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# Reading Literacy in EU Countries: Evidences from PIRLS

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## Introduction

International large-scale assessments, such as the Program for International Student Assessment (PISA), and probably the best known large-scale assessment, have long attracted the attention from the media and policy makers. In particular, focus has been on the relative rankings of countries on the basis of students' average achievement scores. PISA began in 2000 and occurs in three-yearly cycles. A project of the Organization for Economic Cooperation and Development (OECD), 74 countries participated in the most recent assessment cycle in 2012 representing nearly 90% of world's economy. As part of PISA, students complete an assessment including items testing reading literacy, mathematical literacy and scientific literacy.

More than any other skill, the ability to read is fundamental to successfully navigating the school curriculum. Reading literacy is one of the most important abilities students acquire as they advance through their early school years. It is the basis for learning across all subjects. Furthermore, it is vital to determining each individual's trajectory through life, his or her economic wellbeing, and the ability to dynamically and fully participate in broader society (Mullis, Martin, Foy, Drucker, 2011; OECD, 2013a). Reading literacy is a key competence in modern societies.

Due to the importance of this skill, in 1991, the International Association for the Evaluation of School Achievement (IEA) conducted its first international study specifically aimed at analyzing reading achievement, the Reading Literacy Study. Later, in 2001, IEA launched the Program for International Reading Literacy Study (PIRLS). PIRLS is one of the regular research studies of cross-national achievement conducted by IEA, and it relies on collaboration among the research centres accountable for data collection in each country.

In 2001 35 countries participated in PIRLS, in 2006 45 countries took part in the study, and in the last 2011 study 49 countries participated in PIRLS and prePIRLS<sup>1</sup>. So, PIRLS 2011 was the third in an international 5-yearly cycle of assessments designed to measure trends in reading literacy achievement at the fourth grade. Grade 4 was chosen because it represents an important transition point in students'

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<sup>1</sup> Administered for the first time in 2011 at the end of the primary school cycle, prePIRLS responds to the particular demands and circumstances of those countries and sub-national entities whose children are still developing the fundamental reading skills that are prerequisites for success on PIRLS. Three countries implemented prePIRLS in 2011 (Mullis et al., 2011).

development, the point at which students have already learned how to read and are now using reading to learn (Chall, 1983, 1996; Mullis et al., 2011). It is also the point at which many countries start having separate classes for different subjects (for instance, languages, mathematics, and science). Though, given the linguistic and cognitive demands of reading, PIRLS wants to avoid assessing very young children. Therefore, if the average age of grade 4 students at the time of testing would be less than 9.5 years, PIRLS recommends that countries assess the next higher grade (Mullis, Martin, Kennedy, Trong & Sainsbury, 2009).

In 2011, the PIRLS five-year cycle came into alignment with the four-cycle of IEA's Trends in International Mathematics and Science Study, widely known as TIMSS. TIMSS has been conducted at the fourth and eighth grades every four years since 1995. TIMSS 2011 will be the first TIMSS assessment to have data collection in the same school year as PIRLS at fourth grade, providing a rare opportunity for countries to collect internationally comparable information on reading, mathematics, and science in the same year and on the same students.

PIRLS 2011 focused on three aspects of reading literacy:

- (i) purposes of reading (i.e., reading for literary experience and reading to acquire and use information);
- (ii) processes of comprehension (i.e., focusing and retrieving explicitly stated information, making straightforward inferences, interpreting and integrating ideas and information, and examining and evaluating content, language, and textual elements); and
- (iii) behaviours and attitudes towards reading.

PIRLS provides participating countries with unique information on how well their students can read after four years of elementary school and places this information in an internationally comparative context. From its foundation, PIRLS was designed to measure trends in reading literacy achievement. It has been conducted every five years (2001, 2006, 2011). The next assessment is planned for 2016. Many of the countries participating in PIRLS 2011 also participated in the previous study cycles. So, it is possible to measure progress in reading achievement across three time points in these countries. However, in this specific report we only analyze some trends in reading literacy from 2006 to 2011.

In addition to data on reading achievement, PIRLS also collects an important array of contextual information about home and school supports for literacy through the student, home, teacher, and school questionnaires. The data from these questionnaires enables PIRLS to relate students' attainment

to different types of curricula, teaching and learning practices, and school environments. Since educational systems vary widely around the world, the study of their variations provides a unique opportunity to gain a deeper understanding of the effects of different policies and practices. The results obtained by PIRLS can be used to improve teaching and learning methods in reading in many countries. Furthermore, Mullis, Kennedy, Martin & Sainsbury (2006) claim that PIRLS provides “a wealth of information that can be used not only to improve the reading curriculum and instruction for younger students, but also help in interpreting the results for 15-year-olds in PISA” (p. 102). However, as stated by Shiel and Eivers (2009) there is no evidence that students’ achievement in PIRLS is related to literacy instruction. In addition, although the relationship between students’ reading scores and some background variables at the student, household, school and class within school levels have been investigated, more research is needed to identify the effects of the factors associated with reading achievement.

In this report factors that explain reading achievement in EU countries are identified using PIRLS. In the next section the theoretical framework that contextualizes the PIRLS assessment is presented. In section 2 the assessment design is briefly described. The following section presents the rationale for the study. The methodology in terms of participants, data analysis and variables is described in section 4. The results are presented in section 5, regarding descriptive statistics of the variables used in the analysis, multivariate analysis, country-level analysis and, finally, some trends over time are established. In the last section, the results previously presented are discussed and some policy measures are proposed.

## 1. Theoretical Framework

### 1.1. Reading Literacy

To take a comprehensive notion of the meaning of the ability to read, PIRLS joins two terms: *reading* and *literacy*. Combining the terms links the *ability to reflect on what is read* with the *ability to use reading as a tool for reaching individual and societal goals* (Mullis et al., 2009). The term *reading literacy* has been employed by IEA since its 1991 Reading Literacy Study (Elley, 1992, 1994; Wolf, 1995), which served as a basis for establishing the assessment framework used by PIRLS. The framework has been regularly updated and improved since that time, as reflected in the subsequent cycles of the PIRLS assessment (Campbell, Kelly, Mullis, Martin, & Sainsbury, 2001; Mullis et al., 2006; Mullis et al., 2009).

In developing a definition of reading literacy to serve as the basis for PIRLS, the Reading Development Group for 2001 looked to IEA's 1991 study, in which 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 Reading Development Group for 2001 elaborated on this definition for PIRLS so that it applies across ages yet makes explicit reference to aspects of the reading experience of young children. Beginning with PIRLS 2006, the definition was refined to highlight the widespread importance of reading in school and everyday life. The PIRLS 2011 Assessment Framework provides the following definition of reading literacy:

*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 (Mullis et al., 2009, p. 11).*

This definition of reading literacy considers reading as a constructive and interactive process (Alexander & Jetton, 2000; Anderson & Pearson, 1984; Chall, 1983; Rudell & Unrau, 2004; Walter, 1999). Readers construct meaning in an active way, using a range of linguistic skills, cognitive and metacognitive strategies, and their background knowledge. Literate readers are those who enjoy reading but also learn from it, acquiring knowledge of the world and of themselves. They can enjoy and gain information from the many forms in which text is accessible in today's society (Greaney & Neuman, 1990; OECD, 2000; Wagner, 1991). This encompasses traditional written forms such as newspapers, magazines, books, and

documents. It also includes information and communication technologies, such as the Internet, email, and text messaging, as well as text integrated with various video and television media (Leu, Kinzer, Coiro, & Cammack, 2004).

According to Almasi and Garas-York (2009) and Guice (1995), discussing what students have read with different groups of individuals permits them to build text meaning in varied contexts. Galda and Beach (2001) and Kucer (2005) underline that social interactions about reading in one or more communities of readers can contribute in helping students build an understanding and appreciation of texts. Guthrie (1996) also emphasizes the role of socially constructed environments in the classroom or, for instance, in the school library. This kind of contexts can provide pupils with formal and informal opportunities to widen their views about texts and to conceive reading as a shared experience with their classmates. These environments can be extended to communities outside of school as learners share with their families and friends ideas and information obtained from reading.

*Reading to learn* is vital for children, since it allows them to engage in lifelong learning and, consequently, prepares them for their professional future and their personal development. It is commonly established that the move from *learning to read* to *reading to learn* is usually made around Grade 4 (Chall, 1983, 1996; Mullis et al., 2006, 2009).

It is important to note the similarities that exist between the definitions of reading in PIRLS and PISA. Although these programs target two different student populations (Grade 4 for PIRLS and 15-year-old students for PISA), both highlight the constructive and cooperative nature of reading. Similarly to PIRLS, PISA uses the comprehensive term of *reading literacy* and defines it as “*understanding, using, 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*” (OECD, 2010, p. 23). Thus, both programs share similar definitions. PIRLS examines three aspects of students’ reading literacy:

- (i) purposes for reading,
- (ii) processes of comprehension, and
- (iii) reading literacy behaviours and attitudes.

These three aspects are interconnected and are influenced by the contexts in which students live and learn. With the purpose of identifying and characterizing effective procedures and practices for developing pupils’ reading literacy, PIRLS also collects information on these contexts through background questionnaires.

In the next sections, each aspect of the reading literacy examined by PIRLS is discussed in detail.

### 1.1.1. Purposes for Reading

The first aspect studied by PIRLS is directly linked to the question “*Why do people read?*” and, more specifically, “*Why do young students read?*”. PIRLS focuses on two main purposes: *reading for literary experience*, and *reading to acquire and use information*. These two purposes account for a significant part of the reading done by pupils in and out of school, which is frequently related to specific types of text:

- (i) *Reading for literary experience*. Due to the literary experience it provides, fiction is the type of text most often read by children. It allows them to get involved in fictional actions, events, ideas and characters while appreciating the language itself. PIRLS uses mostly narrative fiction, for instance, short stories and novels. This kind of text provides children an opportunity to explore and reflect upon situations that they could come across in life.
- (ii) *Reading to acquire and use information*. This kind of reading is generally related to informational texts, allowing pupils to understand how the real world works and why things happen the way they do. These comprise texts that narrate events (for instance, biographies), expository texts (for instance, textbooks and research papers), persuasive texts (for instance, advertisements), and procedural texts (for instance, instructions and recipes). The structure and presentation of information differs, depending on the kind of text (Labrecque, Chuy, Brochu & Houme, 2012).

Although PIRLS distinguishes between the two purposes for reading, the comprehension processes employed by readers for both purposes are more analogous than different.

### 1.1.2. Processes of Comprehension

Processes of comprehension are related to the question “*How do readers construct meaning from a text?*” The four processes examined by PIRLS are:

- (i) *Focusing on and retrieving explicitly stated information*. This process requires the reader to be able to understand unambiguously stated information and to relate it to the question asked. Since meaning is evident and clearly stated in the text, little or no inferring is required. Though, the importance of the information should be recognized by the reader. Instances of this kind of text processing include tasks such as identifying information that is

relevant to the specific goal, searching for definitions of words or phrases, looking for specific ideas, identifying the setting of a story, and finding the topic sentence or main idea (when explicitly stated).

- (ii) *Making straightforward inferences.* This process enables the reader to fill in the “gaps” in meaning by deducing information from the text. Straightforward inferences require very little effort and are usually performed routinely by skilled readers. Examples of the process include tasks such as inferring that one event caused another event, drawing conclusions about what the main point of a series of arguments is, determining the referent of a pronoun, identifying generalizations made in the text, and describing the relationship between two characters.
- (iii) *Interpreting and integrating ideas and information.* This process allows the reader to construct a more complete understanding of the text by integrating both prior knowledge and the information available in the text. The connections to be made are not only implicit; they may also be open to the reader’s interpretation. Since the interpretation is very much determined by a reader’s personal experience, the meaning constructed through this type of processing is likely to vary among readers. Examples of the process include tasks such as discerning the overall message or theme of a text, considering an alternative to the actions of the characters, comparing and contrasting text information, inferring a story’s mood or tone, and interpreting a real-world application of text information.
- (iv) *Examining and evaluating content, language, and textual elements:* this process enables the reader to stand apart from the text in order to critically consider its content, language, or textual elements. When evaluating the content, the reader may compare the writer’s representation of the world with his or her own understanding, or with information from other sources. When evaluating the language and textual elements, the reader may reflect on how well the meaning is expressed by drawing upon his or her own knowledge of text genre, structure, or language conventions. In any case, the evaluation process depends on the reader’s familiarity with the topic and language. Examples of the process include tasks such as evaluating the likelihood that the events described could really happen, describing how the author devised a surprise ending, judging the completeness or clarity of information in the text, and determining an author’s perspective on the central topic (Labrecque, Chuy, Brochu & Houme, 2012).

The four processes described above are assessed within each of the two purposes for reading (reading for literary experience, and reading to acquire and use information).

### 1.1.3. Reading Literacy Behaviours and Attitudes

The ability to realize one's potential requires not only efficient processes of comprehension, but also behaviours and attitudes that support lifelong reading. Because of this, PIRLS dedicates a considerable proportion of the student questionnaire to the assessment of the following important aspects:

- (i) *Student reading literacy behaviours.* Entertaining activities, such as reading books and magazines, searching for information on the internet, or visiting a library, play an important role in the development of reading literacy. Several studies (Sainsbury & Schangen, 2004; van der Voort, 2001) show that students who read for fun and participate in social aspects of reading by discussing books with family and friends demonstrate higher reading performance. On the other hand, van der Voort (2001) concluded that students who spend most of their leisure time watching television tend to show lower reading achievement. Thus, out-of-school behaviours and social interactions can be considered important aspects when assessing reading literacy.
- (ii) *Attitudes toward reading.* Positive attitudes toward reading are among the most important requirements for lifelong readers. Research indicates that good readers are typically those who enjoy reading and demonstrate a positive attitude toward different reading activities (Mullis, Martin, Kennedy, & Foy, 2007). Furthermore, a meta-analysis conducted by Petscher in 2010 showed that the positive relationship between reading attitudes and achievement is stronger for elementary-school students than for older students.
- (iii) *Attitudes toward learning to read.* Motivation to learn to read comprises the value of reading for the student, his or her interest in what is read, and, most important, the feeling that he or she can do well. It is important for students to have a strong self-concept and self-esteem regarding their own reading skills to be capable to reach higher levels of reading literacy (Quirk, Schwanenflugel & Webb, 2009). Fluent and successful readers enjoy challenging reading, which goes away from simple decoding and word recognition and involves personal interest in what is read.

## 1.2. Contexts for Learning to Read

Young children acquire reading literacy through a variety of activities and experiences within different contexts. During their primary school years, their skills, behaviors, and attitudes associated with reading

literacy are mainly developed at home and in school. Several resources and activities support children's reading literacy, including those that happen as a natural and informal part of the daily life. Actually, less structured activities can be as important in facilitating young children develop reading literacy as the more structured activities that happen in classrooms. Furthermore, each context supports the other, and the link between home and school is a crucial element in learning (Mullis et al., 2009; Park, 2008; Weinberger, 1996).

Further than the direct influence of home and school on children's reading are the wider environments in which children live and learn. Children's homes and schools are sited in communities with different aims, resources, and organizational characteristics. These features will likely influence home environments and schools and therefore children's reading literacy.

The national context in which children live and go to school is also very important. The level of resources generally available in a country; government decisions about the priorities given to education; and the curricular goals, programs, and policies related to reading education will unquestionably impact on school and on home contexts for learning to read (Mullis et al., 2009, p. 33). Because the factors that may foster success in learning or those that may impede learning are distributed across community, home, and school environments, PIRLS has adopted a framework that considers relationships among different contexts:

- (i) *Home context.* IEA studies conducted over the past 20 years have shown a strong positive relationship between the reading achievement of elementary school students and a supportive environment at home (Mullis, Martin, Foy & Drucker, 2012). In order to further investigate this relationship, the PIRLS 2011 Learning to Read Survey was used to collect data on economic, social, and educational resources at home; parental emphasis on literacy development; and parents' reading behaviours and attitudes.
- (ii) *Classroom context.* The classroom context is as important as the home context for literacy development, since pupils spend several hours each day with other pupils and teachers in the classroom. Among *classroom* factors examined by PIRLS are teacher education and development; teacher characteristics and attitudes; teaching, learning and assessment strategies; instructional materials and technology; and classroom characteristics (for instance, class size).

- (iii) *School context.* Since resources and policies established at the school level frequently influence the structure and environment at the classroom level, PIRLS pays particular attention to *school* factors, including school characteristics (for instance, location, composition by student background), school resources, school climate for learning, school organization for instruction, and parental participation in school activities.
- (iv) *Community context.* Contexts previously described - home, classroom, and school - do not function isolated from each other; they are all closely interconnected and shaped by a more global *community* context. The capability of a country to create a literate population depends deeply on its ability to develop and implement effective educational programs and stimulus for further reading improvement. In order to evaluate cultural, social, political, and economic factors at the country level, PIRLS collects information on countries' languages and emphasis on literacy, demographics and resources, the organization and structure of the education system, and the reading curriculum in elementary school (Labrecque, Chuy, Brochu & Houme, 2012).

**Figure 1.** Contexts that influence children’s reading literacy (adapted from Mullis et al., 2009, p. 35).

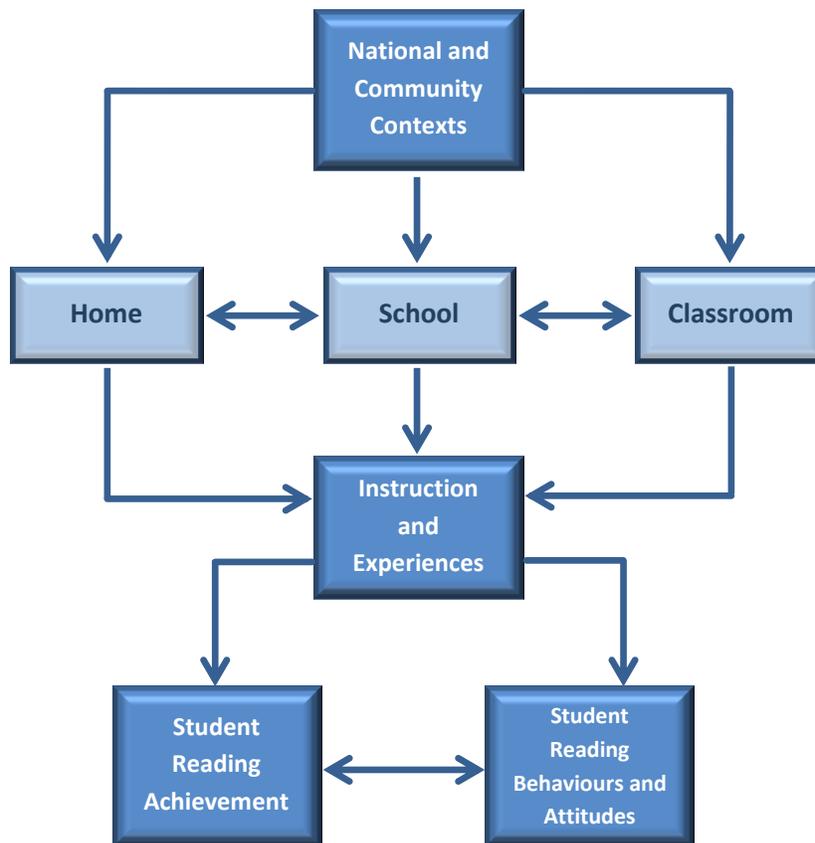


Figure 1 illustrates the interactions among the home, school, and classroom contexts on pupils' reading development and how these relationships are shaped by the community and country contexts. The figure shows how learners' outcomes, such as reading achievement, behaviors and attitudes, are products of instruction and experiences gained in diverse contexts. Also, it is important to underline that achievement and attitudes can strengthen one another. Better readers may enjoy and value reading more than poorer readers, thus reading more and further improving their skills (Mullis et al, 2009, p. 34).

Information about the *home*, *school*, and *classroom contexts* was collected by means of background questionnaires that were completed by the students being tested, their parents or caregivers, their school principals, and their teachers. Information about the *community contexts* was collected through a curriculum questionnaire completed by the national research coordinators in each country. Based on this questionnaire, each PIRLS country prepared a chapter for the *PIRLS 2011 Encyclopedia2* (Mullis, Martin, Minnich, Drucker & Ragan, 2012), summarizing the structure of its education system; the reading curriculum and reading instruction in primary school; teacher-education requirements; and assessment and examination practices.

## 2. Assessment Design

### 2.1. General Design of the Assessment

The goal of the PIRLS assessment is to provide a comprehensive picture of reading literacy achievement across the world (Mullis et al., 2009). The texts and items used in PIRLS 2011 were selected based on the conceptual framework, which targeted two reading purposes and four comprehension processes, as described formerly. The assessment was divided evenly between *reading for literary experience* and *reading to acquire and use information* — the two purposes that account for most of the reading activity. Within each of these purposes, four processes of comprehension were measured: *focusing on and retrieving explicitly stated information* (20 per cent); *making straightforward inferences* (30 per cent); *interpreting and integrating ideas and information* (30 per cent); and *examining and evaluating content, language, and textual elements* (20 per cent). Table 1 shows the reading purposes and processes assessed by PIRLS and the percentages of the test allocated to each.

**Table 1.** Percentages devoted to reading purposes and comprehension processes in PIRLS 2011.

Purposes for Reading	
Literacy experience	50%
Acquire and use information	50%
Process of Comprehension	
Focus on and retrieve explicitly stated information	20%
Make straightforward inferences	30%
Interpret and integrate ideas and information	30%
Examine and evaluate content, language and textual elements	20%

#### 2.1.1. PIRLS 2011 Reading Passages and Question Types

The complete PIRLS 2011 assessment included 10 reading passages: 5 for the *literary experience* purpose and 5 for the *acquisition and use of information* purpose. 13 to 16 questions (also called *items*)

were raised for each reading passage. There were 135 items in total, divided almost equally between multiple-choice questions and constructed-response questions.

**Table 2.** Main characteristics of the reading passages selected for the PIRLS 2011 assessment.

Text feature	Literary texts	Informational texts
<b>Type of passages</b>	Complete short stories or episodes (contemporary and traditional)	Continuous and non-continuous informational passages (covering scientific, ethnographic, biographical, historical, and practical information and ideas)
<b>Number and length of passages</b>	Five passages of approximately 800 words	Five passages of 600 to 900 words
<b>Visuals</b>	Supportive colourful illustrations	Presentational features such as diagrams, maps, illustrations, photographs, or tables
<b>Structure</b>	Two main characters and a plot with one or two central events in each story	Various structures, including structure by logic, argument, chronology, and topic
<b>Other features</b>	A range of styles and language features, such as first person narration, humour, dialogue, and some figurative language	A range of organizational features, such as subheadings, text boxes, or lists

With the purpose of linking the data across years and to provide a groundwork for measuring trends, 6 of 10 passages and item sets (3 literary and 3 informational) were retained from former assessments. The remaining 4 passages and items sets (2 literary and 2 informational) were newly developed. Hundreds of passages were reviewed regarding the selection of those that would satisfy PIRLS requisites:

- (i) Passages had to be appropriate for Grade 4 students in content, level of interest, and readability;

- (ii) Passages had to be well written in terms of depth and complexity to allow for an adequate number of questions;
- (iii) Passages had to avoid cultural bias, and to be equally familiar or unfamiliar to all respondents.

Table 2 summarizes the main features of the reading passages of the PIRLS 2011 assessment.

Students' ability to comprehend text through the four PIRLS comprehension processes is assessed via comprehension questions that accompany each text. As mentioned previously, two question formats are used in the PIRLS assessment — multiple-choice and constructed-response:

- (i) *Multiple-choice*. This question format includes four answer options, which are written in a succinct manner to lessen the reading load. Only one of the four options is correct. The incorrect options were reasonable, but not deceptive. Though any comprehension processes could be assessed with multiple-choice questions, this format was mostly used for processes that do not rely on complex evaluations and interpretations.
- (ii) *Constructed-response*. This question format requires learners to construct a written response, and intends to illicit an interaction between the reader, the text, and the context. The constructed-response items can be either short or extended. They are used to assess any of the four comprehension processes but are mainly suitable for interpretation processes calling for students' background knowledge and experiences.

In the next pages an example<sup>2</sup> of an *informational reading passage* used in the 2011 PIRLS survey is shown: *The Giant Tooth Mystery*. Samples of questions about the same passage are also presented.

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<sup>2</sup> Example of the informational reading passage and of the questions from PIRLS 2011 Assessment. Copyright © 2013 International Association for the Evaluation of Educational Achievement (IEA). Publisher: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College, Chestnut Hill, MA and International Association for the Evaluation of Educational Achievement (IEA), IEA Secretariat, Amsterdam, the Netherlands. Online available: [http://nces.ed.gov/surveys/pirls/pdf/passage\\_full.pdf](http://nces.ed.gov/surveys/pirls/pdf/passage_full.pdf)

# The **GIANT** Tooth Mystery

*A fossil is the remains of any creature or plant that lived on the Earth many, many years ago. People have been finding fossils for thousands of years in rocks and cliffs and beside lakes. We now know that some of these fossils were from dinosaurs.*



Long ago, people who found huge fossils did not know what they were. Some thought the big bones came from large animals that they had seen or read about, such as hippos or elephants. But some of the bones people found were too big to have come from even the biggest hippo or elephant. These enormous bones led some people to believe in giants.

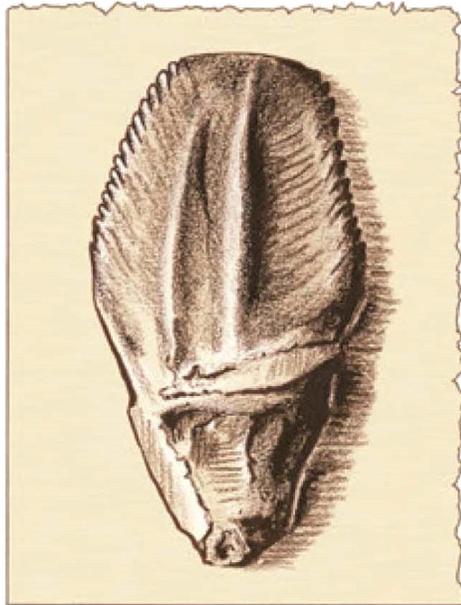
Hundreds of years ago in France, a man named Bernard Palissy had another idea. He was a famous pottery maker. When he went to make his pots, he found many tiny fossils in the clay. He studied the fossils and wrote that they were the remains of living creatures. This was not a new idea. But Bernard Palissy also wrote that some of these creatures no longer lived on earth. They had completely disappeared. They were extinct.

Was Bernard Palissy rewarded for his discovery? No! He was put in prison for his ideas.

As time went by, some people became more open to new ideas about how the world might have been long ago.

Then, in the 1820s, a huge fossil tooth was found in England. It is thought that Mary Ann Mantell, the wife of fossil expert Gideon Mantell was out for a walk when she saw what looked like a huge stone tooth. Mary Ann Mantell knew the big tooth was a fossil, and took it home to her husband.

When Gideon Mantell first looked at the fossil tooth, he thought it had belonged to a plant eater because it was flat and had ridges. It was worn down from chewing food. It was almost as big as the tooth of an elephant. But it looked nothing like an elephant's tooth.



Fossil tooth sketched life-sized

Gideon Mantell could tell that the pieces of rock attached to the tooth were very old. He knew that it was the kind of rock where reptile fossils were found. Could the tooth have belonged to a giant, plant-eating reptile that chewed its food? A type of reptile that no longer lived on earth?

Gideon Mantell was really puzzled by the big tooth. No reptile that he knew about chewed its food. Reptiles gulped their food, and so their teeth didn't become worn down. It was a mystery.

Gideon Mantell took the tooth to a museum in London and showed it to other scientists. No one agreed with Gideon Mantell that it might be the tooth of a gigantic reptile.

Gideon Mantell tried to find a reptile that had a tooth that looked like the giant tooth. For a long time, he found nothing. Then one day he met a scientist who was studying iguanas. An iguana is a large plant-eating reptile found in Central and South America. It can grow to be more than five feet long. The scientist showed Gideon Mantell an iguana tooth. At last! Here was the tooth of a living reptile that looked like the mystery tooth. Only the fossil tooth was much, much bigger.

Iguana

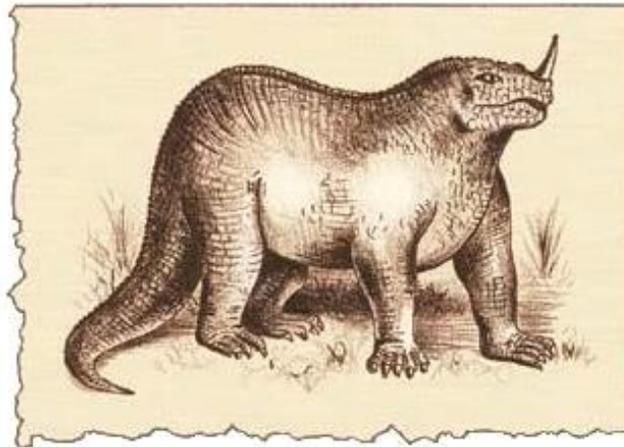


A life-sized drawing of an iguana's tooth from Gideon Mantell's notebook



Now Gideon Mantell believed the fossil tooth had belonged to an animal that looked like an iguana. Only it wasn't five feet long. Gideon Mantell believed it was a hundred feet long! He named his creature *Iguanodon*. That means "iguana tooth".

Gideon Mantell did not have a whole *Iguanodon* skeleton. But from the bones he had collected over the years, he tried to figure out what one might have looked like. He thought the bones showed that the creature had walked on all four legs. He thought a pointed bone was a horn. He drew an *Iguanodon* with a horn on its nose.



What Gideon Mantell thought an Iguanodon looked like

Years later, several complete *Iguanodon* skeletons were found. They were only about thirty feet long. The bones showed that it walked on its hind legs some of the time. And what Gideon Mantell thought was a horn on its nose was really a spike on its “thumb”! Based on these discoveries, scientists changed their ideas about what the *Iguanodon* looked like.

Gideon Mantell made some mistakes. But he had made an important discovery, too. Since his first idea that the fossil tooth belonged to a plant-eating reptile, he spent many years gathering facts and evidence to prove his ideas were right. By making careful guesses along the way, Gideon Mantell was one of the first people to show that long ago, giant reptiles lived on earth. And then they became extinct.

Hundreds of years before, Bernard Palissy had been thrown in prison for saying nearly the same thing. But Gideon Mantell became famous. His discovery made people curious to find out more about these huge reptiles.

In 1842, a scientist named Richard Owen decided that these extinct reptiles needed a name of their own. He called them *Dinosauria*. This means “fearfully great lizard”. Today we call them dinosaurs.



What scientists today think the Iguanodon looked like

The following question is an example of a multiple choice question aiming at examining students' ability to focus on and retrieve explicitly stated information.

**Example 1.** What is a fossil | Multiple-choice question | Focus on and retrieve explicitly stated information

What is a fossil? A. the surface of rocks and cliffs B. the bones of a giant C. the remains of very old living things D. the teeth of elephants
---

Example 2 shows a constructed-response item that examines learners' ability to make straightforward inferences.

**Example 2.** Why people believed in giants | Constructed-response question | Make straightforward inferences

According to the article, why did some people long ago believe in giants? <hr/> <hr/> <hr/>
--

An instance of a correct response for the previous question:

*They thought that the bone weren't from elephants and hippos but from giants.*

An instance of an incorrect response:

They found a giant tooth

---

---

The following question is an example of a constructed-response item aiming at examining students' ability to interpret and integrate ideas and information.

**Example 3.** What was Palissy's new idea | Constructed-response question | Interpret and integrate ideas and information

What was Bernard Palissy's new idea?

---

An instance of a correct answer:

his new idea is that long ago animals were  
extinct

An instance of an incorrect response:

studying fossils

---

Example 4 presents an instance of a constructed-response question that assesses pupils' ability to interpret and integrate ideas and information.

**Example 4.** Tooth from different types | Constructed-response question | Interpret and integrate ideas and information

Gideon Mantell thought the tooth might have belonged to different types of animals. Complete the table to show what made him think this.

Type of animal	What made him think this
A plant eater	The tooth was flat with ridges.
A giant creature	
A reptile	

An instance of a correct response:

Type of animal	What made him think this
A plant eater	The tooth was flat with ridges.
A giant creature	The tooth was big
A reptile	He met an iguana scientist

An instance of an incorrect response:

Type of animal	What made him think this
A plant eater	The tooth was flat with ridges.
A giant creature	Different spiky MM
A reptile	They gulped there food

Example 5 shows a multiple-choice question that aims to test learners' ability to make straightforward inferences.

**Example 5.** Why Gideon took tooth to a museum | Multiple-choice question | Make straightforward inferences.

Why did Gideon Mantell take the tooth to a museum?

- A. to ask if the fossil belonged to the museum
- B. to prove that he was a fossil expert
- C. to hear what scientists thought of his idea
- D. to compare the tooth with others in the museum

The next example presents a constructed response item aiming at testing students' ability to examine and evaluate content, language, and textual elements.

**Example 6.** Purpose of two Iguanodon pictures | Constructed-response question | Examine and evaluate content, language, and textual elements.

Look at the two pictures of the *Iguanodon*. What do they help you to understand?

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An instance of a correct response:

That the scientists learned and studied more to find more information about the Iguanodon.

An instance of a partially correct response:

That Gideon Mantell and other scientists have different opinions.

An instance of an incorrect response:

Ther both life the same.

## 2.2. Background Questionnaires

As mentioned in section 1.2, several contexts can contribute to the development of children's reading abilities. Thus, in order to gather information on community, school, and home environments, PIRLS 2011 administered the following background questionnaires:

- (i) *Student Questionnaire*. This questionnaire was included in the assessment booklets and was completed by each participating student. It asked about aspects of students' home and school lives, particularly demographic information, home setting, school climate for learning, out-of-school reading behaviours, and attitudes toward learning.
- (ii) *Learning to Read Survey (Home Questionnaire)*. This questionnaire was addressed to the parents or primary caregivers of each participating student. It asked about language spoken at home, preschool literacy-centred experiences, homework activities, home-school involvement, number of books at home, parent education and involvement, parents' reading habits and attitudes toward reading.
- (iii) *Teacher Questionnaire*. This questionnaire was addressed to the reading teacher of each participating Grade 4 class. It asked about the teacher's background and education, the school climate for learning, attitudes toward teaching, classroom characteristics, and student engagement.
- (iv) *School Questionnaire*. This questionnaire had to be completed by the principal of each participating school. It asked about school characteristics, instructional time, resources and technology, parental involvement, school climate for learning, teaching staff and the role of the principal.
- (v) *Curriculum Questionnaire*. This questionnaire was completed by the national research centre of each participating country. It asked about the country's reading curriculum, including national policy on reading, goals and standards for reading instruction, time specified for reading, and provision of books and other literary resources (Labrecque, Chuy, Brochu & Houme, 2012).

### 3. Rationale for the study

Given the identified effects of the factors associated with reading achievement in PIRLS 2006 for the EU participating countries (Araújo & Costa, 2012) we sought to continue to contribute to evidence-based policy running a secondary analysis of the PIRLS 2011 dataset for the participating Member States. Specifically, this study addresses the following questions:

- (i) Which variables related with student background characteristics, class characteristics and school characteristics explain reading achievement in the PIRLS 2011?
- (ii) What trends over time can we identify in the countries that participated in PIRLS 2006 and PIRLS 2011?

## 4. Methodology

### 4.1. Participants

The European Union (EU) countries that participated in PIRLS 2011 were selected: Austria, French Belgium, Bulgaria, Croatia, Check Republic, Denmark, England, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain and Sweden.

**Figure 2.** EU countries participating in PIRLS 2011



The total number of students for the 23 EU countries is 109410. Considering each participating country, the minimum number of students that participated in the survey was in French Belgium (3727) and the maximum was 8580 in Spain.

**Table 3.** Number of students per country

Country	N
Austria	4776
Belgium (French)	3727
Bulgaria	5261
Croatia	4587
Czech Republic	4556
Denmark	4594
Finland	4910
France	4438
Germany	4227
Hungary	5204
Ireland	4524
Italy	4189
Lithuania	4661
Malta	3980
The Netherlands	3995
Poland	5005
Portugal	4085
Romania	4735
Slovak Republic	5655
Slovenia	4512
Spain	8580
Sweden	4707
England	4502

## 4.2. Data Analysis

This report is a follow up of the 2012 report entitled “Reading literacy in PIRLS 2006: What explains achievement in 20 EU countries?” (Araújo & Costa, 2012). The model used is similar to the one used with the data from PIRLS 2006. IEA constructed new indexes for PIRLS 2011 similar to the ones used in the previous survey. The indexes, called scales for the new round of the survey, used in our model are

the following: Home Resources for Learning, Students Like Reading, and Instruction Affected by Reading Resource Shortages.

The Home Resources for Learning (HRL) scale is grounded on students' responses to questions in the Student Questionnaire concerning availability of home resources, such as, number of books, and number of home study supports (Number of books in the home; Number of home study supports), and their parents' responses to questions in the Learning to Read Survey (or Home Questionnaire) on the number of children's books, their level of education, and their occupation (Number of children's books in the home; Highest level of education of either parent; Highest level of occupation of either parent). The scale was coded by IEA as many resources, some resources, few resources.

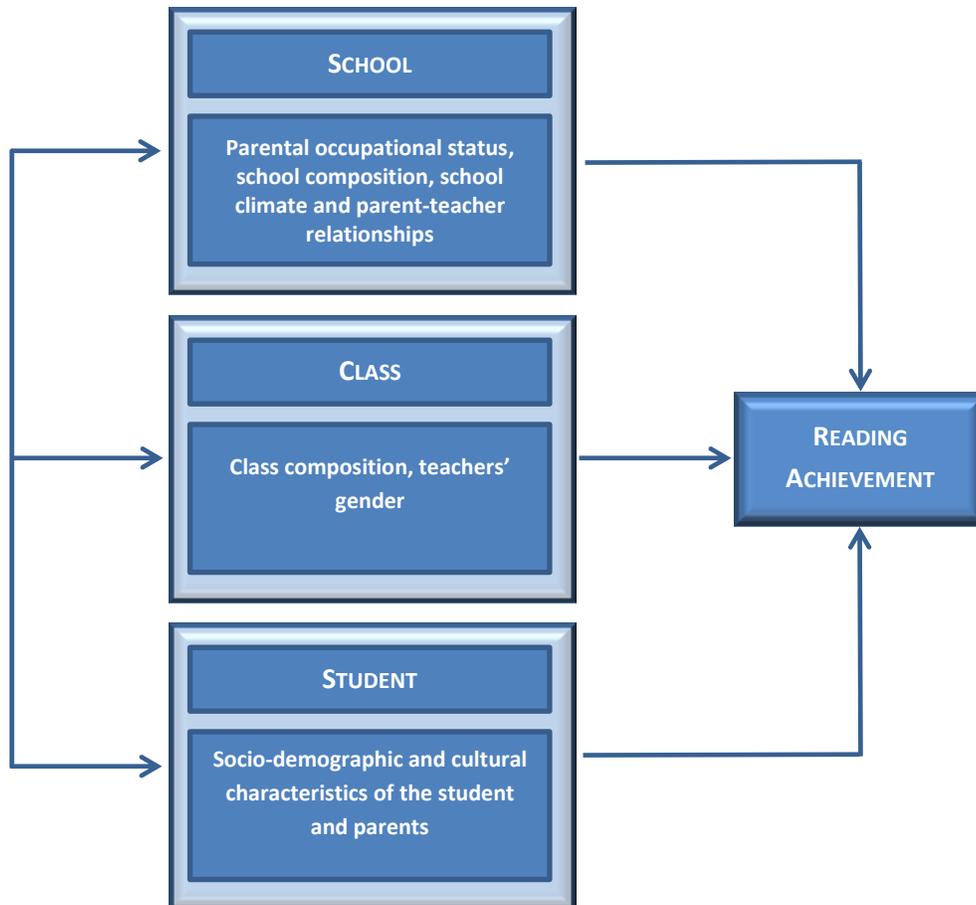
The Students Like Reading (SLR) scale is based on students' responses to the following eight statements of the Student Questionnaire: I read only if I have to; I like talking about what I read with other people; I would be happy if someone gave me a book as a present; I think reading is boring; I would like to have more time for reading; I enjoy reading; I read for fun and I read things that I choose myself. This scale assumes the categories like reading, somewhat like reading and do not like reading.

The Instruction Affected by Reading Resource Shortages (RRS) scale was created based on principals' responses to the School Questionnaire concerning eleven school and classroom resources, as follows: Instructional materials (e.g., textbooks); Supplies (e.g., papers, pencils); School buildings and grounds; Heating/cooling and lighting systems; Instructional space (e.g., classrooms); Technologically competent staff; Computers for instruction; Teachers with a specialization in reading; Computer software for reading instruction; Library books; Audio–visual resources for reading instruction. This variable assumes the categories not affected, somewhat affected and affected a lot.

PIRLS data has a hierarchical structure in which students are nested in classes, and classes are nested in schools. Multilevel modeling (Goldestein, 2003) was used in order to investigate which explanatory factors could be found at students, class and school levels with respect to reading attainment. Three hierarchical levels are included in the models: the first level is composed by student variables, level 2 represents the class and the last level represents the school. The variance components model was applied to the data and the model was then estimated using iterative generalized least squares (IGLS) (Goldestein, 1986). The computational component was generated using MLWin 2.24 software (Rabash, Steele, Browne, & Goldstein, 2009). The bottom-up procedure, the deviance and the Akaike's information criteria (Akaike, 1981) were used to decide which variables to include in the model.

The conceptual framework followed is presented in figure 3 which is based on the previous work done by Araújo and Costa (2012).

**Figure 3.** Conceptual framework of the model



The model explores the impact of home and student characteristics, class variables and school characteristics, as reported by school principals, on students reading achievement. Variables from the background questionnaires were considered.

The results are analyzed for the EU as a whole taking into account country effects and also at the country level to measure the effects of specific variables on reading achievement. We took into consideration the model with country fixed effects because it allows us to control for unobserved heterogeneity that can be found due to historical and/or institutional factors of individual countries. These unique effects of each country correspond to country-specific correlations with the independent variables.

In short, separate multi-level models per country were computed in order to complement the analysis and understand which variables are more or less significant in explaining reading achievement in each country. England, Denmark and Germany were excluded from the analysis because in at least one of the variables of the model most of the values were missing. For instance, in England there was no data for the variable called “Language spoken at home”. Thus, the current analysis presents results for the remaining 20 EU countries.

The description of the variables used at each level of the model is presented below for the 20 EU participating countries as a whole.

### 4.3. Variables

In the first level, corresponding to the individual characteristics of the students, the following variables were entered:

- (i) Gender – dichotomous variable with a value of 1 for girls (reference group) and 2 for boys;
- (ii) Language spoken at home before began school – dichotomous variable with a value of 1 if the language of the test is the same as the one spoken at home and 2 when it is not spoken at home;
- (iii) Parents’ highest occupational status – variable that includes: professional, small business owner, clerical, skilled worker and general laborer. The first category represents the highest level of occupational status for and the last option the lowest level;
- (iv) Employment situation of the father - variable that considers at least full time, part time and not working for pay;
- (v) Employment situation of the mother - the same as the previous variable for the father;
- (vi) Pre-school attendance - dichotomous variable with the value 1 for yes and 2 for no;
- (vii) Home resources for learning scale - variable that considers many resources, some resources, few resources constructed by IEA;
- (viii) Students like reading - variable that considers like reading, somewhat like reading and do not like reading high, medium and low levels constructed by IEA;
- (ix) Recognize most letters of the alphabet – variable with three categories recoded on the

basis of the original four (very well, moderately well, not very well and not at all). Similar to the variable used by Araújo and Costa (2012).

- (x) Parental book reading – variable with three categories corresponding to often, sometimes, never or almost never.

In the second level, corresponding to the class characteristics, were considered the following variables:

- (i) Gender of the teacher – dichotomous variable with a value of 1 for females (reference group) and 2 for males;
- (ii) Percentage of students not speaking the language of the test – variable that expresses the percentage of students in a class who do not speak the test language
- (iii) Percentage of students with few educational resources - variable that expresses the class percentage of students with low home educational resources;

In the third and last level, corresponding to the school characteristics, were entered:

- (i) The percentage of students that come from economically disadvantaged homes – the variable assumes the categories 0-10%, 11-25%, 26-50%, more than 50%;
- (ii) Location of the school/If is non rural or rural – dichotomous variable with 0 for non rural (urban, suburban and medium size city) and one for rural (small town or remote rural);
- (iii) Mean of the parents' highest occupational level – the variable represent the school average of the parents' highest occupational level;
- (iv) Instruction affected by reading resource shortage – the variable assumes three values: not affected, somewhat affected and affected a lot, as defined by IEA;
- (v) Parental involvement in school activities – variable “How would you characterize parental involvement in school activities within your school?” which assumes the categories very high, high, medium, low and very low;
- (vi) School climate - variable defined with basis on teachers' expectations for student achievement: assumes the categories very high, high, medium, low and very low.

There were some adjustments in the variables used in the present analysis when compared to the previous secondary analysis of PIRLS 2006 (Araújo & Costa, 2012), due to the fact that some variables

were not part of the new round of the survey. Specifically, the variable “Teacher uses a variety of organizational/instructional approaches” and the variable “Reading for fun outside school” could not be included in our analysis because in PIRLS 2011 they are part of the index called “Students like reading scale”.

## 5. Results

### 5.1. Descriptive Statistics

Table 4 lists the descriptive statistics for the individual-level variables. The average reading achievement of all the students in the sample (96087) is approximately 529, with a standard deviation of 70.4. For this variable the minimum is 130.6 and the maximum is 800.6. With respect to gender, 50.7% of the students were boys. In what concerns immigration background, 4.5% didn't speak the test language at home before they began school. For the parents' higher occupational level, the mode is the professional category (35.3% of the parents) and the lowest percentage is obtained for general labourer. Most of the students' fathers worked in full time jobs and 5.2% were not working for pay. The percentage of mothers that had a full time job was 58.2% and 17.5% were not working for pay. The percentage of children that attended pre-school is 94.2%. In what concerns Home Resources for Learning, the percentage of students classified in the higher level was 17.8, in the medium level was 78 and for the low level only 6.2%. The distribution of the scale Students like Reading is the following: 28.7% of the students like reading, 55.3% of the students reported somewhat like reading and 16% of the students do not like reading. About forty six percent (45.5%) of students recognized most of the letters of the alphabet very well, 36.4% moderately well and 18.1% not very well or not at all. The distribution of parental book reading is 53.3% for the often category and 4.6% for never or almost never.

**Table 4.** Descriptive statistics of the individual level

Individual level	
<b>Reading achievement</b>	
M	529
SD	70.4
Min	130.6
Max	800.6
<b>Gender</b>	
Boys	50.7%
Girls	49.3%
<b>Language spoken at home</b>	
Is the same of the test	95.5%
Is not the same of the test	4.5%
<b>Parent's higher occupation level</b>	

Professional	35.3%
Small business owner	13.2%
Clerical	27.8%
Skilled worker	16.6%
General labourer	4.1%
<b>Employment situation of the father</b>	
Full time	88.7%
Part time	6.1%
Not working for pay	5.2%
<b>Employment situation of the mother</b>	
Full time	58.2%
Part time	24.3%
Not working for pay	17.5%
<b>Attended pre-school</b>	
Yes	94.2%
No	5.8%
<b>Home resources for learning</b>	
Many resources	17.8%
Some resources	76%
Few resources	6.2%
<b>Students like reading</b>	
Like reading	28.7%
Somewhat like reading	55.3%
Do not like reading	16%
<b>Recognize most letters of the alphabet before ISCED1</b>	
Very well	45.5%
Moderately well	36.4%
Not very well or Not at all	18.1%
<b>Parental book reading</b>	
Often	53.3%
Sometimes	42.1%
Never or almost never	4.6%

Table 5 presents the descriptive statistics for the class level. Most of the teachers are female and the mean percentage of students who do not speak the language of the test is 6.5. The mean percentage of students with few educational resources is 4.46, with a wide range of values between classes.

**Table 5.** Descriptive statistics for the class level

Class level	
<b>Gender of the teacher</b>	
Male	13.4%
Female	86.6%
<b>Percentage of students not speaking test language</b>	
Mean	6.47
Standard Deviation	7.97
Minimum	0.00
Maximum	100
<b>Percentage of students with few educational resources</b>	
Mean	4.46
Standard Deviation	4.8
Minimum	0.00
Maximum	100

The school level variable listed below (Table 6) shows that the most representative interval for the percentage of students in the school that come from economically disadvantaged homes is 0-10%. A large percentage, 48.8% of schools, is located in a rural setting, the mean of parents' occupational level is 2.59, and in most schools instruction is affected by reading resource shortages. About 74% of the teachers' expectations for student achievement are high or very high and the mode of parental involvement in school activities is medium.

**Table 6.** Descriptive statistics of the school level

School level	
<b>Percentage of students in the school come from economically disadvantaged homes</b>	
0-10%	34.27%
11-25%	21.46%
26-50%	20.85%
More than 50%	23.42%
<b>Location of the school/School is rural</b>	
Yes	48.8%
No	51.2%
<b>Mean of parent's higher occupational level</b>	
Mean	2.59
Standard Deviation	0.30
Minimum	1
Maximum	5
<b>Instruction affected by reading resource shortages</b>	
Not affected	24.04%
Somewhat affected	74.79%
Affected a lot	1.17%
<b>Parental involvement in school activities</b>	
Very high	3.70%
High	23.64%
Medium	51.64%
Low	18.12%
Very low	2.90%
<b>Teachers' expectations for student achievement</b>	
Very high	16.30%
High	57.61%
Medium	24.86%
Low	1.12%
Very low	0.12%

## 5.2. Multivariate Analysis

The results of the multilevel analysis for the EU countries as a whole are presented below. The null model, allows us to obtain the proportion of variability, calculated using the variances estimated for the errors, between students, between classes within schools and between the schools. The variance of the reading proficiency can be divided as follows: about 88% of the variance is situated at the student level, 6.5% at the class level and 5.5% at the school level. The results show that a multilevel modelling is adequate for this analysis. All the coefficient estimates presented in bold are statistically significant at the 0.05 level. The values presented in the last column, where it says SE, indicate standard errors associated to the coefficients. The coefficients often take a negative sign because most categorical variables are coded either dichotomously or with the lowest value assuming the best category of the variable.

The value of the r-square of the full model is 0.367, which indicates that 36.7% of the total variance in reading achievement is explained by this model. Comparing the null model with the final model there is a clear reduction in the amount of deviance in relation to that found for the null model. This indicates a better fit and a corresponding increase in the explanation of the reading achievement.

The results show that the variables with the highest impact on students' overall reading score at student level are related to home resources and practices and to students' pre - reading knowledge. More specifically, both the students' home resources for reading and the students like reading variables are about as significant in explaining attainment as their knowledge of the alphabet at the start of compulsory education and their parents' shared book reading practices. An increase between 14 to 19 points in reading achievement is found for these variables. Additionally, the students who spoke the same language of the test at home have an increase of 17 points in reading achievement comparing with those who not speak the language of the test.

Moreover, at the class level the teacher's gender and the percentage of students not speaking the test language also influence students' reading achievement, with a female teacher associated with better performance (increase in reading achievement in about 4 points) and a high percentage of students not speaking test language in a given class with worse performance.

**Table 7.** Results of the multilevel modelling analysis for the 20 EU countries

	Null model	SE	Final model 2011	SE
Reading Achievement	531.546	0.673	735.082	5.508
Gender of the student			<b>-4.333</b>	<b>0.492</b>
Language spoken at home			<b>-17.846</b>	<b>1.414</b>
Parent's highest occupational level			<b>-6.034</b>	<b>0.248</b>
Employment situation of the father			<b>-3.895</b>	<b>0.579</b>
Employment situation of the mother			<b>-1.043</b>	<b>0.371</b>
Attended pre-school			-1.792	1.188
Home resources for learning scale			<b>-19.533</b>	<b>0.649</b>
Students like reading scale			<b>-15.368</b>	<b>0.382</b>
Recognize letters of the alphabet			<b>-16.284</b>	<b>0.342</b>
Parental book reading			<b>-14.264</b>	<b>0.48</b>
<b>CLASS LEVEL</b>				
Gender of the teacher			<b>-3.992</b>	<b>1.234</b>
Percentage of students not speaking test language			<b>-0.149</b>	<b>0.064</b>
Percentage of students with few educational resources			-0.014	0.086
<b>SCHOOL LEVEL</b>				
Percentage of students in the school come from economically disadvantaged homes			0.275	0.233
Location of the school/If is non rural or rural			<b>-3.663</b>	<b>0.89</b>
Mean of parent's highest occupational level			<b>-6.273</b>	<b>1.703</b>
Instruction affected by reading resource shortages scale			-0.618	0.474
Parental involvement in school activities			<b>-3.312</b>	<b>0.542</b>
School climate/Teachers expectations for student achievement			<b>-1.698</b>	<b>0.394</b>

At the school level, the location of school, the mean of the parents' highest educational level, parental involvement in school activities and school climate explain reading achievement. Students reading achievement can vary between 2 and 6 points for the favoured groups in these variables.

The following graph presents the absolute value of the multilevel model significant coefficients producing an effect in reading achievement for the variables at student, at class and at school level.

The graph shows that a female student performs better in reading than a boy (difference of 4 points). This concurs with the results of the PISA 2012 survey, where girls also outperformed boys. In both surveys, Bulgaria and Lithuania are two of the countries with a larger gender gap (European Commission, 2013; OECD, 2013b). The results of the multilevel model for each country can be found in the Annex.

The other variable with an impact on students' overall reading score is not speaking the language of the test at home. Students who do not speak the test language score worse than those who speak the test language with an increase of 18 points in reading achievement for the last group. In PISA 2009 the main domain was reading literacy, and the same result was found: students with an immigrant background who speak a different language at home tend to show lower levels of performance, even after their socio-economic background is considered. However, in some countries, both in PISA 2009 and in PIRLS 2011, students from an immigrant background perform just as well as their non-immigrant peers (OECD, 2011).

Next, the results show that the employment situation of the parents and parents' occupational level also explain reading achievement favouring children of employed parents in a full time job (3 and 1 points ) and those with parents that have high occupational status (6 points of difference). As in PISA 2009, a student's socio-demographic and cultural background is related to his or her reading performance in most of the participating countries (OECD, 2011).

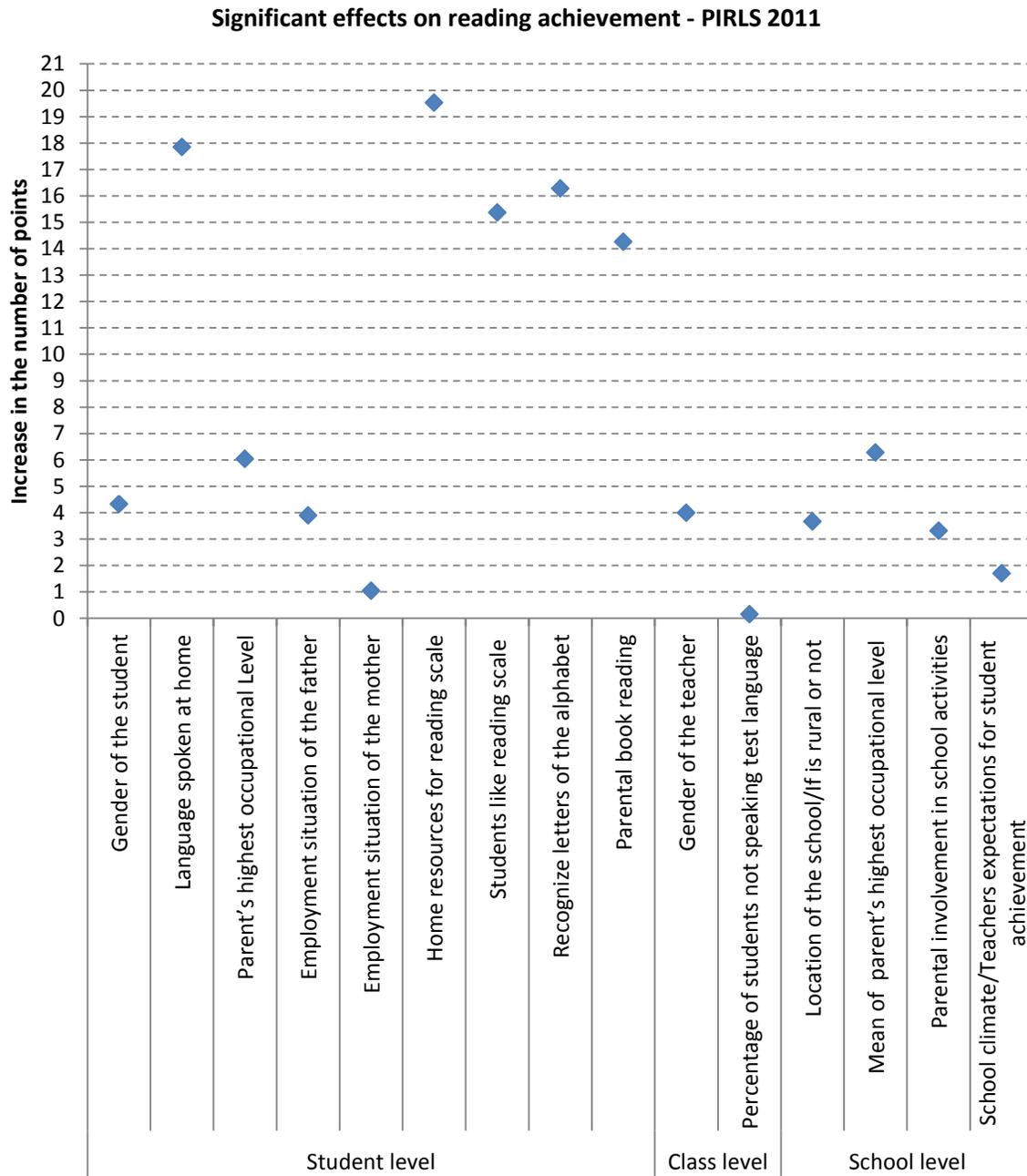
The Index/Scale Students Like Reading has a positive influence, an increase of about 15 points on students' achievement. Students with more resources for learning also exhibit a 20 points increase in reading scores. Clearly, students that knew most of the letters of the alphabet before they began school and students whose parents shared book reading perform better (increase of 16 and 14 points respectively).

At the class level, two variables that are statistically significant were found. If a teacher is female the students have a better reading score than if they have a male as a teacher (difference in reading achievement of 4 points). Classes with a high percentage of students speaking the test language have higher achievement, but not by much.

Finally, considering the school level, results indicate that non rural schools influence positively reading

achievement, with an increase of 4 points. The higher the parents’ occupational level the higher the students’ reading scores (about six points). Moreover, a higher parental involvement in school activities is related to an increase of three points in students’ reading scores. A better school climate result in a higher reading score by about two points.

**Graph 1.** Absolute value of the coefficients statistically significant in the model at students, class and school level that affect students’ reading achievement (20 EU countries as a whole)



### 5.3. Country-level Analysis

The results of the model per country can be found in the Annex (Table A1 to Table A20). In the description of these results we, firstly, highlight the variables that are statistically significant in the EU model with all 20 countries. The results show that the four variables that have a strong impact on reading achievement at the individual level (student and home characteristics) for the model with all countries are still consistently significant in the large majority of individual countries. These are: 1) Home resources for learning, 2) Students like reading, 3) Recognize most of the letters of the alphabet and 4) Parental book reading.

Across all countries, in absolute values, for the index of home resources for learning, the values vary between ten in Lithuania and thirty two in Ireland. Concerning the Index of students like reading, the coefficients vary between three in Croatia and twenty four in France. The variable related to the knowledge of the alphabet varies between seven in Austria and twenty seven in Lithuania. For parental book reading, the variation is from six points in Romania, and twenty one in Malta.

Below, we summarize the statistically significant findings for each country. In all the descriptions we first refer to the total variance explained by the model and then we present the variance partitioned into the three levels. After that, we present the results for the variables mentioned above that consistently show a strong impact on reading achievement across countries. Finally, we explain the results for the other variables at the students', class and school levels that are statistically significant in each country.

Austria: 27.4% of the total variance in reading achievement is explained by the model. The variance partitions of the model show that 92% is the variance between students within classrooms, 4% is the variance among classrooms within schools and 4% is the variance among schools. The most significant effect in reading achievement is the students' home resources for learning. Students with higher home resources for learning can score 22 points higher in reading. Students whose parents share book reading practices perform better in reading (21 points). Students that like reading score 11 points higher in reading than those who do not like reading. Students who recognized most of the letters of the alphabet before beginning primary school have an increase of 7 points in reading achievement. If the students' language spoken at home is the same as that of the test there is an increase in the reading achievement of 21 points and a higher parents' occupational level produces a difference of 7 points. Classes with a higher percentage of students with few educational resources can have students that

score 1 point higher. Students that attend schools in a rural environment score 8 points higher than those in other environments.

French Belgium: The model explains 35.4% of the total variance of students reading achievement. The amount of variation in reading scores which can be attributed to different levels is 91.6% for the student level and 4.2% both for the classroom and for the school levels. The possession of more resources for learning at home increases the students' reading scores in 23 points. The ability to recognize letters of the alphabet at the start of compulsory education impacts positively students' reading achievement (difference of 11 points). Positive attitudes toward reading produce an increase of 19 points in students' performance. Parental book reading is associated to higher scores (13 points). Students that attended pre-school tends to score 31 points more in reading achievement. The students that speak the same language of the test at home have an increase in reading achievement of 23 points. There is an increase of 6 points in reading for students with parents who have a higher occupational level.

Bulgaria: The value of the r-square of the full model is 0.382, which indicates that 38.2% of the total variance in reading achievement is explained by this model. The proportions of variability between students, between classes within schools and between the schools are 78.7%, 10.3% and 11%, respectively. Students' knowledge of the alphabet prior to the start of compulsory school produces better scores in reading, specifically 21 points. Higher home resources for learning are associated to an additional 15 points in reading. If the parents have book reading activities with their children there is an increase of 10 points in students' reading achievement. Students who like reading tend to perform better in reading (9 points). Additionally, at the student level, two more variables have statistically significant coefficients: students' gender and parents' occupational level. For the first variable, there is a better performance of girls compared with boys that corresponds to a 10 point difference. A higher parental occupational level produces a higher performance of the students by 7 points. At the school level, schools with higher teacher expectations for students' achievement have students that score 12 points higher in reading.

Croatia: The model explains 22.1% of the total variance in students' reading achievement. The variance among students within classrooms is 91.4%. The variance among classrooms within schools is 7.1% and the variance among schools is 1.5%. Knowledge of the letters of the alphabet before starting school has a positive impact in students' achievement of 21 points. The possession of home resources for learning produces an increase of 11 points in students' scores. A higher engagement of parents'

reading activities with their children is associated to higher reading performance (11 points). Students who report that they do not like reading present higher reading achievement of 3 points. Girls perform better than boys in reading, with a difference of 9 points. A higher parental occupational level results in an additional 7 points in students' reading achievement. If the school is rural, a negative difference of 9 points can be found for the reading attainment of the students.

Czech-Republic: 29.3% of the total variance in reading achievement is explained by the model. The variance explained at the student level is 92.2%. The variance explained at the classroom level is 7.8% and there is no variance between schools. Higher home resources for learning are associated to higher reading performance (18 points). Students who enjoy reading activities and students whose parents have book reading practices present better scores in reading (13 points for both variables). The students' knowledge of the alphabet at the beginning of primary education results in an increase of 12 points in students' reading achievement. The language spoken at home and having a female teacher impact reading achievement (32 points favoring those that speak the same language of the test and 15 points favoring those taught by female teachers). The highest occupational level of the parents is associated with better reading performance, a difference of about 9 points. Students in schools where parents have higher occupational levels also score 12 points higher in reading achievement. Parents with a higher involvement in school activities results in an increase of reading score of 4 points.

Finland: The model explains 34.4% of the total variance of students reading achievement. The proportions of variability between students and between classes within schools are 92% and 8%, respectively. Additionally, the model indicates that there is no variance between schools. Recognizing most of the letters of the alphabet before school starts has a positive impact in students' performance in reading of 25 points. Students that like reading activities have higher achievement (22 points). Higher home possessions for learning are associated to higher scores in reading of about 16 points. Parental book reading activities produces a positive impact in students' achievement (12 points). In addition, we find a difference in reading achievement of 10 points between girls and boys, favoring the first group. Students that speak the same language of the test achieve an additional 50 points in reading, when compared to students who do not speak the same language. The highest occupational level of the parents is associated with better reading performance, of about 2 points. Students that attend schools that have a higher percentage of students that come from economically disadvantaged homes have lower reading achievement (2 points). The variables associated to the schools that have an impact in reading achievement are: mean of parent's highest occupational level, instruction affected by reading

resource shortages and parental involvement in school activities. For the first variable, the coefficient of the model indicates that a higher mean produces higher students' reading score (16 points). For the second variable, the coefficient is 3 points which means that for schools with better resources for learning the students perform better. A higher involvement of the parents in school activities has a positive impact of 6 points in the reading achievement.

France: 34.4% of the total variance in reading achievement is explained by the model. The variance partitions of the model show that 90.4% corresponds to the variance between students within classrooms, 7.7% is the variance among classrooms within schools and 1.8% is the variance among schools. Students who like reading present higher scores in reading (difference of 24 points). Higher home resources for learning and knowledge of the letters of the alphabet before the beginning of primary education produce an increase in students' reading achievement of 16 points. Students whose parents share book reading practices perform better in reading (15 points). The students that speak the same language of the test at home have an increase in reading achievement of 39 points. Students whose parents present a higher occupational level exhibit an increase of 5 points in the reading scores. A full time job of the father has a positive impact in the reading score of 6 points. Schools that present a better school climate produce higher reading achievement (3 points).

Hungary: The model explains 45.9% of the total variance in students' reading achievement. The variance explained at the student level is 89.9%, at the classroom level is 2.9% and at the school level is 7.2%. Students who possess higher home resources for learning have an increase of 25 points in their reading scores. Students who enjoy reading activities and recognize most of the letters of the alphabet before beginning school perform better in reading (17 and 11 points, respectively). Parental book reading is associated with higher student reading skills (10 points of difference). Girls perform better than boys in reading (difference of 5 points). Students who speak the language of the test at home score better in reading by 25 points. A higher occupational level of the parents and a full time job of the father have a positive impact in the reading score (5 and 12 points, respectively). Similar results, although higher, were found for schools whose students' parents have a high occupational level. Attending non-rural schools results in an increase of 11 points in students' reading achievement. A better school climate and higher parental involvement in school activities produce higher reading achievement (5 and 6 points, respectively).

Ireland: 39.5% of the total variance in students' reading achievement is explained by the model.

The variance between students within classrooms is 96%, the variance among classrooms within schools is 4% and there is no variance among schools. Higher home resources for learning are associated with an increase in students' scores of 31 points. Students who like reading present higher scores in reading (increase of 20 points). Students whose parents shared book reading activities perform better in reading (difference of 18 points). Recognizing the letters of the alphabet before beginning school produces an increase of 15 points in reading achievement. Girls have better performance in reading than boys (6 points). The variable with a strong negative impact on students' overall reading achievement is not speaking the language of the test at home (14 points). Students whose parents have high occupational status and the father has a full time job have an increase in the reading score (3 and 7 points, respectively). Schools with a high percentage of students that come from disadvantaged homes result in an increase in the reading score of the students of 2 points. Rural schools produce an increase of 8 points in the performance of the students. A better involvement of the parents in school activities has a positive impact of 5 points in the reading achievement.

Italy: The model explains 22.9% of the total variance in reading achievement. The variance among students within classrooms is 78.1%. The variance among classrooms within schools is 5.6% and the variance among schools is 16.3%. A higher number of resources for learning at home produce an increase of 16 points in students' scores. Students whose parents read books at home have an increase in the reading score of 15 points. Knowledge of the alphabet and enjoyment for reading activities are associated with high reading achievement (12 and 13 points, respectively). Other variables with an impact in students' reading achievement are not speaking the language of the test and the employment situation of the father. The first variable produces a negative impact of 23 points in the reading score, which means that students that speak the test language perform better. The second one indicates that a better employment situation of the father produces a higher performance by 9 points. In addition, we find a difference in reading achievement of 7 points between girls and boys, favoring the second group. A higher occupational level of the parents reflects a change of 7 additional points in reading achievement.

Lithuania: The value of the r-square of the full model is 0.342, which indicates that 34.2% of the total variance in reading achievement is explained by this model. The variance partitions of the model indicate that 87.9% is the variance between students within classrooms, 5.5% is the variance among classrooms within schools and 6.6% is the variance among schools. Recognizing most of the letters of the alphabet reflects an additional 27 points in students' reading achievement. Parental book reading

activities are associated with an increase of 16 points in students' scores. Higher home resources for learning and liking reading activities impact positively students' performance, 10 and 9 points, respectively. Girls have better performance in reading than boys (10 points). At the individual level and at the school level a higher parental occupational level has a positive impact in reading achievement of 6 and 16 points, respectively. Students whose father is in a full time job have an increase in the reading score of 5 points. A high percentage of students with few educational resources can increase the reading score in 1 point. If the school is rural, a decrease of 14 points can be found for the reading attainment of the students. Better school climate and higher instructional resources produce higher reading achievement (5 points in both cases).

Malta: 43.3% of the total variance of students reading achievement is explained by the model. The partition of variance at the student level is 86.4%, at the class level is 7.8% and at the school level is 5.8%. The ability to recognize most of the letters of the alphabet reflects an additional change of 27 points in students' performance. Students whose parents shared book reading activities perform better in reading, with a difference of 21 points. Students who appreciate reading activities present better scores in reading (19 points). Having more resources at home for reading produce higher reading achievement (14 points). Students who speak the same language of the test have an increase of 14 points in reading achievement. Parents' occupational level has a similar relationship with the students' reading score, 11 points for higher occupations. Moreover, classes with a high percentage of students not speaking the test language are associated with an increased score of 1 point.

Netherlands: The model explains 22.2% of the total variance of students reading achievement. 95.8% of the variance is between students within classrooms, 1.5% is the variance among classrooms within schools and 2.7% is the variance among schools. Students reporting enjoyment in reading activities score higher in reading, specifically 19 points. The possession of home resources for learning has a positive impact in students' scores of 15 points. Recognizing most of the letters of the alphabet before beginning primary school and parental book reading produces an increase in students' reading performance of 11 and 8 points, respectively. Additionally, at the students' level, a higher occupational level of the parents and a full time job of the father and of the mother impact positively students achievement (5 points, 10 points and 5 points, respectively). At the school level, the location of the school and reading resources shortages affects students' reading scores. For the first variable, a non-rural school produces an increase of 7 points in students' proficiency. For the second variable, a school with higher resources reflects an increase of 7 points in students' reading score.

Poland: 34.3% of the total variance in reading achievement is explained by the model. The variance partitions of the model shows that 92.1% is the variance at student level, 4.5% at the class level and 3.4% is the variance among schools. Students who have more resources for learning have an increase in their reading score of 27 points. Knowledge of the letters of the alphabet at the start of compulsory education reflects an additional 21 points in students' reading achievement. Parents that share reading activities with their children contribute to higher scores of their children in reading (20 points). Students who enjoy reading perform better in reading achievement (difference of 15 points). A high occupational level of the parents and a full time job of the father reflect a better performance of the students (7 and 5 points, respectively). In addition, better school instructional resources allow the students to perform better (3 points).

Portugal: The model explains 29% of the total variance in students' reading achievement. The variance partitions of the model show that 91.9% is the variance between students within classrooms, 4.5% is the variance among classrooms within schools and 3.4% is the variance among schools. Positive attitudes toward reading (enjoying reading activities) produce an increase of 16 points in students' scores. The possession of more resources for learning at home increases the students' reading achievement in 15 points. The ability to recognize letters of the alphabet at the start of compulsory education impacts positively students' reading achievement (difference of 14 points). Students whose parents share book reading practices perform better in reading (13 points). Students whose parents have a higher occupational level have a positive impact of 6 points in the achievement of students. In addition, a full time job of both parents influences positively the students' performance in reading by 9 points for the father and 6 points for the mother. A female teacher impacts reading achievement by 18 points favoring those taught by female teachers. Classes with a high percentage of students with few educational resources have a negative impact in the reading scores of the students.

Romania: 41.8% of the total variance in reading is explained by the model. 77.8% of the variance is at the student level, 6.5% of the variance is at the class level and 15.7% is at the school level. The possession of home resources for learning reflects a change of 23 additional points in reading achievement. Students who recognize most of the letters of the alphabet before primary education have an increase of 17 points in their reading scores. Students that like reading and whose parents share reading activities perform better in reading (13 points and 6 points, respectively). The reading score of girls is higher than that of boys by 12 points. The occupational level of the parents has a positive impact in the reading score (of about 6 points). Students that attended pre-school have an increase of 30 points

in reading achievement. If the school is rural, a decrease of 25 points can be found in the reading attainment of the students.

Slovak Republic: The model explains 38.2% of the total variance in reading achievement. The percentage of variability between students, between classes within schools and between the schools is 88.8, 7.6 and 3.6 respectively. Higher home resources for reading produce a positive impact in students' reading achievement (20 points). A higher enjoyment for reading activities and parental book reading reflect an increase of 13 points in reading performance. Knowledge of the alphabet before the beginning of school produces an increase of 11 points in reading scores. Girls perform better than boys in reading, with a difference of 5 points. At the individual level and at the school level a higher parental occupational level has a positive impact in reading achievement (6 and 12 points, respectively). Students that have both parents with a full time job perform better (4 points for the father and 7 points for the mother). Rural schools produce a decrease of 10 points in the performance of the students. Finally, and counter-intuitively, students that attend schools with a better school climate tend to perform worse than those attending schools with a less ideal school climate (3 points).

Slovenia: 31.6% of the total variance in reading achievement is explained by the model. 95.6% of the variance is at the student level, 1.8% is at the class level and 2.6% is at the school level. Higher possession of resources for reading at home and parental book reading activities produce an increase of 21 points in students' reading achievement. Positive attitudes toward reading reflect an increase of 19 points in students' performance. Recognizing most of the letters of the alphabet before beginning school has a positive impact of 18 points in the achievement of students. Girls perform better than boys in reading (4 points of difference). The language spoken at home has an impact in the reading score, an increase of 20 points for students whose language is the same of the test. The occupational level of the parents and the employment situation of the father also have an impact in the reading score (8 and 11 points, respectively).

Spain: The value of the r-square of the full model is 0.281, which indicates that 28.1% of the total variance in reading achievement is explained by this model. The variance partitions of the model show that 89.4% is the variance between students within classrooms, 4.3% is the variance among classrooms within schools and 6.3% is the variance among schools. Knowledge of the letters of the alphabet produces an increase of 24 points in the reading achievement of the students. Higher home resources for reading reflect an additional 17 points in students' reading scores. Students who reported

that they enjoy reading activities present higher performance (14 points). Students whose parents read books to them at home score 10 points higher in reading. In addition, at the individual level, parents' highest occupational level has an impact in students score. A higher occupational level reflects an increase of 3 points in students' reading achievement. Classes that are composed by a high percentage of students who do not speak the same language of the test present a negative relationship with students' reading. Schools located in a rural environment influence negatively students achievement by 9 points.

Sweden: The model explains 36.7% of the total variance in reading achievement. At the students level the variability is 94.3%. At the classroom level the variability is 2.9% and at the school level is 2.8%. Students that possess more home resources for reading present higher scores in reading (21 points). Students' positive attitudes toward reading produces an increase of 19 points in reading achievement. Recognizing most of the letters of the alphabet before the start of primary school and parental book reading reflect a change in students' reading performance of additional 17 and 15 points, respectively. Students that speak the same language of the test at home score 20 points higher in reading. The occupational level of the parents has a significant impact in the reading score of 3 points. Students whose father has a full time job have an increase in the reading score of 8 points.

#### 5.4. Trends over time

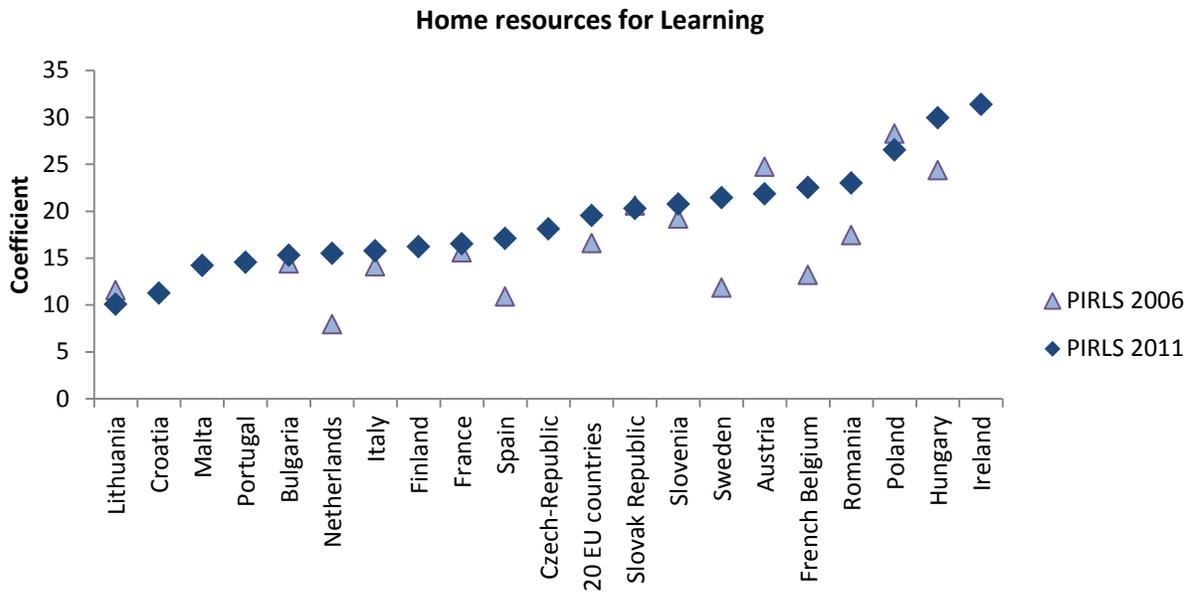
In order to answer to the second research question “What trends over time can we identify in the countries that participated in PIRLS 2006 and PIRLS 2011?” we compared the results obtained in the multilevel models. In terms of the variance explained by the model, we find that, for the EU countries aggregated model, 42.7% was the total variance in PIRLS 2006 and 36.7% is the total variance in PIRLS 2011. It must be taken in consideration that the model of PIRLS 2011 doesn’t include 2 variables previously considered, namely “Teachers uses variety of organizational approaches” and “Reading for fun outside school”. The second variable was included in the students like reading scale as defined by IEA. Despite the fact that the variables used in the PIRLS 2011 model are measuring the same constructs as in PIRLS 2006 model, some of them are slightly different when comparing both models. Specifically, there are some changes in the variables: home resources for learning scale, students like reading scale, location of school, instruction affected by reading resource shortage scale and parental involvement in school activities. Finally, we are not using the same 20 EU countries in the aggregate model for both PIRLS. These differences may account for the difference found in the total explained variance between the two rounds of the PIRLS survey.

For the EU model as a whole, and concerning the percentage of variability between students, between classes within schools and between the schools, the results are, respectively, 85.1%, 9.4% and 5.5% for PIRLS 2006 and 88%, 6.5% and 5.5% for PIRLS 2011.

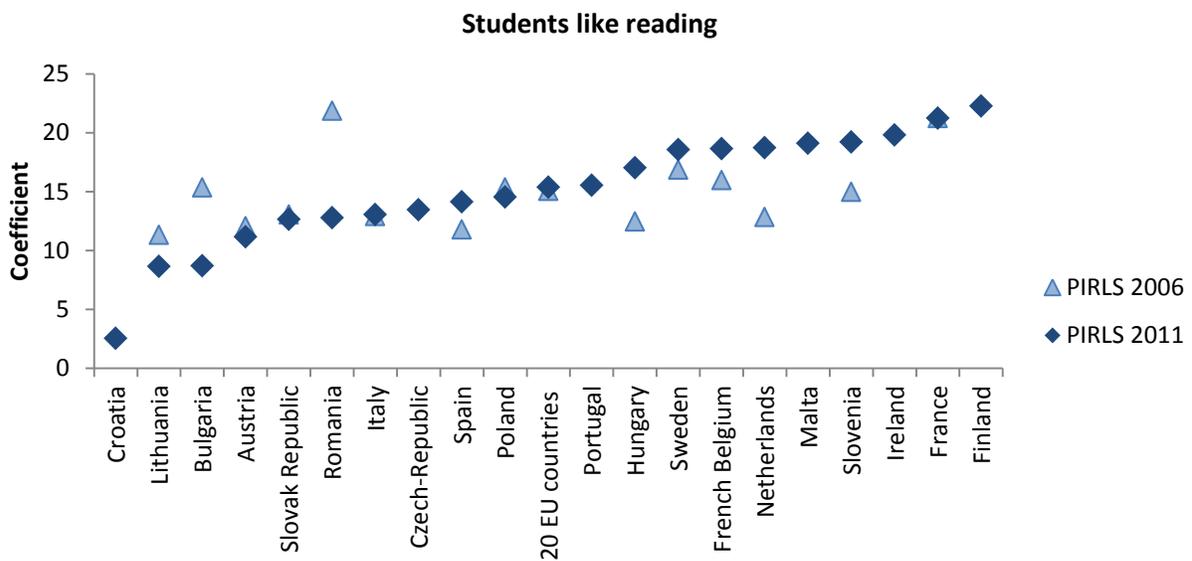
The main findings of the PIRLS 2011 model, both for the EU as a whole and for individual countries, show that the four variables that have a strong impact on reading achievement are: home resources for learning scale, students like reading scale, recognize most of the letters of the alphabet and parental book reading. These findings are in line with the previous analysis performed for PIRLS 2006. The only difference is the variable reading for fun outside school, which was not part of the model used for PIRLS 2011 data. It must be noted that the impact of the variables mentioned above, related with student and home characteristics, is reported and highlighted not only in terms of the large magnitude of values but also in terms of statistical significance.

The following graphs present the absolute value of the multilevel coefficients obtained for the models using PIRLS 2006 and PIRLS 2011 datasets. The coefficients are presented in ascending order of the coefficients obtained for PIRLS 2011 considering the aggregated EU data and individual countries that participated in each round of the survey.

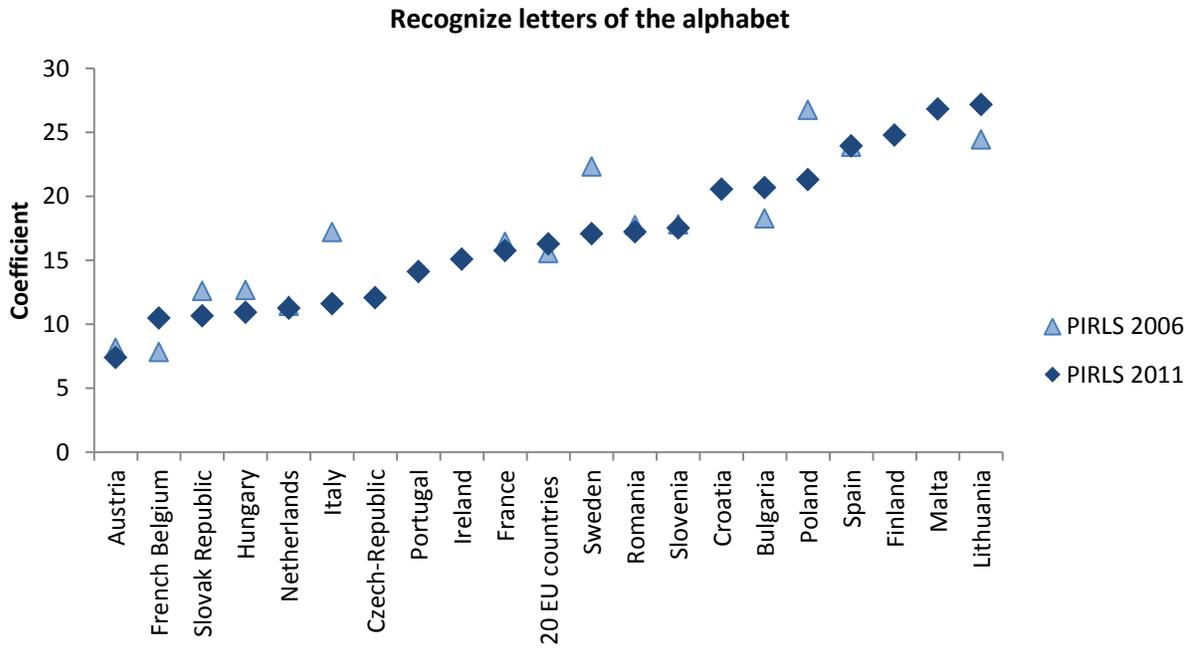
**Graph 2.** Absolute values of the multilevel coefficients for the home resources for learning scale



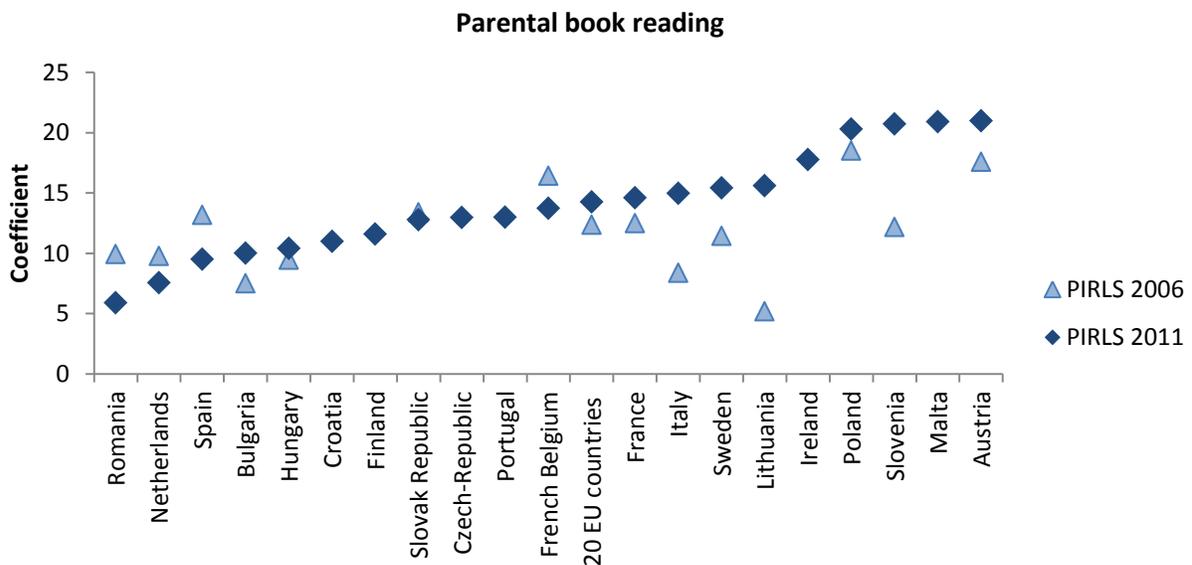
**Graph 3.** Absolute values of the multilevel coefficients for the students like reading variable



**Graph 4.** Absolute values of the multilevel coefficients for the recognize letters of the alphabet variable



**Graph 5.** Absolute values of the multilevel coefficients for the parental book reading variable



Despite the fact that of the results obtained for the models of the two different rounds are not directly comparable, the graphical representations indicate that, in general and for most of the countries, larger differences are found in the number of points influencing students' achievement in PIRLS 2011, when compared to the coefficients of the model used for PIRLS 2006. For the variable "home resources for learning scale" the exceptions are Austria, Lithuania and Poland. Concerning the scale "students like reading" the countries that present a higher number of points in reading achievement in PIRLS 2006 are Austria, Bulgaria, Lithuania, Poland and Romania. In Austria, Italy, Hungary, Spain, Slovak Republic and Sweden, the coefficients obtained for the variable "knowledge of the alphabet" for the model using PIRLS 2006 data are higher than for the model using PIRLS 2011 data. Regarding parental book reading, the graph shows that only for French Belgium, Netherlands, Romania and Spain the coefficients are lower for the data from 2006 than for the 2011 data.

## 6. Discussion and Policy Implications

The results of the multilevel analysis using PIRLS 2011 data indicate that a large proportion of variance is explained by the model. The variables that impact students' achievement the most are related to individual and family/home level background characteristics, including students' that like reading, home resources for learning, home literacy practices in the form of book reading, and students' ability to recognize letters of the alphabet at the start of compulsory education. In some countries, at the student level, the students' gender, the language spoken at home, the occupational level of the parents and the employment situation of the father also explain achievement. At the class level, students attending classes without a large percentage of peers that have few educational resources and also classes with a lower percentage of students not speaking the test language present slightly better reading attainment. At the school level, compositional effects related to the location of the school and school climate were also significant in explaining reading achievement. In general, attending schools located in a rural environment affect students' reading score negatively. A better school climate results in a higher reading attainment on the part of the students.

The individual country analysis reveals that there are substantial differences among countries with respect to the coefficients that are significant and that explain reading achievement. Nonetheless, in all the countries studied the explanatory variables that are consistently statistically significant are: home resources for learning, home book reading practices, students' attitudes toward reading (students like reading) and students' ability to recognize letters of the alphabet at the start of compulsory education.

The proportion of variance between student level, between classes within schools and between the schools, indicates that there is a wide difference across countries. The results show that the proportion of variance between students can vary from 77.8%, in Romania, to 96%, in Ireland. Concerning the proportion of variance between classes within schools, we find that the lowest value is obtained for The Netherlands (1.5%) and the highest (10.3%) for Italy. At the school level, the maximum proportion of variance is 16.3% for Italy. In Czech-Republic, Finland and Ireland there is no variance between schools.

Regarding the models used to establish trends in students' reading achievement for both PIRLS 2006 and PIRLS 2011 data, the results show that the main findings are very similar and that the variables that consistently have a strong impact in students' achievement are related to home resources and practices (Araújo & Costa, 2012). Specifically, home resources for learning, students like reading, recognize most

of the letters of the alphabet and parental book reading are again the most significant variables that explain students' achievement.

The policy implications that can be addressed to improve students' performance should focus on educational interventions and societal changes. It is possible to intervene to make positive changes in the socio-economic conditions of families and their home educational resources in order to improve reading achievement. Although measures related to curriculum and instruction also have an important role to play in improving students' achievement, evidence indicates that ensuring a literate environment in the home is of the utmost importance (European Commission, 2012). For example, launching literacy/reading national plans, like some countries have done, can bring educational resources, such as electronic children's books, to the home environment (Portuguese National Reading Plan, 2011, <http://www.planonacionaldeleitura.gov.pt/index1.php>). In Poland, the campaign "All of Poland Reads to Kids", launched in 2001, has similar goals; to raise awareness of the importance of reading in schools and in society at large and to equip libraries with books (European Commission, 2012). Many other countries, such as the United Kingdom, Germany and Lithuania, have taken similar initiatives and have focused specifically on an early start (European Commission, 2012). Reading to children from birth promotes emergent literacy skills like understanding that print carries a message and that in alphabetic languages letters encode speech and, above all, that reading for enjoyment is a pleasurable activity. As children approach formal primary education, this enjoyment and knowledge base should be expanded to include specific knowledge about the letters of the alphabet and the sounds they represent (Ehri, 1983). As such, and as our study suggests, another important measure that can be conducted by governments is to ensure that children know the alphabet before starting compulsory education. Our analysis of the PIRLS 2011 data shows that the knowledge of the alphabet before the beginning of primary school would significantly improve the future reading development of students in grade four. Thus, introducing curriculum goals and effective instruction to address gaps in this knowledge should be implemented.

Furthermore, measures to reduce the persistent and significant gender gaps in reading literacy should be implemented. Boys' low level performance may be attributed to low levels of motivation for reading and low engagement with school (OECD, 2013b). Therefore, specific approaches aiming at motivating boys to read should be implemented, for instance, through gender-specific reading tasks. These reading tasks should be aligned with writing activities and should be taught as essential skills across the curriculum (European Commission, 2013).

Other significant factors can be addressed by equity measures that can be implemented by national governments, such as the promotion of social and economic diversity in schools to reduce the school compositional effects identified in this study and in previous research (Bellin, Dunge & Gunzenhauser, 2010). In the European Union, one in ten children live in homes where no adult has a job and this affects literacy outcomes as the caregivers may not be able to provide the material well-being related to good literacy outcomes (European Commission, 2012). School aid to buy books may be a strategy to reduce some specific effects of poverty and, subsequently, to increase equity. As highlighted in PISA in Focus (OECD, 2013c), countries that have improved their reading performance have reduced the impact of students' socio-economic status on their performance.

Primary school has the pivotal role of ensuring that children are ready to learn upon entering secondary school but research indicates that their reading literacy level may not be good enough to continue learning other school subjects effectively (European Commission, 2012). Students who do not develop sound literacy skills during primary school tend to avoid reading and to show low levels of motivation for reading (Adams, 1990). Conversely, students who enjoy reading exhibit high engagement in reading and, as our report shows, reading for enjoyment is strongly related to better achievement. As students move on to secondary school, their motivation to read and consequently their engagement in reading activities diminishes.

This report supports and extends recent evidence stressing the role of home literacy practices and resources for reading achievement and it identifies specific areas that need intervention, such as addressing the gender gap and the teaching of the alphabet before the start of compulsory education. Furthermore, this report identifies challenges and opportunities that are specific to each of the countries studied. In this sense, we believe it can be a useful tool to assess common European policies as well as to give each member state more information on their own school system.

## References

- Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.
- Akaike, H. (1981). Likelihood of a model and information criteria. *Journal of Econometrics*, 16, 3-14.
- Alexander, P. A. & Jetton, T. L. (2000). Learning from text: A multidimensional and developmental perspective. In M.L. Kamil, P. Mosenthal, P.D. Pearson, & R. Barr (Eds.), *Handbook of reading research* (Vol. 3) (pp. 285–310). Mahwah, NJ: Lawrence Erlbaum Associates.
- Almasi, J. F. & Garas-York, K. (2009). Comprehension and discussion of text. In S. Israel & G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 470-493). New York: Routledge.
- Anderson, R. C., & Pearson, P. D. (1984). A schema-theoretic view of basic processes in reading comprehension. In P.D. Pearson (Ed.), *Handbook of reading research* (pp. 255–291). White Plains, NY: Longman.
- Araújo, L. & Costa, P. (2012). *Reading Literacy in PIRLS 2006: What explains achievement in 20 EU countries?*. EUR 66894 EN. Retrieved from: <http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/25703/1/lbna24949enn.pdf>
- Bellin, N., Dunge, O., & Gunzenhauser, C. (2010). IEA monograph series, Issues and Methodologies in Large-Scale Assessments, Volume 3. In M. von Davier & D. Hastedt (Eds.), *The Importance of Class Composition for Reading Achievement, Migration Background, Social Composition, and Instructional Practices: An Analysis of the German 2006*, 3, 9-34.
- Campbell, J.R., Kelly, D.L., Mullis, I.V.S., Martin, M.O. & Sainsbury, M. (2001). *Framework and specifications for PIRLS assessment 2001* (2<sup>nd</sup> Ed.). Chestnut Hill, MA: Boston College.
- Chall, J. (1983). *Stages of reading development*. New York: McGraw-Hill.
- Chall, J. (1996). *Learning to read: the great debate* (revised). New York: McGraw-Hill.
- Ehri, L. C. (1983). A critique of five studies related to letter-name and learning to read. In Gentile, L. M. Kamil, M. L., Blanchard, J. S. (Eds.), *Reading Research Revisited* (pp. 131-153). Columbus, OH: Charles E. Merrill.
- Elley, W.B. (1992). *How in the world do students read?* The Hague, Netherlands: IEA.
- Elley, W.B. (Ed.). (1994). *The IEA study of reading literacy: Achievement and instruction in thirty-two school systems*. Oxford: Elsevier Science Ltd.
- European Commission (2012). *EU High Level Group of Experts on Literacy. Final Report*, September 2012. Luxembourg: Publications office of the European Union. Retrieved from: [http://ec.europa.eu/education/policy/school/doc/literacy-report\\_en.pdf](http://ec.europa.eu/education/policy/school/doc/literacy-report_en.pdf)

- European Commission (2013). PISA 2012 performance and first inferences regarding education and training policies in Europe. Retrieved from: [http://ec.europa.eu/education/policy/strategic-framework/doc/pisa2012\\_en.pdf](http://ec.europa.eu/education/policy/strategic-framework/doc/pisa2012_en.pdf)
- Galda, L. & Beach, R. (2001). Theory and research into practice: Response to literature. *Reading Research Quarterly*, 36, 64–73.
- Goldstein, H. (1986). Multilevel mixed linear model analysis using iterative generalized least squares. *Biometrika*, 73, 43-56.
- Goldstein, H. (2003). *Multilevel Statistical Models* (3<sup>rd</sup> Ed.), Kendall's Library of Statistics 3. London: Edward Arnold.
- Guice, S. L. (1995). Creating communities of readers: A study of children's information networks as multiple contexts for responding to texts. *Journal of Reading Behavior*, 27, 379-397.
- Greaney, V. & Neuman, S. B. (1990). The functions of reading: a cross-cultural perspective. *Reading Research Quarterly*, 25, 172-195.
- Guthrie, J. T. (1996). Educational contexts for engagement in literacy. *The Reading Teacher*, 49(6), 432-445.
- Kucer, S. B. (2005). *Dimensions of Literacy: A Conceptual Base for Teaching Reading and Writing in School Settings* (2<sup>nd</sup> Ed.). Mahwah, NJ: Lawrence Erlbaum.
- Labrecque, M., Chuy, M., Brochu, P. & Houme, K. (2012). *PIRLS 2011. Canada in Context*. Council of Ministers of Education, Canada.
- Leu, D. J., Jr., Kinzer, C. K., Coiro, J. & Cammack, D. (2004). Toward a theory of new literacies emerging from the Internet and other ICT. In R.B. Ruddell & N. Unrau (Eds.), *Theoretical Models and Processes of Reading*, Fifth Edition (pp. 1568-1611). Newark, DE: International Reading Association.
- Ma, X., Ma, L. & Bradley, K. D. (2008). Using Multilevel Modeling to Investigate School Effects. In A. Connell & D. B. McCoach (Eds.). *Multilevel Modeling of Educational Data*. USA: Information Age Publishing Inc.
- Mullis, I. V. S., Kennedy, A. M., Martin, M. O. & Sainsbury, M. (2006). *PIRLS 2006 Assessment framework and specifications* (2<sup>nd</sup> Ed.). TIMSS & PIRLS International Study Center. Chestnut Hill, MA: Boston College.
- Mullis, I. V. S., Martin, M. O., Foy, P. & Drucker, K. T. (2011). *PIRLS 2011 International results in Reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. Retrieved from <http://timssandpirls.bc.edu/pirls2011/international-results-pirls.html>

- Mullis, I. V. S., Martin, M. O., Foy, P. & Drucker, K. T. (2012). *PIRLS 2011 International Results in Reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.
- Mullis, I. V. S., Martin, M. O., Kennedy, A. M., & Foy, P. (2007). *PIRLS 2006 international report: IEA's progress in international reading literacy study in primary schools in 40 countries*. Chestnut Hill, MA: Boston College.
- Mullis, I. V. S., Martin, M. O., Kennedy, A. M., Trong, K. L. & Sainsbury, M. (2009). *PIRLS 2011 assessment framework*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.
- Mullis, I. V. S., Martin, M. O., Minnich, C. A., Drucker, K. T., & Ragan, M. A. (Eds.) (2012). *PIRLS 2011 encyclopedia: Education policy and curriculum in reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- OECD (2000). *Literacy in the Information Age. Final Report of the International Adult Literacy Survey*. Retrieved from: <http://www.oecd.org/edu/skills-beyond-school/41529765.pdf>
- OECD (2010). *PISA 2009 assessment framework: Key competencies in reading, science and mathematics*. Paris: Author.OECD. (1999). *Classifying educational programmes: Manual for ISCED-97 implementation in OECD countries* (1999 ed.). Retrieved from <http://www.oecd.org/dataoecd/7/2/1962350.pdf>
- OECD (2011). *PISA 2009 at a Glance*. OECD Publishing. Retrieved from <http://www.oecd-ilibrary.org/content/book/9789264095298-en?contentType=/ns/StatisticalPublication,/ns/Chapter&itemId=/content/chapter/9789264095250-20-en&containerItemId=/content/book/9789264095298-en&accessItemIds=&mimeType=text/html>
- OECD (2013a). *PISA 2015 Draft Reading Literacy Framework*. Retrieved from: <http://www.oecd.org/pisa/pisaproducts/Draft%20PISA%202015%20Reading%20Framework%200.pdf>
- OECD (2013b). *PISA 1012 results: What students know and Can Do. Student performance in Mathematics, Reading and Science. Volume I*. Retrieved from: <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-I.pdf>
- OECD (2013c). *PISA in Focus 34. Who are the stronger performers and successful reformers in education?* Retrieved from: [http://www.oecd.org/pisa/pisaproducts/pisainfocus/pisa-in-focus-n34-\(eng\)-FINAL.pdf](http://www.oecd.org/pisa/pisaproducts/pisainfocus/pisa-in-focus-n34-(eng)-FINAL.pdf)
- Park, H. (2008). Home literacy environments and children's reading performance: a comparative study of 25 countries. *Educational Research and Evaluation: An International Journal on Theory and Practice*, 14(6), 489-505.

- Petscher, Y. (2010). A meta-analysis of the relationship between student attitudes towards reading and achievement in reading. *Journal of Research in Reading, 33*(4), 335–355.
- Quirk, M., Schwanenflugel, P.J., & Webb, M. (2009). A short-term longitudinal study of the relationship between motivation to read and reading fluency skill in second grade. *Journal of Literacy Research, 41*, 196–227.
- Rabash, J., Steele, F., Browne, W. J. & Goldestein H. (2009). *A Users Guide to Mlwin, v2.10*. Centre for Multilevel Modelling, University of Bristol.
- Ruddell, R. B., & Unrau, N. J. (Eds.). (2004). *Theoretical models and processes of reading* (5th ed.). Newark, DE: International Reading Association.
- Sainsbury, M., & Schagen, I. (2004). Attitudes to reading at ages nine and eleven. *Journal of Research in Reading, 27*, 373–386.
- Shiel, G. & Eivers, E. (2009). International comparisons of reading literacy: what can they tell us? *Cambridge Journal of Education, 39*(3), 345-360.
- van der Voort, T.H.A. (2001). Television's impact on children's leisure time reading and reading skills. In L. Verhoeven & C. Snow (Eds.), *Literacy and motivation: Reading engagement in individuals and groups* (pp. 95–121). Mahwah, NJ: Lawrence Erlbaum.
- Wagner, D. A. (1991). Literacy in a global perspective. In I. Lundberg & T. Høien (Eds.). *Literacy in a world of change: Perspectives on reading and reading disability*. Norway, Stavanger: Centre for Reading Research.
- Walter, P. (1999). Defining literacy and its consequences in the developing world. *Journal of Lifelong Education, 18*(1), 31–48.
- Weinberger, J. (1996). *Literacy goes to School – The parents' role in young children's literacy learning*. Liverpool, Paul Chapman Publishing.
- Wolf, R.M. (Ed.). (1995). *The IEA reading literacy study: Technical report*. The Hague, Netherlands: IEA.

## Annex

**Table A1.** Results of the multilevel modelling analysis for Austria

	Final model 2011	SE 2011
Reading Achievement	699.235	32.094
Gender of the student	-1.373	2.141
Language spoken at home	<b>-21.002</b>	<b>5.989</b>
Parent's highest occupational Level	<b>-6.812</b>	<b>1.224</b>
Employment situation of the father	0.81	5.16
Employment situation of the mother	1.524	1.81
Attended pre-school	1.672	16.872
Home resources for learning scale	<b>-21.828</b>	<b>3.068</b>
Students like reading scale	<b>-11.158</b>	<b>1.592</b>
Recognize letters of the alphabet	<b>-7.439</b>	<b>1.29</b>
Parental book reading	<b>-20.975</b>	<b>2.353</b>
Gender of the teacher	-4.765	4.571
Percentage of students not speaking test language	0.116	0.334
Percentage of students with few educational resources	<b>0.873</b>	<b>0.365</b>
Percentage of students in the school come from economically disadvantaged homes	0.81	0.853
Location of the school/If is non rural or rural	<b>8.338</b>	<b>3.352</b>
Mean of parent's highest occupational level	-9.938	9.483
Instruction affected by reading resource shortages scale	2.486	3.446
Parental involvement in school activities	-2.367	1.95
School climate/Teachers expectations for student achievement	-0.987	1.461
Variance (%)		
Student level	92	
Class level	4	
School level	4	
Model	27.4	

**Table A2.** Results of the multilevel modelling analysis for French Belgium

	Final model 2011	SE 2011
Reading Achievement	730.324	26.251
Gender of the student	-0.406	2.333
Language spoken at home	<b>-23.84</b>	<b>6.991</b>
Parent's highest occupational Level	<b>-6.471</b>	<b>1.254</b>
Employment situation of the father	-1.165	2.632
Employment situation of the mother	1.581	1.802
Attended pre-school	<b>-31.038</b>	<b>15.733</b>
Home resources for learning scale	<b>-22.506</b>	<b>3.114</b>
Students like reading scale	<b>-18.639</b>	<b>1.857</b>
Recognize letters of the alphabet	<b>-10.501</b>	<b>1.588</b>
Parental book reading	<b>-13.737</b>	<b>2.171</b>
Gender of the teacher	-2.798	4.421
Percentage of students not speaking test language	-0.541	0.462
Percentage of students with few educational resources	-0.491	0.538
Percentage of students in the school come from economically disadvantaged homes	1.342	1.03
Location of the school/If is non rural or rural	0.085	3.786
Mean of parent's highest occupational level	-8.034	7.722
Instruction affected by reading resource shortages scale	-1.654	2.242
Parental involvement in school activities	-1.962	2.056
School climate/Teachers expectations for student achievement	0.827	1.098
Variance (%)		
Student level	91.6	
Class level	4.2	
School level	4.2	
Model	35.4	

**Table A3.** Results of the multilevel modelling analysis for Bulgaria

	Final model 2011	SE 2011
Reading Achievement	788.37	35.096
Gender of the student	<b>-10.282</b>	<b>2.168</b>
Language spoken at home	-6.737	5.941
Parent's highest occupational Level	<b>-7.262</b>	<b>1.05</b>
Employment situation of the father	-0.834	2.312
Employment situation of the mother	-3.153	1.801
Attended pre-school	-0.693	4.222
Home resources for learning scale	<b>-15.299</b>	<b>2.896</b>
Students like reading scale	<b>-8.692</b>	<b>1.745</b>
Recognize letters of the alphabet	<b>-20.707</b>	<b>1.735</b>
Parental book reading	<b>-10.008</b>	<b>1.813</b>
Gender of the teacher	-8.28	9.659
Percentage of students not speaking test language	-0.221	0.392
Percentage of students with few educational resources	0.312	0.431
Percentage of students in the school come from economically disadvantaged homes	-0.268	1.425
Location of the school/If is non rural or rural	-6.385	5.394
Mean of parent's highest occupational level	-20.374	11.707
Instruction affected by reading resource shortages scale	-0.363	5.425
Parental involvement in school activities	-2.469	3.384
School climate/Teachers expectations for student achievement	<b>-12.035</b>	<b>2.633</b>
Variance (%)		
Student level	78.7	
Class level	10.3	
School level	11	
Model	38.2	

**Table A4.** Results of the multilevel modelling analysis for Croatia

	Final model 2011	SE 2011
Reading Achievement	665.191	25.948
Gender of the student	<b>-8.699</b>	<b>1.879</b>
Language spoken at home	-22.905	12.583
Parent's highest occupational Level	<b>-6.995</b>	<b>0.887</b>
Employment situation of the father	-2.699	1.622
Employment situation of the mother	-1.951	1.177
Attended pre-school	-0.487	2.458
Home resources for learning scale	<b>-11.262</b>	<b>3.011</b>
Students like reading scale	<b>2.545</b>	<b>0.456</b>
Recognize letters of the alphabet	<b>-20.562</b>	<b>1.479</b>
Parental book reading	<b>-10.976</b>	<b>1.743</b>
Gender of the teacher	-8.717	8.209
Percentage of students not speaking test language	0.448	0.263
Percentage of students with few educational resources	-0.196	0.258
Percentage of students in the school come from economically disadvantaged homes	-0.435	0.922
Location of the school/If is non rural or rural	<b>-8.832</b>	<b>3.198</b>
Mean of parent's highest occupational level	4.941	7.058
Instruction affected by reading resource shortages scale	-1.526	3.03
Parental involvement in school activities	-1.182	1.911
School climate/Teachers expectations for student achievement	0.35	1.482
Variance (%)		
Student level	91.4	
Class level	7.1	
School level	1.5	
Model	22.1	

**Table A5.** Results of the multilevel modelling analysis for Czech-Republic

	Final model 2011	SE 2011
Reading Achievement	752.121	24.237
Gender of the student	0.891	1.863
Language spoken at home	<b>-31.763</b>	<b>10.26</b>
Parent's highest occupational Level	<b>-6.889</b>	<b>0.934</b>
Employment situation of the father	3.4	3.843
Employment situation of the mother	0.499	1.688
Attended pre-school	2.798	10.041
Home resources for learning scale	<b>-18.097</b>	<b>2.536</b>
Students like reading scale	<b>-13.467</b>	<b>1.447</b>
Recognize letters of the alphabet	<b>-12.084</b>	<b>1.265</b>
Parental book reading	<b>-12.958</b>	<b>1.952</b>
Gender of the teacher	<b>-15.493</b>	<b>7.878</b>
Percentage of students not speaking test language	-0.245	0.311
Percentage of students with few educational resources	0.357	0.347
Percentage of students in the school come from economically disadvantaged homes	0.616	1.107
Location of the school/If is non rural or rural	-4.104	2.859
Mean of parent's highest occupational level	<b>-11.936</b>	<b>5.637</b>
Instruction affected by reading resource shortages scale	-0.944	2.696
Parental involvement in school activities	<b>-4.359</b>	<b>1.887</b>
School climate/Teachers expectations for student achievement	-0.354	1.673
Variance (%)		
Student level	92.2	
Class level	7.8	
School level	0	
Model	29.3	

**Table A6.** Results of the multilevel modelling analysis for Finland

	Final model 2011	SE 2011
Reading Achievement	839.312	23.006
Gender of the student	<b>-9.753</b>	<b>1.834</b>
Language spoken at home	<b>-49.837</b>	<b>10.343</b>
Parent's highest occupational Level	<b>-2.107</b>	<b>1</b>
Employment situation of the father	-0.724	2.17
Employment situation of the mother	-0.866	1.592
Attended pre-school	-10.303	10.413
Home resources for learning scale	<b>-16.21</b>	<b>2.235</b>
Students like reading scale	<b>-22.263</b>	<b>1.39</b>
Recognize letters of the alphabet	<b>-24.795</b>	<b>1.378</b>
Parental book reading	<b>-11.594</b>	<b>2.082</b>
Gender of the teacher	-3.309	3.096
Percentage of students not speaking test language	0.322	0.388
Percentage of students with few educational resources	0.464	0.386
Percentage of students in the school come from economically disadvantaged homes	<b>1.38</b>	<b>0.782</b>
Location of the school/If is non rural or rural	3.367	2.745
Mean of parent's highest occupational level	<b>-16.49</b>	<b>6.492</b>
Instruction affected by reading resource shortages scale	<b>-3.291</b>	<b>2.234</b>
Parental involvement in school activities	<b>-5.941</b>	<b>1.861</b>
School climate/Teachers expectations for student achievement	-1.881	2.264
Variance (%)		
Student level	92	
Class level	8	
School level	0	
Model	34.4	

**Table A7.** Results of the multilevel modelling analysis for France

	Final model 2011	SE 2011
Reading Achievement	709.152	28.98
Gender of the student	-1.679	2.12
Language spoken at home	<b>-38.898</b>	<b>10</b>
Parent's highest occupational Level	<b>-5.237</b>	<b>1.082</b>
Employment situation of the father	<b>-5.554</b>	<b>2.694</b>
Employment situation of the mother	-0.226	1.621
Attended pre-school	<b>48.169</b>	<b>16.405</b>
Home resources for learning scale	<b>-16.498</b>	<b>2.801</b>
Students like reading scale	<b>-24.241</b>	<b>1.778</b>
Recognize letters of the alphabet	<b>-15.764</b>	<b>1.667</b>
Parental book reading	<b>-14.6</b>	<b>2.081</b>
Gender of the teacher	2.217	3.787
Percentage of students not speaking test language	0.278	0.334
Percentage of students with few educational resources	-0.272	0.516
Percentage of students in the school come from economically disadvantaged homes	1.359	0.809
Location of the school/If is non rural or rural	-0.428	3.276
Mean of parent's highest occupational level	-11.355	8.384
Instruction affected by reading resource shortages scale	-9.017	3.936
Parental involvement in school activities	-2.772	1.911
School climate/Teachers expectations for student achievement	<b>-2.495</b>	<b>1.335</b>
Variance (%)		
Student level	90.4	
Class level	7.7	
School level	1.8	
Model	34.4	

**Table A8.** Results of the multilevel modelling analysis for Hungary

	Final model 2011	SE 2011
Reading Achievement	776.259	63.525
Gender of the student	<b>-5.1</b>	<b>2.22</b>
Language spoken at home	<b>-25.107</b>	<b>12.496</b>
Parent's highest occupational Level	<b>-4.46</b>	<b>1.162</b>
Employment situation of the father	<b>-12.34</b>	<b>2.876</b>
Employment situation of the mother	-1.846	1.797
Attended pre-school	-28.664	55.771
Home resources for learning scale	<b>-24.934</b>	<b>2.852</b>
Students like reading scale	<b>-17.026</b>	<b>1.65</b>
Recognize letters of the alphabet	<b>-10.941</b>	<b>1.353</b>
Parental book reading	<b>-10.41</b>	<b>2.238</b>
Gender of the teacher	-14.311	11.983
Percentage of students not speaking test language	0.07	0.327
Percentage of students with few educational resources	-0.615	0.394
Percentage of students in the school come from economically disadvantaged homes	-0.773	1.542
Location of the school/If is non rural or rural	<b>-11.39</b>	<b>4.031</b>
Mean of parent's highest occupational level	13.49	9.183
Instruction affected by reading resource shortages scale	0.383	3.828
Parental involvement in school activities	<b>-5.904</b>	<b>2.901</b>
School climate/Teachers expectations for student achievement	<b>-4.565</b>	<b>2.442</b>
Variance (%)		
Student level	89.9	
Class level	2.9	
School level	7.2	
Model	45.9	

**Table A9.** Results of the multilevel modelling analysis for Ireland

	Final model 2011	SE 2011
Reading Achievement	751.96	25.853
Gender of the student	<b>-6.047</b>	<b>2.608</b>
Language spoken at home	<b>-13.584</b>	<b>5.75</b>
Parent's highest occupational Level	<b>-2.938</b>	<b>1.274</b>
Employment situation of the father	<b>-7.406</b>	<b>2.261</b>
Employment situation of the mother	2.279	1.618
Attended pre-school	-3.365	4.857
Home resources for learning scale	<b>-31.376</b>	<b>3.051</b>
Students like reading scale	<b>-19.811</b>	<b>1.851</b>
Recognize letters of the alphabet	<b>-15.104</b>	<b>1.765</b>
Parental book reading	<b>-17.76</b>	<b>2.785</b>
Gender of the teacher	0.111	3.381
Percentage of students not speaking test language	0.003	0.469
Percentage of students with few educational resources	-0.512	0.599
Percentage of students in the school come from economically disadvantaged homes	<b>1.591</b>	<b>0.679</b>
Location of the school/If is non rural or rural	<b>7.613</b>	<b>3.192</b>
Mean of parent's highest occupational level	-0.901	9.29
Instruction affected by reading resource shortages scale	0.333	1.633
Parental involvement in school activities	<b>-5.371</b>	<b>1.564</b>
School climate/Teachers expectations for student achievement	-2.064	1.578
Variance (%)		
Student level	96	
Class level	4	
School level	0	
Model	39.5	

**Table A10.** Results of the multilevel modelling analysis for Italy

	<b>Final model 2011</b>	<b>SE 2011</b>
Reading Achievement	707.843	29.802
Gender of the student	<b>7.286</b>	<b>2.407</b>
Language spoken at home	<b>-23.097</b>	<b>6.41</b>
Parent's highest occupational Level	<b>-7.021</b>	<b>1.211</b>
Employment situation of the father	<b>-9.084</b>	<b>3.887</b>
Employment situation of the mother	-0.821	1.595
Attended pre-school	8.337	12.993
Home resources for learning scale	<b>-15.78</b>	<b>3.601</b>
Students like reading scale	<b>-13.059</b>	<b>1.967</b>
Recognize letters of the alphabet	<b>-11.62</b>	<b>1.582</b>
Parental book reading	<b>-14.958</b>	<b>2.063</b>
Gender of the teacher	-18.345	16.251
Percentage of students not speaking test language	0.492	0.274
Percentage of students with few educational resources	-0.083	0.341
Percentage of students in the school come from economically disadvantaged homes	0.753	1.388
Location of the school/If is non rural or rural	5.387	5.102
Mean of parent's highest occupational level	-9.03	6.664
Instruction affected by reading resource shortages scale	-1.828	2.627
Parental involvement in school activities	3.518	3.275
School climate/Teachers expectations for student achievement	2.012	1.998
Variance (%)		
Student level	78.1	
Class level	5.6	
School level	16.3	
Model	22.9	

**Table A11.** Results of the multilevel modelling analysis for Lithuania

	Final model 2011	SE 2011
Reading Achievement	748.021	31.16
Gender of the student	<b>-9.655</b>	<b>2.088</b>
Language spoken at home	-3.063	11.232
Parent's highest occupational Level	<b>-5.757</b>	<b>0.934</b>
Employment situation of the father	<b>-4.551</b>	<b>1.865</b>
Employment situation of the mother	0.909	1.535
Attended pre-school	-0.97	3.482
Home resources for learning scale	<b>-10.062</b>	<b>2.925</b>
Students like reading scale	<b>-8.633</b>	<b>1.681</b>
Recognize letters of the alphabet	<b>-27.189</b>	<b>1.693</b>
Parental book reading	<b>-15.607</b>	<b>1.959</b>
Gender of the teacher	4.467	21.717
Percentage of students not speaking test language	0.3	0.356
Percentage of students with few educational resources	<b>0.78</b>	<b>0.37</b>
Percentage of students in the school come from economically disadvantaged homes	-0.849	1.019
Location of the school/If is non rural or rural	<b>-14.228</b>	<b>4.475</b>
Mean of parent's highest occupational level	<b>-15.924</b>	<b>5.92</b>
Instruction affected by reading resource shortages scale	<b>-4.808</b>	<b>2.421</b>
Parental involvement in school activities	-4.339	3.109
School climate/Teachers expectations for student achievement	<b>-4.771</b>	<b>2.5</b>
Variance (%)		
Student level	87.9	
Class level	5.5	
School level	6.6	
Model	34.2	

**Table A12.** Results of the multilevel modelling analysis for Malta

	Final model 2011	SE 2011
Reading Achievement	752.191	50.887
Gender of the student	-5.529	3.783
Language spoken at home	<b>-14.248</b>	<b>3.568</b>
Parent's highest occupational Level	<b>-10.858</b>	<b>1.7</b>
Employment situation of the father	-6.811	6.154
Employment situation of the mother	-2.185	2.068
Attended pre-school	23.079	22.7
Home resources for learning scale	<b>-14.216</b>	<b>4.569</b>
Students like reading scale	<b>-19.102</b>	<b>2.401</b>
Recognize letters of the alphabet	<b>-26.83</b>	<b>2.547</b>
Parental book reading	<b>-20.919</b>	<b>3.317</b>
Gender of the teacher	-0.496	6.239
Percentage of students not speaking test language	<b>-0.632</b>	<b>0.231</b>
Percentage of students with few educational resources	0.464	0.606
Percentage of students in the school come from economically disadvantaged homes	1.523	1.93
Location of the school/If is non rural or rural	0.519	6.508
Mean of parent's highest occupational level	-19.951	17.512
Instruction affected by reading resource shortages scale	0.543	4.407
Parental involvement in school activities	-6.103	3.972
School climate/Teachers expectations for student achievement	-5.608	4.21
Variance (%)		
Student level	86.4	
Class level	7.8	
School level	5.8	
Model	43.3	

**Table A13.** Results of the multilevel modelling analysis for Netherlands

	Final model 2011	SE 2011
Reading Achievement	693.656	20.392
Gender of the student	1.567	2.584
Language spoken at home	-12.757	7.941
Parent's highest occupational Level	<b>-5.135</b>	<b>1.381</b>
Employment situation of the father	<b>10.072</b>	<b>3.994</b>
Employment situation of the mother	<b>5.426</b>	<b>2.559</b>
Attended pre-school	-9.408	8.404
Home resources for learning scale	<b>-15.488</b>	<b>3.29</b>
Students like reading scale	<b>-18.722</b>	<b>1.93</b>
Recognize letters of the alphabet	<b>-11.26</b>	<b>1.735</b>
Parental book reading	<b>-7.551</b>	<b>2.837</b>
Gender of the teacher	-5.378	3.438
Percentage of students not speaking test language	-0.411	0.296
Percentage of students with few educational resources	0.628	0.6
Percentage of students in the school come from economically disadvantaged homes	-0.352	0.928
Location of the school/If is non rural or rural	<b>-7.309</b>	<b>3.215</b>
Mean of parent's highest occupational level	-4.088	4.245
Instruction affected by reading resource shortages scale	<b>-6.633</b>	<b>3.369</b>
Parental involvement in school activities	-2.158	2.2
School climate/Teachers expectations for student achievement	1.768	1.86
Variance (%)		
Student level	95.8	
Class level	1.5	
School level	2.7	
Model	22.2	

**Table A14.** Results of the multilevel modelling analysis for Poland

	Final model 2011	SE 2011
Reading Achievement	754.004	38.226
Gender of the student	-3.57	2.026
Language spoken at home	-11.817	13.188
Parent's highest occupational Level	<b>-6.197</b>	<b>0.98</b>
Employment situation of the father	<b>-5.149</b>	<b>2.593</b>
Employment situation of the mother	-0.108	1.328
Attended pre-school	0.29	2.633
Home resources for learning scale	<b>-26.506</b>	<b>2.635</b>
Students like reading scale	<b>-14.538</b>	<b>1.55</b>
Recognize letters of the alphabet	<b>-21.329</b>	<b>1.452</b>
Parental book reading	<b>-20.288</b>	<b>2.046</b>
Gender of the teacher	4.501	23.28
Percentage of students not speaking test language	-0.687	0.371
Percentage of students with few educational resources	0.293	0.522
Percentage of students in the school come from economically disadvantaged homes	-0.45	0.81
Location of the school/If is non rural or rural	-5.645	3.411
Mean of parent's highest occupational level	-10.101	9.909
Instruction affected by reading resource shortages scale	<b>-3.156</b>	<b>1.487</b>
Parental involvement in school activities	-1.018	2.195
School climate/Teachers expectations for student achievement	-0.855	1.546
Variance (%)		
Student level	92.1	
Class level	4.5	
School level	3.4	
Model	34.3	

**Table A15.** Results of the multilevel modelling analysis for Portugal

	Final model 2011	SE 2011
Reading Achievement	682.725	25.76
Gender of the student	-2.62	2.38
Language spoken at home	15.33	11.375
Parent's highest occupational Level	<b>-5.679</b>	<b>1.274</b>
Employment situation of the father	<b>-8.939</b>	<b>4.261</b>
Employment situation of the mother	<b>-5.915</b>	<b>3.076</b>
Attended pre-school	-4.316	4.749
Home resources for learning scale	<b>-14.531</b>	<b>2.972</b>
Students like reading scale	<b>-15.527</b>	<b>2.157</b>
Recognize letters of the alphabet	<b>-14.121</b>	<b>1.602</b>
Parental book reading	<b>-12.999</b>	<b>2.261</b>
Gender of the teacher	<b>-17.611</b>	<b>5.21</b>
Percentage of students not speaking test language	-0.082	0.452
Percentage of students with few educational resources	<b>-1.084</b>	<b>0.487</b>
Percentage of students in the school come from economically disadvantaged homes	0.215	1.017
Location of the school/If is non rural or rural	3.602	3.947
Mean of parent's highest occupational level	8.494	8.064
Instruction affected by reading resource shortages scale	2.013	2.025
Parental involvement in school activities	-2.631	2.182
School climate/Teachers expectations for student achievement	-2.245	1.375
Variance (%)		
Student level	91.9	
Class level	4.5	
School level	3.4	
Model	29	

**Table A16.** Results of the multilevel modelling analysis for Romania

	Final model 2011	SE 2011
Reading Achievement	734.751	51.764
Gender of the student	<b>-11.58</b>	<b>2.57</b>
Language spoken at home	7.216	10.559
Parent's highest occupational Level	<b>-5.961</b>	<b>1.326</b>
Employment situation of the father	-2.525	2.283
Employment situation of the mother	1.078	1.878
Attended pre-school	<b>-30.264</b>	<b>10.394</b>
Home resources for learning scale	<b>-22.983</b>	<b>3.533</b>
Students like reading scale	<b>-12.766</b>	<b>2.058</b>
Recognize letters of the alphabet	<b>-17.239</b>	<b>1.827</b>
Parental book reading	<b>-5.893</b>	<b>2.597</b>
Gender of the teacher	-8.63	8.602
Percentage of students not speaking test language	-0.292	0.496
Percentage of students with few educational resources	-0.46	0.358
Percentage of students in the school come from economically disadvantaged homes	0.005	1.458
Location of the school/If is non rural or rural	<b>-24.612</b>	<b>6.686</b>
Mean of parent's highest occupational level	0.388	17.288
Instruction affected by reading resource shortages scale	1.234	7.526
Parental involvement in school activities	-2.96	4.186
School climate/Teachers expectations for student achievement	-3.628	3.865
Variance (%)		
Student level	77.8	
Class level	6.5	
School level	15.7	
Model	41.8	

**Table A17.** Results of the multilevel modelling analysis for Slovak Republic

	Final model 2011	SE 2011
Reading Achievement	724.659	21.077
Gender of the student	<b>-5.297</b>	<b>1.806</b>
Language spoken at home	1.496	7.599
Parent's highest occupational Level	<b>-6.373</b>	<b>0.923</b>
Employment situation of the father	<b>-3.596</b>	<b>1.977</b>
Employment situation of the mother	<b>-7.168</b>	<b>1.492</b>
Attended pre-school	5.167	7.938
Home resources for learning scale	<b>-20.265</b>	<b>2.527</b>
Students like reading scale	<b>-12.638</b>	<b>1.408</b>
Recognize letters of the alphabet	<b>-10.677</b>	<b>1.096</b>
Parental book reading	<b>-12.791</b>	<b>1.867</b>
Gender of the teacher	-1.71	6.043
Percentage of students not speaking test language	-0.004	0.332
Percentage of students with few educational resources	0.076	0.376
Percentage of students in the school come from economically disadvantaged homes	-0.335	0.828
Location of the school/If is non rural or rural	<b>-9.583</b>	<b>3.255</b>
Mean of parent's highest occupational level	<b>-11.711</b>	<b>5.898</b>
Instruction affected by reading resource shortages scale	0.171	2.811
Parental involvement in school activities	-0.542	2.074
School climate/Teachers expectations for student achievement	<b>-2.763</b>	<b>1.159</b>
Variance (%)		
Student level	88.8	
Class level	7.6	
School level	3.6	
Model	38.2	

**Table A18.** Results of the multilevel modelling analysis for Slovenia

	Final model 2011	SE 2011
Reading Achievement	727.241	23.503
Gender of the student	<b>-4.216</b>	<b>2.167</b>
Language spoken at home	<b>-20.203</b>	<b>8.259</b>
Parent's highest occupational Level	<b>-8.426</b>	<b>1.096</b>
Employment situation of the father	<b>-10.756</b>	<b>5.754</b>
Employment situation of the mother	-1.736	3.154
Attended pre-school	3.914	4.269
Home resources for learning scale	<b>-20.752</b>	<b>2.917</b>
Students like reading scale	<b>-19.218</b>	<b>1.706</b>
Recognize letters of the alphabet	<b>-17.525</b>	<b>1.388</b>
Parental book reading	<b>-20.726</b>	<b>2.361</b>
Gender of the teacher	1.091	7.861
Percentage of students not speaking test language	-0.343	0.309
Percentage of students with few educational resources	-0.091	0.358
Percentage of students in the school come from economically disadvantaged homes	0.125	0.863
Location of the school/If is non rural or rural	-0.223	2.923
Mean of parent's highest occupational level	-1.213	6.418
Instruction affected by reading resource shortages scale	0.62	1.532
Parental involvement in school activities	1.141	2.028
School climate/Teachers expectations for student achievement	-2.079	1.548
Variance (%)		
Student level	95.6	
Class level	1.8	
School level	2.6	
Model	31.6	

**Table A19.** Results of the multilevel modelling analysis for Spain

	Final model 2011	SE 2011
Reading Achievement	681.587	15.783
Gender of the student	-1.147	1.671
Language spoken at home	-5.34	4.062
Parent's highest occupational Level	<b>-3.16</b>	<b>0.84</b>
Employment situation of the father	-1.385	1.718
Employment situation of the mother	-0.491	1.038
Attended pre-school	2.979	6.953
Home resources for learning scale	<b>-17.083</b>	<b>2.236</b>
Students like reading scale	<b>-14.124</b>	<b>1.313</b>
Recognize letters of the alphabet	<b>-23.964</b>	<b>1.304</b>
Parental book reading	<b>-9.511</b>	<b>1.485</b>
Gender of the teacher	-3.758	2.794
Percentage of students not speaking test language	<b>-0.445</b>	<b>0.133</b>
Percentage of students with few educational resources	0.009	0.325
Percentage of students in the school come from economically disadvantaged homes	-0.189	0.732
Location of the school/If is non rural or rural	<b>-9.369</b>	<b>4.165</b>
Mean of parent's highest occupational level	-5.027	4.588
Instruction affected by reading resource shortages scale	-1.184	1.019
Parental involvement in school activities	-2.172	1.72
School climate/Teachers expectations for student achievement	-0.706	1.222
Variance (%)		
Student level	89.4	
Class level	4.3	
School level	6.3	
Model	28.1	

**Table A20.** Results of the multilevel modelling analysis for Sweden

	Final model 2011	SE 2011
Reading Achievement	763.825	26.296
Gender of the student	-4.098	2.356
Language spoken at home	<b>-20.308</b>	<b>5.988</b>
Parent's highest occupational Level	<b>-2.889</b>	<b>1.343</b>
Employment situation of the father	<b>-7.66</b>	<b>3.73</b>
Employment situation of the mother	-3.226	2.167
Attended pre-school	-7.901	8.609
Home resources for learning scale	<b>-21.432</b>	<b>2.837</b>
Students like reading scale	<b>-18.552</b>	<b>1.872</b>
Recognize letters of the alphabet	<b>-17.088</b>	<b>1.849</b>
Parental book reading	<b>-15.408</b>	<b>2.55</b>
Gender of the teacher	-6.718	4.268
Percentage of students not speaking test language	-0.479	0.298
Percentage of students with few educational resources	0.018	0.516
Percentage of students in the school come from economically disadvantaged homes	-0.804	0.849
Location of the school/If is non rural or rural	-5.406	3.372
Mean of parent's highest occupational level	-9.598	8.604
Instruction affected by reading resource shortages scale	0.065	3.494
Parental involvement in school activities	-1.134	2.279
School climate/Teachers expectations for student achievement	0.341	1.442
Variance (%)		
Student level	94.3	
Class level	2.9	
School level	2.8	
Model	36.7	



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#### **Abstract**

In this report we used data from the Progress in International Reading Literacy Study (PIRLS) 2011 in order to identify the school, class and individual student background factors that explain reading literacy achievement. We aim to identify the factors associated with achievement at different levels of analysis, both at the EU level and at the individual country level using a multilevel model. Additionally, we intend to establish trends in students reading achievement by comparing PIRLS 2006 and PIRLS 2011 cycles. For the data from 2011 we found that our aggregated model explains 37% of the variance in students' achievement and that the variables with the highest impact on students' overall reading score relate to home resources and practices, students' attitudes toward reading and pre-reading knowledge. Moreover, the results of the country-level analysis indicate that the variables with the strongest influence on students' reading performance are the same, despite of the wide variation across countries in terms of their magnitude due to the characteristics of each country. Furthermore, these findings are in line with the previous analysis performed for PIRLS 2006 (Araújo & Costa, 2012). Our results have important policy implications as they show which factors can be addressed by policy measures to improve students' achievement.

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