# The Teacher of the 21st Century: Quality Education for Quality Teaching

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CAMBRIDGE SCHOLARS
PUBLISHING

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# CHAPTER SIX

# WHERE DOES THE DIFFERENCE BETWEEN PIRLS 2006 AND PISA 2009 RESULTS COME FROM?

ANTRA OZOLA AND ANDREJS GESKE

## Abstract

Comparison of PISA (Programme for International Student Assessment) 2009 and PIRLS (Progress in International Reading Literacy Study) 2006 results for some countries indicate a relative rise of average reading literacy performance; for some countries there is a drop in average achievement. The purpose of this paper is to find out how these changes in reading achievement scores can be explained. PIRLS 2006 and PISA 2009 data are used to compare situation in the countries, which participated in both studies.

**Keywords:** PISA, PIRLS, rote learning, reading engagement, HDI.

## Introduction

There is a broad spectrum of social factors that influence student achievement in reading literacy (Geske, Ozola, 2006; Geske, Ozola, 2009a; Geske, Ozola, 2009b). Many of these factors are included in large-scale international studies of education such as IEA (International Association for the Evaluation of Educational Achievement), PIRLS (Progress in International Reading Literacy Study), OECD (Organisation for Economic Co-operation and Development), and PISA (Programme for International Student Assessment), and they need to be analysed along with student achievement data. Both PIRLS 2006 and PISA 2009 studies have mainly focused on measuring reading literacy. Respondents of

PIRLS study are Grade 4 students, but the PISA study targets 15-year-olds.

A group of 28 participated in both the PIRLS 2006 and PISA 2009 studies: Austria, Bulgaria, Taipei, Denmark, France, Germany, Hong Kong, Hungary, Iceland, Israel, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Qatar, Romania, the Russian Federation, Singapore, Slovakia, Slovenia, Spain, Sweden, Trinidad and Tobago, and the United States.

When results from both studies are compared, a relative rise in average reading literacy performance can be noticed in some countries, and for some countries there is a notable drop in average achievement scores.

The purpose of this paper is to find out how these changes in reading achievement scores can be explained.

## Methods

For the analysis, data from PIRLS 2006 and PISA 2009 studies were used.

PIRLS is one of the international education studies organized by the IEA. The first cycle of this longitudinal study was organized in 2000–2001, the second was implemented in 2005–2006, and the third cycle in 2010–2011. Latvia participated in the first two cycles – PIRLS 2001 and PIRLS 2006.

The target group of the study is Grade 4 students aged 9-11. The study uses tasks for assessing students' reading literacy, as well as surveys of students, their parents, teachers, and school principals. These surveys allow the assessment of the students' learning context and the influence of the surrounding environment on their results. In Latvia, around 4000 students, their parents and teachers, as well as school principals from both Latvian language instruction and Russian language instruction schools participated in each cycle of the study.

Launched in 1997 by the OECD, PISA is an international study, which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. To date, students representing more than 70 countries and economies have participated in the assessment.

Every three years since 2000, randomly selected groups of fifteen-year-olds take tests in the key subjects – reading, mathematics, and science – with focus given to one subject in each year of assessment. The students and their school principals also fill in background questionnaires to provide information on the students' family background and the way the schools are run. Some countries and economies also choose to ask parents



to fill in a questionnaire. In 2000 the focus of the assessment was reading, in 2003 mathematics and problem solving, in 2006 science, and in 2009 reading.

There is a group of 28 countries that participated in both the PIRLS 2006 and PISA 2009 studies.

The reading assessment scale of the PIRLS study was based on the results of PIRLS 2001 results. The international average was set at 500 and the standard deviation was set at 100. The assessment scale for the PISA study was created in 2000 with the average of OECD countries set at 500 and the standard deviation at 100 scale points. Since both of these scales cannot be compared in a straightforward way, ranks of countries are analysed.

The 28 countries were ranked according to their results. Two ranks were created – one for each of the studies (see Table 1). Rank 1 was assigned to a country with the highest average achievement score, and rank 28 to a country with the lowest average result. The highest achieving country in PIRLS 2006 was the Russian Federation but in PISA 2009 – Hong Kong. In both studies Qatar, Trinidad and Tobago, and Romania had the lowest average results.

The rank difference of 0 can be noted for all three countries with the lowest achievement in both studies. In the two countries with a very high achievement level, Hong Kong and Singapore, the rank difference between studies is 1. Countries in which average achievement is much higher in the PIRLS 2006 study than in PISA 2009 are the Russian Federation, Luxembourg and Bulgaria. The Russian Federation is a special case because it had the highest average achievement among all PIRLS 2006 participants, but in the PISA 2009 study, the Russian Federation is ranked 24 out of 28. Countries like Norway, Iceland, Poland, and New Zealand have an inverse situation – their average achievement in the PISA 2009 study is higher compared with PIRLS 2006. Latvian students in PISA 2009 had lower results than in PIRLS 2006; Lithuanian results in PISA 2009 were even lower. When two groups of countries are compared – the first group whose PIRLS 2006 achievements were higher than PISA 2009 and the second group that had higher scores in PISA 2009 than in PIRLS 2006 – no similarities can be noticed. For instance, there are post-Soviet countries that had higher achievement in PIRLS 2006 (the Russian Federation, Latvia, Lithuania, Bulgaria), post-communist countries that had higher achievement in PISA 2009 (Poland), and also post-communist countries whose average achievement was about the same in both studies (Slovakia, Romania).

Rank correlation has been utilized on country-level data for the data analysis.

## Results

We discovered that the achievement gap between PISA 2009 and PIRLS 2006 average reading literacy scores is significantly correlated to three main factors: national wealth, rote learning, and reading engagement.

**Table 1. PIRLS 2006 and PISA 2009 scores, ranks, and indicators of national wealth, rote reading, and reading engagement**

| Country | PIRLS 2006 score points | PIRLS 2006 country rank | PISA 2009 score points | PISA 2009 country rank | Difference in ranks | Human development Index | PISA 2009 Index of memorization strategies | PISA 2009 Agreement with statement "I read only to get information that I need" (%) |
|---|---|---|---|---|---|---|---|---|
| Austria | 538 | 14 | 470 | 22 | 8 | 0,944 | 0,45 | 53 |
| Bulgaria | 547 | 10 | 429 | 25 | 16 | 0,816 | 0,38 | 57 |
| Taipei | 535 | 16 | 495 | 12 | -4 | 0,91 | -0,13 | 45 |
| Denmark | 546 | 11 | 495 | 13 | 2 | 0,943 | -0,18 | 47 |
| France | 522 | 19 | 496 | 11 | -9 | 0,942 | -0,11 | 44 |
| Germany | 548 | 8 | 497 | 10 | 2 | 0,932 | 0,22 | 45 |
| Hong Kong | 564 | 2 | 533 | 1 | -1 | 0,927 | 0,13 | 38 |
| Hungary | 551 | 5 | 494 | 14 | 9 | 0,869 | 0,74 | 47 |
| Iceland | 511 | 24 | 500 | 7 | -17 | 0,96 | -0,34 | 42 |
| Israel | 512 | 23 | 474 | 20 | -3 | 0,927 | 0,22 | 47 |
| Italy | 551 | 6 | 486 | 15 | 10 | 0,94 | -0,17 | 48 |
| Latvia | 541 | 12 | 484 | 16 | 4 | 0,845 | 0,13 | 55 |
| Lithuania | 537 | 15 | 468 | 23 | 8 | 0,857 | 0,19 | 56 |
| Luxembourg | 557 | 4 | 472 | 21 | 17 | 0,945 | 0,23 | 49 |
| Netherlands | 547 | 9 | 508 | 4 | -6 | 0,947 | -0,25 | 49 |
| New Zealand | 532 | 17 | 521 | 3 | -14 | 0,936 | 0,05 | 40 |
| Norway | 498 | 25 | 503 | 5 | -20 | 0,965 | -0,44 | 50 |
| Poland | 519 | 21 | 500 | 6 | -15 | 0,862 | 0,42 | 54 |
| Qatar | 353 | 28 | 372 | 28 | 0 | 0,844 | 0,59 | 51 |
| Romania | 489 | 26 | 424 | 26 | 0 | 0,805 | 0,22 | 61 |
| Russian Federation | 565 | 1 | 459 | 24 | 23 | 0,797 | 0,20 | 60 |
| Singapore | 558 | 3 | 526 | 2 | -1 | 0,916 | 0,06 | 41 |
| Slovakia | 531 | 18 | 477 | 19 | 1 | 0,856 | -0,33 | 56 |
| Slovenia | 522 | 20 | 483 | 17 | -3 | 0,91 | 0,06 | 53 |
| Spain | 513 | 22 | 481 | 18 | -4 | 0,938 | 0,34 | 46 |
| Sweden | 549 | 7 | 497 | 9 | 2 | 0,951 | 0,19 | 42 |
| Trinidad and Tobago | 436 | 27 | 416 | 27 | 0 | 0,809 | 0,38 | 45 |
| United States | 540 | 13 | 500 | 8 | -5 | 0,948 | -0,04 | 47 |



## National wealth

International comparative studies of education over 50 years have shown that student achievement is correlated with socio-economical factors on all levels – individual, school, territorial, and country level. The more resources families have, the higher on average their achievements. The same is true for schools and territories.

In Latvia, students from Riga have the highest average achievement, and their families are richer. Students from rural areas have the lowest average achievement in Latvia (Geske, Ozola, 2006; Geske, Grīnfelds, Kangro, Kiseļova, 2010). Correlation with economical factors exists also on the international level.

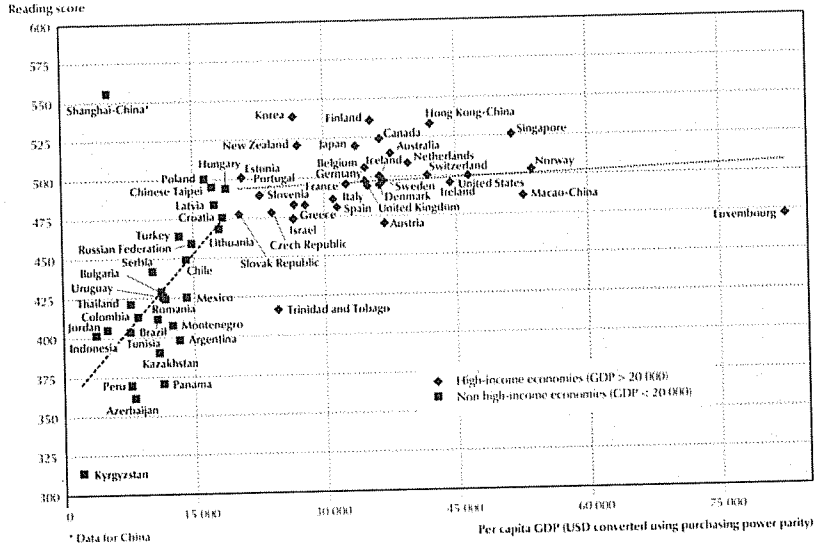
Among OECD countries in the PISA 2009 study, 6% of average student achievement can be explained with differences in gross domestic product (GDP). Among all the countries that participated in the PISA 2009 study, GDP accounts for 30% of student achievement (OECD, 2010b). In Figure 1, a connection between student achievement in reading literacy in PISA 2009 and GDP is illustrated (OECD, 2012). From the group of relatively poor countries (GDP<20000 USD PPP), only Poland has reached the average achievement level of the PISA 2009 study.

Shanghai, with a very high level of student average achievement, has to be noted. Since data on GDP are not available separately for this territory (Figure 1), Shanghai's achievement data have been matched with the GDP of China. It can be seen that for economically weaker countries, correlation between achievement and GDP is stronger. When a certain level of welfare is reached, further increase of prosperity is not that significant. The average achievement level of Latvian students is a little higher than can be expected based on the economic situation in Latvia. Although Latvian average achievement is below the OECD average, it can still be rated as good. Among the six countries where GDP is between 15,000 and 20,000 USD PPP, the average achievement of Latvian students is higher than that of students from Lithuania and Croatia, but lower than Poland, Taipei, and Hungary.

We have chosen the Human Development Index (HDI) as a measure of welfare, as it includes not only GDP, but also education and health indicators (see Table 1). The results of the PISA 2009 study correlate with HDI very highly (0.59), but the PIRLS 2006 results (0.10) reveal that the correlation is low and not statistically significant. Thus, countries with high HDI values and average achievement level in PISA 2009 will be high, regardless of their achievement in PIRLS 2006 (Norway, New Zealand). For countries that had high achievement levels in PIRLS 2006

but low HDI, a drop in the achievement level in PISA 2009 could be expected (the Russian Federation, Bulgaria, Latvia). In the 28 countries analysed, the difference between PIRLS 2006 and PISA 2009 ranks correlate significantly with HDI (0.38). This connection could be explained with the differences between goals and content of education in primary school and upper secondary grades. In many countries as students grow older, so does learning intensity and complexity. To provide education at a high level of quality, the country needs appropriate resources.

Figure 1. Average reading performance in PISA and national wealth (per capita GDP) (OECD, 2012)




Differences in educational levels of PIRLS and PISA target populations can also be characterized by differences in reading literacy definitions. For PIRLS 2006, reading literacy is defined as the ability to understand and use 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. PISA 2009 defines reading literacy as understanding, using, and reflecting on and engaging with written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society. Fifteen-year-olds have to be ready to engage in society, set their own goals, and make important decisions about their



lives. To achieve this, there is a need for help from educated parents and qualified teachers. This is mostly available in the countries with a high HDI.

## Rote learning

It was found that the negative difference between PIRLS 2006 and PISA 2009 results had significant correlation (0.42) with the index of memorization strategies used in PISA 2009. There was also a strong negative correlation (-0.55) between the index of memorization strategies and the PISA 2009 results. The title of the index might sound misleading since it represents a very narrow aspect of memorization processes in learning. In the context of PISA 2009, study memorization strategies refer to the memorization of texts and contents in all their detail and repeated reading (OECD, 2010). The index of memorization strategies is built on student responses to the following statements:

1. When I study, I try to memorize everything that is covered in the text.
2. When I study, I try to memorize as many details as possible.
3. When I study, I read the text so many times that I can recite it.
4. When I study, I read the text over and over again.

In this case, the index of memorization strategies can actually be called an index of rote learning, since rote learning is memorizing something you don't understand (Caros, 2011), and the index of memorization strategies in this case examines how often students use memorization techniques in which new information is stored in the memory with little or no further processing (OECD, 2010).

It is hardly possible to see a process of meaningful learning in this strategy since, by definition, learning is not committing a set of facts to memory, but the ability to use resources to find, evaluate, and apply information (DiCarlo, Stephen E., Lujan, Heidi L., 2005).

M. Strautmane states that learning can happen either as rote learning or as learning by understanding: The second is much more successful because when understanding takes place, new knowledge is linked with already existing knowledge (Strautmane, 2010).

The overconsumption of rote learning strategies of students from counties where average achievement experienced a drop between the PIRLS 2006 and PISA 2009 studies could possibly be connected with different issues. The inclination to use memory as a favoured tool for

learning may be related to a set of different factors comprising of previous learning and educational experience, which hinders the development of analytical skills; lack of confidence in the learner's own abilities, due to insufficient knowledge or understanding and aggravated by the student's anxiety to perform well; or having a different learning routine, due to personal abilities or, more crucially, due to different interpretations of the learning process and objectives (Valiente, 2008).

J. Lublin (2003) calls learning strategies that make use of rote learning a "surface approach". Students who take the surface approach are characterized by the following (Lublin, 2003):

- Memorise information needed for assessments,
- Take a narrow view and concentrate on detail,
- Fail to distinguish principles from examples,
- Tend to stick closely to the course requirements, and
- Are motivated by fear of failure.

So what should we do to prevent a relative drop in reading achievement? Simply restricting the use of rote learning would not help since memorization is what we resort to when what we are learning makes no sense (DiCarlo, Lujan, 2005).

Reading comprehension depends upon combining ideas in a passage and combining ideas from a passage using prior knowledge (not just comprehending each idea on its own). If students are going to become successful readers and academically successful overall, they will need a solid and broad knowledge base. Knowledge is essential to reading comprehension and thinking (Caros, 2011). A key to success in this case could be raising the level of students' understanding of content in other school subjects.

## Reading engagement

Reading only for information was found to be another factor significantly correlating (0.41) with a widening of the gap between PIRLS 2006 and PISA 2009 results. There was also a strong negative correlation (-0.62) between the agreement to the statement "I read only to get information that I need" and PISA 2009 results. This statement is an indicator of reading achievement. It is also one of the components the PISA index of engagement in reading derived from (OECD/UNESCO Institute for Statistics, 2003): 1) the amount of time students spend on reading in general; 2) the diversity of the materials students read



(magazines, comic books, fictions, non-fiction, books, newspapers); and 3) students' attitudes towards reading. The last were determined by their level of agreement with the following statements: I read only if I have to; Reading is one of my favourite hobbies; I like talking about books with other people; I find it hard to finish books; I feel happy if I receive a book as a present; For me reading is a waste of time; I enjoy going to a bookstore or a library; I read only to get information that I need; and, I cannot sit still and read for more than a few minutes. These were answered in a four-point scale with the response categories 'strongly disagree', 'disagree', 'agree', and 'strongly agree'.

Engagement has been found to be a critical variable in reading achievement (Brozo, Shiel, Topping, 2007). For example, Stanovich (1986) described a circular association between reading practices and achievement. Better readers tend to read more because they are more motivated to read, which, in turn, leads to improved vocabulary and comprehension skills.

Another basic component of reading enjoyment, as can be seen from the PISA index mentioned above, is the time spent on reading, in general. The amount of time spent on reading predicts reading achievement and knowledge of the world (Cox, Guthrie, 2001; Guthrie, Wigfield, Metsala, Cox, 1999). Unfortunately, research indicates that reading motivation declines as children grow older (Guthrie, Wigfield, 2000), and this trend sets in at the end of elementary school (Chapman, Tunmer, 1997; Guthrie, Davis, 2003; Unrau, Schlackman, 2006). A drop in reading motivation can be used to explain the decline in the scores of reading achievement in some countries, although it is not a global trend since for a number of countries, there has been an increase in the average reading achievement level (see Table 1).

It has been noted that reading motivation decreases not only with student age, but also for same age students, as time goes by and generations change. As found in the PISA 2009 study, fifteen-year-old students in 2009 tended to be less enthusiastic about reading than students in 2000 (OECD, 2011).

If student engagement in voluntary reading activities could at least be kept consistent, then that could be the first step towards preventing a drop in reading achievement studies in the future.

## Conclusions

We discovered that the achievement gap between PISA 2009 and PIRLS 2006 average reading literacy scores significantly correlated to

three main factors: national wealth, rote learning, and reading engagement. If teachers cannot institute changes in national wealth, then changes in learning strategies and students' reading engagement are the teachers' tools.

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