (2.1)	505 (10.1)	28 (2.2)	508 (7.0)	28 (2.2)	522 (6.3)
Urban	High	33 (1.6)	573 (3.2)	23 (1.0)	567 (3.4)	23 (1.0)	569 (2.4)
	Medium	61 (1.4)	540 (2.2)	66 (1.0)	543 (2.7)	66 (1.0)	546 (3.1)
	Low	6 (0.5)	541 (6.5)	11 (0.9)	510 (4.5)	11 (0.9)	521 (4.5)

( ) Standard errors appear in parentheses.

Early childhood exposure to education resulting in early literacy skills has been found to be an especially important factor (Johansone, Foy, 2004). One way to early exposure to education, assessed in PIRLS (unfortunately the measurement is unavailable for TIMSS), is parents' engagement in different kinds of educational activities with their child before the child begins primary school. Another exposure, also explored in the PIRLS study, is preprimary education. Whether it is in the form of preschool (mostly used in this document to describe preprimary education), kindergarten, or early childhood center, preprimary education plays an important role in preparing children for primary school. Both of those factors are extremely influential (Exhibits 12.7 and 12.8). However, the author is convinced that one factor can compensate for the other if circumstances are not ideal for a child to be exposed to both. In many ways a qualitative preschool education should effectively compensate for a missing or weak parent engagement in early childhood education at home. This is especially important because preschool education can be offered by the educational system, while parents' involvement is much harder to influence. In fact, in the PIRLS 2006 data for rural students in Latvia, the effect of attending preschool for more than two years appears to be even stronger in relation to student reading achievement than the early home literacy activities with the parents. Of course, this is speculative because there might be several hidden factors involved. However, the effect of early literacy skills (Exhibit 12.9) that can be learned either in the family, preschool, or both, had an extremely strong and positive correlation with the student achievement. The author believes that a child who has been exposed to an early childhood education also would easier adjust to studying in school.

Exhibit 12.7: Student Distribution and Reading Achievement by Urbanization and Early Home Literacy Activities Index (EHLA) in Latvia

Urbanization	Level of the EHLA Index	Reading	
		% of Students	Average Achievement
Rural	High	50 (2.7)	537 (5.2)
	Medium	41 (1.9)	519 (7.6)
	Low	9 (1.2)	513 (10.7)
Urban	High	64 (1.1)	555 (2.8)
	Medium	30 (1.1)	540 (3.0)
	Low	6 (0.5)	535 (5.9)

( ) Standard errors appear in parentheses.

Although, early home literacy activities have an obvious positive influence on later reading achievement, rural students at the high EHLA index level achieve an average result just as high as the average score for the urban students at the low or medium EHLA index level. The same conclusion can be drawn when comparing student reading achievement by preschool attendance. Rural students who attended preschool for more than two years had their reading achievement comparable to urban students with just some or no preschool attendance. However, there was one important difference. Even though the difference between student achievement for those who attended preschool for more than two years and those who attended for less or not at all was significant even within the urban communities, preschool attendance had a much stronger influence on the achievement of rural students – differences of 7 and 26 scale points, respectively. Also, 71% of urban students and only 38% of rural students attended preschool for more than two years.

Exhibit 12.8: Student Distribution and Reading Achievement by Urbanization and Preschool Attendance in Latvia

Urbanization	Preschool Attendance	Reading	
		% of Students	Average Achievement
Rural	Not at All	24 (2.8)	519 (8.5)
	Up to and Including 2 Years	38 (2.5)	518 (7.3)
	More than 2 Years	38 (3.1)	542 (6.2)
Urban	Not at All	10 (0.7)	545 (4.5)
	Up to and Including 2 Years	19 (0.8)	543 (3.7)
	More than 2 Years	71 (1.1)	552 (2.6)

( ) Standard errors appear in parentheses.

As mentioned earlier, the result of a child's early exposure to educational activities are early literacy skills that correspond well with reading achievement at the fourth-grade (Exhibit 12.9). On average, reading achievement in Latvia was 573 scale points for those whose parents reported their children could perform early literacy activities very well, 538 scale points for performing activities moderately well, 511 for performing them not very well, and only 491 for not being able to perform the activities at all. The difference between students with very good early literacy skills and those with just moderate skills was 33 scale points, the difference is 82 scale points – comparable to a whole school year – in relation to students with no early literacy skills when starting primary school. The effect was just as strong in both rural and urban communities. However, there was a slight difference in the student distribution among the different skill levels. The percentages of students with weak or no early literacy skills were proportional to the percentages of students with minimal or no parents' involvement in early home literacy activities and no preschool attendance.

Exhibit 12.9: Student Distribution and Reading Achievement by Urbanization and Early Literacy Skills (ELS) in Latvia

Urbanization	Level of Early Literacy Skills	Reading	
		% of Students	Average Achievement
Rural	Very Well	29 (2.5)	562 (6.2)
	Moderately Well	37 (1.8)	526 (6.4)
	Not Very Well	27 (2.2)	500 (7.1)
	Not at All	7 (1.3)	484 (10.7)
Urban	Very Well	36 (1.1)	576 (3.0)
	Moderately Well	42 (0.9)	543 (2.5)
	Not Very Well	18 (0.9)	519 (3.9)
	Not at All	4 (0.4)	497 (10.2)

( ) Standard errors appear in parentheses.

The influence of families' socio-economic background and children's early exposure to education on student achievement at the end of the primary education in Latvia is very strong. However, more information is needed in order to explain the urbanization effect, which was not fully explained by the above determinants alone. Unfortunately, none of the school resources and climate characteristics, explored by the author, shed any more light on the sources of the rural-urban disparities. Moreover, results on available school resources appeared to be confusing when analyzed by urbanization in Latvia (Exhibit 12.10). Surprisingly, there were no rural students at the low level of the index for science and

achievement was actually higher at the medium level than at the high level. In Latvia, the determinant of school resources did not show any significant impact. This, once again, support the conclusion, already drawn by Hanushek in 1997, that uniform resource policies will not work as intended. By simply providing more funding, or a different distribution of funding, is unlikely to improve student achievement. Back in 1997, Hanushek reviewed 400 studies of student achievement and found no strong or consistent relationship between student performance and school resources.

Exhibit 12.10: Student Distribution and Achievement by Urbanization and Available School Resources (ASR) in Latvia

Urbanization	Level of the ASR Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	57 (6.1)	532 (4.6)	27 (6.8)	522 (10.1)	23 (6.1)	518 (10.1)
	Medium	29 (5.8)	523 (12.7)	70 (7.3)	530 (5.1)	77 (6.1)	539 (4.6)
	Low	14 (5.3)	504 (21.2)	3 (2.5)	506 (2.9)	-	-
Urban	High	45 (5.3)	550 (3.3)	21 (4.6)	544 (4.3)	9 (3.4)	539 (6.9)
	Medium	37 (5.0)	545 (4.7)	77 (4.9)	543 (3.0)	87 (3.9)	548 (2.7)
	Low	18 (3.5)	552 (6.5)	2 (1.6)	560 (11.6)	4 (1.9)	569 (8.4)

( ) Standard errors appear in parentheses.

Similarly, school climate did not show any significant effect on student achievement (Exhibit 12.11). The subgroups in the high and low levels of the index tended to be too small to draw any meaningful conclusions. The majority of students were at the medium index level, within both rural and urban communities. The percentages of students in the low index category for PIRLS and TIMSS are rather different. That is because the measurement was not identical, with TIMSS including more information on such matters as teachers understanding and implementing the school's curriculum and parental involvement in the school's activities. If for PIRLS there were just a few, or no, students at the low index category, then for TIMSS a significant percentage of students fell in the low category: 21% of the rural students and only 9% of the urban students fell in this category. The author believes that having a positive school climate is important, but it is a weak determinant in the presence of much stronger factors influencing the climate itself and student achievement as a consequence.

Exhibit 12.11: Student Distribution and Achievement by Urbanization and School Climate (SC) in Latvia

Urbanization	Level of the SC Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	4 (2.9)	561 (63.5)	2 (2.5)	506 (2.9)	2 (2.5)	517 (5.6)
	Medium	96 (2.9)	523 (5.5)	77 (6.0)	529 (5.2)	77 (6.0)	536 (5.2)
	Low	-	-	21 (6.5)	524 (9.1)	21 (6.5)	532 (8.7)
Urban	High	11 (3.2)	562 (8.0)	2 (2.5)	559 (12.6)	2 (2.5)	568 (8.8)
	Medium	88 (3.4)	546 (2.5)	89 (3.6)	545 (2.4)	89 (3.6)	548 (2.6)
	Low	1 (1.0)	561 (0.8)	9 (3.2)	539 (6.7)	9 (3.2)	544 (4.7)

( ) Standard errors appear in parentheses.

The few other variables explored in this research, on such issues as vacancies in school and difficulties filling them, availability of different programs in school, availability of reading specialists, teachers' preparedness to teach mathematics and science topics, and teacher education, showed no significant influence on student achievement. Too few students fell in all categories but one, usually the medium category. For example, 95% of all students were in schools with no vacancies and thus no difficulties filling them. Rural teachers reported being just as well educated and prepared to teach different mathematics and science topics as their urban counterparts.

Obviously, there is no one miracle factor that could be changed in order to close the rural-urban achievement gap. Even though individual student background is proven to be a very important factor, the relationship between student composition in the community and individual student performance appears to be stronger. Further analysis showed that, even despite positive attitudes towards reading, mathematics, and science, as well as a high self-concept of one's achievement, students in rural schools still are lower performers than their urban counterparts (Exhibits 12.12 and 12.13). Also, as mentioned before, Latvia had the lowest percentage of students with positive attitudes toward reading and one of the highest percentages of students with negative attitudes towards reading among all the countries participating in PIRLS 2006. Additionally, students' attitudes towards reading and mathematics are dropping significantly over time. As for self-concept, regardless of the subject, students judge their own abilities relative to their classmates. If all peers are low achievers, a student who outperforms his classmates has a high self-concept of his or her

own abilities, also known as the "big fish little pond effect" (Marsh, Koeller, & Baumert, 1999).

Exhibit 12.12: Student Distribution and Achievement by Urbanization and Students Attitudes towards Reading, Mathematics, and Science in Latvia

Urbanization	Level of the Students' Attitudes Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	27 (2.8)	549 (7.9)	66 (2.1)	531 (6.2)	71 (2.0)	638 (5.0)
	Medium	55 (2.3)	515 (6.5)	16 (1.8)	517 (10.1)	16 (1.3)	526 (9.6)
	Low	18 (2.2)	516 (7.6)	18 (1.7)	519 (8.0)	13 (1.8)	521 (10.6)
Urban	High	36 (1.5)	569 (3.1)	65 (1.2)	552 (2.4)	70 (1.4)	548 (2.6)
	Medium	51 (1.2)	539 (2.6)	18 (0.8)	535 (4.3)	17 (0.8)	545 (3.9)
	Low	13 (0.9)	529 (3.7)	17 (0.9)	532 (3.5)	13 (0.8)	554 (4.0)

( ) Standard errors appear in parentheses.

There was a slightly higher percentage of students with very positive attitudes towards reading in the urban communities, but there were no significant differences in student distribution by urbanization in regards of student attitudes towards mathematics and science. There were just as many rural students liking and valuing mathematics and science as there were in the cities and towns. However, rural students with very positive attitudes still could not quite compete with their urban counterparts.

Exhibit 12.13: Student Distribution and Achievement by Urbanization and Students Self-concept towards Reading, Mathematics, and Science in Latvia

Urbanization	Level of the Students' Self-concept Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	37 (2.8)	558 (7.4)	51 (1.5)	557 (5.2)	57 (2.6)	553 (5.2)
	Medium	58 (2.8)	506 (5.7)	35 (1.4)	502 (5.6)	31 (2.0)	515 (7.2)
	Low	5 (1.1)	498 (9.2)	14 (1.6)	482 (9.2)	12 (1.8)	496 (8.4)
Urban	High	46 (1.1)	571 (2.5)	49 (1.1)	575 (2.7)	57 (1.3)	561 (2.8)
	Medium	51 (1.1)	531 (2.9)	36 (1.0)	523 (2.8)	32 (1.0)	532 (3.1)
	Low	3 (0.3)	498 (9.3)	15 (0.8)	500 (3.3)	11 (0.7)	529 (4.4)

( ) Standard errors appear in parentheses.

Similarly, rural students with a high self-concept achieved higher results than the rural students with lower self-concept, but not as high as the confident urban students. It was

especially obvious at the medium index level, where urban students outperformed rural students by 17 to 25 scale points. Thus, it is true that students in rural communities have a misleading perception of their own abilities, because they judge their own achievement relative to their low-performing peers.

13. The School Mix Matters, or the Importance of Community Composition Effects in Latvia

Based on the literature review on community composition effects on student achievement and the results of the exploratory analysis described above, the author believes that an individual student's achievement in Latvia is highly dependent on the characteristics of his or her classmates. It has been proven in the past that mixing low-performing and high-performing students has a positive impact on achievement in the overall student population, and the gains of the low-performing students offset the losses of the high-performing students (Henderson, Mieskowski, Sauvageau, 1978). Because urbanization and students' socio-economic background are important determinants of student achievement in Latvia and there were more students from low socio-economic backgrounds in rural communities, the impact that peers have on their classmates was expected to be even stronger in the rural communities. Additionally, the exploratory analysis showed that the proportion of students mastering early literacy skills in rural communities was much smaller than in urban communities. Considering the significant effect of early childhood exposure to education and early literacy skills on student achievement, it is another important factor contributing to the disadvantages of rural communities. Because of students' lower socio-economic backgrounds and, in many cases, missing early childhood exposure to education, student composition in rural communities is more likely to have a negative impact on student achievement.

To investigate the impact of peers relative to the urbanization factor, students' socio-economic background, early home literacy activities (PIRLS only) and early literacy skills (PIRLS only), a multilevel analysis was performed and several models were evaluated, explaining how individual student achievement would possibly change if student composition in the school or class would change.

PIRLS 2006 Results

In PIRLS 2006, 98% of urban students were in schools with more than 50% of students from high or medium (SEB index levels) socio-economic backgrounds. In rural communities, there were only 76% of students in such schools. Moreover, 94% of urban

students were in schools with even more than 60% of students from high or medium socio-economic backgrounds, while there were only 64% of students in such schools in rural areas.

Exhibit 13.1 shows to what extent the most influential students' individual and school level characteristics account for the observed differences in reading achievement scores in Latvia. The models first take into account only the students' individual socio-economic background (SEB index levels) and early literacy experiences (including EHLA – Early Home Literacy Activities index levels), then adds the community context and, finally, the aggregated socioeconomic background at the school level represented by threshold effects.

Exhibit 13.1: Socio-economic, Early Literacy Background, and Student Composition Effects on Student Reading Literacy Achievement in Latvia

	Model 1	Model 2	Model 3	Model 4	Model 5
Average Reading Achievement	521 (4.9)	509 (5.3)	502 (6.1)	492 (6.1)	486 (9.2)
Student-Level Effects					
Estimated Advantage for a Student at the Medium or High SEB Index Level	16.0 (4.1)	10.2 (3.5)	9.9 (3.4)	9.0 (3.5)	9.0 (3.5)
Estimated Advantage for a Student at the High EHLA Index Level		9.7 (3.2)	8.5 (3.4)	8.5 (3.4)	8.3 (3.4)
Estimated Advantage for a Student with Very Good Early literacy Skills		40.5 (2.7)	39.5 (2.8)	39.5 (2.9)	39.2 (2.8)
School-Level Effects					
Estimated Advantage for a Student Attending an Urban School			18.6 (6.0)	12.5 (6.7)[1]	14.6 (6.4)
Estimated Advantage for a Student Attending a School where More than 60% of Students are at the Medium or High SEB Index Level				17.7 (7.6)	
Estimated Advantage for a Student Attending a School where More than 50% of Students are at the Medium or High SEB Index Level					20.9 (10.7)

( ) Standard errors appear in parentheses. [1] The effect is not significant.

The results of Model 1:

This first model estimated only the average impact of an individual student's socio-economic background at home. As a result, a student at the level of the low socio-economic

background index (SEB) in Latvia scored on average 521 scale points on the PIRLS 2006 assessment. At the same time, a student at the medium or high level of the SEB index scored 16 points higher. The difference is statistically significant. However, there also is a significant variation in the effect among schools, which is taken into account when building the following models.

The results of Model 2:

This model estimated the effect of adding early literacy activities and skills to the individual student's socio-economic background. The findings can be summarized as follows.

- A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have very good early literacy skills when starting school, scored on average 509 scale points on the PIRLS 2006 assessment.
- The model estimated that, if this student would be at the medium or high level of the SEB index, he or she would be expected to score 10 points higher.
- If this student would be at the high EHLA index, he or she would also be expected to score another 10 points higher.
- It is striking that the estimated advantage of a student having very good early literacy skills when starting school could be as high as 41 scale points.

All estimated effects are significant.

The results of Model 3:

In the previous two models, the effects were estimated only on individual student characteristics. Community or school effects were not considered. The third model added the urbanization effect at the school level.

- A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have very good early literacy skills when starting school, and attended a rural school, scored on average 502 scale points on the PIRLS 2006 assessment.
- A student with the same individual characteristics, but attending an urban school, would be expected to score 19 points higher.

The urbanization effect still is statistically significant even after accounting for the individual student characteristics.

The results of Model 4:

This model estimated peer effects on student reading achievement in Latvia. The author estimated the effect on reading achievement for a student attending a school where more than 60% of the fourth-grade students were at the medium or high level of the socio-economic index. The results are quite notable.

- A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have good early literacy skills when starting school, and also attended a rural school with 60% or less fourth-grade students at the medium or high level of the SEB index, scored on average only 492 scale points on the PIRLS 2006 assessment.
- A student with the same individual characteristics attending an urban school with 60% or fewer students at the medium or high level of the SEB index would be expected to score on average 13 points higher. The urbanization effect is no longer significant in this model.
- A student with the same individual characteristics attending a rural school with MORE than 60% of the fourth-grade students at the medium or high level of the SEB index would be expected to score 18 points higher.

The results of Model 5:

In this model, the author estimated the peer effect by lowering the percentage of students at the medium or high level of the SEB index to "more than 50%". The effect remained very strong. However, the urbanization effect became significant again. Thus, the author considers the "more than 60%" level the most influential threshold in explaining the urbanization effect.

- A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have very good early literacy skills when starting school, and also attended a rural school with 50% or less fourth-grade students at the medium or high level of the SEB index, scored on average only 486 scale points on the PIRLS 2006 assessment.
- A student with the same individual characteristics attending a rural school with MORE than 50% of students at the medium or high level of the SEB index would be expected to score on average 21 points higher. However, the urbanization effect remains significant in this model.

The analysis of the PIRLS 2006 data in Latvia has proven that the community effects are extremely influential in shaping individual student achievement. It is remarkable that Model 4 of the analysis explained almost half of the original rural-urban achievement gap. By desegregating students within the rural areas in Latvia, could potentially improve the average reading achievement of rural students by about 18 scale points and thereby reduce the urbanization.

Apart from student segregation, if rural children of preschool age would have the opportunity to acquire very good early literacy skills, their reading achievement could be expected to improve by additional 40 points.

The main conclusion of these analyses is that rural students with very good early literacy skills when starting school would be expected to score on average 532 scale points. This means that the problem of severe disadvantage in the rural parts of Latvia starts well before the children enter school. If, later on, these rural students would attend schools with more than 60% of fourth-grade students at the medium or high level of the SEB index, they would be expected to have reading achievement of about 550 scale points, which would very likely reduce the urbanization effect to an insignificant level.

TIMSS 2007 Results

Due to the limited amount of family background information, it was somewhat more difficult to analyze the possible background effects on student achievement for TIMSS. One of the most influential socio-economic determinants – parents' education and occupation – in relation to student achievement could not be explored in relation to mathematics and science achievement. Based on the PIRLS results, the TIMSS results at the eighth-grade, and results from the PISA 2003 study, where students provided information on their parents education and occupation (Geske, Grīnfelds, Dedze, Zhang, 2006), the author expects that the relationship would be just as strong. Unfortunately, information on early childhood education and skills also is not available from the TIMSS data. Thus the models built for TIMSS provide less information and are likely to have more measurement error. For example, only the high level of the socio-economic background (SEB) index is used. Due to the index including only the number of books in the home and other home possessions, while missing parents' education and occupation, the probability of being in the high level is much higher, while the effect is weaker. As mentioned before, the home possessions are not very likely to capture the cultural capital a child with more educated parents would have.

From the TIMSS 2007 results, 36% of urban students were in schools with more than 10% of students from high (SEB index level) socio-economic backgrounds. In rural communities, there were only 34% of students in such schools. However, 30% of urban students were in schools with even more than 20% of students from high socio-economic backgrounds, while there were only 14% of students in such schools in rural areas. Thus, although weaker, the segregation by socio-economic status can be seen in the TIMSS data as well.

Exhibits 13.2 and 13.3 demonstrate to what extent students' individual and school-level socio-economic characteristics account for observed differences in mathematics and science achievement in Latvia. The models first take into account only students' individual socioeconomic background, then add community context and, finally, aggregated socioeconomic background at the school level as represented by threshold effects.

Exhibit 13.2: Socio-economic and Student Composition Effects on Student Achievement in Mathematics in Latvia

	Model 1	Model 2	Model 3	Model 4
Average Mathematics Achievement	524 (4.3)	519 (5.7)	516 (5.9)	503 (8.3)
Student-Level Effects				
Estimated Advantage for a Student at the High SEB Index Level	33.7 (4.9)	30.0 (5.0)	27.8 (4.9)	25.5 (4.6)
School-Level Effects				
Estimated Advantage for a Student Attending an Urban School		16.1 (6.7)	12.4 (6.6)[1]	11.6 (6.0)[1]
Estimated Advantage for a Student Attending a School where More than 20% of Students are at the High SEB Index Level			13.1 (6.0)	
Estimated Advantage for a Student Attending a School where More than 10% of Students are at the High SEB Index Level				26.7 (8.3)

( ) Standard errors appear in parentheses. [1] The effect is not significant.

The results of Model 1:

This model estimated only the average impact of an individual student's socio-economic background at home. As a result, a student at the medium or low level of the socio-economic index (SEB) in Latvia scored on average 524 scale points on the TIMSS 2007 mathematics assessment. At the same time, a student at the high level of the SEB

index scored 34 points higher. The difference is statistically significant. However, there also is a significant variation of the effect among schools, which is taken into account when building the following models.

The results of Model 2:

In Model 1, the effect was estimated only on an individual student basis, and did not consider any community or school effects. The second model added the school-level effect of urbanization.

- A student at the low or medium level of the SEB index, who also attended a rural school, scored on average 519 scale points on the TIMSS 2007 mathematics assessment.
- At the same time, a rural student at the high level of the SEB index scored 30 points higher.
- A student with the same level of individual socio-economic background, attending an urban school, would be expected to score 16 points higher.
- Thus, a student at the high level of the SEB index attending an urban school would be expected to score 46 (30+16) points higher than a student at the medium or low level of the SEB index attending a rural school.

When controlling for individual student socio-economic background, the urbanization effect was slightly reduced, but still statistically significant.

The results of Model 3:

This model estimated peer effects on student mathematics achievement in Latvia. The author estimated the effect on mathematics achievement for a student attending a school where more than 20% of the fourth-grade students were at the high level of the socio-economic index.

- A student at the low or medium level of the SEB index, who also attended a rural school with 20% or less fourth-grade students at the high level of the SEB index, scored on average 516 scale points on the TIMSS 2007 mathematics assessment.
- A student in the same school and community context at the high level of the SEB index would be expected to score 28 points higher.
- A student with the same individual characteristics attending a rural school with MORE than 20% of the fourth-grade students at the high level of the SEB index would be expected to score 13 points higher.

- The urbanization effect was reduced to 12 points in this model, which is no longer significant.

The results of Model 4:

In this model, the author estimated the peer effect by lowering the percentage of students at the high SEB index to "more than 10%". The effect was very strong and the results are quite striking.

- A student at the low or medium level of the SEB index, who also attended a rural school with 10% or less fourth-grade students at the high level of the SEB index, scored on average only 503 scale points on the TIMSS 2007 mathematics assessment.
- A student with the same individual characteristics attending a rural school with more than 10% of fourth-grade students at the high level of the SEB index would be expected to score on average 27 points higher.
- The urbanization effect was reduced to 12 points in this model as well. Moreover, the urbanization effect also becomes insignificant.

Exhibit 13.3: Socio-economic and Student Composition Effects on Student Achievement in Science in Latvia

	Model 1	Model 2	Model 3	Model 4
Average Science Achievement	530 (4.3)	525 (5.7)	523 (6.1)	513 (8.3)
Student-Level Effects				
Estimated Advantage for a Student at the High SEB Index Level	30.0 (4.0)	26.9 (4.2)	25.2 (4.2)	23.6 (4.2)
School-Level Effects				
Estimated Advantage for a Student Attending an Urban School		13.8 (6.6)	10.9 (6.4)[1]	10.1 (6.3)[1]
Estimated Advantage for a Student Attending a School where More than 20% of Students are at the High SEB Index Level			10.6 (5.9)[1]	
Estimated Advantage for a Student Attending a School where More than 10% of Students are at the High SEB Index Level				21.6 (8.7)

( ) Standard errors appear in parentheses. [1] The effect is not significant.

The results of Model 1:

This model estimated only the average impact of an individual student's socio-economic background at home. As a result, a student at the medium or low level of the socio-economic index (SEB) in Latvia scored on average 530 scale points on the TIMSS 2007 science assessment. At the same time, a student at the high level of the SEB index scored 30 points higher. The difference is statistically significant. However, there also is a significant variation of the effect among schools, which is taken into account when building the following models.

The results of Model 2:

In Model 1, the effect was estimated only on an individual student basis, and did not consider any community or school effects. The second model added the school-level effect of urbanization.

- A student at the low or medium level of the SEB index, who also attended a rural school score on average 525 scale points on the TIMSS 2007 science assessment.
- At the same time, a rural student at the high level of the SEB index scored 27 points higher.
- A student with the same level of individual socio-economic background, attending an urban school, would be expected to score 14 points higher.
- A student at the high level of the SEB index attending an urban school would be expected to score 41 (27+14) points higher than a student at the medium or low level of the SEB index attending a rural school.

Just as for mathematics, when controlling for individual student socio-economic background, the urbanization effect on student science achievement was slightly reduced, but still statistically significant.

The results of Model 3:

This model estimated peer effects on student science achievement in Latvia. The author estimated an effect on the science achievement for a student attending a school where more than 20% of the fourth-grade students were at the high socio-economic index level.

- A student at the low or medium level of the SEB index, who also attended a rural school with 20% or less fourth-grade students at the high level of the SEB index, scored on average 523 scale points on the TIMSS 2007 science assessment.

- A student in the same school and community context at the high level of the SEB index would be expected to score 25 points higher.
- The urbanization effect was reduced to 11 points in this model, which is no longer significant.
- A student with the same individual characteristics attending a rural school with MORE than 20% of the fourth-grade students at the high level of the SEB index would be expected to score 11 points higher. However, this effect is not significant either.

The results of Model 4:

In this model, the author estimated the peer effect by lowering the percentage of students at the high SEB index to "more than 10%". This time, the effect was significant, leaving the urbanization effect insignificant.

- A student at the low or medium level of the SEB index, who also attended a rural school with 10% or less fourth-grade students at the high level of the SEB index, scored on average only 513 scale points on the TIMSS 2007 science assessment.
- A student with the same individual characteristics attending rural school with more than 10% of fourth-grade students at the high SEB index level would be expected to score, on average, 21 points higher.
- The urbanization effect was reduced to 12 points in this model. As mentioned before, the urbanization effect becomes insignificant in this model as well.

Even though the effects in the models based on TIMSS data were weaker than the ones based on PIRLS data, the results still show a strong impact of student composition on mathematics and science achievement. It is remarkable that Model 4 once again explained almost half of the original rural-urban achievement gap for both mathematics achievement and science achievement. The unexplained part of the urbanization effect would need additional research. However, from personal observations, the author has some insights on possible reasons that, unfortunately, could be difficult to measure. For example, the urban environment that an urban child is exposed to on an everyday basis, including access to museums, theaters, concerts, public libraries, even book stores, exposure to media (including internet at home), and all kinds of extracurricular activities may be all contributing factors.

The main conclusion of these analyses is that the socio-economic background of individual students is an extremely influential factor. However, as shown in Section 12 on

an individual level it does not explain any significant part of the rural-urban gap. Desegregating students within the rural areas in Latvia would possibly improve the average mathematics achievement and the average science achievement by about 27 and 22 scale points, respectively. Moreover, desegregation would be very likely to reduce the urbanization effect to an insignificant level.

ENDNOTES, CONCLUSIONS, AND PROPOSALS

The research in this promotion paper focused on the level of achievement equity in primary education in Latvia. The research was based on the primary, and even preprimary, education because the roots of the education quandary lie in the early years of schooling – both because early learning is a pre-requisite for successful later learning, and because rapid structural changes in modern global economies may require a solid foundation of general knowledge as distinct from specific knowledge. The author proves that qualitative early childhood education is a very influential factor on later educational performance and the effects most likely persist even through adulthood.

When analyzing the quality of an educational system, student achievement results are considered key indicators. Even if Latvia's overall results in the international arena at the primary school level are looking rather good, with the achievement levels being well above the international average in reading literacy, mathematics, and science, how these scores are distributed across the population is very important. An important dimension of educational equity in Latvia is rural-urban disparities in student achievement. Moreover, this is a lasting trend and the gap has kept increasing over time. The review of the literature explains how this situation has developed in Latvia.

Before the collapse of the Soviet Union, compulsory school enrolment was practically universal, and it was taken for granted that schools were easily accessible and all children were in school. Also, the social inequalities were artificially controlled in relation to communities and thus the educational system. In the end, Latvia was functioning under the communist regime. Now it seems that maintaining wide access to basic education has come at the expense of educational quality. Local governments were given increasing responsibilities for education provision from preprimary to secondary schooling. However, in many instances local authorities, particularly in rural areas, were not allocated the financial resources to meet the new responsibilities and have few means to raise additional funds. Moreover, huge differences in the levels of per capita household income and greater inequality in how income is distributed meant that parents in rural areas had fewer financial resources for their children's education. Also, widespread use of extra-curricular private tutoring financed by parents was considered an important source of social inequity. The opportunity costs of education, as opposed to contributing to household income via the informal sector, became very high, particularly among rural populations. Finally, changes in access and quality had important implications for equity. The increasing reliance on

contributions from the community and family to support educational expenses was bound to discriminate children from poorer regions, communities, and families. Socio-economic disparities between households and regions widened dramatically during the 1990s and were reflected in the growing polarization across the educational system. In fact, changes in equality of opportunity in basic education appeared within the system rather than entering the system. That is, most children are in school, but only some have access to a better quality education: better teachers, better school conditions, better extra-educational resources (e.g., private tutoring and various learning aids), and most importantly – more relevant classes. Thus, it is not only a matter of greater deterioration in the rural areas, but also of greater gains in the urban areas, even further widening the rural-urban achievement gap. As a result, the socio-economic status and urbanization ended up being the most important determinants of student achievement in Latvia, especially when measured between groups rather than individual students. Social inequality refers to the ways in which socially-defined categories of individuals are differently positioned with regard to access to social goods, including quality education. Social exclusion is the lack of resources of an individual household, inadequate social participation, lack of knowledge, and lack of power. Social exclusion can be a vicious circle. It can repeat itself for generations. For a small country like Latvia, this situation is devastating. The rural-urban achievement gap represents not only a threat to the quality of the educational system in Latvia but also to its society as a whole.

Unfortunately, educational policy can do very little to change the socio-economic status, including cultural capital, of individual families in the short term, especially when the distribution of wealthy and poor is between communities and not just random. The author of this research searched for determinants of student achievement that can be manipulated externally.

All the objectives set in the promotion paper have been achieved. All six theses of the promotion paper have been proven true and are ready to be defended. All six theses refer directly to educational management. Also, all theses and conclusions refer to Latvia.

The following are main conclusions and their corresponding thesis.

An important dimension of educational equity in Latvia is related to rural-urban disparities in student achievement. In the results of this research, urban students in Latvia outperformed their rural counterparts by about 20 scale points. When Riga was separated

from the other cities and towns, the achievement gap became even bigger. Riga outperformed other cities and towns by more than 20 scale points and rural parts of the country by more than 30 points. Sections 10, 11, and 12 of the promotion paper present the results.

Conclusions:

- The way equality of access in primary education in Latvia is realized right now is not only expensive - for example, having six students per teacher while the average number of students per teacher in Europe is fourteen - but also ineffective in regards to student achievement and clearly comes at the expense of quality.
- For a country like Latvia, with overall results in the international arena at the primary school level looking rather good, with the achievement levels being well above the international average in reading literacy, mathematics, and science, achievement equity across the population becomes one of the most important indicators of the overall quality.
- Even though the achievement variance at the school level in Latvia has become smaller over time (comparing the PIRLS 2006 results to PIRLS 2001 and TIMSS 2007 results to TIMSS 2003), the variations between the achievement levels by school community in Latvia still put children in rural communities at a distinct disadvantage. Children attending rural schools have significantly lower achievement in all three main subjects of primary schooling than their urban counterparts. However, one cannot effectively judge student achievement and, thus, the quality of education without references to contextual factors.
- Socio-economic status and urbanization are the most important determinants of student achievement in Latvia, especially when measured between groups rather than individual students.

Thus, the first of the six theses has been proven to be true: *The variations between the achievement levels by school community in Latvia are significant, especially when groups are defined by urbanization. Children in rural communities are at a distinct disadvantage. Children attending rural schools do not achieve comparable educational outcomes as their urban counterparts.*

In Latvia, students at the high level of socio-economic index had an average reading achievement of 571 scale points with a standard error 3.1, mathematics achievement of 565

(s.e. of 3.6) scale points, and science achievement of 566 (s.e. of 3.1) scale points. They outperformed their counterparts at the low level of socio-economic index by 48, 56, and 44 scale points, respectively. The socio-economic background of the families was highly correlated with student achievement by urbanization. However, rural students with comparable socio-economic backgrounds still were outperformed by their urban counterparts. While rural students at the high level of socio-economic index achieved results of 555 (s.e. of 10.3) scale points in reading, 558 (s.e. of 10.2) scale point in mathematics, and 559 s.e. of (9.4) scale points in science, their urban counterparts from the high index group achieved the result of 573 (s.e. of 3.2) scale points in reading, 567 (s.e. of 3.4) scale points in mathematics, and 569 (s.e. of 2.4) scale points in science.

There was a higher concentration of well-off families in the urban parts of Latvia. About 10 to 12% of rural students came from high socio-economic background, while in the urban communities there were about 23 to 33% of students from high socio-economic background. Moreover, 13 to 28% of rural students and only 6 to 11% of urban students came from economically disadvantaged backgrounds.

Sections 12 and 13 of the promotion paper present the results.

Conclusion:

- It is not just urbanization that influences student achievement. It is the segregation by socio-economic origin that is more obvious in the rural parts of the country. It is likely that such segregation exists in the urban areas as well and is also dangerous because of being less obvious from the overall good results in cities and towns.

Thus, the second of the six theses has been proven to be true: *Even though children from socially privileged families achieve higher performance in school than children from socially disadvantaged families, the urbanization effect cannot be fully explained by socioeconomic differences on individual student level.*

Education is one of those numerous human activities characterized by social spillovers. The spillover argument is particularly easy to understand when social circumstances become extreme. For example, in schools with severe drug problems, parental violence or other serious problems, the learning and teaching activities are constantly compromised, no matter the individual's ability.

The community composition, or peer effects, of this research are presented in Section 13 of the promotion paper. It is quite remarkable that the most effective models explained

almost half of the original rural-urban achievement gap for all three primary school subjects and left the urbanization effect insignificant. Thus, the socio-economic background of individual students is an extremely influential factor, but on the individual level, it does not explain a significant part of the rural-urban gap. Only when desegregating students within the rural areas in Latvia, would it be possible to improve the average student achievement.

Conclusions:

- Just equality and/or simply putting more resources into certain schools will not reliably lead to improvements in student achievement. Equalizing expenditure levels in different districts will not lead to equity in achievement outcomes. Quality, not necessarily the cost, of teachers and students, both the individual and his peer group, are two important factors that affect the level of educational achievement.
- There are significant student composition disparities between districts and even schools within districts. Each student in a school has a part in determining the quality of education for his fellow students by his impact on peer group quality. Maximization of the average student achievement level among students calls for complete mixing of students from affluent homes and students from disadvantaged homes. Moreover, low-performing students are more sensitive to peer effects and would gain more from raising the proportion of high-performing students in a class.
- Within the results for Latvia, students perform better in larger schools in all three subjects. The positive correlation was especially obvious within the rural schools in Latvia.

Thus, the third of the six theses has been proven to be true: *Improving quality of community composition (peer effects) has an important effect on improving achievement of individual students. To minimize the negative effect, student segregation should be minimized to the greatest possible extent. The revealed interactions of the most influential factors and student achievement support the idea of organizing bigger schools in centers of the rural communities.*

Apart from the socio-economic inequalities, such input factors as early literacy activities, early childhood exposure to education, and early literacy skills proved to be extremely important determinants of later achievement in school. Average reading

achievement in Latvia was 573 scale points for those whose parents reported their children could perform early literacy activities very well, 538 scale points for performing the activities moderately well, 511 for performing them not very well, and only 491 for not being able to perform the activities at all. The difference between the students with very good early literacy skills and those with just moderate skills was 33 scale points, the difference was 82 scale points, roughly equivalent to a whole year of schooling, with the ones with no early literacy skills when starting primary school at all.

If rural children of preschool age would have the opportunity to acquire very good early literacy skills, their average reading achievement could be expected to improve by about 40 points. A rural student with very good early literacy skills when starting school would be expected to score, on average, 532 scale points. This means that the problem of severe disadvantage in the rural parts of Latvia starts well before the children enter school. If, later on, this rural student would attend a school with more than 60% of fourth-grade students at the medium or high level of SEB index, he or she would be expected to have a reading achievement of about 550 scale points, which would very likely reduce the urbanization effect to an insignificant level.

Conclusion:

- Early childhood exposure to education resulting in early literacy skills has been found to be an especially important factor. Whether it is in the form of preschool, kindergarten, or early childhood center, preprimary education plays an important role in preparing children for primary school. In many ways, a qualitative preschool education should effectively compensate for a missing or weak parent engagement in early childhood education at home. In fact, the effect of attending preschool for more than two years appears to be stronger in relation to student reading achievement than the early home literacy activities with the parents. Early literacy skills that can be learned either in the family, preschool, or both, have an extremely strong and positive correlation with student achievement.

In addition to the previous statement, in the PIRLS 2006 study, the highest average age of fourth graders among all participating countries was in Latvia, at 11.0 years. The youngest children assessed for PIRLS 2006 were in Italy, at 9.7 years old on average. Similarly from the TIMSS 2007 study, the highest average age of fourth graders among all countries was in Latvia, Denmark, El Salvador, and Yemen. The youngest children assessed

for TIMSS 2007 under 10 years of age, were in Australia, Italy, Norway, Scotland, Slovenia, and Qatar.

Since early childhood exposure to education has proven to be very important, the later students with no previous exposure start their primary education, the lower their achievement will be. As mentioned above, 71% of urban students and only 38% of rural students had attended preschool for more than two years. Also, 36% of urban students and 29% of rural students had very good early literacy skills, and 22% of urban students and 33% of rural students had very weak early literacy skills or did not have any. Thus, the high age of starting school is more likely to harm the rural students even more.

Lowering the school starting age to at least the age of six is a common trend in Europe. For most OECD countries, primary education starts at the age of six.

Thus, the fourth and the fifth of the six theses have been proven to be true: *Early childhood exposure to education and early literacy skills are crucial factors influencing the later achievement in school. Also, the earlier in child's life the exposure to educational activities begins, the greater the benefits will be.*

The fourth-grade students in Latvia are some of the oldest ones among the fourth-graders in many developed countries. Lowering the school starting age with emphasis on early childhood education, especially for disadvantaged children and their communities, will have a positive impact on overall student achievement in Latvia.

Latvia had the lowest percentage of students with positive attitudes towards reading and one of the highest percentages of students with negative attitudes towards reading from all the participating countries. Additionally, students' attitudes towards reading and mathematics are getting significantly lower over time. The correlation between the students' attitudes and student achievement is very strong and thus it should be a concern to policy makers that such a trend might eventually negatively influence student achievement in Latvia. There was a slightly higher percentage of students with very positive attitudes towards reading in the urban communities, but there were no significant differences in student distribution by urbanization in regards to student attitudes towards mathematics and science. There were just as many rural students liking and valuing mathematics and science as there were in the cities and towns. However, rural students, despite very positive attitudes, still achieved results that could not compete with their urban counterparts, i.e., with the same very positive attitudes.

As for self-concept, regardless of the subject, students judge their own abilities relative to their classmates. If all peers are low achieving, a student who outperforms his classmates has a high self-concept of his or her own abilities. Rural students with a high self-concept achieved higher results than the rural students with lower self-concept, but not as high as the confident urban students. Thus, students in rural communities seem have a wrong perception of their own abilities only because they judge their own achievement relative to their low-performing peers.

Conclusions:

- Latvia had the lowest percentage of students with positive attitudes toward reading and one of the highest percentages of students with negative attitudes toward reading among all the countries that participated in PIRLS 2006. Additionally, students' attitudes towards reading and mathematics are becoming significantly lower over time. Correlation between students' attitudes and student achievement tends to be very strong and thus should be a concern to policy makers that this trend might eventually negatively influence student achievement.
- Back in 2001, Latvia's overall reading achievement was higher. Even if the difference was not statistically significant, there is a reason to be cautious of such a trend. Especially because most other international studies so far have shown a rapid growth in Latvia's achievement since regaining its independence.
- Over time, Latvia has kept improving its average achievement in mathematics and science. The improvement in mathematics however was very minimal and has not been statistically significant since TIMSS 2003.
- Rural students with a high self-concept achieved higher results than the rural students with lower self-concept, but not as high as the confident urban students. Students in rural communities have a wrong perception of their own abilities, because they judge their own achievement relative to their low-performing peers. If all peers are low achieving, a student who outperforms his classmates has a high self-concept of his or her own abilities.

Thus, the sixth of the six theses has been proven to be true: *Student attitudes towards learning are significantly declining in Latvia. Students also have wrong perception of their own abilities, because they judge their own achievement relative to their peers. Positive student attitudes towards learning and healthy self-concept, regardless whether it*

is reading, mathematics, or science, should be added as an important goal to the basic education standard of Latvia.

Proposals for Narrowing the Achievement Gap

As a result of this research, the author has stated the following proposals for policy makers that, combined, should help reduce the student achievement gap by urbanization and the variance at the school level.

- Extensive, high quality preprimary education should be provided to all children from three years of age with emphasis for disadvantaged communities and families.
- A program should be developed to provide comprehensive child development services to disadvantaged children and their families, with a special focus on helping preschoolers develop the early reading and mathematics skills they need to be successful in school and in adult life.
- A program involving intensive social work should be developed and should serve the disadvantaged families even before a child reaches the age of three. This should involve enhancing the social and cognitive development of children through the provision of health, nutritional, social, and other services. There is a mounting evidence that the earliest years matter a great deal to children's growth and development.
- As a common trend in Europe and the proven positive impact of early education, lowering the school starting age to six years of age in Latvia should be considered. For most OECD countries, primary education starts at the age of six. Nevertheless, the one year of compulsory preschool education should remain. It has been proven (in the United States for example) that bussing children to school starting at the age of five is age appropriate and works well. Because in some rural areas reaching the closest preschool would be impossible on a daily basis, and bus travel for children below the age of five is unrealistic, preschool education from the age of three to the age of five in these areas should be provided on an individual or semi individual basis using the programs mentioned above.
- Every rural school providing primary/basic education should be carefully evaluated and compared to neighboring schools in terms of student achievement, characteristics of student composition, and the logistical possibility to take in more

students from the neighboring communities. After careful analysis of possible "student movement" to the closest competitive schools, schools with low average achievement and negative student composition (especially the very small schools) should be closed. Bussing students would be a cheaper and proven to be effective method of providing equality of access to one-year preprimary and primary/basic education.

- After rural school desegregation to the greatest possible extent, these schools should receive extra financial support methodically in order to promote teacher movement from towns and cities to rural areas creating healthy competitiveness.
- To achieve the two above points, preschool and primary/basic education should be centrally funded by government, even if the funds coming from different districts would have to first flow into this common budget. This would not allow segregation by district in terms of funding and would make the "money follows the student" approach easier to realize.
- Building positive student attitudes towards learning and healthy self-concept towards one's abilities and achievement, regardless whether it is reading, mathematics, and science, should be added as one of the primary goals within the curricula of preprimary and primary schooling. Additionally, this should involve developing reading programs in order to motivate students, especially boys, to read even before and, of course, after they learn to read.
- Latvia should continue participating in acknowledged international comparative studies conducted by the IEA and OECD in order to monitor trends in student achievement internationally and within the country. Reliable methods of assessing learning achievement are an important part of an educational system that seeks to meet the needs of all children. In fact, international comparative studies are the only reliable way of obtaining trend data and evaluate whether any newly applied policies work the way they have been intended to.

REFERENCES

The following works in English language were consulted during this research:

1. Adams, D. (1993). *Defining education quality*. Pittsburg: University of Pittsburg. Institute for International Research.
2. Allerup, P., Frohling, J.B. (2008). *Denmark*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to mathematics and science education around the world. Chestnut Hill, MA: Boston College.
3. Arcaro, J.S. (1995). *Quality in education*. An implementation hadbook. Delray Beach, FL: St. Lucie Press.
4. Arnott, R., Rowse, J. (1986). *Peer group effects and educational attainment.* Journal of Public Economics, 32(3), p. 287-305.
5. ASCD (1997). *Authentic Literacy and Intellectual Development*. www.ascd.org
6. Babbie, E. (1990). *Survey Research Methods*. Belmont, CA: Wadsworth Publishing Company.
7. Barnett, W.S. (1992). *Benefits of compulsory preschool education*. Journal of Human Resources. 27(2). p.279-312.
8. Barnett, W.S. (1993). *Does Head Start fade out?* Education Week. http://www.edweek.org
9. Barnett, W.S. (1995). *Long-term effects on early childhood programs on cognitive and school outcomes*. In The Future of Children: long-term outcomes of early childhood programs. 5(3). p.25-50.
10. Barnett, W.S. (2002). *Battle over Head Start. What the research shows*. Natianle Institute for Early Education Research. http://nieer.org/docs/
11. Baumrind, D. (1991). *Parenting styles and adolescent development*. In Brooks-Gunn, J., Lerner, R., Peterson, A.c. (eds.) The encyclopedia of adolescence. New York: Garland. p.746-758.
12. Bayefsky, A.F. (1985). *Defining equality rights*. In Bayefsky, A.f. & Eberts, M. (Eds.) Equality rights and the Canadian charter of rights and freedoms. Toronto: Carswell. p.1-79.
13. Bergman, H. (1996). Quality of education and the demand for education: evidence from developing countries. International review of education. 46(6). p.581-604.

14. Bernstein, B. (1960). *Language and social class: a research note*. British journal of sociology. 11(3). London. p.271-276.
15. Bernstein, B. (1970). *Education cannot compensate for society*. New Society. 15(387). London. p.344-347.
16. Bernstein, B. (1971). *Class, codes and control*. Volume 1. London, Routledge & Kegan Paul.
17. Bernstein, B. (1975). *Class, codes and control*. Volume 3. London, Routledge & Kegan.
18. Bernstein, B. (1990). *Class, codes and control*. Volume 4. London, Routledge.
19. Bigeliene, D., Elijio, A., Strickiene, M. (2008). *Lithuania*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to mathematics and science education around the world. Chestnut Hill, MA: Boston College.
20. Black, S.E., Devereux, P.J., Slavanes, K.G. (2008). Too young to leave the nest? The effects of school starting age. IZA Discussion Paper No. 3452. Bonn.
21. Blatz, W.E. (1938). *The Five Sisters; a Study of Child Psychology: A Study of Child Psychology*. University of California.
22. Blau, D., Currie, J. (2006). *Preschool, day care, and afternoon care: who's minding the kids?* In Hanushek, E.A., Welch, F. (Eds.) Handbook of the economics of education. Volume 2. Amsterdam. p.1163-1267.
23. Bonsen, M., Bos, W., Frey, K.A. (2008). *Germany*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to mathematics and science education around the world. Chestnut Hill, MA: Boston College.
24. Bonstingl, J.J. (1992). *The quality revolution in education*. Educational Leadership. 50(3). p.4-9.
25. Bonstingl, J.J. (1996). *Schools of quality. An introduction to Total Quality Management in education*. Second edition. USA.
26. Bradley, S., Taylor, J. (2004). *The economics of secondary schooling*. In Johnes, G., Johnes, J. (eds.). International handbook on the economics of education. Cheltenham: Edward Elgar.
27. Brandon, R.N., Maher, E.J., Joesch, J.M. (2003). *Ohio's school readiness goal: starting early to close the achievement gap*. Human Services Policy Center. Evans School of Public Affairs. University of Washington.

28. Broccolichi, S., van Zanten, A. (2000). *School competition and pupil flight in the urban periphery*. Journal of Education Policy. 15(1). p.51-60.
29. Brown, P., Lauder, H., Ashton, D. (2008). *Education, globalization, and the future of the knowledge economy*. European Educational Research Journal, Volume 7: www.wwwords.eu/EERJ.
30. Buddenbaum, J.M., Novak, K.B. (2001). *Applied communication research*. A Blackwell Science Company. Iowa State University Press.
31. Cahan, S., Cohen, N. (1989). *Age versus schooling effects on intelligence development*. Child Development. (60). p.1239-1249.
32. Case, A.C., Katz, L.F. (1991). *The company you keep: The effects of family and neighborhood on disadvantaged families*. National Bureau of Economic Research. Working Paper No.3705.
33. Central Statistical Bureau of Latvia. www.csb.gov.lv
34. Chamberlain, J.D. (1987). *Equal educational opportunity: Expenditure equalization and peer group effects*. Dissertation in economics: University of California.
35. Chapman, D., Adams, D. (2002). *The quality of education: Dimensions and strategies*. Manila: University of Hong Kong. Comparative Education Research Center.
36. Cheng, Y.C., Tam, W.M. (1997). *Multi-models of quality in education.* Quality assurance in education. Volume 5: MCB University Press.
37. Clarke. P. (2003). *Culture and classroom reform: the case of the primary education project, India*. Comparative Education. 39(10). p.27-44.
38. Cohn, E., Geske, T.G. (1990). *Economics of education.* Oxford: Pergamon Press.
39. Coleman, J.S. (1966). *Equality of educational opportunity.* Washington DC: US Department of Health, Education, and Welfare, U.S. Office of Education.
40. Coleman, J.S. (1988). *Social capital in the creation of human capital*. American Journal of Sociology. Volume 94. p.95-120.
41. Corcoran, M., Gordon, R., Laren, D., Solon, G. (1990). *Effects of family community background on economic status*. American Economic Review. Volume 80. p.362-366.
42. Cotton, K., Wikelund, K.R. (1989). *Parent involvement in education*. NWREL School Improvement Research Series. http://www.nwrel.org/scpd/sirs/3/cu6.html
43. Creamer, F.G. (2000). *Quality, equality, and equity in individual performance measures*. In Janosik, Creamer, and Alexander (Eds). International perspectives on quality in higher education. Monograph Series in Higher Education. (1). Blacksburg, VA: Educational Policy Institute of Virginia Tech. p.54-62.

44. Crosby, P.B. (1979). *Quality is free: The art of making quality certain.* New York, NY.
45. Cummings, W. (2008). *Comparing Educational Systems: The Six Core Models*. International Education and International Affairs; Elliot School of International Affairs and the Graduate School of Education and Human Development. George Washington University, USA. http://www.hku.hk/faced/research/seminarposters/
46. Cunha, F., Heckman, J.J., Lochner, L., Masterov, D.V. (2006). *Interpreting the evidence on life cycle skill formation*. In Hanushek, E.A., Welch, F. (Eds.) Handbook of the economics of education. Volume 1. Amsterdam. p.697-799.
47. Dedze, I. (1999). *Reading ability of latvian students: Results from an international study.* Stockholm: Institute of International Education Stockholm University.
48. Dewey, J. (1900). *The school and society.* (Rev. ed.). Chicago, IL: The University of Chicago Press.
49. Duncan, G.J. (1994). *Families and neighbors as sources of disadvantage in the schooling decisions of white and black adolescents*. American Journal of Education. (103). p.20-53.
50. Dynarski, M., Schwab, R., Zampelli, E. (1989). *Local characteristics and public production: The case of education*. Journal of Urban Economics. (26). p.250-263.
51. Elijio, A. (2007). *Lithuania*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.
52. Elley, W.B. (1992). *How in the world do students read?* The Hague, Netherlands: IEA.
53. Epstein, J.L. (1991). *Effects on student achievement of teachers' practicies of parent involvement*. Advances in Reading/Language Research. (5). p.261-276.
54. Epstein, J.L. (1995). *School / family / community partnerships: caring for the children we share*. Phi Delta Kappan. (76). p.701-712.
55. European Group for Research on Equity in Educational Systems. (2005). *Equity in European educational systems*. Second Edition.SO2-61OBGE. Belgium: Eurpean Commission.
56. Evans, W.N., Oates, W.E., Schwab, R.M. (1992). *Measuring peer group effects: A study of teenage behavior.* Journal of Political Economy. 100(5). p.966-991.
57. Fan, X.T., Chen, M. (2001). *Parental involvement and student's academic achievement: a meta-analysis*. Educational Psyhology Review. (13). p.1-22.
58. Feigenbaum, A.V. (1951). *Quality control: Principles, practice, and administration.* New York, NY.

59. Feinstein, L. (2004). *Mobility in pupils' cognitive attainment during school life*. Oxford Review of Economic Policy. 20(2). p.213-229.
60. Feinstein, L., Robertson, D., Symons, J. (1999). *Preschool education and attainment in the National Child Development Study and British Cohort Study*. Education Economics. 7(3). p.209-234.
61. Fight Crime: Invest in Kids. (2000). *Head Start improves achievement and reduces crime*. Washington D.C. Ste 240. www.fightcrime.org
62. Fitzsimons, P. (1999). *Human capital theory and education*. Encyclopaedia of Philosophy of Education. New Zealand: University of Auckland. http://www.ffst.hr/ENCYCLOPAEDIA/
63. Fjellstrom, C.T., Ramstedt, K. (2008). *Sweden*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to mathematics and science education around the world. Chestnut Hill, MA: Boston College.
64. Foy, P. (2004). *Intraclass correlation and variance components in population attributes and measures of sampling efficiency in PIRLS 2001*. Proceedings of the IRC-2004 PIRLS, 3, p. 171-187.
65. Foy, P., Kennedy, A.M. (2008). *PIRLS 2006 user guide for the international database*. Chestnut Hill, MA: Boston College.
66. Fraser, S. (1965). *Jullien's plan for comparative education 1816-1817*. Comparative education studies. New York: Bureau of Publications. Teachers College: Collumbia University.
67. Fuchs, T., Woessmann, L. (2004). *Govenance and primary-school performance: international evidence*. Ifo Institute for Economic Research at the University of Munich.
68. Fullan, M. (1993). *Chenge forces.* London: Falmer Press.
69. Garces, E., Thomas, D., Currie, J. (2002). *Longer-term effects on Head Start*. American Economic Review. (99). p.999-1012.
70. Geske, A., Grinfelds, A., Dedze, I., Zhang, Y. (2006). *Family background, school quality and rural-urban disparities in student learning achievement in Latvia.* Prospects. XXXVI(4).
71. Geske, A., Grinfelds, A., Kangro, A. (1997). An international comparative assessment *of Latvia's educational system.* Human and Social Sciences: Latvia. 4(17). p.68-100.
72. Geske, A., Grīnfelds, A., Ozola, A. (2008). *Latvia*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide

to mathematics and science education around the world. Chestnut Hill, MA: Boston College.

73. Geske, A., Kangro, A. (2004). *Differences in achievement of urban and rural students in Latvia in the context of international comparative studies*. Humanities and social sciences in Latvia, Educational management in Latvia. 2(42).
74. Gill, J., Johnson, P. (1988). *Research Methods for Managers*. Second Edition. London, Great Britain: Paul Chapman Publishing Ltd.
75. Gilmore, H.L. (1974). *Product conformance cos.* Quality progress. 7(5).
76. Glass, G.V., Hopkins, K.D. (1996). *Statistical methods in education and psychology*. Third edition. A simon & Schuster Company: Needham Heights, MA.
77. Glasser, W. (1992). *The quality school: Managing students without correction*. Second edition. New York: Harper Collins.
78. Glennerster, H. (1991). *Quasi-markets for education?* Economic Journal. (101). p.1268-1276.
79. Goodlad, J.I. (1984). *A place called school: Prospects for the future*. New York: McGraw-Hill.
80. Gorard, S., Sundaram, V., Smith, E. (2006). *Why does the school mix matter?: equity from the students' perspective*. British Educational Research Association Annual Conference. University of Warwick.
81. Gustafsson, J.E. (2008). *Effects of international comparative studies on educational quality on the quality of educational research*. European Educational Research Journal. 7(1). p.1-17.
82. Gylfason, T., Zoega, G. (2003). *Education, social equality and economic growth: A view of the landscape.* Munich.
83. Hamilton, B.W. (1983). *The flypaper effect and other anomalies*. Journal of public economocs. (22). p.347-361.
84. Hanushek, E.A. (1970). *The production of education, teacher quality, and efficiency.* U.S. Office of Education: Do teachers make a difference? Washington, DC: Government Printing Office.
85. Hanushek, E.A. (1971). *Teacher characteristics and gains in student achievement: Estimation using micro-data.* American Economic Review, 61, p. 280-288.
86. Hanushek, E.A. (1986). *The economics of schoolin: Production and efficiency in public schools.* Journal of Economic Literature. Volume XXIV. p. 1141-1177.

87. Hanushek, E.A. (1997). *Assessing the effects of school resources on student performance: an update*. Educational evaluation and policy analysis. 19(2).
88. Hanushek, E.A. (2003). *The failure of input-based schooling policies*. Economic Journal. 113(485). p.F64-F98.
89. Hanushek, E.A. (2006). *Some U.S. Evidence on how the distribution of educational outcomes can be changed*. In Woessmann, L., Peterson, P.E. (Eds.) Schools and the equal opportunity problem. Cambridge, MA: MIT Press.
90. Hanushek, E.A., Kain, K.F., Markman, J.M., Rivkin, S.G. (2001). *Does peer ability affect student achievement?* NBER Working Paper 8502.
91. Hanushek, E.A., Woessmann, L. (2006). *Does early tracking affect educational inequality and performance? Differences-in-differences evidence across countries*. Economic Journal. 116(510). p.C63-C76.
92. Hanushek, E.A., Woessmann, L. (2007). *The role of education quality in economic growth*. World Bank Policy Research Paper. WPS4122.
93. Harbison, R.W., Hanushek, E.A. (1992). *Educational performance of the poor: Lessons from rural northeact Brazil*. Oxford. University of Oxford: Oxford University Press.
94. Harrison, D.M., Raudenbush, S.W. (2006): *Linear regression and hierarchical linear models*. In Green, J., Camilly, G., Elmore, P. (Eds.): Complementary Methods for Research in Education. Washington, DC: American Educational Research Association
95. Heckman, J.J. (1999). *Policies to foster human capital*. Working Paper No. 7288. NBER.
96. Heckman, J.J., LaLonde, R., Smith, J.A. (1999). The economics and econometrics of active labor market programs. In Ashenfelter, O., Card, D. (eds.). Handbook of labor economics. Volume 3A. Amsterdam. p.1865-2097.
97. Henderson, V., Mieskowski, P., Sauvageau, Y. (1978). *Peer group effects and educational production functions.* Journal of Public Economics, Volume 10, p. 97-106.
98. Heyneman, S.P. (1997). *The quality of education in the Middle East and North Africa*. International journal od educational development. 17(4). p.449-466.
99. Holland, J. (1986). *Social class differences in adolescents' conception of the domestic and industrial division of labour*. CORE, London. 10(1).
100. Hornberg, S., Bos, W., Lankes, E., Valtin, R. (2007). *Germany*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.

101. Horvat, M. D. (2007). *Slovenia*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.
102. Hoy, C., Bayne-Jardine, C., Wood, M. (2000). *Improving quality in education*. London and New York: Falmer Press.
103. Jelemenska, P., Ladanyiova, E. (2008). *The Slovak Republic*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to mathematics and science education around the world. Chestnut Hill, MA: Boston College.
104. Jencks, C., Meyer, S.E. (1987). *The social consequences of growing up in poor neighborhood*. In Lynn, L.E., Mac Geary, M.G.H. (Eds.). Inner-city poverty in the United States. Washington: National Academy Press.
105. Jigau, M. (2000). *Rural education in Romania: conditions, issues and development strategies*. Bucharest: Institute for Educational Sciences.
106. Johansone, I. (2003). *Latvia*. In Mullis, I.V., Martin, M.O., Kennedy, A.M., Flaherty, C.L. (Eds.). PIRLS 2001 Encyclopedia. A reference guide to reading education in the countries participating in IEA's PIRLS 2001 study. Chestnut Hill, MA: Boston College.
107. Johansone, I., Foy, P. (2004). *PIRLS 2001 results in the context of the European Union expansion*. Proceedings of the IEA International Research Conference 2004 PIRLS, Volume 3. Lefkosia. Cyprus: Cyprus University Press p. 36-45.
108. Johansone, I., Malak, B. (2008). *Translation and national adaptations of the TIMSS 2007 assessment and questionnaires*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 63-75.
109. Johansone, I., Neuschmidt, O. (2008). *TIMSS 2007 survey operations procedures*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 93-112.
110. Johansone, I. (2008). *Quality assurance in the TIMSS 2007 data collection*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 113-140.
111. Joncas, M. (2008). *TIMSS 2007 Sample Design*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 77-92.

112. Joncas, M. (2008). *TIMSS 2007 Sampling Weights and Population Rates*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 153-192.
113. Juran, J.M., Gryna, F.M. (1988). *Juran's quality control handbook: 4th ed.* New York, NY.
114. Kamerman, S.B., Neuman, M., Waldfogel, J., Brooks-Gunn, J. (2003). *Social policies, family types and child outcomes in selected OECD countries*. OECD Social, Employment and Migration Working Paper No.6. Paris: OECD.
115. Kangro, A. (2000). *International comparative research in education and timely aspects of Latvia's educational policy*. In Ivbulis, V. (Ed.). Humanities and social sciences. Latvia. Education management in Latvia. 2(27). University of Latvia. p.27-44.
116. Katz, L.F., Blanchflower, D.G., Loveman, G.W. (1993). *A comparison of changes in the structure of wages in four OECD countries*. National Bereau of Economic Research. Working Paper No.4297. Cambrige, MA.
117. King, E. (2000). *A century of evolution in comparative studies*. Comparative Education. 36(3): Comparative Education for the Twenty-first Century. p.267-277.
118. Latvian National Development Plan 2007-2013. (2006). Ministry of Regional Development and Local Government of the Republic of Latvia. Latvia: Jelgavas tipogrāfija Ltd.
119. Lee, S.W. (2005). *Encyclopedia of School Psyhology*. SAGE Publications.
120. Leuven, E., Lindahl, M., Oosterbeek, H., Webbink, D. (2004). New evidence on the effect of time in school on early achievement. Scholar Working Paper. 47(4). Amsterdam: Research Institute Scholar.
121. Levin, H.M. (1991). *The economics of educational choice*. Economics of Education Review. 10(2). p.137-158.
122. Lewis, R.H. (2008). *Mathematics, the most misunderstood subject*. Fordham University. http://www.fordham.edu
123. Love, J.M. et al. (2002). *Making difference in the lives of infants and toddlers and their families*. In Powell, D.R. (Ed.). Parent education as early childhood intervention: Emerging directions in theory, research, and practice. Norwood, NJ: Ablex Publishing Corporation. p.79-104.
124. Loveless, T. (Ed.) (2007).*Lessons learned. What international assessments tell us about math achievement*. Brookings Institution Press, Washington, D.C.
125. Lucas, J.R. (1965). *Against equality*. Phylosophy. (40). p.296-307.

126. Lukackova, Z., Obrancova, E. (2007). *The Slovak Republic*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.
127. Machin, S.J., Vignoles, A. (Eds.) (2005). *What's the good of education?* The economics of education in the UK. Princeton University Press.
128. Magnuson, K.A., Ruhm, C.J., Waldfogel, J. (2004). *Does prekindergarten improve school preparation and performance?* NBER Working Paper. 10452. Cambridge, MA: National Bureau of Economic Research.
129. Marchall, G. (1998). *Human-capital theory.* (Second edition) A dictionary of sociology. Oxford. University of Oxford: Oxford University Press.
130. Marcoulides, G.A., Heck, R.H. (1990). *Educational policy issues for the 1990's: Balancing equity and excellence in implementing the reform agenda*. Urban education. (25). p.304-316.
131. Marsh, H.W., Koeller, O., Baumert, J. (1999). *Reunification of East and West German school systems: Longitudinal multilevel modeling study of the big fish little pond effect on academic self-concept.* American Educational Research Journal, Volume 38, p. 321-350.
132. Martin, M.O., Preuschoff, C. (2008). *Creating the TIMSS 2007 Background Indices*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
133. Martin, M.O., Mullis, I.V., Foy, P. (2008). *TIMSS 2007 international science report: Findings from IEA's trends in international mathematics and science study at the fourth and eighth grades.* Chestnut Hill, MA: Boston College.
134. Mayer, S.E., Knutson, D. (1999). *Does the timing of school affect how much children learn?* In Mayer, S.E., Peterson, P.E. (Eds.). Earning and Learning: How School Matters. Brookings Institution and Russell Sage Foundation. p.79-102.
135. McCollum, P.A., Walker, C.L. (1992). *Minorities in America 2000*. Education and Urban Society. (24). p.178-195.
136. Minow, M. (1990). *Making all the difference: Inclusion, exclusion and American law*. Ithaca, NY: Cornell University Press.
137. Mullis, I.V., Martin, M.O., Foy, P. (2008). *TIMSS 2007 international mathematics report: Findings from IEA's trends in international mathematics and science study at the fourth and eighth grades.* Chestnut Hill, MA: Boston College.

138. Mullis, I.V., Martin, M.O., Foy, P., Kennedy A. (2007). *PIRLS 2006 international report: IEA's study of reading literacy achievement in primary schools.* Chestnut Hill, MA: Boston College.
139. Mullis, I.V., Martin M.O., Ruddock, G.J., O'Sullivan, C.Y., Arora, A., Erberber, E. (2005). TIMSS 2007 assessment frameworks. Chestnut Hill, MA: Boston College.
140. Mullis, I.V., Martin, M.O., Gonzales, E., Kennedy, A. (2003). *PIRLS 2001 international report: IEA's study of reading literacy achievement in primary schools.* Chestnut Hill, MA: Boston College.
141. Mullis, I.V.S., Martin, M.O., Ruddock, G.J., O'Sullivan, C.Y., Arora, A. & Erberber, E. (2005). *TIMSS 2007 assessment frameworks.* Chestnut Hill, MA: Boston College.
142. Olson, J.F., Martin, M.O., Mullis, I.V.S, Foy, P., Erberber, E., Preuschoff, C. (2008). *Reviewing the TIMSS 2007 Item Statistics*. In Olson, J.F., Martin, M.O., & Mullis, I.V.S. (Eds.). TIMSS 2007 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. p. 193-224.
143. O'Sullivan, M. (2006). *Lesson observation and quality in primary education as contextual teaching and learning processes*. International Journal of Educational Development. 26(3). p.246-260.
144. Organisation for Economic Co-operation and Development. (2001). *Reviews of national policies for education, Latvia*. Paris: OECD
145. Organisation for Economic Co-operation and Development. (2004). *Early childhood education and care policy in the Federal Republic of Germany*. Paris: OECD.
146. Ozola, A. (2007). *Latvia*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.
147. Palaszewski, B. (2007). *Sweden*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.
148. Parasuraman, A., Zeithaml, V.A., Berry, L.L. (1985). *A conceptual model of service quality and its implications for future research.* Journal of Marketing. 4(4).
149. Pate, P.E., Andrews, P.G. (2006). *Research summary: parent involvement*. http://www.nmsa.org/ResearchSummaries/Parent Involvement/tabid/274/Defailt.aspx
150. Pavesic, B.J., Svetlik, K. (2008). *Slovenia*. In Mullis, I.V., Martin, M.O., Olson, J.F., Berger, D.R., Milne, D., Stanco, G.M. (Eds.). TIMSS 2007 Encyclopedia. A guide to

mathematics and science education around the world. Chestnut Hill, MA: Boston College.

151. Persell, C.H. (1977). *Education and inequality*. New York: Free Press.

152. Peters, T.J., Waterman, R.H. (1982). *In search of excellence.* Harper & Row. New York, NY.

153. Postelethwaite, T.N., Ross, K.N. (1992). *Effective schools in reading*. Implications for educational planners. The International Association for the Evaluation of Educational Achievement. Germany: Grindeldruck GMBH.

154. Psacharopoulos, G. (1991). *Returns to unvestment in education: a global update*. World Development. 22(9). p.1325-1343.

155. Psacharopoulos, G., Patrinos, H.A. (2004). *Returns to investment in education: a further update*. Education economics. 12(2). p.111-134.

156. Ramirez, M.J. (2004). *Understanding the low mathematics achievement of Chilean students: a cross-national analysis using TIMSS data*. Dissertation for the degree of Doctor of Philosophy: Lynch Graduate School of Education, Boston College.

157. Raudenbush, S.W., Bryk, A.S. (2002) *Hierarchical linear models*. Second edition. Thousand Oaks, CA: Sage.

158. Raudenbush, S.W., Bryk, A.S. (2002). *Hierarchical linear models: applications and data analysis methods.* Thousand Oaks, CA: Sage Publications.

159. Reich, R.B. (1990). *Preparing students for tomorrow's economic world*. In Bacharach, S.B. (Eds.) Education reform: Making sense of it all. Boston: Allyn & Bacon. p.194-212.

160. Ronberg, L., Mejding, J. (2007). *Denmark*. In Kennedy, A.M., Mullis, I.V., Martin, M.O., Trong, K.L. (Eds.). PIRLS 2006 Encyclopedia. A guide to reading education in the forty PIRLS 2006 countries. Chestnut Hill, MA: Boston College.

161. Rosenau, J.S. (1998). *Familial influences on academic risk in high school: a multi-ethnic study*. Temple University. UMI No. 9911056.

162. Sadovnik, A.R. (2001). *Basil Bernstein 1924-2000*. Prospects. XXXI(4). Paris: UNESCO International Bureau of Education. p.687-703.

163. Schaefer, T.E. (1990). *One more time: How do you get both equality and excellence in education?* Journal of Education Thought. (24). p.39-51.

164. Schwab, R.M., Oates, W.E. (1991). *Community composition and the provision of local public goods: A normative analysis*. Journal of Public Economics. (44). p.217-237.

165. Schwippert, K. (Ed.) (2007). *Progress in reading literacy. The impact of PIRLS 2001 in 13 countries*. Studies in International Comparative and Multicurtural Education. (7). Munster, Germany.
166. Shaw, J.B. (1918). *Lectures on the phylosophy of mathematics*. Chicago: The Open Court Publishing Company.
167. Snijeders, T., Bosker, R. (1999). *Multilevel Analysis – An Introduction to Basic and Advanced Multilevel Modeling*. London: Sage Publications.
168. Smith, W.J., Lusthaus, C. (1995). *The nexus of equality and quality in education: a framework for debate*. Canadian Journal of Education. 20(3).
169. Stevenson, H.W., Stigler, J.W. (1992). *The learning gap. Why our schools are failing and what we can learn from Japanese and Chinese Education*. TOUSHSTONE. Simon & Schuster Inc.
170. Stigler, J.W., Hiebert, J. (1999). *The teaching gap. Best ideas from the world's teachers for improving education in the classroom*. New York, NY: The Free Press.
171. Strike, K.A. (1985). *Is there conflict between equity and excellence?* Educational Evaluation and Policy Analysis. (7). p.409-416.
172. Strom, B. (2004). *Student achievement and birthday effects*. Mimeo: Norwegian University of Science and Technology.
173. Summers, A., Wolfe, B. (1977). *Do schools make a difference?* American Economic Review. 67(4). p.639-653.
174. The National Coalition for Parent Involvement in Education. (2000). *First annual review of family involvement in education*. NCPIE Review.
175. Tiana, A. (2002). *Preface*. In Papanastasiou, C., Froese, V. (Eds.). Reading literacy in 14 countries. University of Cyprus: Cyprus University Press.
176. Trong, K., Kennedy, A. (2006). *Examining literacy, gender, and the home environment in PIRLS 2001 countries.* The 2nd IEA International Research Conference papers. http://www.iea.nl/irc2006_pirls.html
177. Trong, K.L., Kennedy, A.M. (2007). *Reporting PIRLS 2006 questionnaire data*. In Martin, M.O., & Mullis, I.V.S., Kennedy, A.M. (Eds.). PIRLS 2006 technical report. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
178. Valverde, L.A. (1988). *The coexistence of excellence and equality*. Education and Urban Society. (20). p.315-318.

179. van Zanten, A. (2005). *New modes of reproducing social inequality in education: the changing role of parents, teachers, schools and educational policies*. European Educational Research Journal. 4(3). p.155-169.
180. Vandenberghe, V. (1996). *Functioning and regulation of educational quasi-markets*. Nouvelle Serie No.283. CIACO. Louvain-la-Neuve.
181. Vandenberghe, V. (2002). *Evaluating the magnitude and the stakes of peer effects analyzing science and math achievement across the OECD.* Applied Economics, 34, p. 1283-1290.
182. Vickers, J. (1983). *Major equality issues of the eighties*. Canadian Human Rights Yearbook. (1). p.47-82.
183. Waldorf, G. (1992). *Educational choice and equity in Great Britain*. Educational Policy. 6(2).
184. Weiss, J. (1990). *Control in school organizations: theoretical perspectives*. In Clune, W.H., Witte, J.F. (Eds.). Choice and control in American education. 1(2). The Stanford Series on Education & Public Policy. London: The Falmer Press.
185. Willie, C. V. (1987). *When excellence and equity complement each other*. Harvard Educational Review. (57), p. 205–207.
186. Willie, C.V., Alves, M.J. (1996). *Controlled choice: A new approach to school desegregated education and school improvement.* Education Alliance Press and the New England Desegragation Assistance Center: Brown University,
187. Woessmann, L. (2004). *How equal are educational oppurtunities? Family background and student achievement in Europe and the US*. CESifo working paper. (1162). Category 4: Labour Markets.
188. Woessmann, L. (2006). *Efficiency and equity of European education and training policies*. CESifo Working Paper No. 1779. Category 1: Public Finance.
189. Yamamoto, K., Kulick, E. (2000). *Scaling methodology and procedures for the TIMSS mathematics and science scales*. In Martin, M.O., Gregory, K.D., Stemler, S.E. (Eds.). TIMSS 1999 technical report. Chestnut Hill, MA: Boston College.
190. Zay, D. (2005). *Preventing school and social exclusion: a French-British comparative study*. European Educational Research Journal. 4(2). p.109-120.
191. Zīle, R., Šteinbuka, I., Počs, R., Krūmiņš, J., Ancāns, H., Cerps, U. (2000). *Latvia entering the XXIst century. Economics, Integration. Finance*. Rīga: Nacionālais Medicīnas Apgāds Ltd.

192. Zimmer, R.W., Toma, E.F. (2000). *Peer effects in private and public schools across countries*. Journal of Policy Analysis and Management. 19(1). p.75-92.
193. Zimmerman, D.J. (2003). *Peer effects in academic outcomes: evidence from a natural experiment*. The Review of Economics andStatistics. 85(1). p.9-23.

The following works in French language were consulted during this research:

194. Donni, O., Lejeune, B. (1994).*Inegalites a l'ecole: un modele econometrique applique a des donnees belges*. Mimeo. Departement d'Economie. Liege: Universite de Liege.
195. Duru-Bellat, M. (2002). *Les inegalites sociales a l'ecole*. Paris: Presses Universitaires de France.

The following works in German language were consulted during this research:

196. Schuemer, G. (2004). *Zur doppelten Benachteiligung von Schuelern aus unterpriveligierten Gesellschaftschichten im deutschen Schulwesen.* Schumer, Tillmann & Weiss (Ed.): Die Institution Schule und die Lebenswelt fuer Schueler. Wiesbaden: VS Verlag fuer Sozialwissenschaften.

The following works in Latvian language were consulted during this research:

197. Geske, A. (2000). *Trešais starptatutiskais matemātikas un dabaszinātņu pētījums Latvijā*. Izglītības pētniecība Latvijā. Monogrāfiju sērija Nr.3. Rīga: Mācību grāmata.
198. Geske, A. (2001). *Matemātikas un dabaszinatņu izglītība Latvijas skolās starptautiskā salīdzinājumā*. Promocijas darba kopsavilkums. Vadībzinātnes nozare: Izglītības vadība.
199. Geske, A. (2002). *Matemātikas un dabaszinātņu izglītības attīstības tendenču starptautiskais pētījums*. Uzdevumi un novērtēšanas programmas. Rīga: Mācību gramata.
200. Geske, A. (2004). *Latvijas skolenu sasniegumus ietekmejošie faktori dabaszinatnēs un civilzinībās*. Izglītības vadība. Latvijas Universitātes Raksti. (675). Rīga: Latvijas Universitāte.
201. Geske, A. (2005). *Matemātikas un dabaszinatņu izglītības attīstības tendenču starptautiskais petījums Latvijā*. 4 klašu vecuma grupa. Skolotājs (3). p.31-33.
202. Geske, A., Grīnfelds, A. (2001). *Izglītības pētījumu metodologija un metodes*. Rīga: RaKa.

203. Geske, A., Grīnfelds, A. (2006). *Izglītības pētniecība*. Mācību grāmata augstskolu izglītības un pedagoģijas profesionālo un akadēmisko studiju programmu studentiem. Rīga: LU Akadēmiskais apgāds.
204. Geske, A., Grīnfelds, A., Kangro, A. (1997). *Izglītības starptautiskās salīdzinošās novērtēšanas sistēma Latvijā*. Izglītības pētniecība Latvijā. Monogrāfiju sērija Nr.1. Rīga: Mācību grāmata.
205. Geske, A., Grīnfelds, A., Kangro, A., Kiseļova, R. (2004). *Macīšanās nākotnei*. Latvija OECD valstu starptautiskajā novērtēšanas programmā 1998-2004. Rīga: Latvijas Universitātes Akadēmiskais apgāds.
206. Geske, A., Ozola, A. (2007). *Skolēnu sasniegumi lasītprasmē Latvijā un pasaulē.* Izglītības pētniecība Latvijā. Monogrāfiju sērija Nr.5. Rīga: Latvijas Universitātes Akadēmiskais Apgāds, 59-63.lpp.
207. Geske, A., Ozola, A. (2007). *Skolēnu sasniegumi lasītprasmē Latvijā un pasaulē*. Izglītības pētniecība Latvijā. Monogrāfiju sērija Nr.5. Rīga: LU Akadēmiskais apgāds.
208. Johansone, I. (2002). *IEA starptautiskā lasītprasmes novērtēšanas pētījuma pirmie rezultāti Latvijā*. Izglītības zinātnes un pedagogija mūsdienu pasaulē. Latvijas Universitātes Raksti. (655). Rīga: Latvijas Universitāte.
209. Johansone, I. (2002). *Lasītprasme starptautiskajos salīdzinošajos izglītības pētījumos*. Izglītības zinātnes un pedagogija mūsdienu pasaulē. Latvijas Universitātes Raksti. (649). Rīga: Latvijas Universitāte.
210. Johansone, I. (2003). *Starptautiskais lasītprasmes novērtēšanas pētījums 2000-2003*. Latvijas Universitātes Pedagoģijas un Psiholoģijas fakultātes Izglītības pētniecības institūts. Rīga: Mācību grāmata.
211. Johansone, I. (2006). *Sākumskolas izglītības kvalitātes rādītāji Latvijas laukos un pilsētās IEA PIRLS 2001 un TIMSS 2003 pētijumos*. Izglītības vadība. Latvijas Universitātes Raksti. (697). Rīga: Latvijas Universitāte.
212. Johansone, I., Preuschoff, A.C. (2008). *Izglītības kvalitāte Latvijas laukos un pilsētās ar ieskatu IEA PIRLS 2006 pētījuma rezultātos.* Latvijas Universitātes Raksti. Izglītības vadība. (749). Rīga: LU Akadēmiskais apgāds.
213. Kangro, A., Geske, A. (2001). *Zināšanas un prasmes dzīvei*. Latvija OECD valstu Starptautiskajā skolenu novērtēšanas programmā 1998-2001. Rīga: Mācību grāmata.
214. Korņeva, I. (2009). *Mazo skolu liktenis*. Latvijas Avīze. 19.01.2009. www.la.lv

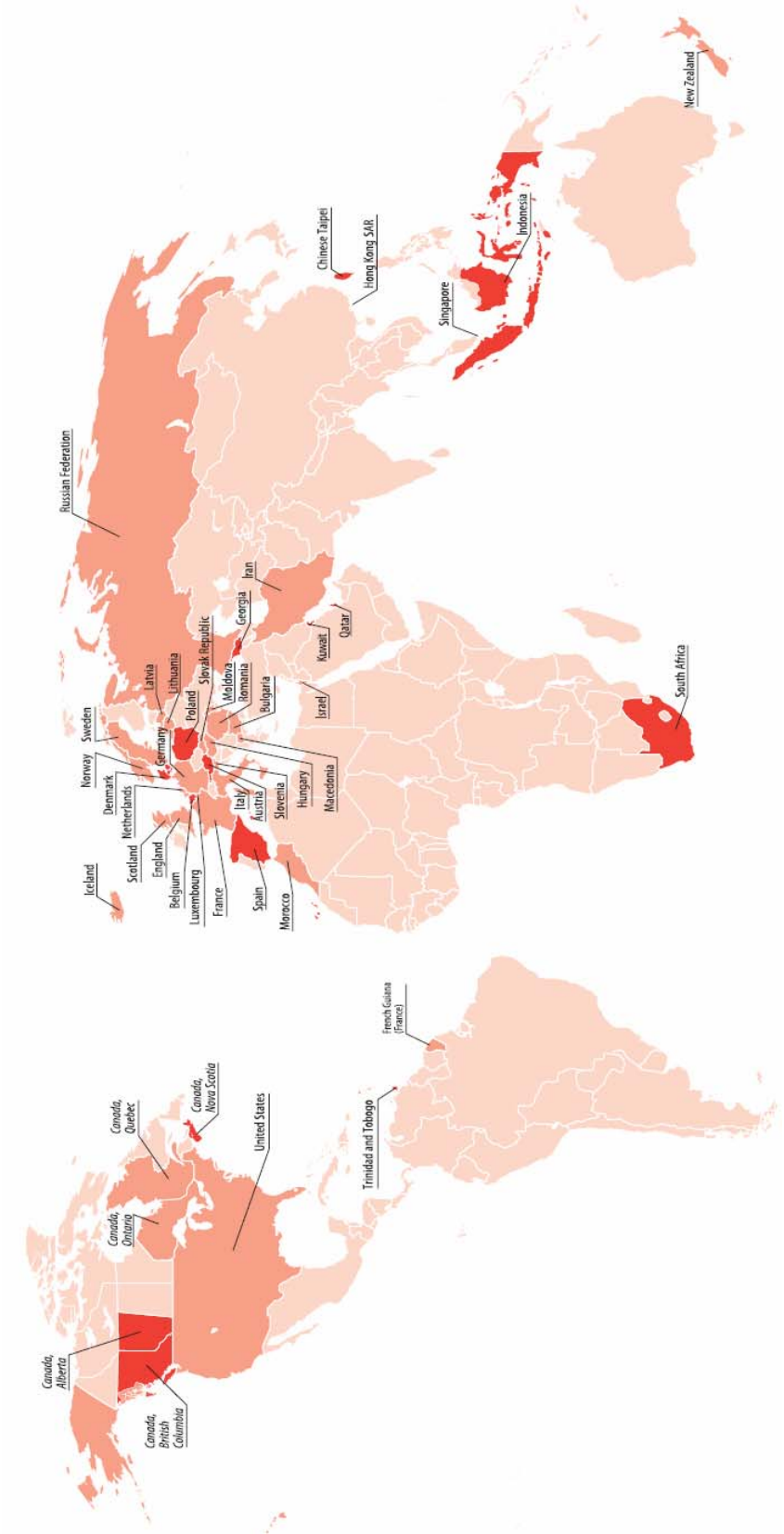
215. Latvijas izglītības sistēma (2006/07). Eurybase: The Information Database on Education Systems in Europe. Directorate-General for Education and Culture. European Commission. www.eurydice.org
216. Ozola, A. (2007). *Dzimuma faktora ietekme uz lasītprasmi sākumskolā starptautiskajos salīdzinošajos izglītības pētījumos Latvijā: maģistra darbs*. LU Pedagoģijas un Psiholoģijas fakultāte. Rīga: Latvijas Universitāte.
217. Pabriks, A. (2008). *Latvijas izglītība – vai izeja no purva?* Diena. 12.marts. http://www.diena.lv
218. Raščevska, M., Kristapsone, S. (2000). *Stastika psiholoģijas pētījumos*. Eksperimentāla mācību grāmata psiholoģijas specialitātes studentiem. Rīga: SIA Izglītības soļi.
219. Rivža, B. (2007). *Par skolu izglītības kvalitāti.* Latvijas Vēstnesis. 40(3616).
220. Saulītis, A. (2007). *Izglītības nozarē smagas reformas nav gaidāmas*. Kas notiek Latvijā? http://www.knl.lv/reksti/196/

APPENDIX A:
PIRLS 2006 AND TIMSS 2007 PARTICIPANTS

PIRLS Participants (Source: Mullis, Martin, Kennedy, Foy, 2007)

2006 and 2001	2006
Bulgaria	Austria
Canada, Ontario	Belgium (Flemish)
Canada, Quebec	Belgium (French)
England	*Canada, Alberta*
France	*Canada, British Columbia*
Germany	*Canada, Nova Scotia*
Hong Kong SAR	Chinese Taipei
Hungary	Denmark
Iceland	Georgia
Iran, Islamic Rep. of	Indonesia
Israel	Kuwait
Italy	Luxembourg
Latvia	Poland
Lithuania	Qatar
Macedonia, Rep. of	South Africa
Moldova, Rep. of	Spain
Morocco	Trinidad and Tobago
Netherlands	
New Zealand	
Norway	
Romania	
Russian Federation	
Scotland	
Singapore	
Slovak Republic	
Slovenia	
Sweden	
United States	

PIRLS Participants (Continued)



TIMSS 2007 Participants (Source: Mullis, Martin, Foy, 2008)

Algeria
Armenia
Australia
Austria
Bahrain
Bosnia and Herzegovina
Botswana
Bulgaria
Chinese Taipei
Colombia
Cyprus
Czech Republic
Denmark
Egypt
El Salvador
England
Georgia
Germany
Ghana
Hong Kong SAR
Hungary
Indonesia
Iran, Islamic Rep. of
Israel
Italy
Japan
Jordan
Kazakhstan
Korea, Rep. of
Kuwait
Latvia
Lebanon
Lithuania
Malaysia
Malta
Mongolia
Morocco
Netherlands
New Zealand
Norway
Oman
Palestinian Nat'l Auth.
Qatar
Romania
Russian Federation
Saudi Arabia
Scotland
Serbia
Singapore
Slovak Republic
Slovenia
Sweden
Syrian Arab Republic
Thailand
Tunisia
Turkey
Ukraine
United States
Yemen

Benchmarking Participants

Alberta, Canada
Basque Country, Spain
British Columbia, Canada
Dubai, UAE
Massachusetts, US
Minnesota, US
Ontario, Canada
Quebec, Canada

TIMSS 2007 Participants (Continued)