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Languages as factors of reading achievement in PIRLS assessments

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UNIVERSITE DE BOURGOGNE

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THÈSE

Texte présenté en vue de l'obtention du titre de
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Discipline : Sciences de l'Éducation

par

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Dijon, 27 Janvier 2011

Languages as factors of reading achievement in PIRLS assessments

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À mes grands parents Blanca Alicia et Jorge

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Résumé

Cette thèse est une contribution aux études sur l'acquisition de la lecture et de la langue. La question clé que nous nous avons posé est : « *l'acquisition de la lecture, peut-elle être plus ou moins effective en fonction de la langue dans laquelle elle s'effectue ?* ». Cet problème peut être simple en apparence, mais il comporte une série d'autres problématiques.

Premièrement, il a été nécessaire de définir ce que nous appelons lecture, ainsi, trois de ses propriétés ont été mobilisées. D'abord, l'accent a été mis sur le caractère multidimensionnel de l'acte de lire, qui peut varier en fonction de paramètres tels que la finalité de la lecture ou les processus cognitifs requis pour comprendre un texte. Ensuite, on a souligné le rôle actif du lecteur autant que constructeur de sens, c'est-à-dire, participant à la création de la significativité d'un texte ; ceci implique de prendre en compte les circonstances qui déterminent l'acte de lire, notamment le contexte individuel et social du lecteur. Finalement, en ce qui concerne l'acquisition de la lecture, l'accent a été mis sur l'évolution de l'oral à l'écrit, en supposant une augmentation progressive de la complexité de la lecture, dans la mesure où elle est un processus cognitif.

Le deuxième problème théorique concerne la détermination de ce qui permet de distinguer une langue d'une autre. Afin de répondre à cette question, des paramètres ont été établis pour classer les langues en vue de mettre en évidence les dissimilitudes qui peuvent exister entre celles-ci. Premièrement, nous avons pris comme référence le concept de *familles linguistiques*, qui permet de faire ressortir les connexions entre les langues en fonction de leurs liens historiques et culturels ; en général, les langues qui proviennent de la même racine, ne partagent pas seulement une étymologie ou des structures syntaxiques, mais aussi un passé commun et une vision du monde. Deuxièmement, il y a certaines propriétés du passage de l'oral à l'écrit qui peuvent faire une différence dans la qualité de la lecture, à savoir, la régularité avec laquelle l'orthographe représente les phonèmes de la langue, laquelle peut faire de la lecture une tâche plus ou moins transparente ; c'est la notion de *profondeur orthographique*. Dans les catégories les plus extrêmes, nous trouvons, d'une part, l'Anglais comme une langue hautement irrégulière et d'une difficile acquisition, et d'autre part, des langues comme l'italien ou l'espagnol dont la régularité se rapproche de l'idéal d'une orthographe phonétique.

À partir de ces références théoriques on a pu aborder plus solidement notre su-

jet, mais pour la mise en œuvre ce travail, il a été aussi nécessaire de disposer d'informations qui permettent de décrire les compétences en lecture, la langue et les facteurs liés aux sujets lecteurs. C'est pourquoi nous avons fait appel aux données produites à partir de PIRLS. Coordonné par l'IEA, il s'agit d'une étude des compétences en littéracie chez des enfants âgés de 9 à 10 de plus de 30 pays à travers le monde. Dans le cadre de notre problématique, cette étude nous a offert la possibilité d'établir des liens entre la lecture et les langues des pays participants, en incluant des renseignements sur les circonstances environnementales et scolaires des élèves. PIRLS suppose comme hypothèse que la maîtrise de la lecture est liée à trois facteurs : l'objectif ou type de texte, les compétences de compréhension requises par le processus de lecture, et les caractéristiques sociales, économiques et culturelles. De plus, PIRLS a permis d'effectuer un suivi des résultats dans le temps puisqu'il y a, jusqu'à maintenant deux vagues de l'étude, 2001 et 2006.

Des procédures

À partir de cette approche théorique et afin de répondre à la question posée dans la problématique, une série de procédures ont été mises en œuvre. La première a été celle de classer les langues présentes dans PIRLS, à partir des deux critères mentionnés, premièrement les groupes de langues liées par familles linguistiques, et ensuite les langues reliées par un même niveau de profondeur orthographique. Parallèlement, les facteurs environnementaux et scolaires ont été étudiés. Après avoir recueilli suffisamment d'informations sur les catégories linguistiques et les facteurs contextuels, nous avons cherché à les rapprocher aux dimensions qui composent l'acte de lecture selon PIRLS (lecture informative, littéraire, processus de compréhension simples et complexes). Finalement, la dernière procédure a été la création d'un modèle d'interprétation statistique capable de rendre compte du rôle de la langue et d'autres facteurs associés au rendement en lecture.

En ce qui concerne l'étude préliminaire des liens entre les catégories linguistiques, les facteurs contextuels, et les dimensions de la lecture, cette démarche avait une double finalité. Premièrement, on a cherché à enrichir l'étude des variables linguistiques en établissant le contexte dans lequel elles prennent place. C'est-à-dire, recueillir les informations nécessaires afin de développer un modèle explicatif dans lequel les langues ne sont pas les seules déterminantes du rendement en lecture, mais aussi d'autres facteurs liés aux individus et au contexte scolaire. Deuxième-

ment, nous avons cherché à mettre en évidence les différences possibles entre les dimensions de la lecture, de façon à intégrer dans le modèle explicatif les facteurs qui ont déterminé différemment une dimension ou l'autre. Cette procédure est fondée sur l'hypothèse que si les dimensions ont été déterminées par des différents facteurs, elles peuvent avoir un pouvoir explicatif différent. Ainsi, une même variable expliquera que 5% de la variance d'une dimension, (e.g. score littéraire), en revanche elle expliquera 10% de la variance d'une autre dimension (e.g. score informatif).

Afin d'identifier ces déterminants potentiels, nous avons estimé les corrélations entre les résultats des tests PIRLS et un nombre important des questions en provenance des enquêtes. Les variables dérivées à partir des réponses des élèves, des enseignants et des responsables des écoles, ont été corrélées avec les différences entre les dimensions de la lecture ; ce qui a permis la création d'indices en représentant les facteurs inférés à partir de ces variables. Les modèles multi-niveaux incluent cinq facteurs en représentant des caractéristiques des individus, dérivée des réponses des élèves, et six facteurs scolaires, dérivés de réponses des enseignants et des directeurs.

La littérature spécialisée est d'accord pour remarquer que ces modèles multi-niveaux présentent un avantage important quand il s'agit d'une analyse de systèmes éducatifs en tenant compte de sa structure hiérarchisée. Dans notre étude, on propose un modèle à deux niveaux : étudiant-école, car d'après la comparaison avec d'autres possibilités, celle-ci s'est révélée la plus adaptée pour expliquer les données.

Résultats

Les résultats de la modélisation, nient l'hypothèse selon laquelle la langue détermine l'acquisition de la lecture. On ne peut pas affirmer que le fait de parler une langue ou une autre fait varier le résultat obtenu dans ce test, car aucune des catégories utilisées (les familles linguistiques, la profondeur orthographique) n'a été en mesure d'expliquer la variance du rendement en lecture, ni entre les individus ni entre les écoles. En outre, les résultats sont similaires pour les différentes dimensions de la lecture, aucune différence n'a été trouvée parmi les facteurs qui déterminent les dimensions prises en compte.

Cette carence de détermination peut être interprétée à la fois négativement et positivement. D'une part, si la langue avait été un facteur déterminant de l'acquisition de la lecture, le modèle aurait pu apporter un nouvel élément aux facteurs déjà connus, par conséquent, la langue aurait été une nouvelle source explicative par rapport au rendement en lecture. Un autre aspect, « négatif », est la transformation du rôle de la langue, vu de son importance dans les premiers moments de l'acquisition de l'écrit ; pendant des tâches de décodage, la complexité orthographique s'est avéré être une source clé d'explication des différences d'acquisition de lecture entre une langue et l'autre.

Cependant, on comprend rapidement que ce manque de détermination de la langue en lecture est plutôt un avantage, car elle provient, en fait, de l'aspect le plus positif de ce résultat : il n'est pas plus facile ou difficile de répondre aux items de PIRLS dans une langue déterminée. Notre recherche montre que, au niveau macro, il y a des scores différents entre les groupes linguistiques ; en particulier, l'Anglais a une moyenne plus élevée que les autres familles linguistiques et que les langues aux orthographe plus simples ; pourtant, selon le modèle, cet avantage ne détermine ni les résultats des élèves, ni celui des écoles. Au niveau des pays, cet avantage pourrait être tiré d'autres aspects (culturels, économiques, sociaux), mais ce n'est pas une conséquence de conditions linguistiques particulières. En outre, s'il dépendait des conditions linguistiques, les résultats des élèves anglophones devraient être au-dessous de la moyenne, puisque la littérature spécialisée suppose une désavantage très probable pour la langue anglaise, compte tenu de son orthographe complexe ; cela n'a pas été confirmé par nos résultats.

Un résultat distinct est obtenu grâce à l'analyse des facteurs liés aux caractéristiques individuelles et des facteurs liés au milieu scolaire. Ils sont en mesure d'expliquer au moins une partie de la différence des scores entre les individus et entre les écoles. Dans la modélisation, quand les variables individuelles sont incorporées comme sources uniques de la détermination, elles expliquent environ 20% de la variance entre les scores des élèves et plus de 40% de la variance entre les écoles. Cette importante proportion indique qu'il y a une correspondance entre les caractéristiques des élèves et les écoles qu'ils fréquentent. Cela peut fonctionner dans les deux sens, puisque, d'une part, il est possible que les caractéristiques soient le résultat de la formation reçue à l'école, et d'autre part, il est aussi possible que les caractéristiques soient la cause du choix d'une école ou d'une autre. Par ailleurs, les facteurs scolaires sont proportionnellement moins explicatifs du rendement en

lecture, seuls, ils n'expliquent que 10% de la variance des scores entre les écoles. Le facteur « *acquérir tôt dans la scolarité des compétences en lecture* » est la variable scolaire la plus déterminante. En plus, les principales sources de détermination entre les facteurs individuels sont les variables « *quantité de livres disponibles dans le foyer* », « *ressources matérielles pour la scolarité* », et « *des attitudes favorables envers la lecture* ». Ces résultats sont constants entre les deux échantillons, celui de 2001 et celui de 2006.

Une forte influence de l'école a été aussi identifiée ($ICC = .42$). Cette influence dépend en grande partie du système éducatif des pays, qui peut être déterminant comme en Macédoine ($ICC = .51$) ou peu influant comme en Slovénie ($ICC = .11$), pays remarquable pour l'homogénéité de ses écoles. En d'autres termes, l'école fréquentée détermine en grande partie le rendement en lecture, avec toutefois des fortes variations d'un pays à l'autre.

Les résultats produits dans cette recherche sont, bien sûr, contingents au contexte de l'enquête PIRLS, ils ont toutefois le mérite de mobiliser une perspective longitudinale qui fait apparaître une cohérence de ces résultats à travers le temps.

Contents

Résumé	3
1 Defining Reading	16
1.1 Premises about reading	20
1.2 Premises about reading learning	22
1.3 Global purposes	25
I Theoretical Framework	27
2 Describing Languages	28
2.1 Ethnographic description	30
2.1.1 Culture and History in Languages Evolution	30
2.1.2 Linguistic Families in PIRLS assesments	32
2.2 Phonological description	43
2.2.1 General notions about psycholinguistic and phonology	43
2.2.2 Orthography and alphabetic systems	49
3 PIRLS Assessment and Reading Research	64
3.1 Description of the study	67
3.1.1 History of the Study	67
3.1.2 Reading definition in PIRLS	69
3.2 What is PIRLS measuring?	73
3.2.1 Aspects of Student’s Reading Literacy	73
3.2.2 Assessment description	81

3.3	Criticism on PIRLS	89
3.3.1	Criticized features	89
3.3.2	Language and Cultural validity	90
3.4	How to compare reading acquisition among languages?	94
3.4.1	Research Problem	94
3.4.2	Hypothesis	95
3.4.3	Research objectives	100
3.4.4	Methodological procedure	100
II	Development of experiments	108
4	Criteria to establish linguistic categories	109
4.1	Language in PIRLS	110
4.1.1	Especial linguistic cases	113
4.1.2	Multilingualism cases	115
4.2	Linguistic Family as factor	119
4.2.1	Descriptive variable	119
4.2.2	Modeling variable	122
4.3	Orthographic depth as factor	126
4.3.1	Orthographic properties of PIRLS languages	127
4.3.2	Classifying orthographic depth	147
5	Individual and school factors related to reading aspects	152
5.1	PIRLS 2001	157
5.1.1	Reading objectives 2001	157
5.1.2	Processes of Comprehension 2001	174
5.2	PIRLS 2006	187
5.2.1	Reading objectives 2006	187
5.2.2	Processes of Comprehension 2006	198
5.3	Description of the findings	211

Contents

5.3.1	Factors related to the purposes of reading	212
5.3.2	Factors related to the comprehension processes	215
5.3.3	Factors related to both aspects of reading	216
6	Factor that influence reading in PIRLS	217
6.1	General Description	219
6.1.1	Variables and Factors to be incorporated in the analysis . . .	219
6.1.2	Comparative sample	225
6.2	Hierarchical Models	231
6.2.1	Structure of the model: the null model	231
6.2.2	Modelling linguistic Variables	237
6.2.3	Contextual determinants	244
6.2.4	Final Models	253
	Conclusion	267
	Answers to the hypotheses	268
	Findings about factors of PIRLS reading achievement	273
	References	277
	Appendix	289
A	PIRLS variables derived from Questionnaires	289
A.1	2001 questionnaires	290
A.1.1	Pearson Correlation Coefficients with TEX 2001	290
A.1.2	Pearson Correlation Coefficients with COM 2001	298
A.2	2006 questionnaires	307
A.2.1	Pearson Correlation Coefficients with TEX 2006	307
A.2.2	Pearson Correlation Coefficients with COM 2006	311
B	Hierarchical models for partial scores	321
B.1	2001 models	322

B.1.1	PIRLS 2001 literary score	322
B.1.2	PIRLS 2001 informative score	323
B.1.3	PIRLS 2001 low order processes score	324
B.1.4	PIRLS 2001 high order processes score	325
B.2	2006 models	326
B.2.1	PIRLS 2006 literary score	326
B.2.2	PIRLS 2006 informative score	327
B.2.3	PIRLS 2006 low order processes score Models	328
B.2.4	PIRLS 2006 high order processes score Models	329
C	SAS and R programs	330
C.1	Programs for preliminary analysis	331
C.1.1	2006 Linguistic families at country level	331
C.1.2	2001 Literary score at countries	332
C.1.3	Example: analysis of a question from teacher 2001 question- naire	332
C.1.4	Macro to create variables	333
C.2	Models	335
C.2.1	Null Models	335
C.2.2	Linguistic Models	335
C.2.3	School variance by country	336
C.3	R. graphics	338
C.3.1	Boxplot in figure 6.1	338
C.3.2	Plots in figure 6.2	338
C.4	\LaTeX	341
	Abstract	345

List of Tables

2.1	The evolution of Romance Languages	39
3.1	PIRLS 2001 distribution of items by reading purpose, process category and format	82
3.2	PIRLS 2006 distribution of items by reading purpose, process category and format	85
3.3	Comparison of items distribution 2001 – 2006	86
3.4	Variable TEX 2006, Pearson Correlation Coefficients	104
3.5	Differences between reading aspects by country	105
4.1	Languages in PIRLS Assesments	110
4.2	2006 Differences by component in Canadian provinces	114
4.3	Literary and Informative scores and their difference in Spain	117
4.4	Linguistic Families in 2001 sample	119
4.5	Linguistic Families in 2006 sample	120
4.6	Linguistic families in comparative sample	122
4.7	Distribution of families in the comparative sample	123
4.8	Degree of opacity of PIRLS languages	149
5.1	French and English countries and TEX 2001	153
5.2	PIRLS 2001 scores	155
5.3	PIRLS 2006 scores	156
5.4	Correlation Coefficients: Variable TEX - Student Indexes	160
5.5	Correlation Coefficients: Variable TEX - Teacher Indexes	163
5.6	Correlation Coefficients: Variable TEX - School Index	167

5.7	Linear regression results: TEX 2001 - Indexes and Language	171
5.8	Correlation Coefficients: Variable COM - Student Indexes	175
5.9	TEX and COM compared correlations	176
5.10	Correlation Coefficients: Variable COM - Teacher Indexes	179
5.11	Correlation Coefficients: Variable COM - School Indexes	181
5.12	Linear regression results: COM 2001 - Indexes and Language	184
5.13	Correlation Coefficients: Variable TEX - Student Indexes	188
5.14	Correlation Coefficients: Variable TEX - Teacher Indexes	192
5.15	Linear regression results: TEX 2006 - Indexes and Language	196
5.16	Correlation Coefficients: Variable COM - Student Indexes	199
5.17	Correlation Coefficients: Variable COM - Teacher Indexes	202
5.18	Correlation Coefficients: Variable COM - School Indexes	206
5.19	Linear regression results: COM 2006 - Indexes and Language	208
6.1	Number of observations in PIRLS dataset	218
6.2	Comparable individual factors	219
6.3	Comparable school factors	221
6.4	Correlation Matrix: scores PIRLS 2001	223
6.5	Correlation Matrix: scores PIRLS 2006	223
6.6	Linguistic Families, Scores and differences in 2001 and 2006	225
6.7	Orthographic depth, scores and differences in 2001 and 2006	226
6.8	Scores and differences in bilingual countries	229
6.9	Scores and differences in New Zealand 2006	230
6.10	PIRLS 2001 total score Null Model	232
6.11	Deviance between two and tree levels models	236
6.12	PIRLS 2001 total score Models	238
6.13	PIRLS 2006 total score Models	239
6.14	Attitudes from children and parents variables	247
6.15	2001 and 2006 final models	255
6.16	Models applied to French sample	261

List of Tables

6.17 Models applied to United States sample	263
6.18 Models applied to Russian sample	265
A.1 TEX 2001 and the Student Questionnaire	290
A.2 TEX 2001 and the Teacher Questionnaire	292
A.3 TEX 2001 and the School Questionnaire	295
A.4 COM 2001 and the Student Questionnaire	298
A.5 COM 2001 and the Teacher Questionnaire	300
A.6 COM 2001 and the School Questionnaire	304
A.7 TEX 2006 and the Student Questionnaire	307
A.8 TEX 2006 and the Teacher Questionnaire	309
A.9 TEX 2006 and the School Questionnaire	310
A.10 Com 2006 and the Student Questionnaire	311
A.11 COM 2006 and the Teacher Questionnaire	314
A.12 COM 2006 and the School Questionnaire	319

List of Figures

2.1 Afro-Asiatic: Semitic Branch	32
2.2 Indo-European: Albanian and Baltic Branches	35
2.3 Indo-European: Germanic Branch	36
2.4 Indo-European: Italic Branch	38
2.5 Indo-European: Slavic Branch	40
2.6 Examples of scripts along history	46
2.7 Seymour’s classification of languages, deepness and complexity . .	61
3.1 Contexts of reading literacy	74
4.1 Plot of languages scores	125
4.2 Plot of languages scores	150
6.1 School Variance and ICC within countries 2006	234
6.2 Variation of the effect of some factors across schools	258

Chapter 1

Defining Reading

Until the mid-twentieth century, reading was often considered as the path to access to the meaning locked in the depth of a written work. All reflections and intellectual efforts turned around this idea. For example, a key work in literary theory is the study of Russian folk tales, achieved by [Propp](#) published in 1928. Through the analysis of a corpus of 100 tales, he identified a series of recurrent *functions* and *characters*. He concluded that any folk tale or fairy tale could be resolved into 31 functions and 8 character types. Later, this theory was applied to other fictional works like theater plays, films, and novels. In such a formalist point of view, the role played by *reading* is evidently secondary. Reading is only an instrument to accomplish the task of identifying the structure, functions, and characters. Another side of this same approach is the notion of “literariness” developed by Propp’s colleges: Shklovsky, Eichenbaum, and others members of Russian formalist theoretical movement. Here too, the literary work is considered like a special object, different from other similar objects like non fictional writing. The formalists aimed to define this *essence*, which is not determined at all by reading conditions or strategies.

This point of view was, at the same time, a continuation and a break point from a long tradition of reading theory focuses in texts and authors; readers were totally absent of these theoretical reflections. If, during the nineteenth century, the focus of attention was put on historical, biographical, and cultural context, Russian formalism reduced the importance of all aspects related to authors to focus on *texts* themselves. The agreeing point of these traditions is the passive role accorded to readers.

This was the predominant approach during the mayor part of the twentieth century, particularly developed by structural theory (Lévi-Strauss (1958), Barthes (1953), starting from Saussure's proposals), which applied this formalism, not only to literary texts, but also to all linguistic communications.

However, through history, this was not the only way of understanding linguistic communication. In previous periods, the *effects* that could be caused in the receptor of a text was the center of concern for Rhetoric. Even if roman rhetoricians like Cicero, were interested mainly in oral communication, they applied their theories in their writing texts. The hypothesis in rhetoric was that effective communication can lead the audience to be convinced of the qualities of the proposal. In this case the interaction between the producer and the receptor of a communicative work was the center of interest.

Returning to the theme of the evolution of reading, during the twentieth century, a major change was caused by the reintroduction of this very same element: the reader. But this time, it was not from the point of view of the text producers, like rhetoricians, but from the point of view of the readers themselves. It was during the highest point of the structuralism influence, that a dissident voice, Jacques Derrida (1967), broke out with one of the main premises of this current: there was not a meaning outside the structure of a text, the structure itself is all there is. From this nihilist point of view, the meaning is only a function of the structure, with no values by itself.

However, this was not the end of text studies; on the contrary, very soon after a new theory put the silent element of structuralism, the reader, in the very center of the discussion. Reader-response criticism was first developed at the German university of Constance, where two mayor scholars: Wolfgang Iser (1997) and Hans Robert Jauss (1978) proposed a *theory of reception* that addressed this issue.

This school of thought, criticized the notion of text proposed by structuralism, saying that the significance of a text depends not only on the text itself, but also on the reader.

According to Wolfgang Iser, the reader is, himself, one of the authors of the text insofar as he participates in the creation of its significance. For the theorist, a text is not an object, but *an effect that is waiting to be explained*. During reading, not all the information is explicit; much of the necessary elements used to construct the meaning of the text are implied. For Iser, the act of reading is to complete the

sense in responding to the challenges of the text, this reaction will be the way to access the deeper meanings. As a result, to successfully construct meaning, the reader must count on the help of his/her reading skills, in other words, this theory encompasses the impact of factors that influence reading, including previous experience with similar texts, cognitive and metacognitive processes, and the effects of context (social, cultural, educational).

Despite of the fact that this exposition mainly focuses on literature and linguistic, it has been only a way to enter into the complex field of *Reading theory*, which is a key concept to understand reading learning and actual studies about its development. In addition, it is important to mention that this is a field of collective work, several research areas participated in the development of this knowledge on reading. Linguistics, anthropology, semiotics, literary theory, sociolinguistics, and cognitive science have all made contributions to the conception of reading which is now used.

To introduce the research work that will be undertaken in the next pages, it is necessary to start with an idea of what reading is today. However, because of the exploratory nature of this research, a complete definition cannot be expected. It is preferable to discuss some current premises that will allow the presentation of the theme and problematic of this work.

In this context, the idea of the reader as a constructor of meaning is the key concept. A review of the definitions of *reading* that are widespread in contemporary literature, can confirm this idea. For example, three definitions from very different books and articles prove this connection:

First, from an encyclopedia of language:

Reading comprehension refers to understanding the meaning of written words; sentences, and text. Readers try to understand the written message of the writer at different levels (lexical, syntactic, semantic, and pragmatic). Reading comprehension is an active process; that is affected by complex interactions between the content of the text itself, the reader's prior knowledge and goals, and various cognitive and metacognitive activities and processes. (Aarnoutse, Leeuwe, & Verhoeven, 2005, p. 255)

Second, in the introductory pages of a research about reading learning, Ziegler

& Goswami (2005) define reading as: “Reading is the process of understanding speech written down. The goal is to gain access to meaning. To acquire reading, children must learn the code used by their culture for representing speech as a series of visual symbols” (p.3). Finally, the central role of readers can be appreciated in the definition made by Bachman (1990) in his deep study about language evaluation: “Most current frameworks of language use are based on the concept of language as communication, and recognize the importance of the context, both discourse and sociolinguistic, in which language is used” (p. 9).

These definitions underline the role of readers in accessing meaning. Readers and reading have become a central element of actual paradigm about written communication. These three definitions also allow to observe two other premises about reading that are fundamental in today’s research: the definition of reading as a cognitive process and the importance of context. Understanding as context all the environmental and individuals elements that determine readers and, consequently, their reading. To introduce the theme to be studied here, it is necessary to introduce first these two notions and also introduce two specific premises derived from the relation of reading and learning.

1.1 Premises about reading

“Today, it is generally agreed that reading is a complex process encompassing decoding abilities and comprehension abilities”(Hagtvet, Helland, & Lyster, 2006). As this definition underlines, reading is a process, but not a simple one. It is determined by its cognitive character and, at the same time, by the social interaction that it implies (see Oakhill & Beard, 1995). Moreover, it has been described as a pluridimensional process: “Skillful reading is not a unitary skill. It is a whole complex system of skills and knowledge” (Adams, 1990, p.3). That is, reading is not only one process, but several cognitive tasks responding to several dimensions that make up a text (see Van Dijk & Kintsch, 1983). This notion is related to the *Reader response theory*, because it underlines the importance of implicit information in the texts to which the reader must gain access. This perspective (close to Cognitive science) underlines the role played by reading *skills* that readers can learn and build up.

From the point of view of the text, there are several dimensions that constitute a text. The deeper ones have been defined as information lying *beyond the surface*, depending on processes of abstraction of an increasing complexity. Van Dijk (1980) described this as *Semantic macrostructures*: overall meaning or topic to which a text refers; it can be explicitly stated in a text, or can be abstracted from it. The *macrostructure* is the deeper level of a text, and it is different from the *microstructure* or superficial level. *Microstructure* is constituted of local elements like words, sentences, and paragraphs.

In relation to education, the fundamental effect of this multidimensional configuration is that the reader must be capable of gaining access to all the different dimensions by applying multiple cognitive procedures. But the reader is not alone in this work, as the following second premise states.

The second premise about reading is the fundamental role played by context, as the quoted by Ziegler & Goswami (2005) remarked, the reading process is determined by culture, and also, by social, economical and historical circumstances in which the reader is immersed. As the Bachman (1990) definition underlined, context determines reading as a social process of language. The consequences of this supposition are numerous, particularly in relation to reading learning. For example, Baker, Afflerbach, & Reinking (1996) developed a series of hypotheses in relation to the diversity of social environments: “There are ... both qualita-

tive and quantitative differences in the ways that children from different cultural groups experience literacy. The influence of these differential experiences during the preschool years may extend into the school years” (p. 3). What is necessary to underline is the importance of the role played by the readers and their contexts of lecture in today’s theoretical research about communication through written language.

In summary, present definitions of reading cannot avoid considering those two aspects, the multidimensional character of reading as a process, and the role played by the context. Both are main determinants of the quality of reading, that is, they can determine how well comprehension is achieved, which is why they cannot be avoided when considering reading learning.

These two aspects put reading in a perspective totally opposite from older theories, but there are other aspects that should be included. They are not related to questions about what reading is, as the previous premises, but they are related to the question about what learning to read is.

1.2 Premises about reading learning

First of all, it is necessary to introduce a developmental element to reading, considering that it is not the same to read during the first years of learning than it is as an advanced learner. Reading learning evolves over time, and so do comprehension abilities.

To describe this phenomenon, one of the current terms used is *stages*. For example, [Chall \(1996\)](#) has proposed several *Stages of Reading Development*, she inspired her proposals by Piaget's theory of cognitive development. Chall defines five stages and a *prereading* period. In this step *zero*, children imitate the act of reading but without having the basic concept of the process, which will be learned during the first stage: *Initial reading or decoding stage*. Then, a *confirmation stage* follows, in which fluency is the main goal, once the aspect of decoding is surpassed. Later, children will be able to use reading to acquire information, this is the stage of *reading for learning the new*, which matches with Grades 4-8, Ages 8-14, according to formal education. Finally, stages four and five: improve the reading to aspects as *multiple viewpoints* and *construction and reconstruction* of the meaning, and correspond to adult life and independent reading.

The importance of quoting this theory is related to the role that it can play in learning. For example, [Goswami & Bryant \(1990\)](#) underline the importance of changes in developmental reading:

It is not just a matter ... of saying that children of seven can now read a lot of words which were too difficult for them a year ago. We need to know if the seven year old has acquired some underlying skill which makes it possible for him or her to read the new words. 'Underlying' is the important word here. Theories about developmental changes have to explain the underlying nature of these changes.(141)

This idea of *change* and variability was already introduced together with the idea of the reader as creator of meaning. Now, besides the differences from reader to reader, there is also an inner change across learning process. Since the object of this research will be related to the first stages of reading development, this is an idea that will be present during the entire exposition.

Secondly, there is another assumption generally accepted by present research, it is related to the association between oral and written comprehension. Oral communication is natural in societies, the essential knowledge to develop linguistic communication seems to be part of our genetic heritage (see [Chomsky, 2001](#)). On the contrary, to use graphical marks to represent language, to read and write, are skills that must be acquired by training. However, there is a relation between both ways of using language: a good understanding of the sounds of a language, called *phonological awareness*. This is related to a faster and more efficient learning of writing language.

A mayor reference pertaining to this subject is the paper of [Bradley & Bryant \(1983\)](#) *Categorizing sounds and learning to read: a causal connection*. Its main point is that the experience reported, proves that phonological awareness plays a role as a predictor of success in learning to read. That was a large scale study involving training processes with children and longitudinal analysis of the results. They concluded that “The awareness of rhyme and alliteration which children acquire before they go to school, possibly as a result of their experiences at home, has a powerful influence on their eventual success in learning to read and to spell” (p. 420). Moreover, the researchers stated that “there were high correlations between the initial sound categorization scores and the children’s reading and spelling over 3 year later” (page 419). This has become a recurrent reference when estimating the importance of phonological awareness not only in beginning reading, but also, in later stages of development.

The importance of phonological awareness is related to the *alphabetic principle*. This principle plays a central role in most modern languages that use conventional representations of sounds to construct *words* and then graphical messages:

Word identification or word recognition constitutes the foundation of the reading process. Word recognition implies, among other things, that children understand the principle of the alphabet or, in others words, see that the sounds of a spoken word correspond to the letters of a written word. Every letter of the alphabet represents, in principle, a speech sound with a meaningful distinction. Word recognition implies at the level of early literacy that children can transpose the letters of a word into sounds (the grapheme-phoneme) association), connect the sounds to a spoken word; and assign a meaning to this word. ([Aarnoutse, Leeuwe, & Verhoeven, 2005](#), pp. 254–255)

1.2. Premises about reading learning

As this quotation underlines, there is a direct connection between sounds, alphabets, graphemes, words, and reading comprehension. These are all concepts that will be referenced during this dissertation.

Besides the recurrent presence of both premises in current definition of reading learning, it is also possible to apply the hypothesis of developmental stages to the ability of making use of sounds in reading. As (Adams, 1990) proposes, this awareness can evolve through time too. The researcher identified five levels: awareness of the sounds of words, ability to focus attention on the component of the sounds, familiarity with the syllable concept, ability to analyze word's phonemes, ability to manipulate phonemes.

This last proposition only gives an example of the vast possibilities of interpretation and application of these premises. These two propositions about learning, together with the two, more general, proposals about reading are the main concept of current research. But, far from giving clues about what reading is, they are only the entrance to the density of this subject.

1.3 Global purposes

These ideas will be present in this research as guiding concepts and as part of the goals and proposals. The theme of this dissertation is reading, that is why it started with this short exposition. However, the subject will be a very specific aspect of the universe of reading. In section 3.4.4.c the research questions and objectives will be presented, but before that, the element that will be part of the study will be deeply described.

There are two element that, along with reading, form the fundamental pillars that support this research. In first place, a precise component of reading was identified as an interesting subject: language, the *linguistic code*, even if it is quite obvious that reading depends on language acquisition, the many facets that are present in this connection are not as obvious. Only to introduce the problematic, the complexity of the relation between reading and phonology can be mentioned. The relation between reading and language will be the subject of chapter 2, where this and other issues will be referenced.

However, the aim of this research is not only theoretical, to be able to propose hypotheses and answer them, a third pillar is necessary, that is, an empirical reference that allows experimenting, proving or refusing the research questions. This basis is PIRLS, the *Progress in International Reading Literacy Study*, a study conducted by the International Association for the Evaluation of Educational Achievement, intended to measure children's reading achievement. Chapter 3, will describe this study and explain why and how it will be used as a source of data in relation to the research problems. Then, part II will be devoted to development and application of experimental tests to investigate the hypotheses, making use of statistical procedures.

In summary, this research is about a specific aspect of reading learning, understanding it as a communication process: the linguistic code. It will be studied in relation to reading comprehension measured by the PIRLS assessment in terms of reading achievement. Many factors can vary during reading, be more or less present or even totally absent, but this process will always be accomplishing through the use of language. The guiding statement of this research is that language is the main source of reading. By searching to understand how language and reading interact, this study aims to touch on the core of this subject.

1.3. Global purposes

But, the goal is not to give any mayor answers, it is simply to study a particular aspect of this relation. This work searches, in first place, to describe the relation of languages and reading. Secondly, from this theoretical framework, to deduce some research questions, and finally, from this starting point, to implement experiments to test the relation of language and reading achievement; without forgetting the *context* that enclose all reading experience.

Part I

Theoretical Framework

Chapter 2

Describing Languages

The first aim of this exposition is to explain why language is considered as an interesting component of the process of reading. To accomplish this task, the relation between reading and language will be deeply studied. A main concern is to link the characteristic of language with the notions about reading that were already presented.

The main supposition that will guide the following pages is that it is not useless to question the role of language in reading, and particularly in a reading assessment like PIRLS. The reason is that, as reading, language can be described from more than one point of view. Consequently, because depending on a chosen point of view, different theoretical approaches and evaluation procedures can determine the way in which reading is tested.

Following the discussion in the previous chapter, two approaches of the relation between language and reading will be discussed. First, a *cultural* approach, that implies to take into account the context and the reception process in this relation. In second place, a *linguistic* approach will be discussed. This is a more abstract approach, that is, isolated from context, but that establish a procedure to characterize the relation between reading and language starting from the structural properties of languages.

With the characterization of these approaches, different concepts will imply different perspectives in a research procedure. If language is defined not as an isolated phenomenon but in interrelation with other factors, the significance given to them will also change. This is the reason why the next step after the definition and de-

scription of the relation between languages and reading will be the development of classifications able to be included as variables in a modelling procedure. However, to accomplish this task a deeper analysis of the rest of the aspects concerned by this problematic should be clarified first. That will be the subject of the other chapters of this theoretical framework.

2.1 Ethnographic description

2.1.1 Culture and History in Languages Evolution

The defined goal of this subsection is to describe languages and their relations from a sociological and cultural point of view, that is, underlying the relevance of context. Starting from that definition, a first proposal to classify languages will follow. The first question that must be answered to get there is: how are languages related from the point of view of society and culture? The key to the answer are historiography and philology: to look at the evolution of languages, how they are born, expand and, sometimes, disappear, along with the societies and cultures that created them.

Historical linguistic is a well developed science; nowadays there is copious information about languages of the world, particularly concerning their properties and their evolution. Moreover, the origins of some of these languages have been hypothesized, getting to recreate disappeared languages as Indo-European. In this context:

A high proportion of lexico-phonetic correspondences is the criterion used by traditional comparative philology to define the language family – members of which, it is assumed, have developed from one and the same language spoken by a single language community at some time in the past. (Posner, 1996, p. 71)

However, for our research, a first problem that will be encountered in this definition is about priorities: if we are pursuing a cultural approach, are linguistic characteristics the best criteria to establish relations among languages? We will see that there are languages very close to each other, in lexicon, phonetic or other linguistic aspects, but whose speakers are incapable of understanding each other; on the other hand, there are languages having no common ancestors but sharing a geographical space or a common cultural history, as in colonial territories. So, if we commit us to define the relation of languages from the point of view of philology, we will put in the same category languages that do not share culture. Or, if we use a *cultural only* criteria, we will link up languages with no common philological roots.

Since this section of our research is guided by a more cultural than technical point of view, a simple classification cannot be done by following criteria already developed. To reach this goal, we will describe languages in the following paragraphs, putting a particular emphasis on their relations and cultural resemblances. Obviously it is not possible attempting to describe even a minimal part of the 6,909 living languages of the world (Lewis, 2009a). Since the empirical chapters of this research will be focused on languages present in one or both versions of PIRLS assessments, this seems to be the best option to work with a manageable and describable sample. Even if it is only in chapter 4.1 that these languages will be defined.

The notion of *linguistic family* (already quoted) is the axis that will allow us to organize this description. Consequently, in this section, *families* more than isolated languages will be illustrated. A family is a group of languages that are related because they descent from a common ancestor, an original language. Through time, depending in economical, social, religious and (or) political factors, they can evolve into different languages and spread through different geographical areas.

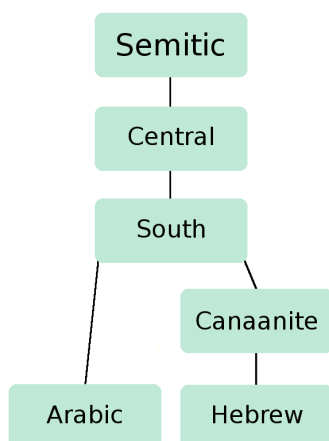
Considering both versions of PIRLS, a total of ten families take part of the sample, with a large presence of languages coming from the Indo-European family. In many other cases there is only one or two languages coming from a specific family, however, this is not an inadequacy of the sample, it corresponds to the actual situation of many regions of the world, where there has been only a small group of societies that have imposed their languages to weaker groups. On the other hand, these few survivors of certain families can also be the withstanders of an external influence as in the case of Basque in Iberia or Georgian in the region of the Slavic influence. Consequently, this lack of balance among families is not a failure but a property of real state of languages, specifically in regions of European or North-American influence.

In the next paragraphs we will mention the families that will constitute our sample and describe their most remarkable characteristics. It must be mentioned that what follows is based on SIL research along with ISO-639 standards and online encyclopedias as *Britannica* and *Wikipedia* to assure the most up-to-date information.

2.1.2 Linguistic Families in PIRLS assessments

2.1.2.a Afro-Asiatic Family

Figure 2.1: Afro-Asiatic: Semitic Branch



There are approximately 374 Afro-Asiatic languages, divided in six documented branches: Berber, Chadic, Cushitic, Egyptian, Omotic and Semitic. However, many of the living languages are spoken in restricted areas of North Africa, the Horn of Africa, and South-west Asia. From these branches, *Semitic* has a prominent place due to its international presence: “Originally limited to the area east of the Mediterranean Sea, the Semitic languages and civilizations spread into North Africa, southern Europe and the Horn of Africa” (Hetzron, 1990, p.160). The key branch, is the *Central Semitic*, from which, *South-Central Semitic* is the direct predecessor of Arabic (along with its 35 living variations) and Canaanite, the predecessor of Hebrew and Samaritan. Some characteristic of Semitic were the existence of only six vowels: short and long *a*, *i* and *u*, the occurrence of double consonants (geminated), and, in morphology, the “root and pattern” principle and the existence of tree number markers: simple, dual and plural (this feature still exist in Arabic, and less often in Hebrew). In relation to the proximity of those languages, the fundamental question for a comparative analysis is if the languages, coming from this same root, are similar from one point of view or another (morphology, phonology, historical development, cultural values, etc.), in this case, it is important to underline what Hetzron (1990) points out:

For the comparative linguist, the Semitic languages exhibit a great

deal of similarity. The family is much more uniform than, say, Indo-European. Yet, from a practical point of view, these languages are very different, there being no mutual comprehensibility even between the close relatives. (p.160)

For instance, from a purely linguistic point of view it can be said that there are structural correspondences among the languages, but from the point of view of culture, and from the point of view of the speakers of these languages, there is not such familiarity.

2.1.2.b Altaic Family

The Altaic family is spread from north Asia to Eastern Europe, and it is particularly present in a wide line along central Asia. Three major languages historically considered as Altaic are Turkic, Mongolic, and Tungusic. Recently Korean and Japanese have also been considered in this family. However, the definition of this family has been full of controversies, and its actual structure has been established only in recent research (Blažek, 2006).

In fact, the existence of the hypothetical *proto-altaic* was questioned by scholars arguing that there is more a resemblance due to interactions than due to a common ancestor. Some of the shared features of Altaic languages are also commonly present in all kinds of languages. Currently, the accepted features considered as Altaic are: an *agglutinating morphology* (frequent use of affixes), the *SOV word order* (subject-object-verb) and the use of *postpositions* (instead of prepositions). Another important distinction of Altaic is their difference with the rest of the languages present in the region: “The Altaic languages differ from the neighbouring languages of East Asia in two important respects. They typically lack honorific language, and there is no significant difference between the speech of men and women. Furthermore, gender distinctions are absent” (Britannica, 2010).

In our sample, Turkish is the only language representing this family, that is why, from the point of view of culture and historical resemblance it is isolated. However, it is a very interesting case because of its phonological properties, which will be discussed in chapter 4.

2.1. Ethnographic description

2.1.2.c Austronesian

These are the native languages of Southeast Asia and the Pacific Islands. Because of this geographical distribution, many of the 1257 Austronesian languages are spoken in isolated islands and / or little communities. Due to this wide spread and the great number of living languages coming from Austronesian, it is difficult to notice familiarity. However, there are common characteristics; a tendency to simplicity in phonemic and morphology, the common use of reduplication to create new words and CV syllables structure.

Two languages of this family are present in the sample: Indonesian and Maori. They are not quite related since they come from two different sub-groups of Malayo-Polynesian, the principal branch of Austronesian. Maori belongs to the Oceanic group, and it is a native language of New Zealand. The Maori alphabet, counts only with 20 letters, and use Latin scripts to be represented, since there is no evidence of an independent graphical system, prior to the arrival of settlers. Indonesian has a very different status, since it is a standardized dialect, established since Indonesian independence. Its origin is Malay, a group spread across Malaysia and Indonesia, derived from Nuclear Malayo-Polynesian branch of Austronesian. This language is phonetically consistent in its writing system, which means that it is close to direct correspondence between graphemes and phonemes.

2.1.2.d Indo-european Family

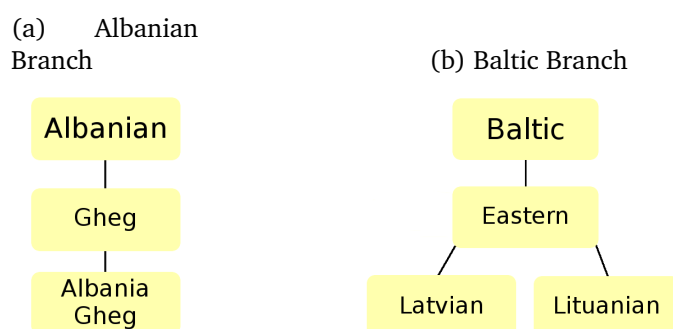
This is the most important historical family, because it encloses some of the world's major languages, with three billion native speakers (Lewis, 2009a); today the greatest part of the world use a language originated from its numerous subdivisions. However, this does not mean that the speakers can understand each other, or that all these languages are similar from the point of view of linguistic structure. It is a:

Family of languages which by about 1000 BC were spoken over a large part of Europe and parts of southwestern and southern Asia. Indo-European is essentially a geographical term: it refers to the easternmost (India) and westernmost (Europe) expansion of the family at the time it was proven to be a linguistic group". (Baldik, 1990, p.21)

As Baldik says, Indo—European is more a regional term than a linguistic link, even if the linguistic conditions to identify a family are present (shared vocabulary and evolutionary features).

Because of this great diversity and the importance of this family in the world today, its subdivisions are almost as important as if they were independent families. The first line of branches of Indo-European counts 11 sub-families, two are extinct: Anatolian and Tocharian, and seven of the living are present in our sample. Celtic is not present in the sample even when Gaelic is currently used in Scotland as a language of teaching, the PIRLS' tests and questionnaires were conducted solely in English. Armenian, like Albanian, is a very restricted family made only for one living language. It is a language very open to foreign influences and clearly related to other languages: “It shows considerable influence from Greek, Arabic, Syriac and especially Persian” (Baldik, 1990, p.30). Regretfully, Armenian is not present in our sample.

Figure 2.2: Indo-European: Albanian and Baltic Branches



Albanian. Even when it is documented since XV century, its connections with Indo-European, and with the rest of the languages of the family is not clearly established. However, it is classified today as an independent branch of Indo—European. It is spoken in areas of the Balkans, particularly in Albania and Kosovo. In the sample is at Macedonian schools that Albanian, particularly its *Gheg* variation is spoken.

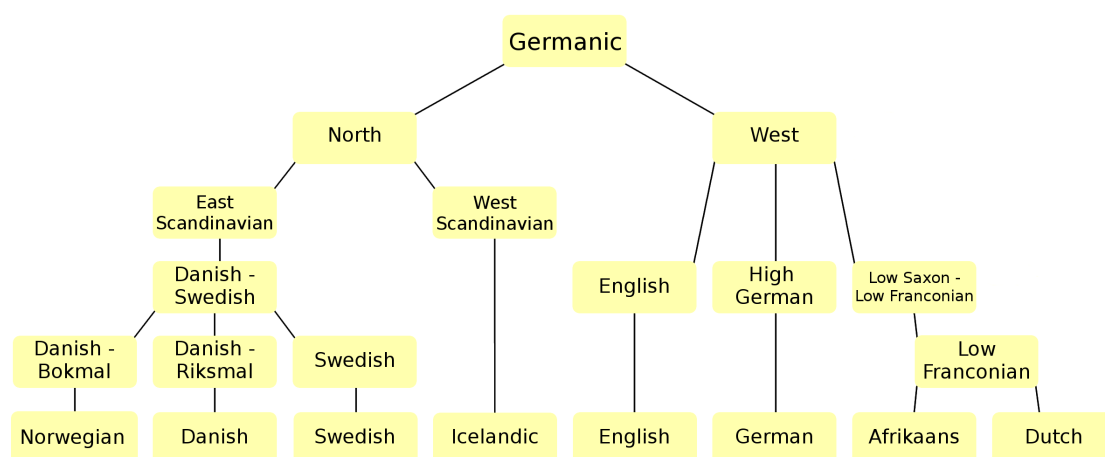
This dialect of Albanian is one of the two which made of this a *macrolanguage*, a “multiple, closely related individual languages that are deemed in some usage contexts to be a single language” (Lewis, 2009b). It is important to remember this concept because it will be present in future definitions. Regarding Albanian,

2.1. Ethnographic description

more details about its characteristic as individual language will be presented in section 4.3.

Baltic. It is often considered as a unique group along with Slavic. What sets it apart is the high degree of conservatism of its languages, since it has preserved several archaic features; this makes of it an interesting source for the study of Indo-European. In contrast, in relation to its use in today's world, only two languages derived from Baltic are alive and in use: Latvian and Lithuanian, they count with 5 million speakers, mainly in the area around east and southeast of the Baltic Sea. Despite their common features and their common conservatism Lithuanian and Latvian languages are not mutually comprehensible and their vocabularies differ.

Figure 2.3: Indo-European: Germanic Branch



Germanic. It is one of the most active Indo-European branches today, particularly through English and German, but it also counts a dozen of other active languages. It is spoken by 200 million people in Europe while English alone is spoken by one billion people around the world.

Germanic is a well documented branch with many shared features that identified their languages as derived from a common proto-germanic origin. Germanic has a specific verbal system and unique classes of verbs (Germanic weak verbs) different from other Indo-European branches, the branch has a distinctive type of adjectives (strong and weak), and a shared etymology that do not seem to be of Indo-European source but which is present in all Germanic languages. These are

just some examples of common distinguishing features. But despite of this clear familiarity, there is less mutual comprehension among the related languages than in other Indo—European branches as Italic or Slavic.

Hellenic. Also known as the Greek family, it gathers a group of languages spoken in Greece, Cyprus, and the Black Sea. The major language of them being Greek, originated From the Attic sub-branch of Hellenic, the variant spoken in Attica region. It is important to distinguish Ancient Greek from Modern Greek, the former is one of the several dialects historically used in the area, and its modern derivation is also one of many variations used currently. Regarding the features of Modern Greek, the language present in PIRLS sample, we will present a more detailed description in section 4.3. But it must be underlined the direct approach of it sound-graphic representation, that made of this one of most transparent languages of the world.

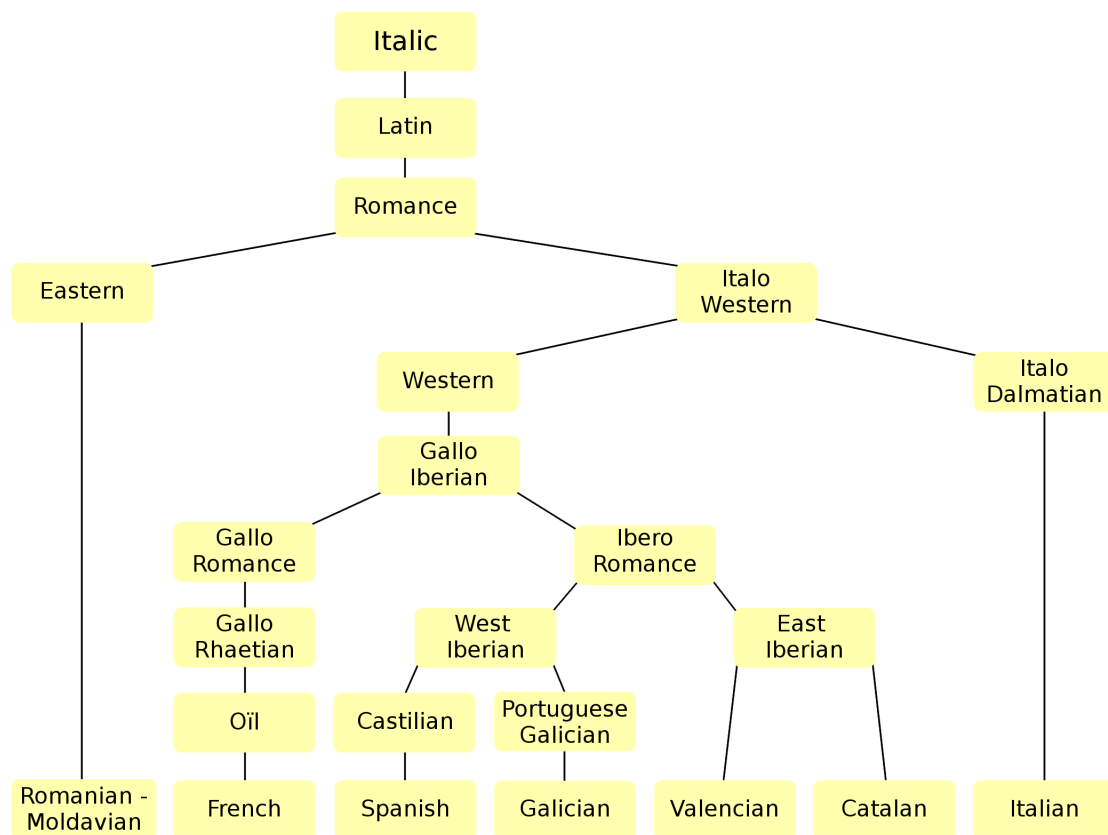
Indo-Iranian. It is the largest sub-branch of Indo-European; today it is spoken by more than one billion people in the world. Geographically, it is located in west, south and central Asia. Two major branches of this family are Indo-Aryan (South Asia), from which derived languages as Sanskrit (one of the Indo-European languages having the most ancient written texts), Romani and Nepali; and Iranian (West and Central Asia), from which derived languages as Armenian, Persian and Farsi. The latter is the only language of this line in the sample.

Italic. This is the antecedent of all called *Roman Languages*, spoken, solely in Europe, by more than 200 million people today. Among the languages of this branch, the most important is Latin, originally spoken only in central Italic Peninsula (Ancient Rome), it was spread to north, east and west Europe through Roman empire expansion.

Contemporaneous with the period of the Roman Empire, a linguistic phenomenon affected the language, a growing gap started to be established between the official language, spoken by the administration and literate men, and the everyday and popular language. Therefore, there were two sociolinguistic registers coexisting during the last days of Roman Republic and during the Empire period. Writers, poets and philosophers spoke and wrote *in good Latin*, later called *classical Latin*,

2.1. Ethnographic description

Figure 2.4: Indo-European: Italic Branch



while the common people, the *vulgus*, spoke (rarely wrote) *vulgar Latin*. This version, not regulated by central powers, was in direct contact with the vernacular languages and specific characteristics of the local populations of the conquered domains. Later, along with the decline of the empire and the diminution of centralism, the dialects spoken in each region were diversified, resulting in different languages, so-called Romance languages, whose first trace are dated about the V and VI centuries.

Table 2.1: The evolution of Romance Languages, the role of non linguistic determinants

Among the contemporaneous survivors of Romance Languages, there are some of the major languages of the world, like French, Italian, Portuguese, Romanian, and Spanish. In all cases the path from Latin to the actual state of languages has been determined by cultural, geographical or social changes that have left their mark on the history of languages.

Linguistically, in contemporaneous Romance Languages, the main link is the shared vocabulary, along with some similar morphological characteristics like verb person markers, the use of noun gender, and their verbal inflectional system (see [Posner, 1996](#), Part I: The Similarities).

In romances, several non linguistic causes participate in the origin of the diversification from Vulgar Latin: in the first place, the obvious geographical distances. Some languages are only distributed in restricted areas like the Pyrenees or the Mediterranean islands. Nevertheless, already in Vulgar Latin there were some general distinctions from Latin: like simplifications of nouns and verbs, a tendency to use a more emphatic and expressive vocabulary than Classical and, finally, a positive attitude towards the inclusion of foreign words. As we can see along with phonetic or syntactic changes, what counts more in the origins of Romance Languages is a different *attitude* in relation to language (see [Lathrop, 1984](#)).

The different duration of the Roman influence in the region was a source of change too. Romania, for example, was the last territory to be conquered by the empire, in 106 AC, very different from those of the conquest of the Iberian Peninsula (218–19 BC). This short period of Roman permanence in Dacia is commonly associated with a tendency to conservatism in its evolution. In contrast, the Romance of Italic Peninsula, due to its geographical situation in the Empire's heart and to longest exposition to Roman influence, is the most innovative of Romance Languages.

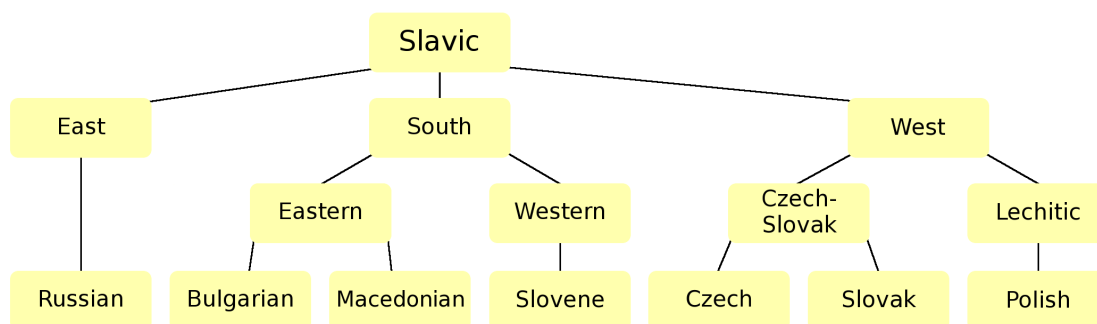
Another cause of romanian diversification was the influence of *substrata* of vernacular languages, among them, the best known case is the influence of Franc, a Germanic language, in the north Gaul provinces. In these cases, Latin was mixed with vernacular influences, but it remained the predominant source of the new language constitution. Influences received by languages after their constitution (*superstrata*) have also existed, as in the case of Slave in Romanian (10% to 15% words)

Finally, to emphasize the importance of culture, we will like to mention the case of diminutives and simplifications. The Romans: soldiers, workers, farmers, and all non literate people preferred to use diminutives instead of the original words, like *auricula* instead of *auris*. Moreover, an easier pronunciation of complex sounds was preferred, and that was the source of new phonetic phenomena: like the syncopation of none accentuate diphthongs: *speculum* > *speclum*; *angulus* > *anglus*; *oculus* > *oclus*; and also simplification of consonant groups: *ns* > *s* (*ansa* > *asa*), *ps* > *ss* (*ipse* > *isse*), *nct* > *nt* (*sanctum* > *santu*) (see [Probus, s. III](#); [Lapesa, 1980](#); [Lathrop, 1984](#); [Meireles & Barbosa, 2008](#))

2.1. Ethnographic description

Slavic. It is the ancestor of languages like Russian, spoken by more than 300 million people today, Ukrainian and Polish (both spoken by more than 40 millions) “In phonological and morphological structure the Slavonic languages are very close to one another, more so than the Romance languages” (Comrie, 1990).

Figure 2.5: Indo-European: Slavic Branch



2.1.2.e Sino-Tibetan

This family includes all forms of Chinese. Variations are usual and accepted as part of the main language, as a result of the extended territory over which this language is used and its 1.3 billion speakers worldwide. Moreover, Chinese is defined as a *macro-language*, this means that it can be divided in several specific variants and dialects (14 principal), but, eventually, their speakers can get to understand each other with no need of a formal or extensive training process. Two Chinese areas are present in PIRLS sample, the first is Taipei North County in Taiwan, where the instruction follows a *standard Chinese* derived from Mandarin. The second area is Hong-Kong Island where *modern standard Chinese* is used during reading learning, even if *Cantonese* variation is more current in everyday life (but it is not a written language). However, the differences among them are not like those of two different languages, and all share a common written system. If we add to this consideration the fact that in our sample, the readers are just learning to read in this language, it becomes unmeaning to distinguish both variations as different languages.

2.1.2.f Uralic

Uralic proto-language is believed to be located somewhere around the Uralic mountains. At present times its derived languages are spoken in a wide region around this area. It has at least seven sub-branches (like Samoyed or Finnic) from which Hungarian, the only Uralic language present in the sample, is a direct descendent of the protolanguage. Considering the number of speakers, Hungarian is the most widespread Uralic language, followed only by Finnish and Estonian.

Some common characteristics of Uralic languages are: suffixes agglutination, marking of grammatical cases with agglutinative suffixes; the absence of a verb to express the concept of “to have”, which is replaced with syntactic structures; palatalization of consonants expressing variation of meanings; and first syllable stressing preference. More features characterizing Hungarian, will be described in section 4.3, particularly in relation to its phonological representation.

2.1.2.g Other Isolated Languages

There are other languages in the sample, having a very reduced presence, the first is Basque which does not belong to any family (see 4.1.2.b). The second is Georgian belonging to the not very vast Kartvelian family. An important number of indigenous languages of South Africa is also present in the sample, even if they play a minor role there will be described in section 4.1.2.a.

It must be mentioned that all those classifications are theoretical agreements, consequently there can be different versions of them. For example, some linguists consider Armenia as related to Greek, others distinguish four branches of Indo-Iranian instead of two. Our choice is to stay with the simpler explanation, since the goal of this exposition is to describe clearly the linguistic context of a particular group of languages and not to propose any new hypothesis about languages evolution. It is also the reason why we use references from encyclopaedias, which will not be the case in the rest of our research where more specialized literature is needed.

Now, the importance of culture in language evolution has been proved, and we have made a description detailed enough to be able to distinguish the linguistic families present in the sample, and to infer their hypothetical relevance in determining reading achievement. But, to actually create a variable representing

2.1. Ethnographic description

linguistic families, other issues must be described first, like a detailed characterization of the sample that we are talking about, along with a description of the experiment in which this variable will be taken into account. Consequently, more concepts will be introduced before reaching the point of modelling and variables creation. It is important to mention that the previous paragraphs will have a direct prolongation in chapter 4, that will be dedicated to the development of linguistic variables.

2.2 Phonological description

2.2.1 General notions about psycholinguistic and phonology

The researches about reading made in comparing different languages have contributed in a very important way to the improvement of the theoretical models and the better comprehension of the reading process. To underline a notion of language as a system with a cognitive purpose, correspond to a point of view that can be called psychological or psycholinguistic. One of the premises of the psychological studies about reading is the possibility of explaining the cognitive process of reading through general models that can be validated in any time and in any context. Moreover, these models seek to be useful in explaining developmental reading as well as in explaining acquired reading or reading disorders. Evidently, this universalist ideal has not been reached. However, actual researches imply this principle as a starting point.

As it was mentioned in section 1.2, a key component of this reasoning is the role played by phonology in decoding writing. Now, from this perspective, the question to be answered in the following paragraphs is *what consequences bring the inclusion of language as determinant factor?* It was already stated that phonology is a key factor in developmental reading. Now, this concept will be connected with languages, through the study of the notion of orthography and orthographic depth. In this regard, since this point of view is common to both language and reading, these paragraphs are an extension of the introductory description in 1.2.

This point of view of language, and this universalistic perspective, can be understood as a renewed and up to day proposal connected with the synchronic paradigm enunciated by Saussure, who first defined language as a formal system of differential linguistic signs. Both theories, the foundational *Cours de Linguistique Générale* (1916), and the actual psycholinguistic, surpass the particularities of the living languages to center their attention in a universal model of language. It is evident how far are these proposals from those that underline the relevance of history and culture in the development of languages. What counts in Saussure's is the abstraction and formalization, this is why the analogy that is most used in the *Cours de Linguistique Générale* is that of a *system*. This idea is what Saussure seems to be expressing when he said "Au fond, tout est psychologique dans la langue, y compris ses manifestations matérielles et mécaniques, comme les changements de

2.2. Phonological description

sons” (Saussure, 1995, p.21). Clearly, the genevese professor, is not alluding to psychology or psycholinguistic as the science that we are familiar with nowadays, but to the abstract and intangible nature of the object. In addition, he is not denying the existence of language in the reality, but its historical manifestation, the diachronic facts, are not considered as a part of language itself but as a derivative product: “La langue est un système qui ne connaît que son ordre propre” (Saussure, 1995, p.43).

2.2.1.a Empirical research and Phonology

Now, these introductory remarks have led to what will be the core of this section: the finding of empirical research in language and its association with reading. It was already affirmed that the key factor through which this connection is established is *phonology*. This is the reason for underlining the importance of experimentation. From the point of view of phonology, most of the reasoning about reading has been done starting from an experimental disadvantage, that is, starting from a particular phonology: English language. Hence, experiences show that, when several languages are included in a reading experiment, the results put in evidence that English is not the most suitable language to be taken as a model. This is particularly important when considering developmental reading, since, as Seymour, Aro, & Erskine (2003) point out “the decoding process ... develops more slowly and less effectively in English than in other European languages” (p. 144). More precisely, again quoting the findings from Seymour (2005), English beginner readers are slower and around 20% less effective than children learning to read in other languages, (see 2.2.2.b). The causes and consequences of those differences will be examined later in this study, what is needed at this point of the exposition is to state that English is not an exemplary phonology. Moreover, it can be added that there is no such thing like an exemplary phonology. Moving forward from English, what comparative research shows is that languages are dissimilar; the concrete materialization of this diversity is what is going to be detailed in the following pages.

Now, from the linguistic point of view, what is the role of phonology in the system? And, which is its connection with reading? First of all, a basic notion must be introduced, the difference between oral and written language. Until now, the relation between phonology and reading was described in general terms without

indicating this particularity. Phonology is a dimension of speech, just like syntax and vocabulary, what phonology does is to describe the way sounds function in a particular encoding system (a language). However, reading is related to another aspect of language, the writing system. To be able to read written information, a person must be able to decode specific symbols employed in this particular form of communication: the *graphemes* system, furthermore, the system of rules that regulate this decoding process, which is the *orthography* of the language. Between *orthography* and *phonology* there are different degrees of resemblance.

2.2.1.b Written systems and the role of phonemes

An essential difference between oral and written communication is that to speak is a part of the biological nature of human being, is one of the innate conditions of humankind. Our organism is equipped with several physiological structures (air cavities, larynx, tongue, thoracic diaphragm, alveoli, etc.) capable of transforming aerodynamic energy into acoustic energy, to produce sounds that represent a language. Another sign of the universality of speech is that every society possesses a language, it is a property of human organization. It could be created from zero, if the community is isolated, or it can be derived, adapted or mixed with the languages of other communities, as described in section 2.1.2.g.

Ferrand (2007) states: “tout permet de penser que nous sommes programmés en tant qu’êtres humains pour devenir des « hommes de parole », mais c’est la culture qui pourra éventuellement faire de nous des « hommes de l’écrit »” (p. 10). Graphemes and written communication are part of cultural heritage, they are human inventions of particular societies, expressly created with the purpose of representing speech in a way that can be preserved in the course of time (mnemonic function) and moved through space. In other words, written communication has the goal of to expand the communicative range already created in oral speech (see Coulmas, 1989, pp.11–14). The same Coulmas (1989) is more radical in his appreciation of the role of writing systems:

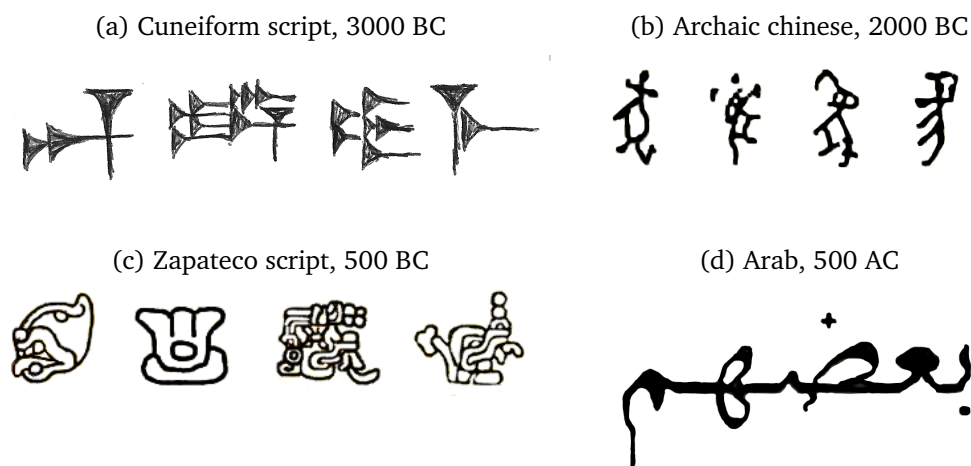
Writing is a cultural achievement rather than a universal property and as such is much less important than speech for our self-understanding. Anything that is an invention might as well not be there, and writing, unlike speech, falls into this category. (p. 3)

2.2. Phonological description

But, even if the importance of writing is not comparable to that of speech, when it comes to inquiry about reading, the characteristic of the writing system and its relation to speech become fundamental.

Besides its artificiality, what distinguishes writing systems from other codes like information signs, graphics, maps, and algebra, is that none of them requires another pre-existing knowledge to be understood, only to acquire their own rules. On the contrary, to understand and make use of a writing system, prior comprehension of the oral language is necessary ¹.

Figure 2.6: Examples of scripts along history



Another particularity is the amounts of signs that can be used, due to its dependency in human anatomy, the variety of phonemes (the smaller sounds that compose words) are limited. During XX century, linguistics as Roman Jakobson and Noam Chomsky, have contrasted languages to discover that there are around 12 or 30 distinctive features needed to characterize phonemes ([Britannica, 2009](#)), in other words, all phonemes of all languages can be characterized following these features, which are binary attributes (if a phoneme is glottal or not, syllabic, sonorant, etc). In contrast, the written signals, are eventually unlimited and each society could have their own script system, as we can appreciate in figure 2.6. Through history, the variety of signals invented by different societies is extremely rich.

¹eventually it is possible to learn only to read a written code when learning a secondary language but is not the usual way to learn the mother tongue.

Now, knowing that among the characteristics of writing systems there is artificiality, circumstantiality (it is not essential to communication), dependency on the pre-existent oral system, and the great arbitrariness in its graphical representation. From this last characteristic, it is possible to make out a typology of writing systems that will lead to recognize the origin and particularities of their relation to speech. The question about how speech is graphically represented has been historically answered through three main solutions, depending on which unity is taken as reference. Those different writing systems can be ordered in a line going from the more abstract representation of ideas to the more technical representation of the sounds of the languages.

Pictographs and Ideographs. In first place, there are writing systems that use images and concepts as units of representation: Pictographs are graphic signs with an illustrative resemblance to a physical object. More subjective, Ideographs are symbols that represent abstract ideas. There is not register of a writing system totally pictographic; civilizations have implemented combination of both forms of signals, already in incipient development of writing. However this kind of script do not trespass very specific functions in society as ritual, narrative or artistic functions².

However, this script do not fulfill one of the characteristic earlier mentioned about writing systems, since its express meaning through images, these scripts do not depends in previous knowledge of the language. In fact, contemporary pictographic signs as traffic signals, computational emoticons or statistical diagrams, all can be defined as pictorial scripts. The more ancient writing that is dependent in already existent language is the logographic system.

Logographes. In many cases, a logographic system is an evolution of a previous ideographic script (like ancient Chinese or Classic Maya). The fundamental difference with ideography is that a logography does not represent the meaning, a concept, but the significant, words or morphemes (the smallest meaningful unit of language). Moreover, this relation is arbitrary; the visual shape of the sign do not has a direct relation with its meaning. In consequence, to surpass this arbi-

²To do not extend this paragraph further, It is interesting to mention, as example, the very interesting case of writing in Mesoamerican cultures that was considered as a pictorial art just like their scribes were artists (see [Justeson, 1986](#)).

2.2. Phonological description

trariness, like [Frost \(2005\)](#) points out, a *mapping* becomes necessary, this, like any other combinatory or representational rule, is organized by the orthographic system, the more a language is arbitrary and dependent on conventions, the more orthography becomes fundamental. However, in a system purely logographic, the work of the orthography becomes very difficult, since the lexicon of a well developed language can easily reach hundreds of words. Consequently, if each one of those words is represented by a particular sign, this makes very difficult for the speakers to learn and use each graph.

Phonemic Systems. The final solution to the representational problem is entirely dependent in language itself; which is, to graphically represent the *sounds* of the language, instead of concepts or words. In other words, an *alphabet* is used to represent the *phonology* of the language. This is considered by researchers of writing to be the essential form of artificial communication:

The decisive step in the development of writing is *phonetization*: that is, the transition from pictorial icon to phonemic symbol. The ultimate consequence of phonetization is the alphabet, which is often praised as the finest and most highly developed writing system. ([Coulmas, 1989](#), p.33)

But, even the earliest graphic system like Egyptian hieroglyphs and Chinese logographs already has graphemes that represent phonemes. This implies that most of the writing systems depend, to some degree, in representations of sounds, even those that are not directly phonemic. As [Frost \(2005\)](#) states: “any human writing system cannot do without phonographic signs” (p. 273).

In consequence, this dependency implies also a major degree of complexity, as the subtlety of the system increases, the exigency of correctness and accuracy of the structure of rules increases too, this is what [Klima \(1972\)](#) remarks:

The history of writing shows a clear development to less and less arbitrariness: from the character to the syllabary to the alphabet. (...) The end of this development would logically be a system where characteristics of the form of the letters would be related in a systematic way to distinctive phonetic features of the individual sound segments. (p. 62–63)

In other words, following the historical evolution from ideographic to phonology, it is possible to envisage how an ideal alphabetic system ³ could be: it will lean hardly in the systems of rules that regulate the interactions:

Bien qu'universel, le principe phonographique se présente sous des formes qui varient avec les langues, les orthographes et les sociétés. La différence la plus importante concerne le degré de régularité. Comme la phonographie désigne pour l'essentiel un jeu de correspondances entre des unités phoniques et des unités graphiques, la régularité sera d'autant plus grande que le nombre respectif de ces unités sera proche. (Fayol & Jaffré, 2008, p. 86)

What the authors are trying to underline is the fundamental importance of *orthography* in an alphabetic system. This last is in charge of this “jeu de correspondances” that must be capable of represent the speech unequivocally minimizing arbitrariness and at the same time, preserving all its richness. How languages resolve this problem? And, what are the consequences to reading learning? This is what will be discussed in the following section.

2.2.2 Orthography and alphabetic systems

As Fayol & Jaffré (2008) state: “L'écriture propose, l'orthographe dispose”(p. 86). If we observe the period in which the learner cross from speech to reading comprehension, what is seems to be the key in developmental reading is how the writing system represents the oral system. This is where the *orthography* of the language becomes central. Orthography is specific to each human language, since it is an assemblage of conventions that indicates the correct way of using writing systems. Consequently a major subject is how to represent the phonological characteristic of each particular language; the answers are divers, almost divers as languages themselves. But there are some general notions to be referenced.

Considering that “the relation between spelling and phonology varies widely between orthographies” (Frost, 2005, p. 278). A fundamental concept, issue of

³The most commonly alphabetic system is the Latin alphabet, but is certainly not the only available, there are also the Gothic, Irish, Runic, Oghamic, Armenian, or Georgian alphabets, more or less related to Latin (see Kersaudy, 2001, chap. III)

2.2. Phonological description

comparative research has been developed: the notion of *orthographic depth*. As we mentioned before, in a perfect alphabetic system, the orthography will be totally phonemic. In other words, it will be an orthography where each phoneme will correspond with only one grapheme and vice versa. Nevertheless, any human language fit this ideal, all of them have irregularities, having graphemes that can represent several sounds, or phonemes that can be represented by different graphemes, and also complex ways of combine graphic signs, syllables having many possible structures, words spelled in similar forms but pronounce differently, several orthographies, etc.

The concept of orthographic depth offers a framework model to categorize languages in accord to this adequacy. In consequence, it is possible to identify what is called a *shallow* orthography which is closer of being phonemic (Spanish, Greek and Finnish among others), and also *deep* orthographies which, by one reason or another, are farther of being an ideal orthography.

Two main subjects are derived from this notion. First of all, the criteria to establish if the orthography is more or less transparent in relation to the phonology of the language. Secondly, in relation to our particular research, we can ask about the consequences of orthographic depth in learning to read. To answer the first question, some fundamental notions will be described in the next paragraphs, through their discussion in bibliographical references. A representative sample of the discussion and finds will be mentioned, however, since the problem is copious, all details cannot be mentioned, particular attention will be put on more up to date research. About the second problem, through this bibliographic discussion, the actual state of the question can be understood, since several experiment take reading as the subject of the study, because it is during reading development that the orthographic differences between languages become more visible. Moreover, since this is, in fact, a nuclear question about reading and languages, this second question will become later an objective of the experimental tests to be carried out.

2.2.2.a Early discussion about phonological differences among languages

Various hypotheses have been proposed to explain orthographic depth, a major line in the Anglophone world, comes from the publication of the Chomsky and Halle's theory of sound structure: *The Sound Pattern of English* (Chomsky & Halle, 1968). In describing the general properties of English sound structure, the book accomplish the improvement of the inventory of segmental features of English phonemes (that was mentioned in section 2.2.1.b), during the reasoning, one of the arguments is that this orthography is complex because it reflexes the deep structure of English words. To surpass it, the generative method can be employed to corroborate that is possible to go from pure phonology of a word to orthography in a series of transformational steps.

Even if the theoretical issues represent a major advance in phonology, critics have proved that the relationships between phonology and orthography in English are far away from this ideal. One of the first critical studies that develop this concept is the one from Edward S. Klima (1972). In his paper, the linguist analyzed the relation between English phonology and orthography in comparing it with other languages like Russian or German. He did not disagree with the idea that orthography reflex phonology, but recognized that there are different ways in which such orthographies can solve the distance between linguistic units and their orthographic representation (not a unique way as Chomsky and Halle have implied). As a result, he concluded that: "some real orthographies do often ... reflect more nearly the underlying lexical representation of a word than its sound form when the two diverge" (p. 72). Subsequently, terms like *deep-structure*, *opacity* and *transparency* where used to describe this distance, which seems particularly long in the case of English.

Even if it is not a comparative experiment, in this argumentation, the problems that will be the subject of such experiments are already announced. This problem is the diversity of orthographies, that is expressed making use of the extended metaphor of transparency. But, beyond rhetoric, it is necessary to answer this question: What were the criteria used by Klima to determine the depth of a language?

The criteria followed to determine the relation between orthography and phonology was that of the properties of an *optimal orthography* "in which no phonetic variation is indicated orthographically where it is predictable by general phono-

2.2. Phonological description

logical rule” (p. 61), there are four factors of such orthography: minimal arbitrariness (in the relationship between orthography and linguistic units), minimal redundancy (economic performance), maximal expressiveness (minimizing ambiguities) and a standardized spelling (to each unit, there should be only one spelling and no more). This way, the researcher accomplish to develop a theoretical model to establish orthographic depth, that comes from an abstract reasoning, even if it was corroborated by developing some examples it cannot be said that there was an actual experimental development.

As we mentioned before, this kind of analysis respond to the criteria to establish orthographic depth. The importance of mention this characterization is that it allows a continuous classification of languages in accord with these properties. Starting from the orthography which is closer to the optimal until the farthest. Since the possibility of developing a classification is a goal of this research, that comparability will be emphasized.

Another interesting paper to reference in one wrote ten years later by [Katz & Feldman \(1981\)](#): *Linguistic Coding in Word Recognition*. Comparing this paper with these of Klima, is evident the improvements that the concept of orthographic depth have made. Moreover, this was a practical research through empirical experimentation in comparing languages. Here, the introduction contained a key concept: the *visual code* as part of orthography.

[Katz & Feldman](#) were guided by two main questions that were very close to those that are here been inquired about: “What kinds of information are provided to readers by their orthography; how much of this potential information is actually used; and how does this selection vary with reading experience?” (p. 85). Consequently, in experimenting with reading tasks like naming and lexicon recognition, the researches confirmed the distance between a shallow orthography: the Serbo-Croatian ⁴, and a deep orthography: English.

As part of the theoretical framework, the concept of orthographic depth was complemented with another factor that can influence depth: *morphophonology* or word-level information. An orthography, like English contains information which is not coded in a phonological way but morphophonological, consequently, the decoding process will depend, not only in the access from orthography to sounds but also in the degree to which the orthography relay in this word-level informa-

⁴We use this denomination as authors did even if nowadays is being replaced by separate denominations for each ex-Yugoslavian regions and more "politically correct" alternatives.

tion. In other words, instead of profundity levels, as Klima suggested, Katz and Feldman proposed a dichotomy: a direct or indirect way of reflecting phonology. English would not be directly reflecting phonology but morphophonology. The conclusion was that “the kind of code that is used for lexical access depends on the kind of alphabetic orthography facing the reader. Specifically, it depends on how directly the orthography reflects the phonetic surface” (p. 85).

Regretfully, the difference between the code itself and the processing method were not clear enough, since it is said that there is word level information in English orthography, and, at the same time a decoding process that is morphophonological. Later studies of the same author and others will clarify this difference recognizing that English is a phonological orthography too (see [Frost, 2005](#), p. 272–275) and that is the processing that can be focused in a different way in phonemes or bigger units (see [Katz & Frost, 1992](#)).

Another important notion introduced to the discussion by these authors is that of the *change* of the decoding process between younger and older readers. The first will use more phonological information while the last will tend to use “nonphonological (e.g. word-specific) mechanisms” (p. 86). In other words, through time, the *style* of decoding will pass will become less phonetic and more morphological.

About those two proposals, even if they took distance from the definition of orthography made by Chomsky and Halle, their point of view was still reliant in generative theory. First of all because both of them were formalistic, that is, understanding language processing as a transformational procedure, having an internal logic: “the character of a code is described by the range of a transform” said Katz and Feldman (p. 85). However, the limits of these studies were not established by this point of view but, moreover, by the more general framework of traditional linguistics. Greater development in studying orthography and reading will arrive along with the incursion of psychology and cognitive scientists in this field.

The evolution of this line of thinking can be established in referencing another paper by Leonard Katz, this time in collaboration with R. Frost. In their paper of ([1992](#)), the researchers proposed an explicative hypothesis of the relation between reading and orthography, the *Orthographic depth hypothesis (ODH)*: “we can meaningfully address the question of whether or not the relative amount of assembled phonological coding decreases with increasing orthographic depth: the orthographic depth hypothesis” ([Katz & Frost, 1992](#), p. 74). A more recent def-

2.2. Phonological description

inition of the same ODH describe it as: “The hypothesis that the correspondence between spelling and phonology in different orthographies affects the processes of visual words recognition” (Snowling & Hulme, 2005b, p. 543). The central point of this proposal is the role played by visual as a decoding alternative to phonology, which was already announced in the referenced paper of 1982. Now, the improvement is the major importance gave to this aspect as a decoding strategy, instead than being focused in morphophonology as a linguistic property of particular orthographies. In other words, visual recognition is not in the code itself but a way of accessing to it.

Concerning ways of access, there are several models that search to explain the strategies used by readers to processing written language. Among them, and directly related to the notion of orthographic deep, there is the *dual route model*, that is also described as competing for being the principal processing strategy:

Assume that the processing system is capable of using either code: a dual-code model. Suppose that a phonological representation is the *default* code for any given word but processing of a word via its phonological code can be replaced by processing via its visual–orthographic representation when the word has been experienced by the reader a sufficient number of times: a words frequency criterion. ... The criterion word frequency that is required in order to replace processing by assembled phonology with processing by visual–orthographic representations should be a function of the cost involved—in part, the cost for assembling the phonological representation and using it to access the lexicon. A higher replacement criterion will obtain in a shallow orthography where assembled phonology is easy to generate than in a deeper orthography. (Katz & Frost, 1992, p. 81)

At this point, it is possible to specify the two major achievement of the discussion about orthography and phonology referenced until now. In first place there are two major criteria to answer the question about defining orthographic complexity: in one hand there is a structural criterion that Klima defined (arbitrariness, economy, expressiveness and standardized encoding), that we can describe as a way of judging the *functionality* of orthography. In the other hand, in the definition made by Katz and his colleges, there is a more purely linguistic way of establish

the transparency: how phonological a language is, depends in how visual can be the encoding.

This last state is connected with the second major achievement of these researches: through ODH *dual route* theory, which was conceived as a decoding hypothesis free of any particular orthography is now defined as depending in the phonetic properties of orthography in each specific language. In other words, the chosen route in dual route theory is not a question of simple strategic decision but an inherent property of the orthography of the language.

The importance of this discussion to understand the relation between reading and language is manifest. From both points of view, purely linguistic or focused in the cognitive processing of information, both are aware of the importance of orthographic properties in reading. The major achievement comes from Katz in whose work, through empirical experimentation, the advantage in reading processing for the shallow orthographies has been confirmed. However, we must point out that the reading described here respond to a very simple processing, in fact is more suitable to call it *decoding*. But even keeping this distinction, we can say that is confirmed (and so did later researches) that shallow orthographies are decoded faster and easily than deep orthographies, as [Snowling & Hulme \(2005b\)](#) remark: “because they support faster assembly of phonological codes from letter strings” (p. 269).

This discussion shows that the problem of visual versus phonology is a main topic. However at present, the orthographic depth appears as a key to go beyond this dichotomy, because deepness is an invariant characteristic of the orthography, definable and describable. This is why our concern will still be the orthography and the criteria to determine it. At the same time, this means that to define the role of whole-words will be not a major concern to this research, however, in the next section, we will see that upper-phonemic units still being an important key to understand orthographic complexity, particularly in opaque orthographies.

Consequently, it is necessary to still working on the previous question about the criteria to establish the degree of complexity of languages, because not all deepness is equal in causes and consequences. To do so, it will be discuss in the next paragraph some other researches about orthographic dept, that are more contemporary and that focus their work more accurately in comparative methodology.

2.2. Phonological description

2.2.2.b Contemporary discussion

Being the subject already identified as a valid problem, the research about differences in reading among orthographies has been increasing in quantity and quality in the last twenty years. There are more sophisticated experiment designs, a growing number of orthographies included in comparisons, along with more detailed information about the characteristic of languages. These improvements have helped to take into account more complex aspects of the subject. Going slowly away from the old English monopoly in research, it can be said, as [Snowling & Hulme \(2005b\)](#) said, that “we have moved closer to a universal theory of reading than we ever supposed would be the case” (p. 271). At least in this aspect of language, by unexpected ways, Saussure’s aim seems to still be searched.

Thus, bibliographical researches allow to affirm that *Orthographic depth hypothesis* is the actual explanation to the difference in reading achievement among orthographies. However it is necessary to deepen the understanding about it by referencing some experiences that have tested its explicability in comparing languages and also have proposed other solutions.

Cambridge professor Usha Goswami, has conducted several experiments, in comparing languages searching to define the role of linguistic units of different size in reading. In [Goswami, Gombert, & Barrera \(1998\)](#), a comparison among English, French and Spanish children (7–9) was made. The difference in reading tasks achievement was confirmed, showing advantages in reading in Spanish and disadvantages in English.

Moreover, in reading words and non-words English children showed facilities when the stimulus, monosyllables and bisyllables, shared rhymed onset or rime (beginning and ends of words) with a familiar word, French readers also used this resource of phonology resemblance but with reduced effect, in Spanish, the positive effects of rhyme were of considerably less importance. The conclusion is that: “Nontransparent languages may be more predictable in terms of spelling-sound correspondence at levels other than the phoneme” and that in English and to some extent in French “onsets and rimes function as units of print” (p. 21). That is why, through rimes analogy children of the deeper orthographies found an extra support in reading, on the other hand “The more transparent the orthographic system, the more analogy use will reflect the grapheme-phoneme code, and the easier and faster this code will be mastered by the novice” (p. 47). In other words,

readers of transparent orthographies found all the information that their need at the phoneme level, not being necessary to rely in more complex strategies.

A particularity of this study that must be remarked is that here the represents of Spanish language are from schools in Venezuela. This is a country with educational results considerably lower of those of France or England, homelands of the other children. Even considering these general differences, Venezuelan children get better reading results in correctness and speed as well. Without wanting to move forward to the next chapters of this works, an obvious question is what happened in later reading progress of those students to achieve scores that are so far away of other countries in international comparative tests.

Analyzing the conclusions, it is easy to connect the efforts of Goswami and his colleges with those of Katz, both searching to define units larger than the phonetic level to improve the understanding of reading in English. This tendency is more evident in a book published in 1990 in collaboration with Peter Bryant (whose contribution about phonological awareness was mentioned before in section 1.2). Both researchers share a concern about phonological units other than phonemes which they think could be the key in learning to read “There may well be different forms of this kind of awareness [phonological], because there are different ways in which words and syllables can be divided up into smaller units of sound” (Goswami & Bryant, 1990, p. 2).

Consequently with their previous researches, the proposal is that onset and rimes are intra-syllabic units of major importance in early reading. In fact they assume that these intra-syllabic units are the real subject of awareness since rhymes (sounds resemblance of onset and rimes) are naturally closer to the children experience before and during reading learning. Regretfully, a comparative viewpoint is absent of this reasoning, since by the information until here referenced, it is evident that this analysis reflexes the particularities of English as language of learning, and it can hardly be applied to understand learning in a transparent orthography where rhymes and phonemes have a different status, as the same Goswami proved in 1988. Other similar experiments can be referenced like Goswami, Ziegler, Dalton, & Schneider (2003), Goswami, Ziegler, & Richardson (2005) and Ziegler, Perry, Jacobs, & Braun (2001). All those researches, and many others, lead to a brand new proposal, looking at the problem from a broader perspective:

More recently it has been recognized that the question of whether small

2.2. Phonological description

units or large units are used first in reading acquisition may be misplaced. There appears to be evidence for the use of both types of units in children, depending on the nature of the reading task, the type of words being read, the teaching method being used, and the orthography under investigation. (Goswami et al., 2003, p. 236)

Goswami and Zeigler are the authors of this new proposal which they call *psycholinguistic grain size theory* (PGST) (Ziegler & Goswami, 2005, 2006): “the dramatic differences in reading accuracy and reading speed found across orthographies reflect fundamental differences in the nature of the phonological recoding and reading strategies that are developing in response to the orthography” (Ziegler & Goswami, 2006, p. 431).

In words of Frost (2006) this theory can be described as an improved and modern alternative to the Orthographic depth hypothesis. The divergence is that ODH recognize two routes in reading: the non—lexical path, which is preferred by those shallow orthographies where phonemes are sufficient to decode, and the lexical pathway in the case of less transparent orthographies. Now, what Ziegler and Goswami do is to emphasize and redefine this lexical route. The key concept is that beyond simple phonemes’ awareness, the principal factor in reading development is the grain size of linguistic units mostly used by the specific language. The way in which sounds are mapped to letter is defined as a determinant factor of how a child learns to read, or as Nergård-Nilssen (2006) explains: “because languages vary in phonological structure and the consistency with which the phonology is represented in the orthography, there will be developmental differences in the grain size of lexical representations and reading strategies across languages” (pp. 270–271). Going from ODH to PGST, a general notion of lexical representation becomes a very detailed description of several component of this lexical universe.

Remembering the previous questions that guide us in this work, it is pertinent to ask: does this improvement allow a better understanding of the reading difference across orthographies? In other words, can PGST be employed to establish a classification of languages?

To demonstrate empirically that there are differences in identifying units of different sizes, Zeigler and Goswami quote a series of studies about reading in several languages (English, German, Japanese, Spanish, Italian, etc.) that prove that the granularity differs in relation to the complexity of the language, they do not make

use of the term *transparency* but prefer to differentiate between consistent and inconsistent languages. However, from these very examples a doubt arises, it is *consistency* a better criteria to discriminate orthographic complexity?

It seems that grain size hypothesis is focuses in phonological and reading development but not in orthographic depth, being the disadvantage of deep orthographies a recognized fact and a starting point : “The data from all of these studies support the notion that grapheme–phoneme recoding skills are taking longer to develop in less transparent orthographies” (Ziegler & Goswami, 2005, p.11). Consequently, this hypothesis tries to explain the mechanisms of decoding an inconsistent orthography but did not explain its depth itself.

PGST explains why the process of reading in an inconsistent orthography is slower and more demanding: “beginning readers have to learn additional correspondences for large orthographic units, such as syllables, rimes or whole words. There are many more orthographic units to learn when the grain size is large” (Ziegler & Goswami, 2005, p. 19). The connection of this perspective and double route theory is remarkable, but just like them, and, as the same Ziegler and Goswami assert, those processing architectures “may in fact only develop for English ... giving the large number of studies of reading conducted in English” (p. 20). Regretfully, the majority of the paper is dedicated to considerations about English too . This is why the concept of consistency seems to be very functional in explaining complexity in this particular language but could not be as useful in explaining others orthographic circumstances.

It can be concluded that, as Durgunoglu (2006) remarks, PGST is successful in stating the need of a better comparative perspective in understanding reading across languages but it is not as successful in separating this perspective from the particularities of English as complex language. As Zeigler and Goswami remark, more systematic cross–language research and diversified experiments are needed to improve this proposal which is only a “first sketch” (p. 23).

A few descriptions of languages made by Ram Frost in 2005 can help to get a better understanding of the distinction between this two ways of categorize orthographies (consistence or transparency). According to Frost, the opacity of English would be determined not only by consistency, but also by a second factor: *regularity*: the recurrence of exceptions in the grapheme–phoneme conversion rules, more exceptions means more irregularity. On the other hand, consistency

2.2. Phonological description

is the “unique pronunciation of an orthographic body” (p.278), consequently, inconsistency is the difference in pronunciation of words that are spelled similarly. Assembling this two factors, in English there are many words that “can be regular but inconsistent, or irregular but consistent” (idem). Consequently, it is clear that those are two different sources of variation in English.

In addition, a very different situation is the case of Hebrew orthography, which is “different in character from that of English orthography” (p. 279), here the complexity is given by absence of graphemes representing vowels, which are omitted, on the contrary, a *pointed* writing, like those of the learning material for children, is transparent, this means that, as Frost indicates, “opaque spelling-to-sound connections arise simply from *missing* phonemic information” (idem).

A third case is that of French, here, while a grapheme (letter or letter clusters) is always pronounced in the same way, there are phonemes that can be represented graphically through several forms, e.g.: “The phoneme /ɛ̃/, [can be represented] by 'in' (*fin* [thin]), *ain* (*main* [hand]), or *ein* (*rein* [kidney])” (Jaffré & Fayol, 2006), the consequence is that “the mapping of phonology to spelling is opaque in French” (Frost, 2005), but not the mapping of spelling to phonology. Finally it can also be defined as another source of orthographic depth, the case of languages having several orthographies, like Korean (*Hangul* and *Hanza*) or Japanese (*Kanji* and *Kana*), in which the same spoken forms can be represented by two totally independent graphical systems. This comparison confirms that there are different sources and directions of complexity, that is why is not possible to depend only in the notion of consistency to discriminate orthographic distance from phonology.

Other effort in the same cross-linguistic line is that of Seymour, Aro, & Erskine (2003). The advantage of this study is a wider range of languages with different characteristics, due to cooperation with an international network of researchers from 16 European countries. The focus of research is a particular moment in early reading denominate *Foundation literacy* (see Seymour, 2005, pp. 306–307): “through assessments of letter knowledge, familiar word reading, and simple non-word reading” Seymour et al., p. 143.

The objective is to examine the language effects in developmental reading in European languages. Besides English (in Scotland), other 12 languages were included in the experiments: Finnish, Greek, Italian, Spanish, German, Norwegian, Icelandic, Portuguese, Dutch, Swedish, French, and Danish. To classify orthogra-

phies, Seymour and his colleagues make use of orthographic depth, and also a second factor: *Syllabic complexity*. From the previous discussion, it is possible to define this dimension as a grain of a size bigger than the phoneme and smaller than whole words, rimes or onsets. This complexity:

Refers principally to the distinction between the Romance languages, which have a predominance of open CV syllables with few initial or final consonant clusters (e.g. Italian, Spanish), and the Germanic languages, which have numerous closed CVC syllables and complex consonant clusters in both onset and coda position (e.g. German, Danish, English). (Seymour et al., 2003, p. 145)

Thus, this distinction is particularly suitable to the sample that is under research, but may not be equally useful if the sample was different (including Semitic or Asian languages). The classification of languages according to the two dimensions previously defined was graphically represented in figure 2.7.⁵

Figure 2.7: Hypothetical classification of participating languages relative to the dimensions of syllabic complexity (simple, complex) and orthographic depth (shallow to deep)

		Orthographic depth			
		Shallow		Deep	
Syllabic structure	Simple	Finnish	Greek Italian Spanish	Portuguese	French
	Complex		German Norwegian Icelandic	Dutch Swedish	Danish English

The researchers assert about this classification:

The expectation is that the difficulty of acquiring literacy will increase as one moves from simple to complex syllabic structures, and from shallow towards deep orthographies. Hence, if linguistic complexity affects the foundation phase of acquisition, it is hypothesized that the

⁵From (Seymour, Aro, & Erskine, 2003, p. 146) Copyright 2003 by the British Psychological Society

2.2. Phonological description

initial steps in reading will be traversed more rapidly in languages with simple syllabic structure than in languages with complex syllabic structure, and that acquisition will be slower in deeper orthographies than in shallow orthographies. (p. 146)

In all tasks, the general results confirms the advantage of transparent orthographies in speed and accuracy in reading: “From the beginnings of learning, the alphabetic decoding process develops more slowly and less efficiently in some languages than in others” (Seymour, 2005, p. 310). The result of familiar words reading is particularly eloquent:

In most European orthographies children read familiar words very accurately (>95% correct) and fluently (1.6 sec/item) before the end of the first school year. These levels are substantially lower in Portuguese, French, and Danish (approx 75% correct), and far lower in English (34% in grade 1, rising to 76% in grade 2). Syllable structure appeared not to have a damaging effect. Further, there was no significant relationship with age (Scottish data excluded). It seems that orthographic depth directly retards the rate at which a sight vocabulary is learned. (p. 310)

Besides of being an interesting result in terms of the quantity of languages described by the experiments, it also offers a final clue about the best way of classify languages in accord with their orthographies. This study confirms that deepness is the key factor, at the same time, it proves that syllabic complexity is not determinant in reading accuracy, since language of different complexity degree have similar results (e.g. Italian, Spanish, German and Norwegian).

These findings do not make explicit mention to the problem of decoding units' size, however, the distinction between simple and complex syllable structure is, in fact, an upper-phonemic unit: Its irrelevance in reading *accuracy* can be interpreted as a prove against the proposal that these units plays a role on it. The word *accuracy* is highlighted because it is about a particular reading task that this result was found, in other words, this do not deny that non-phonological units are a component of reading development, particularly in languages with complex structures, being this fact largely proved, as mentioned in this literature review.

Whereas, in concerning reading achievement, which is the interest of this research to measure, its explicative power seems to not be equally evident.

To conclude, it is clear that *orthographic depth* is a determinant factor in reading accuracy that allow to discriminate among orthographies and, consequentially, among languages. To be able to measure its role played in reading achievement, the next step will be to define concretely which languages have transparent or depth orthographies in our PIRLS sample, and, secondly, to develop an efficient way to turn this factor into a measurable variable. But, before that, two elements of the framework must be described to complete the theoretical review done until now. First, it is necessary to describe the survey that will be the source of data to the search experiments. Secondly, only after gathering all these theoretical elements it will be possible to clarify what is exactly our research proposal, hypothesis and objectives. These will be the subject of the next chapter.

Chapter 3

PIRLS Assessment and Reading Research

Reading acquisition has become a high priority subject, at schools, communities and internationally. As the subject of this research is the connection between language and reading, it is suitable to obtain data that comes from only one reading test translated into several languages. Two possibilities to obtain data were considered: it might be a national test from a country where several languages co-exist or an international test administered in several countries.

The advantage of choosing the first option is the possibility of equal educational policies, methodology, and evaluation. These languages of teaching are all members of the same educational system; moreover, the system shares the same cultural and social conditions. However, this is not always the case, in a nation, the coexistence of several languages can also mean local educational policies, as in countries such as Spain and Canada (see subsections [4.1.2.b](#) and [4.1.1.c](#)). Two principal inconveniences are exemplified by such countries.

Firstly, languages may come from the same root. In this case, they would not be as diverse as is suitable for this research. Secondly, to find linguistic diversity, that is, at least three or four languages well represented in a sample and not coming from the same root, one should search among countries with a colonial history, as this diversity is often a result of colonization processes. In this case, other problems arise such as the presence of connections between a particular language and social group or class, unequal distribution of languages among population, and the availability of data for the research (less available in developing countries).

African countries provide an interesting example to illuminate a situation in which there exists a very extensive linguistic diversity. Not only is there a coexistence of a colonial language along with several local languages, but there are also different extents of representation of the languages in the national educational systems. (e.a. see section 4.1.2.a). In addition, there are other circumstances that make it difficult to work with such countries, like the problem of availability of data, the connection between some languages and particular social groups, and the fact that in its actual state of development there are other influencing factors, mostly economic and social, that are particularly explicative of those countries' results (see [Pulleyblank, 1990](#)).

Contrarily, in regards to the second alternative: a reading test translated into several languages, the major issue of dealing with different educational contexts that will increase the importance of controlling these variables, an achievable objective.

On the international level there are several organizations working in reading research. Such as the OCDE program for International Student Assessment: PISA, the research of the Latin American Laboratory for the Assessment of Education Quality – LLECE and the UNESCO Institute for Lifelong Learning (previous Institute for Education).

This last organization was particularly important in the early beginnings of the internationalization of educational research. Formerly a German foundation, (by its institution in 1952) it became the research center of UNESCO with the mission of generating East-West cooperation in education. It was in this context, in 1958, when a group of scholars, educational psychologists, sociologists and psychometricians, intended to develop more systematic and quantitative international comparisons of educational systems. This was a response to the growing needs of internationalization of educational research and to the proliferation of studies founded in general notions and based on data-free assertions, “sweeping generalizations were being made about the relative merits of various national systems of education” ([Husén & Postlethwaite, 1996](#), p. 130). These were the origins of the International Association for the Evaluation of Educational Achievement (IEA), a non-profit, private association founded in Amsterdam (1959), its works is to carry out international comparative studies.

Since its first international study, conducted in 1959–62 and known as Pilot Twelve-Country Study ([Foshay, Thorndike, Hotyat, Pidgeon, & Walker, 1962](#)), the IEA has

been developing and improving educational research, and undertaking more extensive investigations of learning achievement. The principal goal of this research is to identify the factors having a positive effect in learning and achievement at school. One of this works is the *Progress in International Reading Literacy Study* (PIRLS), defined as, “a regular cycle of studies of children’s reading literacy and the factors associated with its acquisition in countries around the world” (Mullis, Kennedy, Martin, & Sainsbury, 2006, page 2). The target population for the study was:

The upper of the two adjacent grades with the most 9-year-olds. In most countries, this is the fourth grade. This population was chosen for PIRLS because it is an important transition point in children’s development as readers. Typically, at this point, students have learned how to read and are now reading to learn. (Campbell, Kelly, Mullis, Martin, & Sainsbury, 2001, p. 6)

3.1 Description of the study

PIRLS is the study in which, the data to test the hypothesis of this research will be taken. A detailed description and characterization will be provided previous to the data analysis. Before, since it is fundamental to the precision of this work, the reasons why it was chosen will be immediately clear.

First, IEA asserts that “systems of education represented units that were responsible for the education of young people within their boundaries” (Postlethwaite, 1995, p. 3). Consequently, their assessments provide numerous data from several different countries and several different languages. To assure comparability and the quality of the translations, important measures were taken. For example, multiple revision and contrasting of pre-test results (see section 3.3). Secondly, a point of interest in this particular assessment is the fact that PIRLS is a cycle. In other words, it offers the possibility of having data available, not only for one particular evaluation processes, but rather for several. In this particular case, two evaluations have been carried out and a third one is scheduled for 2011. This will allow comparisons and allow the statement of the persistence or modifications of observed behaviors in a phase of time. Thirdly, the age of the evaluated students in PIRLS, is satisfactory (around ten years), because the object of this study is the development of reading skills after the first stages of learning, period in which the development of cognitive strategies and processes become central. Finally, the definition about reading, as it will be described later, is in accord with the actual conceptions about reading, and it has, consequently, the necessary elements to do a study, not only of general achievement scores, but also of specific reading dimensions and languages.

3.1.1 History of the Study

PIRLS is the current product of the IEA's interest in language assessment. It is also the present result of numerous previous works through which the association has been developing their expertise and systems of evaluation in this area. The first international study of IEA, in 1959, already included a reading comprehension section. The first objective of this study was, “to discover the possibilities and the difficulties attending a large-scale international study” (Husén & Postlethwaite, 1996, p. 130). The second study was part of a more ambitious evaluation in sev-

3.1. Description of the study

eral aspects of education: *The Six Subjects Survey* (1968–1972) (Walker, 1976), in which, along with mathematic and science tests, a reading comprehension assessment was developed, along with tests on French and English as foreign languages. A more accurate explanation of the underlying assumptions of testing was developed for this new assessment. The factors considered as possible determinants of accomplishment in reading included: home environment, language in home, exposure to mass media, availability of reading materials, educational practices, background and the interests and attitudes of the students. From these predictors, two main instances were recognized: home and school factors. This point of view has persisted over time in following studies of the IEA.

During the eighties, the areas of research of the IEA, consolidated in the previous decade, start to enlarge. In the period from 1984 to 1985, a study focusing on writing composition was done. Writing composition is a different subject of assessment than reading comprehension. It is unlike reading comprehension in that the production can be assessed directly (Davies et al., 1999). It is important to note that one of the factors studied along with the curriculum and teaching practices was cultural background. In the reading studies, culture was not classified as a main factor. It was only studied through individual aspects such as home habits and / or language use. The importance of culture in this kind of international research has been the object of constant controversy, a declared purpose of international research is to compare, to be able to do that, international research make generalizations that undervalue cultural differences. The next section (3.3), discusses this problem in relation to PIRLS, and also, in relation to the problem of language as cultural identity.

In the decade of nineties, the 1990–1994 IEA reading literacy study, reached a higher level in reading research. Researchers improved and updated the definition of reading and the methods and objective of their study. Reading and the teaching of reading were defined as *cognitive-linguistic acts* (Lundberg & Linnakyla, 1993). At the same time, Reading was classified as a particular kind of literacy. This definition implies the acknowledgement of other ways to process information other than through linguistic codes. Furthermore, it implied the inclusion of both, literacy and reading in the wider theoretical framework of cognition, in other words, both are defined as mental processing of information. This cognitive definition will prove to be the most improved aspect in future assessments.

For the purposes of the study, reading literacy was defined as: “the ability to un-

derstand and use those written language forms required by society and / or valued by the individual” (Elley, 1992, p. 3). Because of the constraints of mass testing, the stress was placed on *understanding* more than on *use*. Another important distinction was the discrimination of three domains or types of materials: narrative prose, expository prose and documents. This particular classification of reading tasks depends on the previous stated definition. Moreover, the performance of the countries was often reported separately in the analysis.

For the IEA, what was most fundamental for the assessment, even more than measuring reading in general terms, was the study of factors that determined those results. Particular attention was paid to identifying the different reading policies and instructional practices, and their relation to students’ achievement and voluntary reading. Other objectives of the study were to produce valid international tests and questionnaires and to provide a baseline to monitoring changes over time. It showed that in the beginning of this study to create a cycle of assessment was already present in the IEA program. This theoretical development of concepts, objective,s and methods, suggest a main change in comparison to the first works of the IEA. It also established the support for the following studies, those of which the data for this research were taken.

3.1.2 Reading definition in PIRLS

The PIRLS study was created using the previous researches as references, of particular use was, the 1990–1994 study viewed as a direct source which: “served as a foundation for PIRLS. It provided a basis for the PIRLS definition of reading literacy and for establishing the framework and developing the assessment instruments” (Campbell et al., 2001, p. 2). However, there were many improvements in the design of the test that aim to reflect the latest approaches to what reading is and how to measure it. Concerning the definition, PIRLS 2001 was improved by adding the idea that reading is a constructive and interactive process. Therefore, reading is now 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, and for enjoyment. (Campbell et al.,

3.1. Description of the study

2001, p. 3)

In this definition, the second sentence, which is new, reflects the constructive character of reading, that is, the fact that the reader is not passive but active in the process of making sense of the text. This points towards the concept of reader that was developed by reader-response theory (see section 1): “La lecture est interaction dynamique entre le texte et le lecteur. Car les signes linguistiques du texte et ses combinaisons ne peuvent assumer leur fonction que s’ils déclenchent des actes qui mènent à la transposition du texte dans la conscience de son lecteur” (Iser, 1997, p. 189). The third sentence, also new, goes ahead of Iser’s theory, as it remarks that the act of reading is realized, not only in *the conscience of the reader*, but also in a social dimension. Now, reading is not understood as a closed process but as a practice which is only completed obtaining the reader objectives. These objectives have a social dimension, in which reading is used as a tool for attaining individual and societal goals (see Austin, 1970; Street, 1993; Tryphon & Vonèche, 1996).

For the development of PIRLS 2006 assessment new reflections about this definition were made. The result was not a theoretical enlargement, but a clarification of one of the aspects already considered:

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., 2006, p. 3)

The only addition to the previous definition is the specification of the communities in which the students participate. This is not simply a refinement, but rather a way to link this definition to the approaches followed in the construction of the study and their later evaluation. On the other hand, this part of the definition has the subtle mission of harmonizing with the more cultural approaches of reading theory. The principal problem confronted here, is the fact that these approaches understands culture not only as a factor determining reading ability but also as a result of an evaluation process; the evaluation itself is determined by cultural context. This was not, until now, added to PIRLS methodology because of the

characteristic of this international assessment and its goal of maintaining comparability across countries.

On the other hand, a more abstract side of the definition of reading is the concept of *ability*. Ability is the central notion of all three explanations that have been discussed (the two PIRLS definition and that of the 1991 study). The notion of ability can be defined as the “*Current capacity to perform an act*” (Davies et al., 1999, p. 1). It is in this way that reading is probably understood by the IEA. It is not, in the more general meaning in which ability is used, as a loose synonym of *aptitude* (Pellegrino & Varnhagan, 1985, p. 1): a potential ability or the learning capacities of an individual. A closer idea to the concept of intelligence.

The difference between them exists in the incorporation of the term *current*. The term *current* states the involvement of *time* into *ability*. From this point of view, and because PIRLS is a cycle, the study has incorporated this relation between time and ability. This interest became the goal of monitoring changes over time. In other words, following this interpretation, the reading ability of a sample of students is representative of their capacities, only by the time of the test being taken. Several evaluations, in different periods, must be done to get a general perception of their reading ability.

Along with the question of measurement of ability in time, the other fundamental difference stated by this notion, is related to the fact of being evaluating an educational system. PIRLS has no intention of being a test of intelligence of aptitudes, in fact, “it is designed to measure children’s reading literacy achievement” (Mullis, Martin, Gonzalez, & Kennedy, 2003, p. 277). This is to say, it refers to the mastery of what has been learned; “An achievement test therefore is an instrument designed to measure what a person has learned within or up to a given time. It is based on a clear and public indication of the instruction that has been given” (Davies et al., 1999, p. 2). Remembering the previously enunciated objectives of the IEA: *quantitative international comparisons of educational systems*, and knowing that the IEA has studied carefully the curriculum of each participating country. The conclusion reached was that reading ability is conceived as mainly determined by the fact of being part of an educational system. In other words, this ability is an effect of formal education.

In spite of this explanation, the process of measurement reading is still a complex procedure. Ability cannot be directly observed because it is a mental capacity, a

3.1. Description of the study

construct, and not a physical fact:

Abilities, or capacities, or aptitudes, or intellectual skills, or whatever you choose to call them, are measured in terms of response products to standardized stimulus situations. The stimulus is presented to an organism which by some process comes up with a response. (McNemar, 1964, p. 881)

In trying to measure reading ability, the question of which factors and components of reading will be taken into account become fundamental. In the two PIRLS definitions, several components of the assessment itself are elicited, like the factors to study in explaining reading ability, the aspects of reading considered, and the notion of reading as a set of processes of comprehension, which can be classified in several areas. Moreover, a number of questionnaires were developed, in search of information about the condition of reading learning. Each one will be described in the next section.

3.2 What is PIRLS measuring?

The principal objective of PIRLS is to measure children's reading ability. Since this cannot be directly observed, indirect ways of evaluation were defined. PIRLS determined the way in which the tests were elaborated, the conception of methods to collect information, and the factors that can determine reading.

Three aspects are highlighted, specifically, because they would play a key role in reading literacy. These aspects are the support of the assessment's structure: a) the reading **processes of comprehension**, similar to the idea of how to *understand and use and construct meaning* in PIRLS' reading definition; b) the **purposes for reading**, related to the idea of *variety of texts and reading to learn, to participate in communities, and for enjoyment*; c) finally, PIRLS believes that **reading behaviors and attitudes** are also determinant aspects of reading achievement, connected with the phrase: *forms required by society and/or valued by the individual*, and also with the *construction of meaning*. The description of these three aspects will start by mentioning the characteristics of generalities in the next paragraph.

3.2.1 Aspects of Student's Reading Literacy

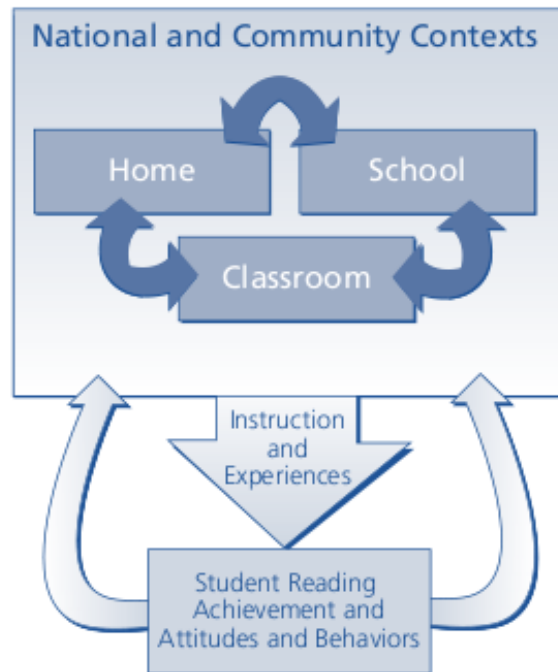
3.2.1.a Home and individual factors

PIRLS identifies two major types of external factors with equal influence in reading achievement: home and school. In both, there are behaviors and attitudes to be studied that can help to understand reading achievement. In concrete terms, PIRLS includes this aspect in the assessment, through a series of questionnaires addressed to teachers, schools responsible, parents, and the children themselves (all the participants of the learning process). These questionnaires are a fundamental source to analyze the influence in reading achievement of aspects such as reading habits, social and economic circumstances, methodological choices, and school character, among many other aspects.

As figure 3.1 shows, PIRLS framework suggests that there are two main sources of influence: home and school. There are also several micro and macro levels of influence, for instance, national policies or ethnological characteristics. A main premise is to suppose is that school factors have the same importance as home factors. Both home and school count 50% of this aspect of reading. In other

3.2. What is PIRLS measuring?

Figure 3.1: Contexts for the development of reading literacy. From (Mullis et al., 2006)



words, formal education is supposed to be as important as family background. For this reason, the questions in the questionnaires were designed to investigate in depth these individual factors. It is important to mention that the aspects to be researched were deduced from recent reading research, along with the conclusion of previous IEA studies (see Mullis et al., 2006, chapter 3). In general terms, each questionnaire was relative to different goals:

Learning to Read Survey: This questionnaire was answered by one of the parents or caregivers of the children that participated in the assessment. It inquired about “child-parent literacy interactions, home literacy resources, parents’ reading habits and attitudes, and home-school connections” (Mullis et al., 2006, p. 45). It contains demographic and socio-economic indicators too.

Student Questionnaire: Each child that took part in the PIRLS study, answered a questionnaire about his /her home and school reading experience: “classroom experiences and reading for homework, self-perception and attitudes toward read-

ing, out-of-school reading habits, computer use, home literacy resources, and basic demographic information” (idem).

Teacher Questionnaire: The reading teacher of each fourth-grade class that participated in the study answered this questionnaire:

The questionnaire asks teachers about characteristics of the class tested, such as size, reading level and language ability of the students; instructional time, materials, and activities for teaching reading and promoting the development of students’ reading literacy; grouping of students for reading instruction; classroom resources; assessment practices; and home-school connections. (Mullis et al., 2006, p. 46)

It is important to notice that since it is only one teacher that answers the questionnaire, it will not necessarily be representative of the background experience of the students in learning to read. The students may have been in contact with other methodologies, other reading strategies, and other perspectives. Consequently, the resulting data is not necessarily representative of teachers’ general point of view about reading in a country. Its importance goes along the line of comparing its results to those of the students’ questionnaire, and to those of the school, as will be done in chapter 5 and chapter 6.

School Questionnaire: Since the first study completed by the IEA, it was clear that the principle was to evaluate educational achievement in scholarly contexts. The objective of the study was defined as *educational systems*. This assumed that school was viewed as a primary factor of educational achievement. But, this pre-eminence was questioned by the growing recognition of the social nature of reading. PIRLS 2001 and 2006 asked the principal or director of the schools that participate in the study to describe the school in a variety of subjects that covered both aspects:

... about enrollment and school characteristics, such as location, resources available in the surrounding area, and indicators of the socio-economic background of the student body; instructional time; emphasis and materials used in reading instruction for students in primary

3.2. What is PIRLS measuring?

grades; school resources, such as the availability of instructional materials and staff; home–school connections; and school climate. (Mullis et al., 2006, p. 46)

Are the 2001 and 2006 questionnaires the same? A very important feature of this study is the possibility of developing a comparative study between both points in time. Are reading habits a determinant factor of reading achievement? Does its influence continue to be the same in later assessments? These are the kind of issues that the questionnaires allow to investigate. But, to accomplish this goal, the comparability of the data must be without doubt. In the documents that complement the assessment, PIRLS has explicitly declared the purpose of improving this comparability. Moreover, in reading the questionnaires and in using them to create research variables, it confirmed that in most cases, the questions of 2001 and 2006 are exactly the same.

During the questionnaires' review, there was only one topic that had changed: in the 2001 students' questionnaire, an important amount of questions explore the relation between oral literacy and reading. Later, in 2006, the importance of this topic was considerably decreased, since the questions related to it were significantly fewer. This seems to be a change in the theoretical importance given to oral activities: even if it is generally accepted as an important aspect. PIRLS 2001 research did not give answers of a consistent and positive relation, similar to the results of this research (see table 5.4). Apart from this singular topic, the questionnaires from both assessments are comparable.

Consequently, in relation to the main concern of this research, the context that these questionnaires provide must be taken into account in the study of language. It is only in studying the role that language plays along with other significant factors, that its importance can be dimensioned with accuracy. This sheds light on why the analysis of languages as factor complements the study of home and school factors.

3.2.1.b Purposes for Reading

In previous IEA studies, other kinds of classifications were presented. In 1991, the concepts used were *domains*, which is closer to the idea of classifying reading tasks. Now as the definition of reading has evolved, the notions that support

this categorization evolved too. In PIRLS, the basis of classification is the idea that the reader has a *purpose* previously fixed. Consequently, the text read is chosen depending on this purpose. In the study, two main reading objectives were specified: reading for *literary experience* and reading to *acquire and use information*.

In relation to the previous definitions used by IEA, what makes this a different classification is the fact that the *perspective* is now focused exclusively on the reader. It is important to mention that this perspective is valid in the context of this study. If a general viewpoint about the nature of texts is the objective, the producer must also be taken into account. In writing, objectives and motivation are a departing point too. In the next paragraphs, the two purposes of reading will be described in detail.

Reading to acquire and use information. PIRLS defines the informative lecture emphasizing its connection with reality. The purpose of these texts is to, “understand how the world is and has been, and why things work as they do” (Mullis et al., 2006, p. 19). Two characteristics of the informative texts are underlined as distinctive properties of this reading purpose: their formal presentation and the particularities that differentiate them from other kind of texts.

Concerning the method of reading, IEA remarks that in reading these texts, readers can simply select the information needed and not necessarily read the whole text. This is true in the case of a dictionary or an encyclopedia, which are both informative texts. A common order of informative text is *chronological*, as in the case of describing historical events or news. This is similar to the case of step by step instructions, for example, recipes (procedural texts). Besides chronological orders, informative texts can be *logical*, for example, “a research paper may describe cause and effect, articles can compare and contrast such things as societies or the weather”, or *expository* “presenting explanations or describing people, events, or things”.

In relation to the differences that distinguish these texts from others, the most important is the difference in relation to literary text: “the reader engages not with imagined worlds, but with aspects of the real universe”. However, even if the divergence with literary text is clearly established, what can be an obstacle in PIRLS definition of informative texts, is the fact that there is not a distinction

3.2. What is PIRLS measuring?

between the processing of information and its evaluation. The theoretical models tend to make this differentiation (see Jakobson, 1960), and identify a third text type: the argumentative or rhetoric text. On the contrary, PIRLS includes this task as part of the informational lecture:

Persuasive texts aim directly at influencing the reader's view as in the presentation of a problem and recommended solution. In discussion and persuasion, the reader must follow the development of ideas and bring to the text a critical mind in forming his or her own opinion. (Mullis et al., 2006, p. 20)

The aims of an informative text are explanation, analysis, and syntheses of facts, while the argumentative text is based on subjective judgment of the same information. In any case, the level of simplicity of the texts included in the assessment, and the questions associated with them, decrease the importance of this distinction, this would have been essential in evaluating reading comprehension in higher levels.

Reading for literary experience. Research studies underline the importance of the literary experience as one of the first contacts between children and the writing world. PIRLS also joins this point of view stating, "The early reading of most young children centers on literary and narrative text types" (Mullis et al., 2006, p. 18). In understanding literary texts, the reader "engages with the text to become involved in imagined events, setting, actions, consequences, characters, atmosphere, feelings, and ideas, and to enjoy language itself. ... For young readers, literature offers the opportunity to explore situations and feelings they have not yet encountered" (Mullis et al., 2006, p. 19).

The definition of text types, purposes, and genders have been a subject of scholarly discussion for a long time. Since Aristotle's *Poetics*, a central issue in this area has been the definition of the literary text. *Poetics* studies, that were mentioned in the introduction (1), searched to answer the question of what is the essential property of a literary text that, is unique in relation to other kinds of texts, and shared by all forms of literature. Jakobson answers to this question is the notion of *Poetic* as a *function of language*, in which verbal communication, "focus on the message for its own sake" (Jakobson, 1960, 356). In addition to these kinds of classifications,

which are highly abstract, there is a tendency in actual research to include the act of lecture and the readers as part of the essence of texts, along with socio-cultural circumstances.

These brief paragraphs underline the complexity of establishing a definition of literary reading. This complexity can be also further explored in the definition of informative texts. It is inferred from its unclear frontier with argumentative texts. In both cases, the level of simplicity of the texts presented by PIRLS, created for beginner readers, provides an interesting opportunity to study the limits of these definitions. Moreover, as will be described later, the results of the assessment are presented separately for each purpose of the reader. This will allow further study of each feature, and to study factors that can play a different role in each type of text.

3.2.1.c Processes of Comprehension

These so-called *processes* give a systematic response to the question: *what does the reader do to reach comprehension?* In comparison with the previous assessments developed by the IEA this distinction is innovative. In the 1991 precedent study, the processes were named only in terms of specific tasks of each reading domain. Furthermore, they were not considered in the subsequent analysis of the data. PIRLS 2001 framework stated the idea that there are several ways to construct meaning from a text. The study defined four processes that should be taken into account in the creation of the reading test and in the resulting data-sets. Each question of the test is referred to one process. Moreover, the processes were proportionally distributed following a previously established sketch (see section 3.2.2.a), increasing the importance given to this idea. PIRLS 2006 not only recognized these processes, but also took them into account in the data analysis. Four reading comprehension processes were identified:

Focus on and retrieve explicitly stated information. In reading, the information is visually present. The reader finds it in the surface of the text and understands what is stated explicitly, an almost automatic process. However, the level of automatism will depend on the general reading ability achieved by the reader. Some examples of tasks related to this process are: “identifying information that is relevant to the specific goal of reading, looking for specific ideas, searching

3.2. What is PIRLS measuring?

for definitions of words or phrases, identifying the setting of a story (e.g., time, place), finding the topic sentence or main idea (when explicitly stated)” (Mullis et al., 2006, p. 13).

Make straightforward inferences. To construct meaning by inferring, the reader must connect two or more ideas contained in the text. These ideas are explicitly text-based, but the connection is not. Meaning from sentences can be the subject of an inference but also global and whole text ideas. Normally, a skilled reader is capable of developing this task automatically. Some examples of this process are: “inferring that one event caused another event, concluding what is the main point made by a series of arguments, determining the referent of a pronoun, identifying generalizations made in the text, describing the relationship between two characters” (Mullis et al., 2006, p. 14).

Interpret and integrate ideas and information. Processing information in this level, supports a global comprehension of the text meaning. The reader may need the support of explicit or local information, but it must be interpreted and connected to other parts of the text or other levels of meaning to reach comprehension. The process depends, not only on the reader’s experience, but also in their background knowledge, and understanding of the world. The process can differ from one reader to another and different interpretations may result in superior comprehension. Some tasks are: “discerning the overall message or theme of a text, considering an alternative to actions of characters, comparing and contrasting text information, inferring a story’s mood or tone, interpreting a real-world application of text information” (Mullis et al., 2006, p. 15).

Examine and evaluate content, language, and textual elements. What characterizes this type of process is the idea of criticizing. In fact, it is not exactly a comprehension process, but rather, a *result* of a satisfactory comprehension in connection with the experience of the reader. Comparing texts with other texts already known or with a personal experience are two fundamental ways of developing this process. Some examples of tasks are: “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,

determining an author's perspective on the central topic" (Mullis et al., 2006, p. 17).

These four processes are considered by PIRLS as fundamentals of reading comprehension at the age of the examinees, considering the years that they have spend learning to read. In the next section the details about how these skills and text types are distributed in the assessment will be described. But before continuing, it must be highlighted again the fact that both aspects of students reading literacy, along with the external factors, are all the result of theoretical choices made by IEA's researchers. This should be considered when setting the limits of the interpretation of these results.

3.2.2 Assessment description

A final point to consider, which is fundamental to the goals of this research, is to review the translation of this theoretical conceptualization into the evaluation. In other words, it is necessary to describe how these notions are represented in the materials by means of which the evaluation is done, and the criteria employed for this evaluation. In general terms, both PIRLS assessments are constructed with the same theoretical framework. The texts employed as stimuli are conceived to be equally understandable to all the examinees, with high standards of comparability among international translation (see Mullis et al., 2006, chapter 4) and (Mullis, Martin, Kennedy, & Foy, 2007, chapter 5).

Regarding the questions created to evaluate reading comprehension, its constitution and distribution responds to the previously described approach. Every item in the assessment is conceived to evaluate a specific pair of purpose–procedure in relation to a predetermined lecture stimulus. Besides the main purpose of keeping the comparability of both tests, there are some differences that must be mentioned, even if they do not prevent general comparisons. Both tests will be now described separately to remark later they differences and resemblances.

3.2.2.a PIRLS 2001 assessment

Table 3.1 represents a detailed description of how the theoretical conceptions are related to the items in the 2001 test. There are two horizontal blocks presenting

3.2. What is PIRLS measuring?

Table 3.1: PIRLS 2001 distribution of items by reading purpose, process category and format

		Retrieve Information		Make inferences		Interpret		Evaluate		Total
	format	MC	CR	MC	CR	MC	CR	MC	CR	
informative	Items	10	5	3	6	4	11	4	4	47
	%	8,7	4,3	3	6	5,3	14,7	4	4	50
	points	10	7	3	10	4	22	4	7	67
	%	7,5	5,2	2,2	7,5	3	16,4	3	5,2	50
literary	Items	5	5	11	7	4	12	5	2	51
	%	4,5	4,5	8,6	5,4	5,0	15,0	4,3	1,7	49
	points	5	7	11	8	4	23	5	3	66
	%	3,8	5,3	8,1	5,9	3	17	3,8	2,3	49

the two purposes of lecture and four vertical blocks presenting the four evaluated skills. In each case, the table shows the number of items and the percentage that this represents in relation to the total test. Finally, there is also information about the format of the items: multiple choice (MC) and constructed response (CR). The table clearly shows that their distribution is not as balanced as the other features of the items.

In both types of texts, in the booklets developed as stimuli, there are the same number of passages, four for each purpose. Here in the assessment items, there are almost the same proportion of items and points for each one: 47 informative items (which represent 67 points), and 51 literary items (66 points). This equilibrium answers directly the hypothesis that considers the cognitive development of children at this age; both of them have the same importance (Campbell et al., 2001, p. 15).

Regarding the comprehension processes, as they work independently of the purpose, they are equitably distributed across them. Although there are some variations which are necessary to mention: the first process, *retrieve information*, has a higher existence than the informative points (13% of the points against 9%), whereas the second process, *make inferences*, has a higher presence among the literary items (9% against 14%). The other two processes are more equally distributed: around 20% and 7%.

This distribution shows the logical connection between the processes of retrieving information from a passage and the informative purpose of the lecture. It is also easier to conceive an inferential process in relation to a literary text, since its meaning is not present in a superficial level, but in the more complex stages of comprehension. In spite of this, the general tendency of the distribution, considers separately this two components of reading. The first is inherent in the text it-self and the second in the reader (being the reading process an interaction between them).

However, the balance of the distribution of items does not have a counterpart regarding independently each process of comprehension. Looking at the table, if the four percentages representing *interpret* points are added (3% 16,4% 3% and 17%), it is clear that this is the capital process. Their items represent 40% of the score points. This can be explained in relation to the theoretical model, because the assessment suggests that at the children's learning stage, they should already know and master the simpler processes, *retrieve information* and *make inferences*. In this stage they are most likely learning to connect the superficial level to the deeper levels by means of the process of *interpretation*. The *evaluate and examine* process is considered still too complex, and is not accessible if they are not able to dominate the prior process.

Regarding the two items format: multiple choice (MC) and constructed response (CR), there are important differences that exist between them, even if the number of items is almost equal (47 MC and 52 CR). The constructed items are considerably more significant in terms of score points, the reason being that the answer to one CR item can be scored from one to three points depending on the complexity of the question, while the MC items always have a value of one point.

Subsequently, this format represents 65% of the total score. Considering this fact, it is possible to view in the importance of this format a possible bias, because of its dependency on certain writing expression ability, and because the time required to answer. Time longer than the required to simply make a mark (see [Gustafsson & Rosén, 2006](#)). Moreover, analysis on PIRLS 2001 results have shown that there was a general sensibility to question format, "with those answers requiring written elaboration attracting the highest rate of non-response". This tendency was particularly high in some countries like France. French students "...did better when they did not have to construct a response to a question, and this applied no matter what the comprehension process involved. Certainly, French students have

3.2. What is PIRLS measuring?

a strong tendency to refrain from answering open-ended questions” (Schwippert (2007, p. 82); see also Rémond (2006)). Consequently, this evidence demonstrated that item format is not without consequence in the test achievement. In addition, this can affect some countries or communities more than others.

3.2.2.b PIRLS 2006 assessment

As was mentioned before, PIRLS 2006 is explicitly built on PIRLS 2001 (see Mullis et al., 2007, p. 16), their purposes and goals being the same. Both studies are part of one only project, and, in general terms, it is possible to establish correlations and juxtaposition between them. But, in the fine points of this general resemblance, there are some important variations which must be taken into account. These differentiations can be reordered into two principal lines: internal and external. First, there is some dissimilarity concerning the structure of the test itself, related to the incorporation of the comprehension process among the objectives of analysis. Secondly, there are variations related to the changes in the sample, regarding the participant countries and the languages used by them.

In the paragraphs to come, an explanation of why the internal changes do not force the introduction of alteration into this research will be provided. Dissimilarly, the external changes do compel the careful study of the new sample and to adapt this work. That is why these changes will be described in a different section (see chapter 4) centering the focus of interest on the linguistic changes of the sample (new languages, percentage of representation, validity of the data, etc.).

Adjustments on comprehension processes. In describing PIRLS 2001 items, it was mentioned that the questions used for testing constituted the tangible formulation of the theoretical conceptualization about reading developed for this assessment. Because those notions have not changed, the questions are structurally similar to the previous ones. There is one variation inside this theoretical framework: the importance given to the difference between the comprehension processes at the moment of interpreting results. The purpose of the 2001 report was only “to report results for the two major types of reading students do in school” (Mullis & Martin, 2004, p. 6). Later, PIRLS developers had the intention of improving the assessment by providing information on comprehension processes in addition to reading purposes as an *important goal* of PIRLS 2006, as defined in the mentioned

rapport by [Mullis & Martin](#).

To be able to report the results on comprehension processes, the number of passages was increased from 8 to 10, five for the literary purpose and five for the informational purpose. This expansion, suggests a larger amount of questions (125) and score points (165) ¹, still a high comparability was searched. In fact, there are four passages, two literary and two informational retained from PIRLS 2001, they represent 49 items and 66 score points.

Table 3.2: PIRLS 2006 distribution of items by reading purpose, process category and format

		Retrieve Information		Make inferences		Interpret		Evaluate		Total
	format	MC	CR	MC	CR	MC	CR	MC	CR	
informative	items	11	7	12	6	1	15	5	4	61
	%	8.8	5.6	9.6	4.8	0.8	12.0	4.0	3.2	48.8
	points	11	9	12	9	1	27	5	7	81
	%	6.7	5.5	7.3	5.5	0.6	16.4	3.0	4.2	49.1
literary	items	8	5	17	8	5	13	4	4	64
	%	6.4	4.0	13.6	6.4	4.0	10.4	3.2	3.2	51.2
	points	8	8	17	9	5	27	4	6	84
	%	4.8	4.8	10.3	5.5	3.0	16.4	2.4	3.6	50.9

Items distribution. This table shows the item distribution in the same way as in 2001, likewise, every item evaluate a pair of purpose–process in relation to a predetermined lecture stimulus using a particular format of item. As it was done for 2001, here are two blocks presenting the two purposes of reading. They respect the same proportion of items and points. The only difference is the total amount, there are more items and points than in 2001: 14 informative items (14 score points) and 13 literary items (18 points). This increment keeps the proportions, and the literary part of the items is barely one point higher than the informative part.

In regards of the comprehension processes, there was some dissimilarities detected

¹Our values can differ from the PIRLS publications because we considered omitted, not administer or different coded question taking these data from the results of the assessment.

3.2. What is PIRLS measuring?

in 2001 concerning the distribution of the two first processes between the two purposes. Now, the first process is more equally distributed, reducing the difference from 4% higher in the informative texts to only 2%. There is still a difference between the score points in the inferential process, but it falls from 5% to only 3% of the score points. The rest of the processes as it was in 2001, are more equally distributed. Finally, concerning the types of questions employed in this test, there were not changes in the formats: multiple choice (MC) and constructed response (CR). In 2001 half of the items followed each type. However, the constructed response items had a greater importance in terms of score points. The ratio in 2001 was preserved at 38% of the score obtained from multiple choice items and 62% obtained from the constructed response questions. This proportion represents only a reduction of 3% of the difference between this two formats (in terms of points).

Table 3.3: Comparison of items distribution 2001 – 2006

		Retrieve Information	Make inferences	Interpret	Evaluate	Total
2001	Items	25	27	31	15	98
	%	25,5	27,6	31,6	15,3	100
	points	29	32	53	19	133
	%	21,8	24,1	39,8	14,3	100
	% of points	45,9		54,1		100
2006	Items	31	43	34	17	125
	%	24,8	34,4	27,2	13,6	100
	points	36	47	60	22	165
	%	21,8	28,5	36,4	13,3	100
	% of points	50,3		49,7		100

2001 and 2006 compared. Table 3.3 led the observation of a global comparison among the test questions, the proportional representation, and the aspects of reading literacy in both versions of PIRLS assessment. In both cases, 2001 and 2006, the frameworks specified precise percentages of the reading assessment devoted to each reading purpose and each processes. Between the frameworks, those fractions are equivalent, 50% for each reading purpose. The skills are distributed as follows:

- 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%

However, table 3.3 shows that in terms of number of items and in terms of score points, these proportions are not always maintained. The first process is almost identical in both, items and points, the items represent around 25%, that is 5% more than planned, while the points are close to 20%. This difference can be explained by the high number of 1 point MC items used to measure this ability; their amount decreases as the complexity of the process increases. The second process is, in both cases, closer to the goal of 30% in number of items, but they differ in percentage of score points. In 2001, they reached only 24%, 6% under what was expected. In 2006, they almost reached the goal, (this shows how the 2006 test is an improved version of 2001 assessment).

The *interpret* process has a higher variation in relation to the goal of 30%. The items do represent it, but the score points are 10% and 6% over the objective. This over-representation has a detrimental effect on the process *evaluate* which only reach 14% of the total score point, very far from the 20% theoretically expected.

This particular distribution will not be without consequences in the assessment. Whether the students master this skill or not, will determine their results more than any of the other comprehension processes. However, the assessment does not consider the four processes separately. To be able to produce valid scores for each one, many more questions will be needed, and that will increase the extension and complexity of the test itself. This will not be suitable for the students age and level of reading learning (see Mullis et al., 2007, chapter 2). Consequently, the scores derived from the assessment only take into account two reading process scales: “Equal proportions among the first two and last two processes support the reporting of separate scales for two processes of comprehension: retrieval and straightforward inferencing and interpreting, integrating, and evaluating” (Mullis et al., 2007, p. 21).

Comparing the two low level comprehension processes and the two high processes, an important change exist, that is related to the new objective of PIRLS 2006: to

3.2. What is PIRLS measuring?

incorporate the analysis of the processes. The second process altered its proportion 4.4%, allowing the combination of the two lower processes to reach 50% of representations in the test in terms of points. On the other side, the sum of both high processes: interpret and evaluate has decreased: 1% (interpret) and 3% (evaluate). This reduces the presence of these processes in the test to nearly 50%. It could have been a perfect match of half and half score points to each scale, except for one question that was not considered because the item discrimination was too low for many countries (Foy & Kennedy, 2008, Supplement 2, p.113).

To conclude, it is necessary to confirm that the theoretical framework, the distribution of the items, and the means to evaluate them, do not stray way from this study. On the contrary, they provide more clues to develop this research than PIRLS 2001. In relation to the question of whether the mastery of the skills affect the achievement, that will be one of the complementary questions of this research, now focused in low and high level scales.

3.3 Criticism on PIRLS

As it can be assumed, to develop a study involving so many countries, educational systems, and languages, is not a process exempt from detractors and polemics. Especially when media coverage is extensive and a country's results are very good or very bad. For example, in England, when the 2001 results were published: "Typical headlines were, 'English rank third in world reading chart' (TES) or 'English primary pupils are among the best readers in the world', and 'the most successful English-speaking country'(DFES)" (Clark, 2004, p.27). Obviously these are statements that are out of context and disproportionate. They do not represent the aim of the survey, which does not search to 'rank' countries, as Rocher (2008) says "La mise en perspective des données issues des évaluations internationales nécessite un exercice de comparaison plus fin qu'un simple ordonnancement des pays" (p. 63). In contrast, this kind of mediatic repercussions illustrate the impact of these researches on public opinion, making of the surveys an especially delicate issue.

3.3.1 Criticized features

The criticism related to this study are referred to several aspects of the assessment. Whetton, Ruddock, & Twist (2007) classified the criticisms derived from the English polemics:

The criticisms can be grouped into four types: those that relate to the underlying conceptualisation of the studies as research enterprises; those that concentrate on cultural and linguistic factors; those that question the statistical and psychometric basis; and finally those which examine the sampling methodology. (p. 4)

All these criticisms can be summarized in two main aspects: *methodology* and *culture*. Regarding methodology, several researchers have deeply investigated the validity of the instruments used to measure reading in PIRLS study. For example, Hilton (2006) criticizes many aspects of the test, questioning its overall validity in reference to the general quality of the English educational system. Among her targets, the items' dimensions (the subject of the previous paragraphs) are mentioned, along with the representational sizes of the sample, the geographic dispersion, and the linguistic and cultural bias. Vrignaud (2006) Describes how difficult

3.3. Criticism on PIRLS

is to empirically prove the existence of different dimensions in PISA assessment, considering that there are strongly correlated (see tables 6.4 and 6.5) . Other researchers inquired about the use of two different types of items. As mentioned previously, they suggest different cognitive procedures and different amount of time. The *constructed response* items considerably more complex and slower to be answered (see Gustafsson & Rosén, 2006). Another criticized point is the use of IRT statistical methodology. Its validity in such large scale surveys cannot be the same as in simpler psychometric tests (see Goldstein, 2004).

Evaluation, criticism, or even description of the psychometric features of this test (or any other international comparison) could not be done without doing a complete investigation of the subject. Psychometric cannot be treated superficially and it is out of the aims of this work. Consequently a further explanation of criticism on this particular subject will not be developed. This decision agrees with Whetton et al. (2007) assertion: “Ultimately, each interested person must make their own view on the reliability and validity of these international surveys and of the methodological criticisms made of them. But this cannot be a single view of them all” (p. 7).

But there is another issue that is directly related to our main subject, and that should be discussed before proceeding: *culture*. Reading achievement is not outside the influence of culture, on the contrary it is in the center of the discussion. Reading is a fundamental ability in the present world, as this world depends on societies and on reading. For this reason it will be determined by the idiosyncrasy of the cultures of each society. As Barré-de Miniac (2003) highlights: “Savoir lire et savoir écrire sont des compétences qui ne peuvent se définir dans l’absolu, comme des compétences cognitives indépendantes des conditions sociales et culturelles de leur développement et de leur mise en œuvre” (p. 117).

3.3.2 Language and Cultural validity

The criticism related to culture can involve a wide range of issues, from translations, languages, populations, to the ideology behind international comparisons. Being all aspect of culture itself, the first two subjects are at the center of the problem and are directly related to the subject of this research. For this reason a more systematic description will be given in the next paragraphs.

About languages and translations. As was already described, there are more than 40 languages present in PIRLS test, and many tasks have been done to assure comparability. The original passages that make up the test were contributed by several of the participating systems. The translation and verification process is described in (Martin, Mullis, & Kennedy, 2007, chapter 5), the major steps in this process were the following:

In first place, the assessments, questionnaires, and manuals, were developed in English (this fact, as will be discussed later, is an important source of criticism). Secondly, with the help of guidelines created by the IEA, each participant country translated the materials and adapted them to fit their cultural context. Among the recommendations of the guide, was the preservation of the original register and information (not omissions, not additions), the use of correct grammar, spelling and punctuation, and the translation of idiomatic expression preserving meaning and not word by word. IEA encouraged participants to hire a highly competent translator with experience in educational fields along with literary texts to do the translation. It is important to mention that each educational system that participated in the study did its own translation. There was not a general translation for all the countries sharing a language.

Later, a reviewer was also asked to read the translation to verify their readability in relation to the target population. A third step to assure the quality and equivalence of these translations was an “international translation verification process” (Martin et al., 2007, p. 49). Two independent translation companies were hired to assure the quality of the international translation (one from England and the other from Belgium). Their principal task was to ensure that the translation did not affect meaning, difficulty, order or options, and that no omissions were made.

As can be seen, translation was a subject of great effort to assure quality, however it is questionable that all the source texts were in English because it can bias the results of a test, particularly in this case where the goal of the assessment is as related to language as to read. An analysis made by Diepen, Verhoevenand, Aarnoutse, & Bosman (2007) studied this subject in comparing English and Dutch translations of PIRLS. The compared texts presented differences in the quantity and length of words, and there were modifications introduced to improve Dutch version. Although the changes did not show an impact in the results:

The use of more and longer words did not produce a higher level of

3.3. Criticism on PIRLS

complexity with respect to content, sentence structure, text structure, or test items as judged by a panel of bilingual experts. ... The omission of passages and the modification or omission of test items were found to have no consequences for the psychometric properties of the Dutch version of the test were examined. (p. 1)

In relation to this problem, even if it was unrelated to IEA work, the shadows of the translation issues in IALS are present. IALS (1995) was an international study about Adult Literacy. It was published by the OCDE and developed by *Statistics Canada* along with the participant countries. In that occasion, the results were contested, France, after having participated in the development of the study and completing the tests in a sample of adults aged 16 to 65, raised objections to the results and finally asked for a total withdrawal of any reference to its education system in IALS report (see [Bottani & Vrignaud, 2005](#), Chapter 1.7.2). As [Bottani & Vrignaud](#) describe, French researchers proved that there were three problematic domains in the development of this study: “le problème de la traduction des items de test, mais aussi de la formulation des questions dans les questionnaires et le problème des biais de nature culturelle” (p. 41). In particular, the evaluation questionnaire consisted of half of the questions related to professions and texts that came from the United States or Canada, which explains the cultural bias, and the linguistic and translation issues (see [Bonnet, 2006](#), p. 96).

In conclusion, the issues surrounding this study, proved that an international survey can fail, particularly, in a subject as susceptible as culture and translation. Even if the IEA was not involved, [Bottani & Vrignaud](#) are right when they affirm that “On peut donc distinguer une période antérieure à l’enquête IALS et une période postérieure à cette enquête, un « avant 1994 » et un « après 1994 »” (p. 39). The demands for an extra effort in avoiding cultural and translation biases is higher than ever. In the case of PIRLS it is not possible to reject, *a priori*, the presence of a certain degree of linguistic influence when a specific language is the source of the entire assessment. Finally, these authors are also right when they state:

La traduction de l’épreuve dans les différentes langues des pays participants a donné lieu à de nombreuses vérifications. Ce point mériterait néanmoins davantage de recherches et d’explicitations. D’abord, sur un plan théorique, on aimerait savoir dans quelle mesure la variabilité

linguistique peut influencer sur la performance à des épreuves utilisant le langage comme la littéracie. (p. 126)

On the other hand, researches about PISA, like that from [Duru-Bellat, Mons, & Suchaut \(2004\)](#) underlines that “les pays dont les élèves sont les plus performant appartiennent à des aires culturellement très différentes”, the same remark can be made about PIRLS, where, in 2006, the three best countries are Russian Federation, Hong Kong and the province of Alberta in Canada. This force to consider linguistic bias as a possibility, and consequently, as a subject of research, what cannot be done is to suppose that language and culture are a problem in international comparisons without systematically measuring it.

3.4 How to compare reading acquisition among languages?

The purpose of this section is to state which are the specific assumptions and the hypothesis that will guide the development of the experimental pathway; all the previous chapters are the source of this proposal. The first subsection, searches to clarify the conclusions from the previous theoretical discussion. Then, the hypothesis will be presented. Next, the specific objectives of this research will be presented in a way that seeks to be clear and concise, so that these can be developed in the work of analysis and easily identified by the reader. Finally, and to conclude with this exposition, the methodological steps to be accomplished will be described.

3.4.1 Research Problem

Starting from the general question about the relation between language and reading, some distinguishing characteristic of this connection have been identified. First of all, it was established that reading is a complex process, in which decoding is only the first step to comprehension. Its complexity is determined by its double dimensionality: it is a cognitive act and, at the same time, a social process ([Oakhill & Beard, 1995](#)). Moreover, this complexity changes in time too. Consequently, it will not be the same to read a novel as to read a newspaper. It will not be the same to read a newspaper as a 7 year old as it is as a 25 year old nor will it be the same to read just to pass time and for amusement, as it is to study for an exam. However, all these different situations are reading examples, all of them come from a common root, use cognitive processes, and take place in social situations.

Now, the obvious question is how to develop an empirical research about such a variable subject. In this case, the solution has been to find support in a specific constituent that is always present in this process, no matter what the goal or subject of the reading is: language is the exclusive code to accomplish this tasks (see [Jakobson, 1960](#)). Nevertheless, the advantage of studying the relation between language and reading is also relative, since language is a complex system too and the two dimensions that play a role in reading, cognitive and social, also play a role in language. All this, makes a comprehensive empirical research become a

very difficult task to accomplish. However, in the same way that a definition of reading was out of the aims of this research, a general definition of languages is not either the objective. The aim is the less ambitious goal of to merely describe *human tongues* and its relation to reading, without forgetting, obviously, the more large-scale problematic. In summary, from the theoretical framework, three premises can be stated: first, languages are cultural-social entities, second, the act of reading is complex and multidimensional, and differences can take place from one stage of reading to another.

3.4.2 Hypothesis

At this point, there are more questions than answers about the subject; the most general being *how to compare reading acquisition among languages?*, and the two most specific are: *how languages of learning are related to the multiple aspects that compose the act of reading*, and *does the influence of languages change in time?*. These questions will now be translated into a more specific research hypothesis with the support of the previous discussion. The first question is, obviously, the one that cannot be answered in a definitive way, it simply stands in to support IEA's reading study to be able to develop experiments. PIRLS, as a source of information, allows us to measure reading achievement in different languages, in a particular point of development of this ability, considering different cognitive processes and types of texts. Connecting this with the previous framework, we can establish a principal and three auxiliary hypotheses.

THE LANGUAGE IN WHICH THE PIRLS TEST IS PERFORMED, AND/OR THE MOTHER TONGUE OF THE EXAMINEES, CAN INFLUENCE THE TEST RESULTS

If languages determine reading ability in different ways, a trace of this diversity should be found in test results. The revision of literature, has showed that languages are diverse, even if all of them have the same social and cognitive function in their societies; there are many aspects that differentiate them. Two major lines have been documented: the social characteristics (historical roots, resemblance in evolution, geographical proximity), and the orthographic properties (in particular, the way of mapping phonology into writing). Starting with such classifications as framework, it is possible to create variables representing these notions using

3.4. How to compare reading acquisition among languages?

PIRLS database to confirm or refute the presence of variation in reading scores in relation with languages.

As it can be easily supposed, that is not an innovative hypothesis at all; many researchers have constant similar tendencies among countries while examining international survey results. For example in analyzing PIRLS 2001 [Givvin, Hiebert, Jacobs, Hollingsworth, & Gallimore \(2005\)](#) found that:

Teachers within countries plan and implement lessons that share at least some important similarities. The extent and nature of a given pattern depends on the country examined and the lens used. These national patterns may arise from a shared cultural “script” that teachers have internalized as they participate in the educational system of their country. Or the patterns may be generated from other sources (e.g., similarities in the curriculum mandated within a country). (342)

In this research the question is, *can we get to a similar conclusion about the influence of language?*. Closer to this problem is the observation made by the IEA report of their 1992 reading survey, when one of the findings of the assessment was the better performance in the narrative domain of the students in Cyprus and Greece: “while students in Hong Kong, Switzerland, Germany and Denmark performed better in Documents” ([Elley, 1992](#), page XII), in this finding there is an interesting linguistic relation between two countries that share a language and also a transparent orthography. This can be considered as a precedent of the linguistic topic that will be studied in the present research.

Even closer to the aim of this research, is the finding of [Schwippert \(2007\)](#), who made the following observation about PIRLS 2001:

In France, the test items on which the students scored most highly were (1) an advertising leaflet that presented the services of a rent-a-bike shop and included a map of a cycle trail (informational text), and (2) an animal fable (a narrative literary text). France’s across-country ranking for the first item was third and for the second was 10th. However, for another narrative text, France’s ranking was much lower, at the 26th position. In Québec, the only other French-speaking community in PIRLS, students’ performance on these three texts followed the

same hierarchy. It seems that language and culture maintain some influence on students' comprehension of what they are reading despite all the methodological efforts to reduce it. (p. 82)

As these two final quotes suggest, the tendencies related to languages, will not necessarily be present in the total results. In other words, we can suppose that these linguistic differences will also be manifested in the specific aspects that conform the reading process. That is the reason why it is important to define the following auxiliary hypothesis.

LANGUAGES, CAN HAVE A DIFFERENT INCIDENCE CONCERNING THE ASPECTS AND COMPONENTS OF THE READING PROCESS

Achievement in reading can change, if considering specific reading aspects; this is the premise that is the starting point of this hypothesis. The relative independence of these aspects is itself a premise derived from the notion of reading as a multidimensional process. This connection has been stated by researchers, as for example, [Rémond \(2006\)](#) who said: "Cet effet du «format des textes» peut probablement se rattacher à des différences culturelles et à des options pédagogiques privilégiant davantage certains écrits que d'autres" (p. 74). The dimensions that PIRLS differentiate are very specific: two types of texts and four comprehension processes, PIRLS data-sets will allow us to obtain specific scores in reading literary texts and informative texts, along with two scales of comprehension, the high and low order processes.

Therefore, only these specific dimensions will be included in the analysis. As was previously mentioned, they are very limited because they depend on the theoretical choices made by PIRLS. Nevertheless, it is still very interesting to include them into a modelling process, and to prove or refuse with empirical data the reality of possible differences between reading with a literary purpose and reading with an informative purpose, and between processing low level information and processing high level information, along with the possible connection of those dimensions with linguistic factors.

3.4. How to compare reading acquisition among languages?

LANGUAGES, AS A FACTOR THAT INFLUENCES READING DEVELOPMENT CAN PLAY A DIFFERENT ROLE THROUGH TIME

The implicit question in this auxiliary hypothesis is whether the influence of languages can change, increase or decrease over time, particularly in relation to languages phonology. In section 2.2.2.b, it was shown that the language of teaching determines speed and accuracy of reading learning. Consequently, it is a relevant factor in learning to read. Some researchers have hypothesized the consequences of this fact in later stages of reading, for example Ziegler & Goswami (2005, p.3) talk about *developmental “footprints” in the adult lexicon*: “The lexical organization and processing strategies that are characteristic of skilled reading in different orthographies are affected by different developmental constraints in different writing systems”. Following this idea, in a reading test like PIRLS, one should find differences among languages, but one cannot suppose what will be the nature of these differences. They could simply be differences concerning the score, or, as was already mentioned, differences regarding the purposes of each text used in the test, or the cognitive processes implied. It can be assumed that children that used to have a global point of view of text since the very start of the learning process, (as in languages like English) will be better at high level processes of comprehension than at low level, which depends more directly on word comprehension (as in languages like Spanish).

However, it can also be assumed that the previous differences will not continue in time, since the task in which they were confirmed was simple decoding with children not surpassing 8 years old. Now, in more skilled reading, the role of *comprehension* implies another perspective to be taken into account. For example, Van Orden & Kloos (2005, p. 67), in talking about English, has said: “so far no one has discovered a generally robust phonology effect in skilled reading”; Moreover, following the design of double route theory, “broad classes of codes” in competition to be the more effective way of process information, Katz & Feldman (1981, p.86) he proposes that the style of decoding of skilled readers will become less dependent on phonological information and more morphological: “younger readers tend to rely more on phonological information and less on nonphonological (e.g. word-specific) mechanisms than do older readers”.

Consequently, the models will aim to test the following possibility: If linguistic distance between phonology and orthography affects the initial phases of reading

acquisition, there can also be consequences or at least traces of those initial differences in the following phases of reading learning. A final observation is that, this hypothesis refers principally to orthographic transparency as decisive factor to discriminate among languages, as the bibliographical references allow inferring. No evidence has been found to attest to an incidence of linguistic family, the socio-cultural factor, in earlier steps of reading development. This, however, does not prevent the continuation of this research and the study of a possible connection between families and reading.

HOME AND SCHOOL CHARACTERISTICS THAT DETERMINE READING ACHIEVEMENT CAN HELP TO IMPROVE AN EXPLICATIVE MODEL INCLUDING LANGUAGES AS FACTORS

This last hypothesis is very self-explanatory, and search to take into account context into reading and language study. If contextual factors are not integrated in this research and modelling, language, as factor, will be isolated. Language is one factor among many others, that may play a role in reading achievement. In any case this research proposes that this factor is more or less important than others. The role of language can only be estimated if the potential findings are put in a context.

Through this triangulation of factors, the expectation is to be able to compare the incidence of language and other determinants of reading, to develop an explicative model that explains the examinees' achievement as accurately as possible. However, while the general hypothesis that there is a school and home factor can be accepted with no doubt, it is still worthless if specifics determinants are not named. The use of PIRLS assessment makes it easier to define home and school factors, since their questionnaires study several actual theories about possible determinants, like early literacy, availability of reading material at home, motivation, etc.

A central aim of this hypothesis will be the search of variables that can provide evidence that contrasts the aspects of reading, in other words, it can be acknowledge that a factor can affect a component of reading or another in a different way, just as was also hypothesized for languages. An early experience in reading, before school, can be more significant in explaining a literary score than an informative score or the achievement on high level comprehension instead of low. The

3.4. How to compare reading acquisition among languages?

experiments of this research will attempt to prove or refuse these hypotheses.

3.4.3 Research objectives

The general objective, what this research hope to achieve is: *To describe the interaction between language and reading in PIRLS database, its relation to components of reading, and the connections with other factors that could explain variations in reading achievement.* To accomplish this task the following specific objectives will be developed:

1. To classify the languages present in PIRLS, in terms of their ethnological relations (linguistic families).
2. To gather information about the orthography of each language participant in PIRLS.
3. To use this information to classify languages in accord with their orthographic resemblance.
4. To transform these classifications into measurable variables.
5. To determine the connection of the two resultant variables with reading achievement in PIRLS.
6. To describe other significant factors that explain differences in reading achievement.
7. To verify if all these factors (linguistic, home and school) differ in their explicative power, while taking into account diverse dimensions of reading.
8. To create a statistical model, using the previous findings, able to explain variations in reading achievement in PIRLS.

3.4.4 Methodological procedure

The steps to be followed to accomplish the purpose of this research are implicit in the hypothesis and in the research objectives; they can be also found in the index of the part II of this work. Each time that a new procedure is introduced all

necessary details will be presented, aiming to be as clear as it is possible to avoid shadowy areas in this research. Now, in order to introduce the work done with PIRLS database, a general presentation of these steps will be done. Not all details will be mentioned, as this will be developed in the next chapters, but, at least all of them will be named, and most importantly, all of them will be justified. Thus, the aim of the coming paragraphs is to explain why decisions were taken in relation to the data treatment and the statistical procedures.

3.4.4.a Properties of PIRLS database

As was mentioned before (3.3.2), the fact of taking PIRLS data as source has several advantages from the methodological point of view. The most important advantage is the resemblance of 2001 and 2006 data sets. Almost all descriptive variables are repeated in both studies, demographic characteristic of the students like age, sex and language, answers in the tests, scores, characteristics of the schools, and all the necessary links to connect the different collections of data: the questionnaires and the results of the assessment. Thus, it is totally possible to identify one specific student and the score that he/she obtained on the test, to know which kind of questions he/she is best at, the conditions of his/her life at home, if he/she is younger or older than his/her classmates, to know how many years his/her teacher has been teaching reading, the kind of activities that they do in class, to know if these activities are repeated in other classes at the school, and to know if the school is rural or urban, if it is in an advantaged area or in a poor suburb, if there is violence among the students or if they do a lot of group activities. These, among many other characteristics can be observed in both data sets. This similarity has allowed us to reproduce the same procedures from one year to another with minor modifications and great comparability potential.

Therefore, to proceed to study a specific question, the amount of books at home, for example, the variable at the student questionnaire is searched, where the answer given by each student is present. Then, it is possible to manipulate the variable to obtain a score in relation to each possible answer, and to know the score of each student that has 100 books at home, and the score of each student that has only 10 books at home. A third parameter can be included in order to know the score of only the girls, or only the students of a certain country or that speak a certain language. Finally it is possible to combine those parameters to obtain,

3.4. How to compare reading acquisition among languages?

for example, the average score of French girls that have 25 books or less at home.

A variable, which will be particularly important to this research, is the one called ITLANG, present in both databases. It indicates the language in which the test has been answered by the student. There can be several languages in one country. From ITLANG, the linguistic factors will be developed into variables following our theoretical frameworks. Another important set of variables, also present in all datasets, indicate what language the student speaks at home, the amount of time that each student uses the school languages, and other linguistic particularities. These variables will be fundamental in the creation of language variables and will allow us to explore the incidence of having different languages at home and school.

A final property of the databases is that the information of all the data sets can be combined to obtain variables representing different *levels*: all the answers from the tests and the questionnaires can be used as attributes of the student (one student = one datum for each variable) or they can be aggregated forming a new data type, creating a score or an average of the answers at the teacher, school or country level. However, more than a simple calculation of an average, the important thing is that PIRLS has a number of operation procedures to assure the quality and comparability of the information. Since the starting point to create the database is a representative sample of schools and students in each educational system (see [Martin et al., 2007](#), chapter 9).

In relation to this property of PIRLS data sets, of being combinable, a key component is the *sampling weight* defined as “the product of the three intermediate weights: the first stage (school) weight, the second stage (classroom) weight, and the third stage (student) weight. The overall student sampling weight was the product of these three weights including non-participation adjustments.” ([Martin et al., 2007](#), p. 113). In other words, taking into account the population target, the selected and non selected (due to adjustments or to special conditions that leave them out of the sample) schools, classrooms, and students, a value was linked to each observation in the data that represents its possibilities of being selected. Later, these weights will be taken into account when performing analyses in the form of weight variables (TOTWGT for a total or TCHWGT for teachers).

PIRLS offers to researchers a set of programs and macros prepared for statistical systems such as, SAS and SPSS, that allow the calculation of percentages, means,

regression coefficients, and their standard errors. Taking into account the weights and the PIRLS methodology to obtain the survey results, jackknife repeated replication (JRR) is used (see [Foy & Kennedy, 2008](#), chapter 5). Using these programs and macros to obtain results, the comparability of the data and the representational properties of the sample were preserved. It must be mentioned that the software that was used here to develop analysis was SAS², for which a series of macros to improve the collection of information from the data sets was developed (see appendix C).

3.4.4.b Descriptive research

Now, it is important to mention the type of variables that were derived from the data sets using the procedures described in the later paragraphs. In accord with the research objectives, it was necessary to be able to develop interactions among the studied factors: languages, home and school, and the PIRLS's test results. Consequently the first task was to create variables that represented those factors from the data available.

In relation to the language factors, two approaches have been presented in chapter 2, and to study them two variables will be created. The first one, combines the information presented in section 2.1.2.g and the languages present in each PIRLS assessment. Since all languages presented in the test have a known linguistic family that can represent its historical and cultural relations, it is simple to develop a new variable FAMILY representing the family to which each language belongs. A more difficult task will be the creation of a variable indicating the orthographic depth of each language present in the study. For that reason the use of this variable will be more restrained as will be detailed in section 4.3.

In relation to the home and school factors, the mentioned SAS programs will be used to obtain scores, taking advantage of the fact that it is possible to obtain specific scores for each type of text and each order of comprehension process. This will allow several comparisons, for example in comparing the scores, it will be possible to observe if students that have 100 or more books at home are better literary or informative readers, or if they can read both kind of texts equally. Using this procedure, as shown in table 3.4, it will be possible to identify significant factors that are related to specific aspects of the reading process from the PIRLS

²SAS Institute (2002), Statistical analysis system.

3.4. How to compare reading acquisition among languages?

questionnaires. Obviously, not each question will be treated like a factor, in a second stage, after identifying variables the set of connections among them will be searched to create indexes that represent factors.

Table 3.4: Variable TEX 2006, Pearson Correlation Coefficients

Question derivated variable	ALL	TEX
BOOK_FEW (Percentage of students who declared to have twenty five or less books at home)	-.70***	-.32**
BOOK_LOT (Percentage of students who declared to have more than one hundred books at home)	.62***	.30*

This first step does not seek to present at once all the complexity of the problem, but, rather, to outline a way to develop a more precise and accurate analysis in the subsequent procedures. For this reason, only *countries* will be taken as observations (one country = one datum) and the technique employed will be simply descriptive. A Pearson correlation procedure will be used to establish relations among the derived variables from the questionnaires and the difference between the two types of texts and the two processes of comprehension scales. For example, in table 3.4, the coefficients indicates that to have a lot of books at home is very positive in relation to the total score (ALL). On the contrary, to have a little amount of books is correlated to a disadvantage in the total score.

This table has a second correlation coefficient with a variable called TEX, which is the difference between the two purposes of reading: literary and informative. For example, table 3.5 shows the scores of two countries: Germany and France, for each process scale in the case of Germany and for each type of text in the case of France. The difference between the scores can be calculated by simply subtracting one score from the other. By taking away the high order score to the low order score a new variable, called COM, is created. The same procedure of taking away the informative score from the literary score gives a difference called, TEX, that will be used in this analysis. If one looks again at the coefficients in table 3.4, it is possible to read that, having few books is correlated to an advantage in informative reading. The negative correlation associated TEX to an informative advantage, like in the case of France. On the other hand, to have *a lot of books available* is related to a literary advantage. In neither of these cases, the correlation is as strong as in relation to the total scores, since the values of r are smaller.

Table 3.5: Differences between reading aspects by country

	Low order Score	High order Score	Difference
Germany	553,48	539,55	13,93 (COM)
	Literary Score	Informative Score	Difference
France	516,3	526,08	-9,78 (TEX)

Finally, it is important to mention that the scores used in calculations are those obtained using PIRLS programs and macros. Even if the programs can be used to obtain specific scores using only part of the items, as those of constructed responses or those associated with a particular text, they were not modified, neither the items. As it was previously stated, the psychometric properties of the study are a complex subject, they cannot be described or manipulate in a superficial way without a deep study of IRT characteristics of the items and a deep comprehension of the equations used to calculate the scores. It was preferred to work with the information already provided by PIRLS, that includes total scores and scores for each PIRLS reading aspect.

To summarize, in this first descriptive step, these two differences: TEX and COM will be used to search for connections between reading aspects and the factors associated with home and school at country level using correlation as procedure. Through this inquiry, no conclusive results are expected, it is only considered as a way to discover a path to the best analysis of the problem.

3.4.4.c Statistical Modelling

Once this descriptive task is accomplished, all the necessary elements to compile an explanation of reading achievement are available: the linguistic properties of the sample and a series of school and home factors. Now, the variables that represent those elements can be incorporated in a statistical model that serves to explain the scores. Because the procedure is equivalent, is it possible to develop regressions for each score associated to the aspects of reading and to the total scores.

The main methodological question is to determine the best analytical technique,

3.4. How to compare reading acquisition among languages?

taking into account that the objects explained are, basically, educational systems. The principal property of these types of organizations is to count several nested levels. In PIRLS, students, classrooms, teachers, schools, school locations, countries, or even geographic regions can be considered as different floors of a structure. The regression technique taking into account this organization is the *hierarchical* or *multilevel model* (Rumberger & Palardy, 2004; Bressoux, 2008). The principle is that if several schools of a region or a country are studied, it will be not the same to consider all students as equals, as to consider that their answers can be influenced by their classroom, teacher or school. As Rumberger & Palardy (2004) said:

Student learning is influenced by experiences and activities of individual students, such as the amount and nature of the homework that they do. But student learning is also influenced by the amount and nature of the instruction that they receive within their teachers' classrooms, as well as by the qualities of the schools they attend, such as school climate and the nature of the courses that are provided. (p. 237)

A multilevel statistical model considers each level as nested in the upper level. The model allow to calculate, for example, if a factor determined outcomes in a different way from one school to another, or if the estimated performance of an individual is determined by the school in which he / she is enrolled or the classroom or the teachers. In these models the factors can vary in their explicative power at more than one level.

In the case of this research, the interest of implementing such a model in the analysis is, in first place, an answer to the need of support to improve the interpretation of the results, by taking into account the hierarchical structure of PIRLS database. The large variety of educational systems that has participated in this survey makes it mandatory that at least some of the levels of educational organization are incorporated in the modelling. Secondly, because through this regression technique, parameters representing the influence of the factors will be estimated, it is essential to the goal of this research that these values and significance are as exact as possible. At least part of the factors that will be incorporated in the models have not been tested before, that is, the linguistic factors, they must be clearly contextualized to be able to develop interpretations of their role as determinants of reading achievement.

Finally, it must be mention that another goal of the model integrated in this analysis is to be able to compare the results from the 2001 and 2006 surveys. To be able to compare, the multilevel models will only include countries and languages that participated in both assessments. The consequence of this is an important reduction of data, but, the number of observations at students' level is still very important. Moreover, this is the only condition that assures the comparability.

Part II

Development of experiments

Chapter 4

Criteria to establish linguistic categories

The goal of this chapter is to clarify some particularities of PIRLS sample of languages and to describe the process of creating both linguistic variables. One referred to cultural and historical links among languages, and the other referred to their phonological and orthographic structure.

Particular attention will be paid to the description of the relation between phonology and orthography in the countries that are present in both versions of PIRLS assessment, and that consequently, will be part of the comparative sample. In other words, not all languages present in PIRLS assessments will be described from this point of view, but rather, only those that will be in the main analysis. As it will be explained later, the creation of an orthographical variable implies a new perspective of the linguistic problematic on PIRLS assessment.

Accomplishing this task, some interesting linguistic situations, exceptions, and special cases will be referenced. Particularly, from the perspective of the developing of new comparative studies of languages. Then, the historical–cultural approach to language will be the base for the constitution of linguistic family as criteria to classify languages. The variable will be illustrated in both assessments separately and in the comparative sample. Finally, this chapter will close with the question of orthographical deepness and the orthographical properties of PIRLS languages.

4.1 Language in PIRLS

Table 4.1: Languages in PIRLS Assessments

Language	Countries	n 2001	2001%	n 2006	2006%
Afrikaans	South Africa			1,678	0.78
Albanian	Macedonia	1,127	0.77	1,563	0.73
Arabic	Israel	1,166	0.80	1,280	0.59
"	Kuwait	7,126	4.86	3,958	1.84
"	Morocco	3,153	2.15	3,249	1.51
"	Qatar			6,680	3.10
Basque	Spain			29	0.01
Bokmal	Norway	2,669	1.82	3,506	1.63
Bulgarian	Bulgaria	3,460	2.36	3,863	1.80
Catalan	Spain			668	0.31
Chinese	Chinese Taipei			4,589	2.13
"	Hong Kong (Sar)	5,050	3.45	4,712	2.19
Czech	Czech Republic	3,022	2.06		
Danish	Denmark			4,001	1.86
Dutch	Netherlands	4,112	2.81	4,156	1.93
English	New Zealand	2,488	1.70	5,990	2.78
"	Singapore	7,002	4.78	6,390	2.97
"	South Africa			2,793	1.30
"	Trinidad And Tobago			3,951	1.84
"	United States	3,763	2.57	5,190	2.41
"	England	3,156	2.15	4,036	1.88
"	Scotland	2,717	1.85	3,775	1.75
"	Canada Ontario	2,764	1.89	2,552	1.19
"	Canada Quebec	1,701	1.16	1,459	0.68
"	Canada Alberta			4,163	1.94
"	Canada British Columbia			4,123	1.92
"	Canada Nova Scotia			4,121	1.92
"	Belize	2,909	1.99		
Farsi	Iran	7,430	5.07	5,411	2.52
Flemish	Belgium Flemish			4,479	2.08
French	France	3,538	2.42	4,404	2.05
"	Belgium French			4,552	2.12
"	Canada Ontario	1,531	1.05	1,436	0.67
"	Canada Quebec	2,257	1.54	2,289	1.06
"	Canada Alberta			80	0.04
"	Canada British Columbia			27	0.01

Chapter 4. Criteria to establish linguistic categories

Language	Countries	n 2001	2001%	n 2006	2006%
"	Canada Nova Scotia			315	0.15
Galician	Spain			88	0.04
Georgian	Georgia			4,402	2.05
German	Austria			5,067	2.36
"	Germany	7,633	5.21	7,899	3.67
"	Luxembourg			5,101	2.37
Greek	Cyprus	3,001	2.05		
"	Greece	2,494	1.70		
Hebrew	Israel	2,807	1.92	2,628	1.22
Hungarian	Hungary	4,666	3.19	4,068	1.89
"	Romania	127	0.09	185	0.09
"	Slovakia	167	0.11	566	0.26
Icelandic	Iceland	3,676	2.51	3,673	1.71
Indonesian	Indonesia			4,774	2.22
IsiNdebele	South Africa			1,055	0.49
IsiXhosa	South Africa			1,470	0.68
IsiZulu	South Africa			798	0.37
Italian	Italy	3,485	2.38	3,581	1.66
Latvian	Latvia	2,111	1.44	3,091	1.44
Lithuanian	Lithuania	2,567	1.75	4,701	2.19
Macedonian	Macedonia	2,584	1.76	2,439	1.13
Maori	New Zealand			266	0.12
Nynorsk	Norway	790	0.54	331	0.15
Polish	Poland			4,854	2.26
Romanian	Romania	3,498	2.39	4,088	1.90
"	Moldova	2,951	2.01	3,298	1.53
Russian	Latvia	908	0.62	1,071	0.50
"	Moldova	582	0.40	738	0.34
"	Russian Federation	4,093	2.79	4,720	2.19
Sepedi	South Africa			1,733	0.81
Sesotho	South Africa			1,349	0.63
Setswana	South Africa			959	0.45
Siswati	South Africa			1,147	0.53
Slovak	Slovakia	3,640	2.49	4,814	2.24
Slovene	Slovenia	2,952	2.02	5,337	2.48
Spanish	Argentina	3,300	2.25		
"	Colombia	5,131	3.50		
"	Spain			3,182	1.48
Swedish	Sweden	6,044	4.13	4,394	2.04
Turkish	Turkey	5,124	3.50		
Tshivenda	South Africa			784	0.36
Valencian	Spain			127	0.06
Xitsonga	South Africa			891	0.41

4.1. Language in PIRLS

Table 4.1 clarifies the languages present in the sample in which the test was translated and the countries where these languages are spoken. As can be observed, as there are languages present in several countries, there are also countries with more than one language. When there was more than one language in the educational system of a country, multiple translations were done (see 3.3.2).

Directly related to the previous subject is the increase of languages from 2001 to 2006. There is a more complex distribution of languages in the sample because there are more countries and more languages (28 languages before, 46 languages in the new test). The two principal contributors for this change are South Africa, having eleven different official languages, and Spain, having five. A brief interlude to explain in detail the characteristics of these two countries will be made at the end of this section.

The amount of countries where English is the language of the test is remarkable, even if only six of these countries have participated in both versions of the assessment. However, this number is increased by taking into account Canadian provinces as independent countries; this is a special case that will be discussed in the coming paragraphs.

French is the next language in terms of its presence in different countries, however, in Canada, excluding Ontario and Quebec, the proportion of French speakers is low. In this research, Ontario is the most important province, along with Quebec, as both are present in the two versions of the assessment, as is France. This will be an interesting point for this analysis, because French has remarkable characteristics in regards to linguistic families (as a romance language) and also concerning its phonetic, as a language of intermediate depth (see 4.3.1.h).

In an opposite situation, there are languages with a very limited percentage of participation, that were part of only one version of PIRLS and with few speakers. Among these languages are Basque, Galician, Valencian, Maori, and some South African languages. In all cases, these languages are minority or regional in countries where another language occupies the role of national language (Spanish, English, and Afrikaans).

From these characteristics it is already evident that it will not be possible to include, in this analysis, all the languages present in the assessments. For this reason, it is necessary to describe various special cases and to explain the decisions that will be made on including, excluding, or how to include some languages and

countries with special conditions.

Over the next few paragraphs, these changes will be described. It is necessary to underline that here, only the characteristics that can affect the constitution of the sample will be considered, specifically in linguistic terms. In other words, not all the changes in the sample will be pointed out, but only those directly related to this research and that can influence the applicability of the analytical procedures.

4.1.1 Especial linguistic cases

4.1.1.a English

Apart from the main Anglophone countries, there are two others that will not be considered in equal conditions with the rest. Belize will not be considered as part of the English family, nor Singapore because of their special linguistic conditions. In Belize, although English is the official language, there are at least four other languages currently spoken in the country (Kriol, Spanish, Garifuna, Maya, Plautdietsch) English is often a second language. Moreover, the PIRLS 2001 report indicates that only 28% of the examinees claimed to speak English every day (see [Mullis et al., 2003](#), p. 101), far from the 88% of English students or the 85% in the United States. Similarly, in Singapore *Singlish* (Standard Singapore English) is the official language, but the population is particularly varied in their origins and there are three other official languages: Malay, Chinese (Mandarin), and Tamil. the PIRLS 2001 report indicates that 43% of the examinees said they spoke English daily, while a 50% spoke it only sometimes.

4.1.1.b Qatar, Kuwait, Morocco and South Africa

A common problem in this kind of research, is that some countries have missing data or abnormal results in relation to the rest of the sample. Countries with such problems can cause a bias in the interpretation of data due to aberrant values. With this in mind, the most extreme cases can be found in countries having deviations too high in comparison to the average of the mean scores, and also having an unusual score distribution. Such was the case of the four last countries in the PIRLS 2006 achievement ranking: Qatar, Kuwait, Morocco, and South Africa (whose characteristic will be detailed later).

4.1. Language in PIRLS

These four countries were one and a half standard deviation under the international average score, and their achievement benchmarks were also lower than the others. In all the cases, only less than 33% of the students reached the lower benchmark (scores at or above 400), in comparison with an international median of 94% (see [Mullis et al., 2007](#), chapter 1). Notwithstanding these facts, the total scores are not the central objective of this research, and in terms of aspects of the reading process, the low performances are not going to be necessarily a source of bias. But, there is another reason to consider eliminating those countries from this research: there is simply not enough information available about the achievement in the reading comprehension processes, because their results did not reach the necessary validity. The missing data, added to the score problems, made it necessary to totally leave out the four countries from the sample, in order to avoid result debasement, and in order to have the same countries included in both analyses.

4.1.1.c Canadian Provinces

Canada is represented in PIRLS 2006 by five provinces (only two in 2001) and the results were always presented as individual countries. However, as the purpose of this research is more related to linguistic characteristics than to political or economic divisions, a possible source of debasement is having five extra English speaking countries in contrast to the rest of the linguistic sample.

Table 4.2: 2006 Differences by component in Canadian provinces

Province	TEX	COM
Alberta	5	11
British Columbia	6	11
Nova Scotia	4	15
Ontario	3	19
Quebec	-4	-2

Moreover, if some data of Canadian provinces is observed, it is clear that they are very similar (see table 4.2). For example, in this table, the differences TEX and COM 2006 are presented. All provinces have similar results excepts for Quebec, in that case, the mean of TEX (difference between reading objectives) is -4, favorable to informative reading, whereas for COM (difference between processes

of comprehension) the mean is -2, far away from the average of 14 of the other provinces. Hence, the Canadian region of Quebec has very dissimilar results from the rest of the country, not only in the total score, (533, against an average of 554) but also in the components of reading process.

Following these facts, in order to include the Canadian provinces in the sample, only a linguistic division was established: only Ontario and Quebec, the two Canadian regions that are present in both assessments will be included. These English and French provinces will be considered as two bilingual and independent countries.

4.1.2 Multilingualism cases

The cases of multilingualism are South Africa and Spain, which have only participated in 2006 assessment. The term multilingualism makes reference to those countries with more than two official languages. There are many cases like these in the sample, but only these two have made several translations of the test, giving students the possibility of answering in their closest language. Due to this particular condition, and the interest of this research in languages, it is important to offer some lines to describe those multilingual cultures before continuing with this analysis, even if it is already clear that South Africa will not be part of this analysis, and that the modeling will include only those languages that take part in both versions of the survey.

4.1.2.a South Africa

The language in the case of South Africa is a very complex scenario since there are eleven official languages: Zulu, Xhosa, Afrikaans, Northern Sotho, Tswana, English, Sotho, Tsonga, Swati, Venda, Ndebele. The government of the country is engaged in the promotion and development of all these languages, particularly of the indigenous languages, that have been historically diminishing. PIRLS 2006 offers to the students translations of the test in all these languages. There are several cultural and linguistic differences between them, but at least five big families can be identified:

- Afrikaans, which as was described in section [2.1.2.d](#), is an Indo-European

4.1. Language in PIRLS

language from the Germanic–Low Franconian branch and a direct derivation from Dutch; it is recognized as a language in itself and not only a Dutch dialect since s. XIX. Afrikaans is spoken by 13.3% of the South African population as a mother tongue ([Statistics South Africa, 2001](#)). It is the primary language used by the Afrikaners (mostly the white population) and the Coloureds (mixed race, but not enough to be considered as black).

- English, (Indo–European, Germanic–West branch) even if it is only the sixth–most common language in the country, and the mother tongue of only 8.2% of the population, it is the dominant language for commerce, administration, and the medias.
- The languages derived from the Sotho-Tswana branch of Narrow Bantu (common ancestor of all the indigenous language of South Africa), they are: Sotho, Northern Sotho and Tswana. Altogether, they are the home language of 25.5% of the population, principally in the northern third of the country.
- The languages derived from the Nguni branch: Zulu, Xhosa, Swati and Ndebele, they are predominant in the south-eastern third of the country. Zulu is the first language of the country spoken by 23.8% of the inhabitants. Together with the other three Nguni derived, they represent 45.7% of languages spoken at South African’s homes.
- Finally, There are two other derived languages of Bantu, but not related to the previous branches: the Venda and Tsonga, which are spoken as first language by 6.7% of the population.

In spite of the fact that it is already known that South Africa will not be considered in this sample, it was necessary to describe its linguistic complexity and to remark on the fact that this country is by it–self a source of study in regards to the relation between language and reading learning. It is very probable that at the current point of development of the South African nation, there are other factors that influence reading acquisition more than this one, but this linguistic diversity is certainly a key aspect of their educational system. Moreover, it makes this a unique source for the study of the relation between languages and education.

4.1.2.b Spain

The most spoken language in Spain is Spanish (also known as Castilian), but there are many other languages spoken in the country too. Organizationally, the Spanish nation is composed into 17 Autonomous Communities; some of them have their own education systems (along with their own elected parliaments, governments, public administrations, budgets and health systems). Some of the communities also have particular languages which have been declared co-official in the territories in which they are spoken (Catalan, Basque, Galician and Valencian). Therefore, in schools, the instruction can be done in any of the two official languages of the community, the proportional presence of one or another language at a school will depend on the particular educational policy of the community. The PIRLS 2006 assessment chose to translate the test into the five official languages: Spanish, Catalan, Valencian, Galician, and Basque.

Table 4.3: Literary and Informative scores and their difference in Spain

Languages	Percentage	Lit Score	Inf Score	TEX
Castilian	75.02	519.28	508.31	10,97
Catalan	18.05	513.07	510.69	2,38
Galician	2.53	512.11	508.73	3,38
Valencian	1.28	502.81	505.40	-2,59
Basque	3.13	476.28	491.52	-15,24

As presented in figure 2.4, the first four are part of the same linguistic family, because they are all Romance languages. The exception is Basque, far away from Vulgar Latin, this is the tongue of the only people who have resisted the Roman conquest of the Iberic peninsula, and who have preserved their native linguistic culture until the present time. Linguistically the Basque is considered an isolated language because it has not demonstrated a relation to any other language.

Moreover, in PIRLS sample, it is possible to observe a performance of Basque that clearly differs from the rest of the Spanish sample. Looking at this data (see table 4.3), and particularly looking at TEX, the different behavior of the Basque responders is clearly remarkable. This difference is also a support to the hypothesis of this research, suggesting the possible relation between language and specific aspects of reading. The same holds true for South Africa, the special status of lan-

4.1. Language in PIRLS

languages in Spain needs to be the object of a deeper analysis by itself, particularly with more representative samples of the languages that make up the educational system (there are only 29 Basques in the sample).

To summarize, from all the countries and languages with special cases, the only that will be present in the analysis are Ontario and Quebec. English will be obviously present but without Belize and Singapore. The mentioned African countries will not be considered. Finally, Spain will only be considered as part of the Latin family during the preliminary analysis of 2001 sample.

4.2 Linguistic Family as factor

Since the family of each language present in the test is known, a variable indicating the families is easy to create using the information that was exposed in section 2.1.2.g. This versatility will allow for the inclusion of this variable, not only in the models, but also in the preliminary descriptive tasks. To create these variables, two stages of selection were done, a first step for the inclusion of this variable in the descriptive analysis, and a second step to include it in the models.

4.2.1 Descriptive variable

Table 4.4: Linguistic Families in 2001 sample

Others	Latin	Slavic	Germanic	Anglo
belize	Argentina	Bulgaria	Germany	New Zealand
Cyprus	Colombia	Czech Rep.	Iceland	United States
Greece	France	Russian Fed.	Netherlands	England
Hong Kong	Italy	Slovakia	Norway	Scotland
Hungary	Romania	Slovenia	Sweden	Ontario
Iran	Moldova	Macedonia		
Israel	Quebec			
Kuwait				
Latvia				
Lithuania				
Morocco				
Singapore				
Turkey				

For the first selection, all the countries were distributed into linguistic families to create a country-level variable. It is important to notice that, at this point, the countries are to be the observations and not the languages, even if in most of the cases one country has only one language, there are also several cases of bilingualism or even more than 3 or 4 languages in the same country. The criteria have been to use the preeminent family in the country. If table 4.1 is compared with tables 4.4 and 4.5, it can be seen that bilingual countries such as Moldavia,

4.2. Linguistic Family as factor

Table 4.5: Linguistic Families in 2006 sample

Others	Latin	Slavic	Germanic	Anglo
Taipei	France	Bulgaria	Austria	New Zealand
Georgia	Italy	Poland	Denmark	United States
Hong Kong	Spain	Russian Fed.	Germany	England
Hungary	Quebec	Slovakia	Iceland	Scotland
Indonesia	French Belg.	Slovenia	Luxembourg	Ontario
Iran	Moldova	Macedonia	Netherlands	
Israel	Romania		Norway	
Singapore			Sweden	
Trin. & Tob.			Flemish Belg.	
Latvia				
Lithuania				

Romania, Quebec, and Ontario are assimilated to the mayor language of each country.

A second difficulty is the fact that the limited number of languages that are part of the sample makes it impossible to establish a large number of different linguistic families. It was necessary to limit the variety to those families well represented in the sample. A regretful loss of this limitation was the case of Arabic countries, that show an interesting behavior than can be observed in comparison of their results in tables 5.2 and 5.3. However, as it was pointed out before (see 4.1.1.b), Kuwait, Morocco, and Qatar did not reach the necessary validity to develop the high and low order processes scale. As the use of this scale is central to the analysis, it is not possible to include them in a hypothetical Arabic family. Another interesting languages, that eventually could have been considered as families were French, Greek, and Chinese. However, the small amount of countries and students using these languages in the assessments prevented the creation of families representing them. This is especially true in country dimension, where valid conclusions could not be obtained with only two observations.

However, before arriving to this distribution, the significance of another kind of distributions was tested, considering the principal languages and linguistic families present in the samples. For example, the *Latin* family was pulled apart to stress the role of the French language, the Arabic was tested as a new linguistic family,

and also Chinese. Taking all these possibilities, different distributions were made, merging and combining these eight variables. (i.e. “Anglo – Slavic – Germanic – Franco – Others – Arabic”; “Anglo – Slavic – Germanic – Others – Arabic”; “Chine – Franco – Anglo – Slavic – Germanic”). Of course all these possible combinations were made according to logical and significant associations between the languages and the sample. Finally, the main criterion for choosing the families to be studied was the size of their presence in the sample, which was, to this analysis, the key to a valid comparison among families. Even if the analytical procedures described in section 3.4.4 make it possible the comparison of groups of students of different sizes (due to the use of sampling weights); this could have been applicable only in the second stage of analysis.

The final sample of linguistic families are presented in tables 4.4 and 4.5. If both are compared, the changes in the sample are visible, due principally to countries that have not participated in the first or the second assessments. From these changes there are two missing languages that were a particularly regrettable loss for this research, Greek and Spanish. These languages do not show continuity from one sample to another. Greek because their countries simply did not participate anymore, and Spanish because the countries that were previous participants: Argentina and Colombia, have departed, while a new country, Spain, appears. However, there is hope for a future study of Spanish in PIRLS since two of those countries, Spain and Colombia, will participate in the 2011 version of the survey.

The families are included in the database in two ways: as a qualitative variable, mostly descriptive, in where each family is represented with a different value. Secondly, there are five dichotomous variables, each one referred to a specific family, the possible values are 1 if the country is part of the family or 0 if it is not, these variables will be used during the analysis.

Observing the sample of families, the first thing that can be observed is that there is not even one linguistic family, because Latin, Anglo, Slavic, and Germanic are all sub-branches of Indo-European. However, as was mentioned in section 2.1.2.d, the unity of this family is mostly geographic or historical before linguistic; their speakers can not necessarily understand each other, more unity and similarities can be found among the members of each sub-branch. Moreover, the family is not particularly over-represented since it is one of the biggest families of the world and include several mayor languages. It is perfectly possible to consider Sub-branches as groups of languages because of their common characteristics, and,

4.2. Linguistic Family as factor

importantly, because of their common historical, cultural, and linguistic roots.

The Italic branch is represented by the *Latin* family, the Germanic branch, north and west, is the *Germanic* family, and the *Slavic* branch is called in the same original way. The *Anglo* family, represents a single west-Germanic language, however, considering the particularities of this language it seems not only possible but mandatory to isolate it because of the important amount of countries and students that answered the tests in this language. Furthermore it is, in fact, the original language of the test from which all the translations were done (see 3.3.2).

The significant amount of countries that were considered as part of a general *other* group can also be an area of difficulty, however, it is expected that the very same number and variety can play a role in avoiding the effect of countries with extreme results, by neutralizing their effects. This possibility must be confirmed in the analysis.

4.2.2 Modeling variable

Table 4.6: Linguistic families in comparative sample

Others	Germanic	Slavic	Latin	Anglo
Albanian	Bokmal	Bulgarian	French	English
Arabic	Dutch	Macedonian	Italian	
Chinese	German	Russian	Romanian	
English	Icelandic	Slovak		
Farsi	Nynorsk	Slovene		
Hebrew	Swedish			
Hungarian				
Latvian				
Lithuanian				

The second stage of creation of this variable is the implementation of a more refined version of the previous work to be incorporate in a model that fits to explain reading achievement. The goal is also to compare the languages from countries that participated in both surveys. Keeping the same five alternatives, now the languages spoken by each of the students of the test are directly associated with

the correspondent family. The relations among the languages and their common root have been translated into a graphic representation in table 4.6. As the goal is comparison, only the 23 languages from the countries that participated in both assessments are present.

Viewed from this perspective, the family *Others* appears as the larger, while English seems to be underrepresented, however, it is important to consider that the observations to which the families will be associated are students, not countries anymore. From this point of view, is table 4.7 which provides a clearer panorama of the distributions of the families in the sample. There, it is shown that English, far away of being underrepresented, is the language of 15% of 2001 sample and 19% in 2006. The biggest family is *Germanic* in both samples even if it reduces its total in 2006. *Latin* has a very stable proportion in both samples, being, in both cases, the smaller linguistic family. *Slavic* has increased its proportion from 2001 to 2006; as a result the distribution is very similar among the three main families. In the case of *Others*, besides the variety of the languages that made it up, it is around 30% of the sample, its quantity is bigger than the other families but not as far from the other proportions to considered it as an abnormal or disproportionate amount.

Table 4.7: Distribution of families in the comparative sample

Family	n 2001	2001%	n 2006	2006%
Anglo	16,589	15	23,268	19
Slavic	18,218	16	22,982	19
Germanic	24,924	22	23,959	19
Latin	17,270	16	19,096	15
Others	34,222	31	34,595	28

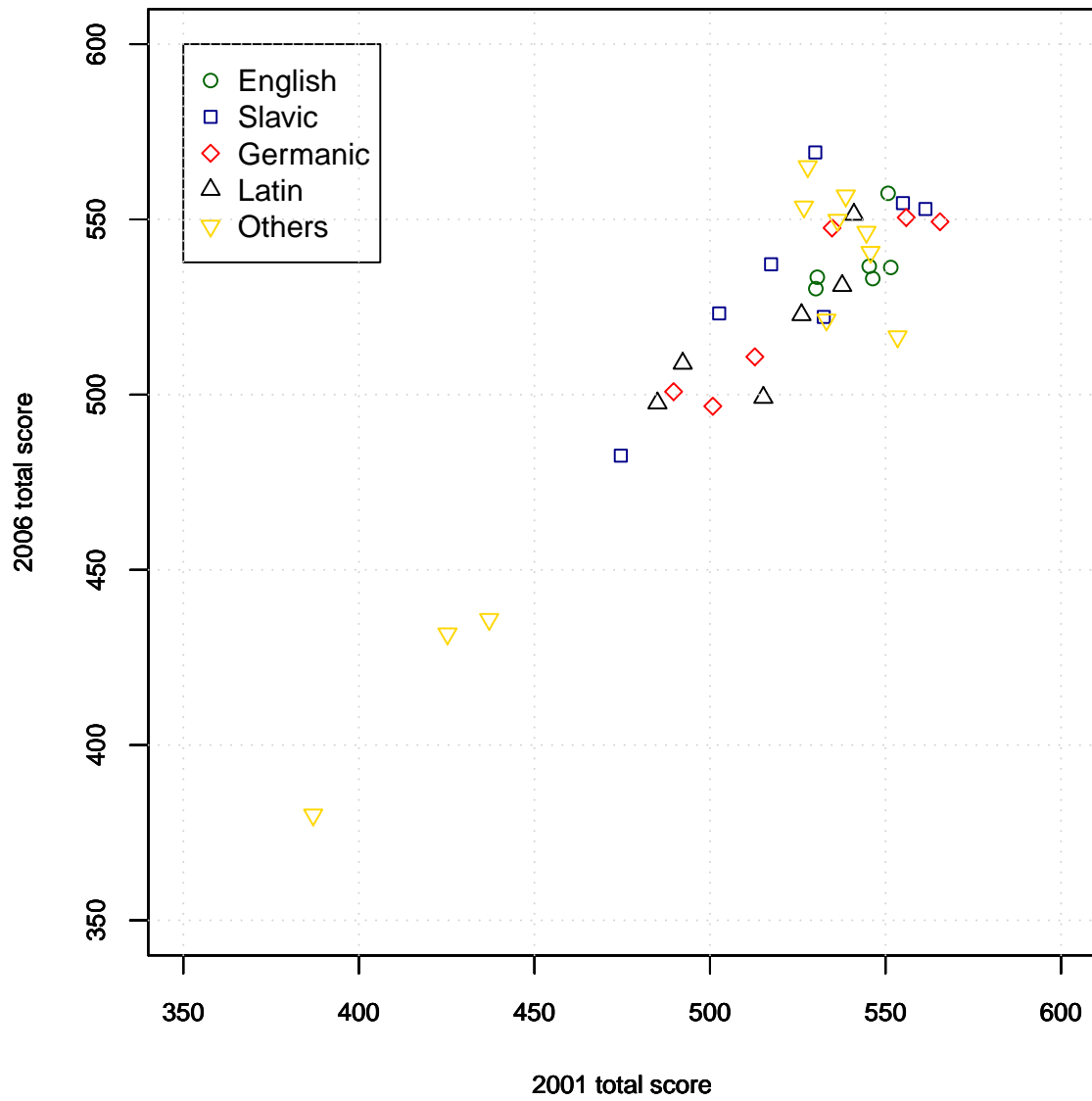
It is important to mention that only the students of these countries are included in this sample, and inside those countries, languages that participated in both versions of PIRLS. This means that all the changes in the quantity of students being examinees are internal changes; it does not take into account other external changes as the incorporation of new languages belonging to the same family. The real reasons for the changes in the distribution, can be found in table 4.1 where it can be observed, for example, that in France almost 1000 new students pass the tests in French in 2006, while in Kuwait 3000 examinees less take part in the new

4.2. Linguistic Family as factor

assessment.

To further clarify the relation between countries and linguistic families, an interesting question is to incorporate the score into the discussion, is the score particularly better for certain families or countries? This question can be answered by observing figure 4.1, there are presented the interception points of scores 2001 and 2006 for each country, bilingual cases where treated as different countries. *Germanic* family, for example, has half of their countries distributed around a score of 550 point, and the other half around a score of 500. *Slavic* family has also a very regular distribution, among which, Russia stands out with its improvement in 2006. The group *others* is the most diverse of all, being the area in which the observations are spread bigger than all the others, the reason is the great diversity of scores from the countries included in this group. In contrast, *Latin* is a family clearly spread in the plot, even if it is distributed in a limited area, smaller than the three groups mentioned before. The most uniform family is *anglo* (it was already mentioned that it has an average that is over the other families), in this case, the graphic confirms that there is certain homogeneity among the members of this family, only Ontario stand out of this homogeneity surpassing the frontier of 550 point in 2006. In contrast, England, the rightmost point, did not keep its advantage from 2001 losing several points. The main inference that can be made in observing the graphic is that it is not possible to establish *a priori* a link between score and the linguistic families. In general terms, the points representing them are broadly spread along the plot area. Consequently, the relation between languages, scores and countries need a deeper study to measure how they are related.

Figure 4.1: Plot of countries scores by language and linguistic families



4.3 Orthographic depth as factor

In previous discussions, orthographic deepness has been defined as a linguistic factor, as a part of the “linguistique synchronique”, as Saussure said, this definition contrasts with the definition of language as a cultural product, as part of a “linguistique diachronique”. Orthography is an internal feature, different from other characteristics of languages directly related to history and culture. Nevertheless, orthography is not purely linguistic, because it varies from one language to another. The great variety of these rules among languages is the result of cultural evolution:

Toutes les écritures européennes utilisent le principe alphabétique mais chacune le fait à sa façon. Aucune d’entre elles, et *a fortiori* aucune orthographe, n’est le fruit d’un calcul linguistique délibéré. Toutes sont les filles naturelles de bricolages et de tâtonnements qui aboutissent malgré tout à un équilibre quasi fonctionnel.

Produits d’un déterminisme culturel, les écritures alphabétiques sont en même temps le fruit d’un hasard. Et si nos orthographes contemporaines ont opté pour l’alphabet latin, ce n’est pas en vertu d’une quelconque logique. Une analyse, même succincte, de ce fameux contexte sociohistorique montre assez que la diffusion de l’alphabet en Occident passe par l’influence conjuguée des pouvoirs politiques et religieux. (Jaffré & Fayol, 1997, p. 42)

Therefore, the different degrees of regularity in grapheme-phoneme correspondences, which is the origin of the notion of orthographic deepness, are cultural factors too.

In the next paragraphs, the question to be answered will be *how deep are the languages in PIRLS sample?*. This information will allow the development of a variable that classifies the languages in the sample, according to their degree of opacity. During this description of languages, the influence of culture will be put in evidence, and it will be shown that there are languages whose opacity is due to a long cultural tradition and others that, being very ancient languages, *choose* transparency. There are other very shallow languages that are also very recent in their constitution, thus, they have had a political will in developing a regular orthography.

Regarding the classification structure, an important question is the categories to be employed: how many degrees of opacity can be identified? Frost (1987; 2005) describes orthographic depth as a continuum from transparent to opaque languages, “in this view languages may be aligned one next to the other where one language would be considered deeper than another but shallower than a third one” (Frost, 2005, p. 278). Seymour (2003; 2005) also recognizes that orthographic depth can be a continuous variable, but specifies that in terms of its cognitive effect in reading acquisition it may be mostly dichotomous: “there is a range of low degrees of complexity, collectively classifiable as *shallow* orthographies, and then a threshold level of complexity that marks the boundary for a group of *deep* orthographies” (Seymour, 2005, p. 311).

Consequently it seems that the key to classifying languages is being able to determine their opacity. Then, it will be possible to think about a more general model if more information about orthographies is gathered. As Caravolas (2005, p. 338) thinks, the ideal will be a comparable database with statistical estimates for all those languages from which an exact calculation of their deepness can be made. Even if it is less formal, we expect to be able to develop a referential framework, getting information from general descriptions, specific studies of languages properties, and international comparisons. This is not the ideal starting point for classified languages, but it is not completely ineffective since the high degree of formalization that the research about orthographic properties has reached in the last two decades.

Concretely, since this language sample is limited to those present in PIRLS studies, here is a description of each of the languages, paying particular attention to their phonological and orthographic characteristics, to determine which languages are transparent and which ones are deep.

4.3.1 Orthographic properties of PIRLS languages

4.3.1.a Albanian

Albanian is a very independent language in relation to alphabets. This characteristic explains the shallow phonetic representation of its orthography. Albanian, as a language, precedes the adoption of the Latin alphabet. Before this system, Albanian was written in Greek characters and in autochthonous scripts, like ‘El-

4.3. Orthographic depth as factor

basan script' (created and used in Elbasan during s. VIII) and Beitha Kukjo script, created in s. XIX (see [Coulmas, 1999](#), p. 7). This independence has made possible that Albanian speakers accept reforms as part of a normal linguistic development. The most recent reforms were made in the 1970s with the publication of several normative books, like "Fjalori drejtshkrimor i gjuhës shqipe" that promotes a phonological and spelling normalization.

Consequently, Albanian is one of the shallowest orthographies in the sample: "Albanian orthography has a one-to-one correspondence between graphemes and phonemes as well as between phonemes and graphemes, that is, it is one of the few 'ideal' alphabetic orthographies with high feedforward and feedback consistency" ([Landerl, 2006](#), p. 525).

However, there are not many analyses of the effectiveness of this transparency in reading learning, only one study: *Learning to read words in Albanian: A skill easily acquired* (quoted in [Landerl, 2006](#)). This paper shows that, in reading isolated words of increasing difficulty, Albanian children performed better than their counterparts in English and Welsh. Besides this study no other direct comparison has been referenced.

4.3.1.b Arabic

Arabic is characterized by its derivational and inflectional morphology. The key in Arabic orthography is the distinction between vowels and consonants, there are not only different kinds of sounds, but also, holders of different types of morphological and semantic information.

Semitic languages are based in a root-relative structure. The root is the core of a word and is usually formed by consonants, vowels are only used to generate relatives:

Semitic words that are related by derivation or inflection have a common core (usually three consonants). Although the vowels in each of the different relatives may be quite different and although there may be additional consonants in a prefix or suffix, there remains an invariant series of three consonants, the root. ([Katz & Frost, 1992](#), p. 69)

In Arabic orthography, this different status is translated into different graphical

values. Consonants are the key of writing, because the root represents the basic sense of the word while vocals are often omitted, indeed they are only represented in poetry, or instructional reading texts. In regular Arabic writing, vocals sounds must be deduced. In learning to read, during the first period of instruction, children study from vowelised text and then gradually abandon the use of vowels: “In sum, beginning readers are introduced to vowelised Arabic, but skilled readers are introduced to unvowelised Arabic” (Abu-Rabia, 2002, p. 300).

If vowels are explicit in a text, Arabic is mostly shallow. However, even if the texts in PIRLS assessments are all vowelised,¹ there is a second attribute of Arabic that increases its opacity to beginner readers.

Arabic is not the language of one nation, it is spoken in a vast region of North-Africa and the Middle-East. Several countries share the same language. The situation resembles that of Latin in the Roman Empire: there is Standard Arabic, that is equal in all countries and allows the communication among the entire community, as well as regional variations from country to country or even in the same nation, and those dialects are not necessarily understandable to each other (see Kaye, 1990). What makes a fundamental difference in relation to the status of Latin is that this dissimilarity of Arabic does not include a social component, as Abu-rabia, Share, & Mansour (2003) describe:

The educated Arabs use literary Arabic for reading, writing, and speaking on all official occasions. However, both educated and uneducated native Arabic speakers use the spoken language on a daily basis for everyday communication: family dialogues, shopping, cultural talks, and entertainment. Literary Arabic differs in vocabulary, phonology, grammar, morphology, and syntax from the accepted spoken language, in which there is a diversity of dialects. (p. 424)

Consequently, the difference between literary and spoken Arabic is formal, not social or regional. In relation to education, since at home spoken Arabic is usually used, it is at school that children have their first contact with literary Arabic. If they have not had any experience with this language before, this can become a difficult process. Some researchers state that this learning is more similar to the

¹we cannot be certain because it was not possible to have access to the translations into Arabic, moreover since each country developed an independent translation.

4.3. Orthographic depth as factor

process of learning a second language instead of the mother tongue, this linguistic phenomenon is called diglossia (see [Abu-Rabia, 2002](#); [Abu-rabia et al., 2003](#); [Zuzovsky, 2010](#)).

Diglossia is a cross-national problem in learning Arabic, and this could be the explanation for the delay in learning to read, which can be deduced from reading achievement of these countries in international comparisons like PIRLS. From this language, after cleaning the sample (see [4.1.1.b](#)), the only speakers that remain are a thousand Israel–Arabic children, in describing their results (one s.d. under Hebrew), [Zuzovsky \(2010\)](#) affirms: “These findings supported the explanation according to which Arabic diglossia is the main cause of the low reading attainment of Arabic-speaking students in Israel and may have implications for the low achievement in other Arabic-speaking countries as well” ([Zuzovsky, 2010](#), p. 7).

Because of this phenomenon Arabic cannot be considered as a transparent orthography. Even if this is not exactly a phonetic or orthographic property of the language, it is determinant in learning Arabic, for any learner, a second language will always be more opaque than the mother tongue (see [Koda, 2007](#)).

4.3.1.c Bulgarian

Bulgarian is mostly transparent in its orthography; the alphabet has 30 Cyrillic letters that represent 42 phonemes. Thus there is some degree of non one-to-one correspondence, that affects consonant sounds specifically, the 6 vowel sound of Bulgarian having all one-to-one representation in the alphabet. However, [Janyan & Andonova \(2006\)](#) Bulgarian report for the *Handbook of orthography and literacy* supposes some degree of complexity when they state:

...the Bulgarian language lacks definite rules for stress, which means that the accent of every word must be learned individually and that most words (being multisyllabic) require adequate access to the lexeme representation before they can be read out correctly despite the generally close grapheme-phoneme fit. (276)

There is not comparative research of reading acquisition that includes Bulgarian in their sample. However, all the linguistic studies of Bulgarian that at least mention its degree of opacity, describe this orthography as shallow or mostly transparent (see [Jetchev & Bertinetto, 2002](#)).

4.3.1.d Chinese

Traditionally, the reflections about this writing system have been defined by the belief that Chinese is ideographic or logographic: that the units directly represent ideas or real objects. However, even in the earliest period of its development (1200 bc. during Shang dynasty) the system did use this principle, actual characters of written Chinese have other properties:

Approximately 80 to 90% of characters are semantic-phonetic compounds consisting of an element called the *semantic radical*, which gives information about the meaning, and an element called the *phonemic*, which gives information about the pronunciation of the word. Hence, it is possible to extract from most Chinese characters cues to word meaning *and* pronunciation. (Caravolas, 2005, p. 339)

There are about 56,000 characters, of which, only around 3,000 are in common use, the knowledge of this portion of the characters will allow readers to understand most of the texts. From the characters that follow the phonemic-radical structure, there are 200 different radicals and 1000 different phonemics.

Accordingly, the Chinese writing system differs importantly from the other studied languages, that are strictly phonetic and that do not carry semantic information in their graphical manifestation. Moreover, even if the phonemic component of Chinese characters approaches the orthography to sounds, it is far from being a transparent relation. Caravolas (2005) states that only 30% of these phonetic elements are unambiguous, while “The remaining components are semitransparent or opaque offering only partial clues or no clue to pronunciation or meaning”(p. 339).

It is difficult to make a decision about the opacity of such a particular language; however, some researches have stated that phonology is a determinant factor in learning to read Chinese:

There is now a substantial body of evidence showing that children are sensitive to both the radical and the phonetic components of Chinese characters, and, interestingly, the regularity of the phonetic component (the consistency with which it is associated with the same pronunciation) affects the rate at which a character can be learned. A related

4.3. Orthographic depth as factor

finding is that readers of Chinese have better syllable and morpheme awareness than readers of English. Variations in phonological skills do predict learning to read in Chinese but less powerfully than in English, however the independence of phonological skills from other language skills as predictors of learning to read in Chinese has yet to be established unambiguously. (Snowling & Hulme, 2005a, p. 270)

If phonetic determines reading learning, the relation between Chinese orthography and phonology also plays a part in reading. Phonetic methods are used to introduce children to reading, *Pinyin* in mainland China and *Zhu-Yin-Fu-Hao* in Taiwan. Considering the elements that characterize this relation, it is possible to define it as a language of an intermediate complexity, not as deep as English but certainly not as transparent as Italian.

However, besides the complexity of the language itself, there is a second source of difficulty in this language. As was mentioned in section 2.1.2.e, Chinese is defined as a *macro-language* because it has numerous variations which are accepted as part of the main language. Looking now at PIRLS, there are two of the Chinese variations that are present in the sample: Taiwan Mandarin Chinese, mostly conservative, and Hong Kong Cantonese variation. Even if Hong Kong children are taught to read in Mandarin, the differences between it and Cantonese can add extra difficulty in the learning process:

A Mandarin speaker would find it quite difficult to read a newspaper from Hong Kong written in Cantonese, and a monolingual Cantonese speaker would struggle to read text written in Mandarin. This is because the syntax of the two languages is different, and because the meaning of some characters differs in Cantonese and Mandarin. (Hanley, 2005, p. 319)

To summarize, Chinese is certainly not a transparent language, but, in accord with our research the use of phonetic in teaching reading is an element that approach this language to regularity. Moreover, there is not evidence indicating that this language is as complex as English in terms of its relation to phonetic. This language will be defined as deep but not in the same level as English.

4.3.1.e Dutch

Dutch has been defined as a language of an *intermediate consistency* (see [De Jong, 2006](#)). [Seymour et al. \(2003\)](#) describe Dutch as a language with a complex syllabic structure and an intermediate degree of orthographic depth. Seymour and his colleagues observed that in the test of accuracy, speed and fluency, Dutch children ranked among the deeper languages along with Danish, French, and English.

The cause can be found in a similar orthographic structure to French, where syllabic complexity goes only in one direction:

Written Dutch is morphophonemic, this feature has different consequences for reading and spelling. That is, grapheme-to-phoneme relations appear to be more consistent than phoneme-to-grapheme relations, which renders written Dutch relatively transparent for reading but somewhat opaque for spelling rules, affects reading for beginning readers and spelling for both beginning and advanced spellers. ([Bosman, Graaff, & Gijssels, 2006](#), p. 135)

An example of this complexity, is described by the same Bosman: "... in native-Dutch words, only 9 sound-letter couplings are unique; the remaining 26 native phonemes have at least two, often three, and sometimes four different written possibilities" (p. 145). Consequently this language must be considered as opaque, even if instruction in Netherlands has a phonological perspective.

4.3.1.f English

From the point of view of orthographic depth, English is a very particular case. In the general argumentation of section [2.2.2](#) it is already understood that English is a deep orthography, at least, deeper than those compared with (German, Serbo-Croatian, French). Now, how long is the distance between English phonology and orthography?

From the point of view of reading, it seems that the distance is the longest if compared with languages described until now. No child is slower than the English when comparing reading tasks that search to explore this distance (words, pseudowords, non words reading). [Goswami et al. \(2005\)](#), for example, believe that

4.3. Orthographic depth as factor

“English children decoding less than 50% of simple familiar words successfully during the first year at school” (p. 347). In their comparative study of English and other European orthographies, [Seymour et al. \(2003\)](#), point out that many studies “suggest that the decoding process ... develops more slowly and less effectively in English than in other European languages” (p. 144), the conclusions of their own research indicate that their English sample (Scottish) has a very low reading accuracy (34%), one year older children only reach the lower accuracy of other languages (80%). In terms of age, it takes many years for English children to reach the first year accuracy of other languages, like [Aro & Wimmer \(2003\)](#) have demonstrated:

At the end of Grade 1, reading accuracy levels were already around 85% for the German, Dutch, French, Spanish, and Finnish children and above 90% for the Swedish children, leaving little room for further improvement in all these orthographies. A markedly different developmental trend is apparent for the English children, who, having achieved only 50% accuracy by the end of Grade 1, did not attain the high accuracy shown by their Grade 1 counterparts in other orthographies until Grade 4. (627)

These findings have led researchers like Seymour and his colleagues to such emphatic conclusions like: “the slow rate of foundation literacy acquisition by the Scottish sample can be seen as an inevitable consequence of the complexity of the orthography and phonology of English” ([Seymour et al., 2003](#), pp. 168–169). Others have simply classified English as a “chaotic” orthography ([Caravolas, 2005](#), p. 336).

Accordingly, English can be defined as a very special situation of orthographic complexity, deeper than any other referenced language. Regarding the possible causes, researchers argue that this deep structure is the result of a double condition in English orthography: it “contains many words that are either irregular or inconsistent” ([Frost, 2005](#), p. 278).

First of all, English has an inconsistent system of grapheme–phonemes, other deep languages show complexity when going from phonemes to graphemes or from graphemes to phonemes, English has both directions of opacity: grapheme → phoneme and vice/verse. [Ziegler & Goswami \(2005\)](#) underline that one letter or

letter cluster can have multiple pronunciations, while a phoneme can have multiple spellings, which they call the “bidirectional inconsistency of English”(p. 11). [Goswami et al. \(1998\)](#) gives an example of this inconsistency: “the consistent spelling of morphemic invariances (e.g., *heal–health*) lead to different pronunciations for the same spelling and identical pronunciations for different spellings (e.g., *peel–deal*).” (pp. 19–20).

Secondly, besides the inconsistency, English has a complex syllabic structure ([Goswami et al., 2003](#); [Ziegler & Goswami, 2005](#), see), because of the high frequency of consonant clusters (groups of consonant with specific morphological or semantic properties) that leads to a large amount of syllables: English is said to have at least 8000 syllables. Moreover this language has a particularly important repertory of vowels: 15 vocalic phonemes represented by fewer graphemes.

Currently, English represent a key in studying orthographic depth, as many other researches about languages are done in comparing their behavior with those of English readers. This is why it is particularly interesting to include English in this research; because of its complexity it cannot be compared with any other language and it will constitute a specific value of *degree of opacity*.

4.3.1.g Farsi

Farsi (Persian) is the Iranian variation of Persian, macrolanguage of Afganistan, Iran, Tajikistan, Uzbekistan and Russia. Even if it is an Indo–European language, Farsi is written using Perso-Arabic script, a variation of Arabic made of 28 Arabic letter plus 4 additional Farsi letters that correspond to 23 consonants and 6 vowels. As in Semitic scripts, Farsi is written omitting vowels, equally a vowelised text is very transparent. A description of Persian is similar to that of Arabic: “There is a direct, one-to-one relationship between letters of the alphabet and phonemes in Persian. Moreover, Persian script, insofar as grapheme-phoneme correspondences are concerned, in its fully vowelised format is a highly regular orthography” ([Baluch, 2006](#), 367).

A deeper analysis made by ([Rasekh & Eshghi, 2007](#)) explains how phonetic and orthographic correspondences work in this language:

- Farsi orthography is naturally phonetic. All letters, except some cases, are phonemes...

4.3. Orthographic depth as factor

- In Farsi all the letters in a word has one phoneme. There is not any letter with two or more phonemes.
- In Farsi almost all the letters in a word are pronounced. Unpronounced letters are so sparse.
- Each phoneme is corresponded to one letter in a word. In the other word, the combination of 2 or more letters does not present a new phoneme in Farsi language. (155)

Despite this transparency, there is another similarity with Arabic; [Baluch \(2006\)](#) reported that there is a “strong dissociation of standard written Persian and colloquial Persian (Teherani accent)” (p. 374), even if this does not reach the level of diglossia as in Arabic. Because of this last factor it is not possible to classify Farsi as a transparent orthography and it must be treated only as a language with an intermediate opacity.

4.3.1.h French

[Ziegler & Goswami \(2005\)](#) describe French as a language with a complex syllable structure, similar to English, with many consonant clusters and a large repertory of vowels. However, French is not as opaque as English, because the complexity of the language goes only in one direction: “although written French is less complex than English in grapheme-phoneme mappings (i.e., reading), it is as inconsistent as English in phoneme-grapheme mappings (i.e., spelling)” ([Caravolas, 2005](#), 338).

Conversely, the opacity of phoneme-grapheme mappings is very high and cause difficulties for learners, because it is the source of an important degree of homophony in spoken French, like [Frost \(2005\)](#) describes: “There are ... several possible spellings for a given phoneme (e.g., *o*, *au*, *eau* may represent the vowel /o/). Thus, the mapping of phonology to spelling is opaque in French” (p. 280). There are 30 phonemes in spoken French that can be represented by 130 phonograms, letters or letter clusters (see [Fayol & Jaffré, 2008](#)).

The reason for this complexity is described by [Alegria, Morais, Carrillo, & Mousty \(2003\)](#) as the intention of representing graphically several language levels, in other words, French orthography searches to represent not only phonology but also morphology and syntax at the same time:

Le Français, par exemple, représente systématiquement la morphologie, y compris dans les aspects qui ne sont pas représentés dans la phonologie. La conséquence en est que certains graphèmes ne représentent aucun phonème. Par exemple, la phrase *ils marchent* comporte des marques orthographiques du pluriel qui n'apparaissent pas dans la prononciation. (51)

Jaffré & Fayol (2006) indicate that only 85% of French graphemes are phonograms, there is also 4% that have a lexical function and 13% that are only historical traces in writing the language. This historical factor is very important since it is the source of homophony, due to a process of morphological erosion, old sounds and morphological information have disappeared from pronunciation but still remain in writing French (see Posner, 1996, 245). This erosion originated from the Celtic substrate that separated French from the rest of the Roman languages: “the Germanic period resulted in the erosion of the final letters of words that convey essential grammatical information” (Jaffré & Fayol, 2006, p. 81).

Along with the erosion of the original Latin components and homophony, *conservationism* must be added to the sources of French complexity (see Coulmas, 2003, pp. 96–97). This language and its orthography were one of the first European languages to be standardized, since then, few reforms have been undertaken, and the gap between the French of everyday life and its graphical representation has been increasing:

This system thus acquired a stability that has been hard to shake ever since, despite the considerable linguistic changes that have occurred. As a result of the large-scale educational projects introduced in the 19th century, the conventional orthography was taught in the schools without any attempt being made to render it more accessible to the new users of the written language. French children all over the country simply had to learn to master a system of orthography designed by and for an elite section of the population, and to achieve this aim and overcome the problems involved, they were simply given an extremely thorough grounding in the grammatical rules of French. (Jaffré & Fayol, 2006, p. 88).

The effects of French opacity in reading learning are visible in decoding tasks, Seymour (2005) states that French children’s performance is poorer than Finnish,

4.3. Orthographic depth as factor

Greek or Italian children in decoding simple nonwords, even if it is not as low as the performance of English children. In Goswami et al. (2005, p. 347) reading learning in French is described as “more slowly” than in other European languages, closer to English and Danish, the two most difficult languages to learn. Another important characteristic is the methodology employed during instruction, in France as Aro & Wimmer (2003) describe: “it appears that a sight-word vocabulary was used to support an analytical phonics approach, for example, by pointing out that rhyming words share the same letter spelling body” (624). Thus, in this educational system the teaching of reading is not purely phonic, while great debates have been raised in later years about the best didactical method for teaching reading, today the strategies used in this country cannot be compared with the systematic phonics approach used in teaching Spanish or Slovak.

In summary, several factors make of French a complex language from the point of view of orthography and phonetic relationships. In PIRLS sample, there is a significant amount of children that completed the test and answered the questionnaires in French, which is why it is important to consider this language in this analysis.

4.3.1.i German

German is at the same time, defined as a language with a complex phonological structure (with many complex syllables, like English), and a language with a consistent orthography (like Italian or Greek). It is often defined as a shallow orthography (Snowling & Hulme, 2005a; Goswami et al., 1998, see). At the same time, German is often related to English because of their similar orthography and phonology; except that there are different degrees of consistency: “For example, the words *ball*, *park*, and *hand* exist in both languages in identical form; however, the grapheme *a* receives the same pronunciation in all three words in German but a different pronunciation in each word in English” (Goswami et al., 2003, p. 238).

Now, concerning reading development, experiments like those of Goswami et al. (2003), Goswami et al. (2005), and Seymour et al. (2003), all proved that accuracy and speed of German children in decoding reading is much closer to transparent orthographies, but not reaching such favorable results as Greek, Spanish or Finish.

There are two main reasons for defining German orthography as shallow. First, the accuracy in decoding already referenced. Secondly, as Aro & Wimmer (2003)

point out, in learning to read, German children were subject to systematic phonics teaching. Both are fundamental factors in describing the relation between reading and orthography. In terms of this research, this special condition of Germans, led to the conclusion that it represents an intermediate condition, not as deep as English, not as transparent as Italian. However, the reading achievements and teaching methodology influence the link of German to transparent orthographies in spite of syllabic complexity.

4.3.1.j Hebrew

Hebrew characteristics are similar to those of Arabic languages, but without the diversification derived from the large amount of countries that share that language. Hebrew, while spoken in numerous places, due to migration processes, is only primarily and officially the language of Israel. The distinguished property of South-Central Semitic orthography is present in Hebrew: only consonant sounds are graphically represented, vocalic sounds must be inferred from reading: “Standard written Hebrew is an orthography in which all diacritics (or *points*) are omitted. These diacritics represent nearly all of the vowels and are also used to disambiguate some of the consonants” (Katz & Frost, 1992, p. 69).

Therefore, Hebrew is quite an opaque language in every day reading, but not as difficult during beginning learning. As Frost (2005) argues, it is important to distinguish this kind of opacity from others like English, the source of the lack of transparency is purely superficial, directly related to the way in which sounds are represented.

In Hebrew opaque spelling-to-sound connections arise simply from *missing* phonemic information, mainly vowel information. Note that when the diacritical marks are presented in the text, Hebrew orthography is entirely shallow, as the phonemic structure of the printed word can be easily assembled using simple grapheme-phoneme conversion rules. (p. 279)

Consistency or the syllabic structure, are not questioned because a fully voweled text reaches a high degree of transparency.

Consequently, to determine the degree of transparency of the Hebrew sample it was necessary to know how the texts were presented: with or without diacritics.

4.3. Orthographic depth as factor

This research led to the understanding that at the age of ten, the students are still working with pointed texts, while they started reading texts without diacritics progressively: “children begin learning to read with pointed text, but are gradually exposed to unpointed text in a systematic manner around grade 3. By grade 4, a child is expected to be competent in both scripts” (Share & Levin, 1999, p. 105). Given that PIRLS examinees have not totally crossed the frontier of expert reading and they are still beginning readers. The translation to Hebrew maybe has been not totally unpointed. It can be inferred that orthography in the PIRLS Hebrew sample was mostly shallow. This is a specific condition of this sample, due to the age of the children; consequently, the conclusions that can be made will be only valid to this kind of reading: beginning reading with pointed Hebrew.

4.3.1.k Hungarian

The Hungarian alphabet is an extension of the Latin alphabet. Hungarian orthography follows a phonetic principle, even if there is also a conservative component. “Transparent orthography is one of the main characteristics of the Hungarian writing system, therefore, no differences are present in the regularity of letter sequences ... no particular rules are required for translating orthography into phonology” (Csépe et al., 2003). A more expressive description says:

Le hongrois est exempt des nombreuses complications présentes dans les langues indo-européens : les substantifs, les pronoms, les articles, etc. n’ont pas de genre (ni masculin, ni féminin, ni neutre) ; la conjugaison est simple, et surtout la prononciation est régulière, sans la moindre exception. L’accent tonique, également régulier, porte toujours sur la première syllabe du mot ; la morphologie et la syntaxe donnent l’impression d’une superbe mécanique de précision, parfaitement réglée. (Kersaudy, 2001, p. 81)

Consequently all our reference indicates that Hungarian must be considered as a transparent language.

4.3.1.1 Icelandic

Icelandic orthography is often classified as being mostly shallow, but with some degree of opacity, particularly in the path from sound to graphemes. Thus reading is easier than spelling: “The current Icelandic orthography is pretty regular in the mapping from print to sound, making it relatively easy for most children to learn to decode. The mapping from sound to print is much more difficult to master” (Pind, 2006, p. 13). Pind states that the reason for this separation between phonemes and graphemes is an important tendency of conservatism: “The current Icelandic spelling is a compromise between opposing viewpoints arguing either for an Orthography that is close to the pronunciation or one that remains faithful to the long tradition of writing in the country” (p. 12). Seymour et al. (2003) describe Icelandic as orthography of a complex syllabic structure and a quite regular relation to phonology, features that this language shares with German and Norwegian. From this information it can be concluded that Icelandic can be considered as mostly shallow, even if it is not as regular as Albanian, Italian, or vowelised Hebrew.

4.3.1.m Italian

All literature concerning orthographical deepness agrees with qualifying Italian as “a regular, transparent and phonologically predictable language” (D’Angiulli, Siegel, & Serra, 2001, 484), the high accuracy and fluency in reading at early stage of instruction is also a common characteristic (see Job et al., 2006; Ziegler & Goswami, 2005; Seymour, 2005; Seymour et al., 2003; Goswami et al., 2005).

Consequently there is not much information to add, that is not already noticeable from our exposition about orthography and phonology, except for noting that the one-to-one phoneme-grapheme correspondence in Italian should be reflected in some way in reading achievement, if is accepted the hypothesis that this advantage in early stages of reading learning leaves a footprint in later stages. As a result, Italian together with the other highly transparent orthographies in the sample is going to be one of the focuses of this analysis.

4.3. Orthographic depth as factor

4.3.1.n Latvian

Standard Latvian was developed during XX century, under the influence of Finnish, Polish and German. [Kersaudy \(2001\)](#) states that it is easier than Lithuanian because of the regularity of its structure. Latvian is defined as a language, “plus moderne” (p. 94), than Lithuanian because of the acceptance of changes in the search for adequacy between rules and use.

Its basis is the Latin alphabet and it is phonetic because it follows the pronunciation; there are only three exceptions in grapheme to phoneme translation. The main property of Latvian is the use of diacritical marks that improve the regularity of the language.

Latvian is one of the language of which not much information is available and no direct reading comparisons have been made. However, the descriptions of its alphabetic system and its relation to phonology indicate that this is a transparent orthography.

4.3.1.o Lithuanian

Lithuanian is closely related to Latvian, but they are not mutually intelligible. The only reference found ([Kersaudy, 2001](#)) indicate that Lithuanian is more difficult than Latvian, because is most conservative. This language was originally several dialects that have been reunified today.

4.3.1.p Macedonian

Originally, it was part of a collection of related dialects, all local variations of Bulgarian; nowadays, Macedonian has become a language due to its independent development along with the autonomy of the region where it is spoken; Macedonian and Bulgarian are mutually intelligible.

Macedonian orthography is consistent and mostly phonemic close to the principle of one-to-one grapheme-phoneme correspondence, although, there are some inconsistencies and exceptions.

Similar to Albanian, Macedonian has no historical attachment with a script. Before standardization, it had been written in a variety of different versions of Cyrillic.

Moreover, since the Macedonian disconnection from Bulgarian is recent, all the regulation and standardization rules are also recent. The Macedonian alphabet started its standardization in 1944 by a committee formed in the Socialist Republic after Nazi defeat. The orthography was developed following a phonemic principle and the alphabet was influenced by Serbian Cyrillic, which is well known by its high degree of transparency.

4.3.1.q Norwegian

PIRLS bibliography describes Norway as having two different languages, but the research shows that they are not separated languages, but two mutually intelligible official forms of written Norwegian. In other words, Bokmål and Nynorsk are two different orthographies, defined as variations of the same Norwegian language (see [Kersaudy, 2001](#), pp. 102–103). [Hagtvet, Helland, & Lyster \(2006\)](#), gives a clear description of Norwegian variations:

Today we have two standard, official orthographies: urban Norwegian (Bokmål), which originally developed from Danish and was based on the southern and eastern dialects centred around Oslo, and rural Norwegian (Nynorsk), which is based on dialects of the western parts of the country. Norwegian has furthermore many different dialects, which are appreciated and used officially. (16)

[Hagtvet et al. \(2006\)](#) underlines another important characteristic of the linguistic situation in Norway: there is a dynamic approach of this society to their languages: “The orthographies are regularly being reformed, not only in accordance with dialectal changes, but also in accordance with the ongoing debate of the two official orthographies” (p. 16). In other languages like Icelandic or French, conservatism is a source of distance between written language and speech; it can be expected that this language can be adapted more easily to the evolution of orality.

It does not seem necessary to treat Bokmål and Nynorsk as different languages, because of this dynamic structure, and because the two variations are closely related since they take part of a larger collection of dialects. Moreover there is no evidence of differentiations in the relation between phonology and orthography. Besides, the quantity of Nynorsk speakers that take part in the PIRLS assessment is

4.3. Orthographic depth as factor

very small: in the 2001 sample there were only 790 Nynorsk speakers, a quantity that was reduced dramatically to only 331 in 2006.

Norwegian is defined by [Hagtvet et al. \(2006\)](#) as a semi-transparent orthography, easier than French or Danish, but less transparent than Spanish or Italian. A similar conclusion was shown in figure 2.7. [Seymour et al. \(2003\)](#) considered Norwegian as a unique language and described it as a shallow orthography with a complex syllable structure, like German or Icelandic. What makes this a shallow orthography, are the consistent mappings between letters and sounds: “Because of the fairly systematic sound-letter correspondence of Norwegian orthography, learning the sound-letter relationships associated with early reading is easy even for children at risk of developing reading problems” ([Hagtvet et al., 2006](#), p. 15). In summary, the Norwegian orthographic situation is similar to that of German: its orthographies do not represent a major obstacle for beginner readers, even if there are some subtle details about semantic representation (see [Nergård-Nilssen, 2006](#)).

A final characteristic of Norwegian is that reading instruction is generally phonics oriented. This is the definitive factor that leads us to classify Norwegian as a shallow orthography, although it is less transparent than other languages present in the sample.

4.3.1.r Romanian and Moldavian

Moldavian Romanian is often called *Moldavian*, in fact, Moldavian is the same as Romanian, so it is considered such by the *Ethnologue* [Lewis \(2009a\)](#). The distinction originated in the ancient use of Cyrillic characters in the writing of the language, instead of Latin characters. This was the only distinction from Romanian, but these characters are no longer in use nowadays: “Depuis 1991, les Moldaves roumanophones ont remplacé l’écriture cyrillique par l’écriture latine, de sorte que leur langue ne se distingue plus du roumain” ([Kersaudy, 2001](#), p. 87).

Romanian is a regular language, as its spelling system was standardized only in s. XIX, its spelling system is largely phonemic with straightforward grapheme-phoneme correspondences ([Coulmas, 2003](#), p. 442). Romanian alphabet count 27 letters, 20 consonants, and 7 vocals; a small amount if compared with more irregular languages.

4.3.1.s Russian

Researchers agree in defining Russian spelling as anything but transparent, [Grigorenko \(2006\)](#) wrote that the Russian language is “heaven for experts and hell for novice writers and readers” (p. 319).

On one hand, Russian orthography consist in a mix of morphological and phonetic principles, there is also an important amount of etymological and historic forms present in spelling or written representations. On the other hand, all these elements follow logical connections in their participation of the system, as [Kerek et al. \(2009, p. 8–9\)](#) sum up:

Although Russian graphics can often represent one-to-one phoneme-grapheme correspondences, they also contain numerous irregularities. Their rules are highly positional and far from straightforward. At the same time, they are a sufficiently logical system with a high degree of regularity and predictability. (p. 8–9)

Among the 33 letters that constitute The Russian alphabet, there are letters that represent one sound (27), two sounds (4) and two mute letters. In addition letter clusters (combinations of letter) can also represent specific phonemes. From them, 10 are vowels and 21 are consonants. This important amount of vowels approach Russian of deep languages as French or English and move it away from transparent orthographies as Spanish were there is only five vocalic sounds.

The characteristic that define Russian orthographic depth is that sounds, and, consequently, meaning depend of contexts, position, and stress, that is, in morphological features:

Phoneme-grapheme correspondences are not always straightforward in Russian because many letters in the Russian alphabet are not bound to representing only one phoneme each. ... The essence of this is that phonemic values cannot be assigned to the consonants and vowels in a syllable without evaluating either or both the left or right context of a given grapheme. One of the most common examples is the representation of palatalized consonant phonemes: 15 consonant letters out of the 21 each correspond to two phonemes, where one letter signifies both hard and soft consonant phonemes. ([Kerek et al., 2009, p. 6–7](#))

4.3. Orthographic depth as factor

For beginning readers and writers, Russian writing may be difficult to learn, because of the distance from phonology to orthography. Its mastering depends in a third element, morphology, which plays a role of communicating mediatory between oral and writing.

Consequently, beginning reading starts not only with the mastery of one aspect like phonology, but with the mastery of several aspects at the same time, as [Grigorenko \(2006\)](#) points out:

The primary grade course of Russian includes extensive introduction to phonology, orthography, morphology, and lexicology. Specifically, children are familiarized with the main principles of Russian orthography (phonological, traditional, and morphological). Reading, writing, and spelling are taught simultaneously within one subject matter titled “Russian Language”. (p. 314)

In addition, there is not one teaching program but several approaches to teach reading, as [Kerek et al. \(2009\)](#) describe:

Several types of reading and writing programs with supplementary materials, based on different principles and approaches to reading acquisition, are available for use in Russian schools. Most programs are phonics-based, but they differ in their presentation of irregularities of Russian orthography. (p. 10)

To this research aims, these characteristics indicate that Russian must be classified among deep languages. Regretfully, there were not reference available comparing Russian and English or Dutch, because the relation between its phonology and orthography may be as complex as that of these languages in accord to the description.

4.3.1.t Slovak

Slovak orthography is related to Czech in its origins and later during the existence of Czechoslovakia. Because its system of rules is dynamic, Slovak has undergone multiple changes throughout history that allow the adaptation of written Slovak

to changes in spoken Slovak. There is a high degree of regularity in the Slovak alphabet; it is an adapted version of Latin alphabet that employs 38 letters to represent 46 sounds. Moreover, this language follows a phonetic principle, and morphology or etymology play a secondary role in graphical representation of words.

Regarding reading learning, Slovakian educational system used a phonemic method; [Schwippert \(2007\)](#), describes this approach:

Reading instruction in Grade 1 (ages six to seven) is devoted to ensuring children acquire basal reading skill. The procedure follows a prescribed letter-by-letter sequence and lasts about eight to 10 months on average. ... The aim of the next two or three years of schooling is to improve and reinforce children' 'reading technique' (skill). (pp. 195-196)

This information leads us to classify Slovak as a mostly shallow orthography, along with Italian and Albanian.

4.3.1.u Slovene

Regretfully there are not many descriptions of this language in scientific literature. The nearest reference is Serbo–Croatian, which is well known for been considered one of the shallowest languages. Coming also from several regional dialects, today's Slovenian language is well uniformed and standardized.

4.3.1.v Swedish

This is a language with consistent grapheme-phoneme correspondences, [Seymour et al. \(2003\)](#) describe Swedish as a shallow orthography with a complex syllable structure, similar to Dutch, but less transparent than German and more than French. [Elbro \(2006\)](#) compares its orthography with Danish to conclude that Swedish is much shallower. If this language is compared to other European languages, the results indicate that this is an orthography easy to acquire: "At the end of Grade 1, reading accuracy levels were already around 85% for the German, Dutch, French, Spanish, and Finnish children and above 90% for the Swedish

children” (Aro & Wimmer, 2003, 627). In summary, even if like other Nordic orthographies, Swedish has a complex structure, the regularity of this same structure made this a shallow orthography.

4.3.2 Classifying orthographic depth

According to the information gathered, it is possible to judge how regular the languages in the sample are. Three factors will be key to the classification: first, the main characteristic of the languages, how they are generally defined or described in related literature; second, if available, their descriptions in comparison with other languages, if the language is defined as more or less transparent than others.

Finally, since this variable will be connected with reading, it is important to consider the methodology preferred to teach each language. However it is not easy to find direct descriptions, considering the purpose of the classification of this analysis. What is necessary is to know if the teaching of reading follows or not a phonemic perspective, in other words, if a phoneme-by-phoneme sequence is followed. The importance of this characteristic is that a systematic work with phonemes can increase the tendency of regularity and transparency of a language. On the contrary, most of the languages that employ other teaching methods do it because the structure of the same language cannot be taught using only phonemes; consequently this can also be a prove of the complexity of the language. Regretfully, this information is not available for each language in the sample, it is only included in half of the cases.

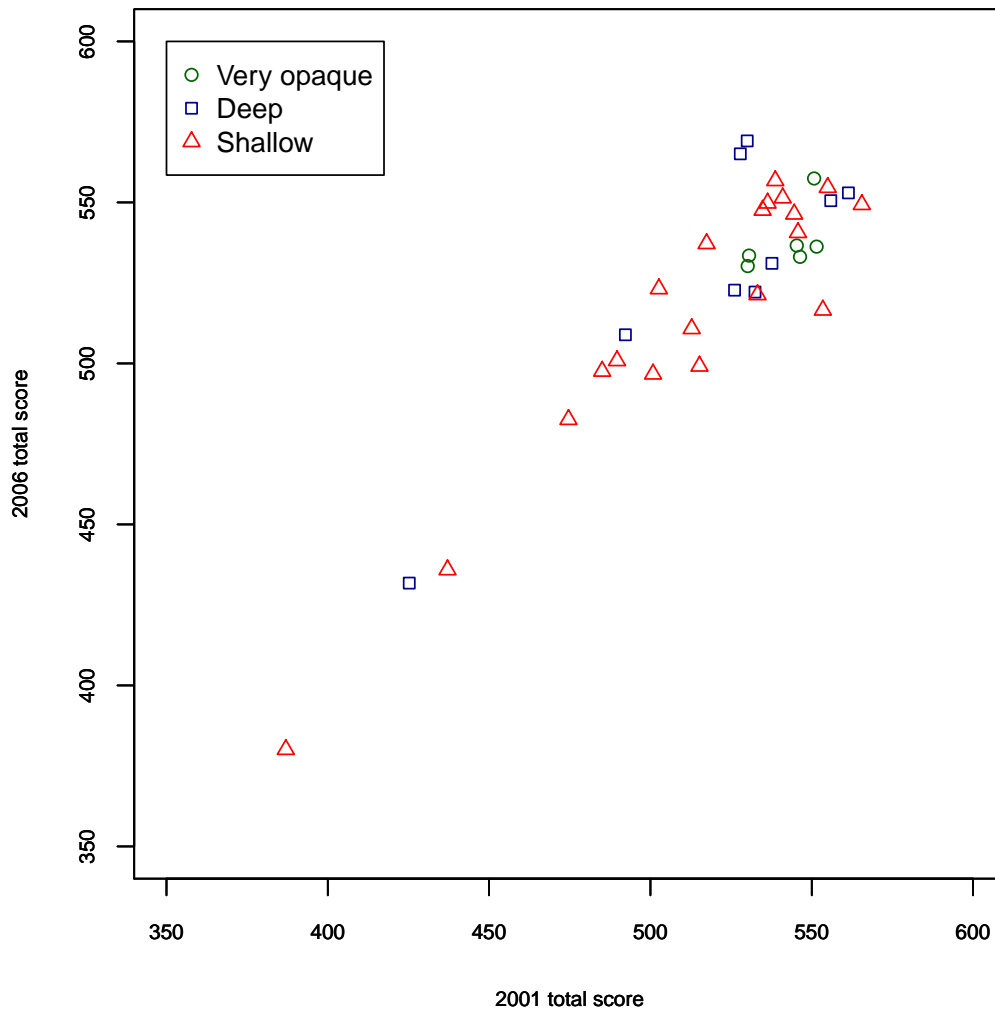
To summarize, all this information has been synthesized in table 4.8. Here, the main characteristic, comparison and reading methodology of each language of the sample is presented, along with the classification. There are two main categories: shallow and deep languages. Shallow languages have in common regular graphemes-phonemes relations, while deep orthographies have a variety of factors that originate their complexity. It can be said that what they have in common is *to not be regular*. A third category was created specially for English, due to the particularity of its orthography and the role that this language plays in the assessment. Because all literature underlines the complex relation between English and reading learning, it seems more appropriate to follow the general tendency to isolate English from other languages.

Table 4.8: Degree of opacity of PIRLS languages

Language	Opacity	Main characteristic	Comparisons	Teaching reading
Albanian	shallow	very independent from scripts	shallower than English and Welsh	-
Arabic	opaque	derivational and inflectional morphology	diglossia issues	phonological perspective
Bulgarian	shallow	mostly transparent	-	-
Chinese	opaque	characters are semantic-phonetic compounds	-	phonetic scripts (Pinyin)
Dutch	opaque	morphophonemic script	second deepest after English	phonological perspective
English	very opaque	irregular and inconsistent	deepest language studied	non phonological
Farsi	shallow	very transparent if vowelised	-	phonological perspective
French	opaque	inconsistent in phoneme-grapheme mappings	deeper than shallow languages	non phonological
German	shallow	complex structure and consistent orthography	closer to shallow orthographies	phonological perspective
Hebrew	shallow	shallow if fully vowelised	shallower than English	phonological perspective
Hungarian	shallow	follows phonemic principle	-	-
Icelandic	shallow	regular in mapping from print to sound	shallower than other European languages	-
Italian	shallow	regular, transparent and predictable	one of the more regular languages	phonological perspective
Latvian	shallow	diacritical marks improve regularity	-	-
Lithuanian	shallow	regular orthography	-	-
Macedonian	shallow	follows phonemic principle	-	-
Norwegian	shallow	fairly systematic sound-letter correspondence	similar to German or Icelandic	phonological perspective
Romanian	shallow	straightforward grapheme-phoneme correspondences	-	-
Russian	opaque	morphophonemic and irregular	-	non phonological
Slovak	shallow	high degree of regularity	-	prescribed letter-by-letter sequence
Slovene	shallow	similar to Serbo-Croate	-	-
Swedish	shallow	high reading accuracy levels from grade 1	deeper than German, less than French	-

4.3. Orthographic depth as factor

Figure 4.2: Plot of countries scores by language and orthographic depth



Having this information, a first approach to the question relating opacity and reading achievement is to observe the score distribution by countries, languages and opacity, here presented in figure 4.2. As it was the case for linguistic families, *anglo* is the most uniform group distributed, its average score will be certainly over the rest of the sample, but not further conclusion can be assumed at this point. Among deep languages there are some countries with important improvement from 2001 to 2006, Russian Federation and Hong-Kong, both having orthographies characterized by a high degree of complexity but not as irregular as English. Shallow languages are numerous, and get very diverse results, but it is important to notice that the lower scores are from transparent languages. This fact, along with the better score of English countries, allows us to start questioning the possibility that transparent languages can obtain better scores due to its regularity. This plot

indicates that transparent orthographies are not better in reading achievement than the rest of the sample. Consequently, the possibility of a trace of the earlier advantage of these languages in reading acquisition could be questioned by the experience that will be carried out in this research.

Chapter 5

Individual and school factors related to reading aspects

Following the research objectives from the section [3.4.3](#), the first four have been accomplished: the identification of linguistics factor and the implementation of variables representing them. The objective number five implies the inclusion of these variables in a model that attempts to explain reading achievement which is the task defined in the last objective (number eight). Before reaching that point, it is necessary to do an analogous study of contextual factors, that correspond to objectives six and seven. This chapters search to advance in objectives six and seven by describing home and school determinants that play an important role influencing the conditions in which reading learning is carried out. Only after having a clear understanding of those determinants, an explanation of reading achievement can be researched.

The starting points of this study are the factors which had already been identified, specifically those considered by PIRLS as significant contextual elements. To research the role they played in reading results, they were tested by means of the questionnaires described in section [3.2.1.a](#). The aim of this chapter will be to investigate how those factors interact with reading achievement. However, since one of our aims is to take advantage of the structure of PIRLS that allow the separate observation of several aspects of reading, there will be a special emphasis placed on this.

As described in sections [3.2.1.b](#) and [3.2.1.c](#), the aspects considered were the purposes of reading: literary and informative, and four comprehension levels summed

in two scales: high and low order processes of comprehension. Now, an important question is how to emphasize the differences. PIRLS made the questionnaires to explore general reading achievement and not the specific aspects, therefore, they can be factors *implicit* in the questionnaires. The research will then consist of using the questions to create variables and discovering whether or not they are related to specific aspects of the reading process.

To represent these specific aspects, two variables were created which were calculated from one aspect less the other. Variable TEX was calculated by subtracting the informative score from the literary of purposes of reading, variable COM was calculated by subtracting the high order score from the low order score of the processes of comprehension. In other words, $\text{literary score} - \text{informative score} = \text{TEX}$; $\text{low level process score} - \text{high level process score} = \text{COM}$.

The total score, the score obtained in each aspect and the differences mentioned are presented in two tables: 5.2 and 5.3. They also show the countries that will be used as observations for this part of the analysis. The differences between the scores can be as great as 29 score points (COM in Moldova 2006); half of the standard deviation of the scores, that is 60 in 2006, and three times the s.d. of the differences that is close to 9.

Table 5.1: French and English countries and TEX 2001

Canada Quebec	-6,79
France	-14,98
Canada Ontario	9,66
England	13,55
Scotland	2,00
New Zealand	6,51
United States	17,08

Since most of the countries that participated in PIRLS 2001 and 2006 were considered, comparisons cannot be done; this will be the subject of chapter 6. However, there are two general remarks which cannot be omitted. First, there was a connection between TEX, COM and languages, for example, if the 2001 difference are extracted from table 5.1, they show the tendencies of French and English countries. It is particularly interesting to note the contrast between Quebec and Ontario, while sharing the same nationality, more affinity is seen with the others

countries of the same language (case described in detail in section 4.1.1.c). Apart from those two languages, Slavic and Arabic countries have also shown common tendencies. One of the hypothesis, presented in the section 3.4.4.c, is related to this: specific linguistic families could explain specific aspects of reading. For example, the *Anglo* family may explain high order scores, since it seems to be related to them (this was our second hypothesis: *Languages, can have a different incidence concerning the aspects and components of the reading process*, see 3.4.2). In addition, this link between aspects of reading and languages has been stated by several researchers (see Sainsbury et al. (2004); Mullis & Martin (2004); Comparative Education Research Unit (2005); Rémond (2006)). This possibility will be confirmed or denied when it is implemented a model, including families as determinants of these specific scores.

The second feature of the differences TEX and COM is that, in several cases, they were constant in time. Even if comparisons are not the theme of this chapter, it is interesting to notice how the scores of some countries evolved. For example, Honk Kong had a significant improvement of its general score but, in looking at the difference between the scores, beside general progress, the country continued to get better results in informative reading and high order processing. In contrast, in 2006, England lost the literary advantage that it had in 2001, and Singapore lost the informative advantage of 2001. These changes help to explain why their results were not as good as in the first test. Other cases of consistency were France, Iran, Norway, Hungary and the United States, all of which held the same tendency in both assessments.

In summary, this chapter will study the connection of contextual factors with the difference obtained from both aspects of reading considered in PIRLS assessment structure. The method to be followed is to search for correlations between these differences, TEX and COM, and the variables derived from the Students, Teachers and School questionnaires. By measuring the estimate of Pearson product-moment correlation squared, it is expected that factors will be discovered, which will have the property of being associated specifically with one reading aspect (literary reading, informative reading, low order processing of comprehension or high order processing). Approximately 200 questions were analyzed one by one to determine the coefficient of determination with the differences.

Table 5.2: PIRLS 2001, total score, scores by aspect of reading and differences

n	Country	Total Score	Literary Score	Inform Score	Diff Lit-Inf	Low Pro. Score	High Pro. Score	Diff High-Low
1	Sweden	561	559	559	1	563	558	5
2	Netherland	554	552	553	-1	556	552	4
3	England	553	559	546	14	546	556	-10
4	Bulgaria	550	550	551	-2	550	550	-1
5	C. Ontario	548	551	542	10	538	554	-15
6	Latvia	545	537	547	-10	543	545	-2
7	Lithuania	543	546	540	6	541	545	-4
8	Hungary	543	548	537	11	540	545	-5
9	United States	542	550	533	17	535	548	-12
10	Italy	541	543	536	7	538	541	-3
11	Germany	539	537	538	-2	543	535	9
12	C. Quebec	537	534	541	-7	534	541	-6
13	Czech Rep.	537	535	536	-1	540	533	7
14	New Zealand	529	531	525	7	522	535	-14
15	Scotland	528	529	527	2	529	528	1
16	Singapore	528	528	527	1	531	527	4
17	Russian F.	528	523	531	-8	529	525	4
18	Hong Kong	528	518	537	-20	522	533	-10
19	France	525	518	533	-15	526	524	2
20	Greece	524	528	521	7	519	529	-10
21	Slovakia	518	512	522	-10	521	513	8
22	Iceland	512	520	504	16	513	512	1
23	Romania	512	512	512	-1	509	515	-6
24	Israel	509	510	507	3	503	513	-10
25	Slovenia	502	499	503	-4	503	501	2
26	Norway	499	506	492	14	505	495	9
27	Cyprus	494	498	490	8	493	495	-3
28	Moldova	492	480	505	-25	491	494	-3
29	Turkey	449	448	452	-4	448	451	-3
30	Macedonia	442	441	445	-4	441	446	-5
31	Colombia	422	425	424	2	429	417	13
32	Argentina	420	419	422	-3	424	413	12
33	Iran	414	421	408	12	422	405	16
34	Kuwait	396	394	403	-9	401	-	-
35	Morocco	350	347	358	-11	353	-	-
36	Belize	327	330	332	-3	333	329	4

Table 5.3: PIRLS 2006, total score, scores by aspect of reading and differences

n	Country	Total Score	Literary Score	Inform Score	Diff Lit-Inf	Low Pro. Score	High Pro. Score	Diff High-Low
1	Russian F.	565	561	564	-3	562	563	0
2	Hong Kong	564	557	568	-11	558	566	-8
3	Singapore	558	552	563	-12	560	556	5
4	Luxembourg	557	555	557	-2	565	548	17
5	C. Ontario	557	557	553	4	547	563	-16
6	Italy	551	551	549	3	544	556	-12
7	Hungary	551	557	541	16	544	554	-10
8	Sweden	549	546	549	-3	550	546	4
9	Germany	548	549	544	4	555	540	14
10	Netherland	547	545	548	-3	551	542	9
11	Belgium Flemish	547	544	547	-3	545	547	-3
12	Bulgaria	547	542	550	-8	538	553	-15
13	Denmark	546	547	542	6	551	542	9
14	Latvia	541	539	540	-1	534	545	-11
15	United States	540	541	537	3	532	546	-14
16	England	539	539	537	2	533	543	-10
17	Austria	538	537	536	1	544	530	14
18	Lithuania	537	542	530	12	531	540	-9
19	Taipei	535	530	538	-8	541	530	11
20	New Zealand	532	527	534	-6	524	538	-14
21	Slovakia	531	533	527	7	529	531	-2
22	C. Quebec	530	526	532	-5	530	529	1
23	Scotland	527	527	527	0	525	528	-4
24	France	522	516	526	-10	523	518	6
25	Slovenia	522	519	523	-4	519	523	-5
26	Poland	519	523	515	8	516	522	-6
27	Spain	513	518	509	9	509	516	-7
28	Israel	512	516	507	9	507	516	-9
29	Iceland	511	514	505	9	516	503	13
30	Moldova	500	492	508	-16	486	515	-29
31	Belgium French	500	499	498	2	501	497	4
32	Norway	498	501	494	7	502	495	7
33	Romania	489	493	487	6	489	490	-1
34	Georgia	471	476	465	11	478	461	17
35	Macedonia	442	439	450	-11	446	439	7
36	Trinidad	436	434	440	-6	438	437	2
37	Iran	421	426	420	6	428	418	10
38	Indonesia	405	397	418	-20	409	404	5

5.1 PIRLS 2001

5.1.1 Reading objectives 2001

5.1.1.a Student Questionnaire

The answers to PIRLS' questionnaires were analyzed in order to discover underlying high and low tendencies. The following themes studied in those questionnaires were considered: attitudes and preferences in reading, learning methodologies, evaluation, teaching models, and language characteristics. In particular, the students' questionnaire sought to describe reading attitudes, concepts about reading, activities fostering literacy, habits at home, learning methodology, materials at school, classroom environment and structure, economic resources at school and at home, and some social and linguistic characteristics.

Because of the objectives of our research, the number of subjects taken into account was reduced, leaving out some economic aspects, like the use of computers in learning (that depends in resources) and other demographic characteristics (sex, age, and origins). The result was a list of 63 questions from which two to six variables were derived. For each one correlations were searched: with the total score of the test, the difference between literary and informative score (TEX), and the difference between high and low order of comprehension processes (COM). After this, 33 variables derived from 23 questions were founded to be significantly correlated to TEX (see Table A.1); the greater part (21) was positively related to the literary advantage.

From these correlations, a description of two types of readers was deduced: the one that answers better having a literary purpose, and the one that answers better if the aim is informative.

On one hand, the *literary readers* showed particular habits at home and at school. At home, they did not talk with friends about reading, speak the same language at school and at home, have more than 100 books available. Regarding their reading habits, they read stories or novels but never read news papers. At school, they did not read aloud; neither to the whole class nor to small groups, and they frequently read books chosen by they self; about his own abilities as reader, they did not thought to be less competent than others.

On the other hand, the *informative readers* spoke a different language than the one used at school, and had learned a second language before starting school. At home, there were not many books available (less than 10), but the students often listened to someone at home reading. At school, they often followed along while others students read aloud, and after having read they answered questions aloud and talked with other students about what they had read.

Particular attention was paid to three variables because they were significantly correlated to TEX and were not derived from direct questions but from *indexes*, which were constructed by PIRLS to summarize the information obtained combining a number of questions. The three indexes were: SATR *student attitudes towards reading*, SRSC *student reading self concept* and HER *home educational resources*.

In fact, the first of them showed the higher correlation of this questionnaire with TEX (SATR_low $r=.48^{**}$). The index SATR gathered information about students' agreement with the following statements: *I read only if I have to, I like talking about books with other people, I would be happy if someone gave me a book as a present, I think reading is boring, and I enjoy reading*. The index indicated a high, medium or low attitude towards reading; a low value, that is, a negative attitude, was related to an advantage in reading literary texts. This result was interesting because, when analyzing each variable, they did not show significant correlations, excepts when considered together. We have concluded that as this index has stated, there was a correlation between the purposes of reading and the attitude of the reader.

The index *student reading self concept* (SRSC), showed a similar connection to TEX; the individual questions that composed this index were not correlated, except for one. In spite of this, a high value of this index was, in fact, correlated to TEX (SRSC_high $r=.37^{**}$). It summarized the agreement with the following ideas: *reading is very easy for me, I do not read as well as other students in my class* ($r=.30^*$), and *reading aloud is very hard for me*.

It was interesting that a positive SRSC_high, i.e. high reading self concept, and a negative SATR_low, negative attitudes about reading, were both pointing in the same direction, literary advantage. It was surprising, as a positive correlation between these two factors could be expected, that is, a high positive attitude towards reading could be correlated to a high self-concept about reading capacities, but it was the opposed. In fact, those two aspects were not necessarily in accord because they were not describing the same conduct. On one hand, the first index

was composed of students' *opinions about reading*, what reading meant for them as an *activity*. On the other hand, the second variable indicated how children *felt* when they were *actually reading*, what was happening within them at that moment, independent of the answer to the former question. Therefore, it was certainly possible to think about a student who did not like to read, as a preferential activity, but at the same time, not feeling feebler than others performing this task. Moreover, this attitude can most likely be associated with a general self-confidence in their capacities.

It was previously stated that economic factors were not included, an exception was the last index, *home educational resources* (HER). Although it is not exactly "economical" because it evaluated material resources, it include only those directly related to educational aspects: availability of reading resources (*number of books in the home, daily newspaper*); educational resources (*computer, study table for own use, books of their own*) and the *parents' education*. The index included a number of variables from parents questionnaire, which was not studied.

This index entailed that the children from families with few resources could obtain better results in reading informative texts than literary ones. This assertion was confirmed by the fact that all the variables derived from the original index were significantly correlated to TEX (GPS_high, low, noGPS and GPS). This could be explained by a predeterminism in which the literary world is too complex for children having no access to culture or reading resources. However, it is preferable to refer to another interpretation, that of the sociologist Bernard Lahire. Speaking of the workers reading habits, he corroborates a tendency among them to prefer "concrete" lectures, but for him, these practices are not just a consequence of the work conditions or the social class but also: "c'est la volonté objective d'ancrage des textes dans une autre réalité que la seule réalité textuelle : dans une configuration pratique, dans un espace connu, vécu" (Lahire, 1993, p. 105). If we translate this interpretation in the analysis, it can be said that the reading resources at home were not only a cause but also a consequence of the reading home habits. Furthermore, those habits reflected a particular way of life: "Ce goût pour les ouvrages qui expliquent les fonctionnements réels (physiques, naturels...) est très lié à l'affinité pour des textes qui s'annulent comme tels pour énoncer le réel. Là encore, il y a un intérêt profond pour des 'choses vrais'" (Lahire, 1993, p. 114). It will be important to return to this hypothesis when the analysis of the PIRLS 2006 questionnaires are done.

5.1. PIRLS 2001

After studying the variables that have been developed, the next step was to gather this information to draw more wide-ranging conclusions. The method chosen was to interpret the correlated variables to infer underlying factors, then, their validity was tested to create *tendency indexes*. An obvious question was why not simply use the indexes already done by PIRLS, the answer is that the indexes created by PIRLS were not conceived to describe particular aspects of the reading process but the final and general results. In other words, it was simply not the objective of the assessment, as it was mentioned in section 3.2. But this does not mean that answers to this questions can not be found here, that is the reason why this inferential method was followed.

Table 5.4: Correlation Coefficients: Variable TEX - Student Indexes

<i>LNGsec, second language experience</i> : The students declared to have learned a second language before starting school and to have never spoken the language of the test at home.	-.36**
<i>MSoc_high, oral activities in learning</i> : At school, the students answered questions aloud and talked with others students after having read something, they read aloud to the class or to small groups and also followed along while others read.	-.36***

From the correlated variables in table A.1 two factors were derived and presented in table 5.4, the first factor observed is directly related to language. There were four variables derived from two questions describing the use of languages by the students: *to speak at home a language different than the used at school* (LANH_NEV) and *to have learned a second language before starting school* (LAN2_high), both were correlated to an informative advantage. In many cases, it was likely that both facts were directly related (in fact, the coefficient was $r=.62^{***}$), in other words, if the children had learned this second language early, it was due to the daily practice because it was their mother tongue. There was a variable describing this situation that was not correlated to TEX but to the variables constituting this index: BRN_low, which represented the percentage of students having both parents born in another country, and it showed some positive correlation to LAN2_high ($r=.31^*$) and to LANH_NEV ($r=.40^{**}$).

In summary, immigration was certainly an educative factor, concerning its connection to language. The students who had this kind of background, also had significant probabilities of understanding informational texts better than literary

texts. Finally, it was not unrelated to the previous problem, that the derived index, LNGsec, also had a high and negative correlation to the total score ($r=-.53^{***}$).

A second index was created: MSoc_high, from activities done during reading learning, many of which involved oral interactions: to read aloud, to listen to others read or answers questions aloud. In all the cases, a high proportion of students doing these activities frequently at school, was related to an advantage in reading informative texts. From the index derived, all variables were correlated to TEX, in others words, these class activities were significantly related to the results depending on the type of text read. MSoc_high was also correlated to the total score: MSoc_high $r=-.55^{***}$. Orality is often a methodology used during reading learning, but this negative result made it become unhelpful. Moreover, considering that the index LNGsec was also negatively correlated, it could be possible to think about informative advantage as a negative factor. These possibilities must be confirmed or denied by deeper analysis, therefore will be necessary to resume this problem later.

5.1.1.b Teacher questionnaire

The teachers' questionnaire was focused in characterizing the class condition during reading learning, the teachers' background and the resources available at the school. The variables correlated with TEX can be seen in appendix [A.2](#).

It can be observed that this was one of the questionnaires with more correlations, from a total of 91 questions, 25 allowed the creation of 49 variables correlated to TEX, 19 of them were related to a literary advantage and 30 to an informative advantage. Because of this important number, they will be immediately presented here, ordered not only by tendency but also by unifying concepts, in order to improve clarity. Among the variables that showed a *literary* correlation, factor were found, as the time spent on reading instruction, the supports of texts, the subjects of reading, the methods used in teaching and the teacher's expectations about their students.

First, the amount of time spent in reading instruction showed a correlation favorable to literary advantage. Although, this measure must be carefully considered, [Suchaut \(2009\)](#) showed the existence of a variety of definitions about *time* in scholar contexts. A first and *quantitative* measure is the time explicitly planned: "la quantité officielle de temps d'enseignement" (p. 2); then, besides the official

planning it is necessary to take into account the real educative time a *qualitative* measure which can differ from official: “la quantité d’instruction reçue par l’élève, celle-ci pouvant différer de la précédente” (p. 2).

PIRLS have taken into account partially this distinction. In this questionnaire, teachers had indicated the time explicitly designated in the scholar program to work on reading, in hours and minutes. Then, teachers had indicated the time spent on reading instruction regardless of whether or not it was formally scheduled. This was referred to as a partial description because it was not possible to infer the real learning time from teacher’s judgments, an impartial description of time could not be done. Consequently, these variables were actually the teachers’ evaluation of teaching time.

There were seven questions that described time distribution in reading activities, only two were significantly correlated on three variables (ATBGRINH, RINH, FRIN). A particular characteristic of time variables was that none of them was related to the total score, in other words, more or less time for reading instruction did not affect the general results.

The index (TIME_high, high proportion of time dedicated to reading) derived from these variables was correlated to TEX: $r=.43^{***}$, and had no connection to the total score either. Nevertheless, it was not included in the analysis as its validity seemed suspect since there was not enough mention about a tendency, particularly in this case were many other variables were not correlated. This is the opposite case of the index LNGsec, where the problem is the small quantity of variables describing linguistic characteristics, but all had a coherent connection. However, it will be important to think again about the role of this factor when developing a deeper analysis.

The second group of variables referred to materials or support that teachers used frequently during reading instruction: to work frequently with computer software, on-line material, to use lectures from other subjects or a variety of children’s books. They were also related to literary advantage. The key seems to be the concept of *variety*, because this variables did not say anything about the purposes of reading, difficulty levels or comprehension processes; they simply described different supports and explicitly refers to the plurality of them. The presence of computers as learning media; even if not well represented enough to be an independent index, can be see as a signal of this variety of resources to learn reading. Consequently,

an index under the concept of *variety* was created, as seen in table 5.5, it was significantly correlated to literary advantage and the total score: $r=.31^*$. This means that, if an amelioration of the literary score is researched, the use of a variety of text will be suitable because this also helps with the total score.

Table 5.5: Correlation Coefficients: Variable TEX - Teacher Indexes

<i>VATY_high, variety in materials:</i> Teachers propose texts of different kind to the students during reading instruction: computer software, on-line reading materials, a variety of children's books and reading from other subjects.	.42**
<i>CAAS_high, Concern about assessment:</i> Teacher control learning through classroom test, national and or regional examinations and oral questioning.	-.40**
<i>VOC_high, instruction in vocabulary:</i> Teacher frequently teach vocabulary systematically and help the students with the new vocabulary in texts.	-.40**

There are two others support that have shown a contrary tendency: one directly related to informative reading as the use of children newspapers (RES3), and the other describing the lack of a material, instead of its frequency: the fact of do not using textbooks during reading instruction (noRES1), that was related to a literary advantage.

An isolated variable, with a literary advantage was directly related to the objective of reading: to frequently reading long fictional books (TXT3). This connection can be see as obvious, although many other variables describing the purpose of lecture were tested, there were no other significant result. Moreover, in describing the results related to informative reading, some contradictions will be mentioned which are difficult to interpret.

In connection to the activities during reading instruction, there were two related to a literary advantage: *the teacher use to read aloud to the class and gives time to read books of the students own choosing*. It was difficult to create an index from them, as they represented very different activities, moreover the first one was focused on the teacher and the second on the students. For this reason it has been preferable not to draw out generalizations.

Finally, in relation to the literary texts, a last isolated variable was the teachers'

answers to the question: *About how many students in this class do you expect will grow up to be good readers?*, all derived variables were significant. GOOD_high which indicated the percentage of teachers who believed that more than a half of their students *will be good readers* was the variable more correlated to TEX ($r=.61^{***}$), the second largest correlation was its opposite: GOOD_low which indicated the percentage of teachers who believed that less than a half of their students will be good readers ($r=-.53^{***}$). Consequently teachers' beliefs were an important factor in connection to the difference between types of texts. However these variable were not correlated to the total score; if this connection is true, this means that the TEX difference is influenced by a highly subjective aspect of the instructional process. This possibility will have to be further researched later.

Now, variables and factors related to informative reading will be described. Some factors already mentioned were also correlated to this type of reading, such as reading subjects and methods of teaching. Moreover, there were new factors such as the assessment systems and the emphasis on vocabulary.

First, an isolated variable described organization: *to frequently develop reading instruction as a whole class activity*, this was favorable to an informative advantage. Regretfully there were not other significant information about other ways of organizing the class, such as mixed ability group, same ability groups or individual attention to students.

Previously, some contradictions about variables representing purposes of reading were mentioned. Here, a variable related to informative advantage was the low frequency of lectures such as descriptions, explanations, charts, diagrams and graphs. Thus, the absence of non-fictional lectures cannot be related to the improvement of informational reading, but was probably related, more generally, to a low reading ability. This is why it was preferable not to draw any conclusion about these variables, moreover, the high frequency of poetry reading, appeared as related to an informative advantage. Those contradictory results were probably related with the level of observations in this analysis, (countries) too general to observe details, and must be reconsidered when developing a deeper analysis.

Three variables related to reading evaluation were correlated to TEX, two of them described the scope emphasized by the teacher: national exams and classroom tests. Both have been considered as having little in common because of this difference in the scale. However, what was considered as the similarity was that they

expressed a general concern about assessment, like the third variable, the high frequency of oral questioning. From this trio, an index was created under the concept of a *high concern*. In table 5.5, CAAS_high represent the high frequency of those variables, and it was related to an advantage in reading informative texts. The index also had a negative correlation with the total score, even if it is not very significant $r = -.31^*$.

The third variable about evaluation is *oral questioning*, it was also related to one of the indexes created from the students questionnaire, *Msoc*, as the components of this index, *oral questioning* was an act of socialization of knowledge. There was a second variable, not mentioned yet, which was also interpreted in this sense: the frequency of students reading aloud during instruction. This last was the same question discovered in the students questionnaire, now, asked to the teachers, it was also related to an informative advantage. Therefore, going beyond the limits of each questionnaire, these two variables were added to the index, which has increased the correlation with TEX ($r = -.39^{**}$) and also with the total score ($r = -.49^{***}$).

Finally, a third index was created starting from two variables related to vocabulary, they were referred to: *frequency of systematic study of new vocabulary* and *emphasis in studying the new vocabulary that students encounter while reading*. This time an index with only two variables was created, as those were the only two asking about vocabulary in this questionnaire. Table 5.5, shows that this is also an index describing an informative advantage; there was not correlation with the total score.

In connection with literary advantage, there were three activities developed during reading instruction: the students read aloud daily and the teacher helped them with new vocabulary systematically, particularly from the text they were reading. It is interesting that the high frequency of teacher reading to the class was related to literary reading and this one to informative reading, this can be interpreted as two opposite methods during instruction. One more focused on teacher and the other on students, regrettably there were not more significant variables to study this possibility.

5.1.1.c School questionnaire

In this last questionnaire, from the original 59 questions that were analyzed, a total of 50 variables were correlated to TEX, derived from 27 questions; 27 of which had a literary correlation and 23 had an informative correlation. The correlated variables can be observed in appendix A.3. Although this was the shorter questionnaire, it had as many correlations as the others. One of the reasons was the presence of many questions whose derived variables were all or almost all significant. There were also a set of variables having more derived variables (six instead of four), they described the moment in which the instruction of some aspect of reading has begun, these variables are very important in the study of the reading components.

Starting to interpret, it can be observed that schools having few children speaking other language and having economically affluent homes, were schools having better literary scores. At those schools there was a concern about national standards, they had their own statement for instruction, programs adapted by levels and programs to help teachers in this task, who were themselves highly satisfied with their job and had high expectations of the students' achievement. The students also had a high level of desire to do well, and they took care of school property and they were highly supported by their parents. On the other hand, their wishes were not considered in curriculum or methodology. The principal's perception of the school climate was good ¹. Finally and more directly linked to what is learned during reading instruction, the literary advantage was related to an early study of the letters of the alphabet, the relationship sound-letter, making generalizations and inferences, and describing style and the structure of text.

Now, in analyzing literary variables, it was possible to construct indexes from this information, but was first necessary to observe the variables that remained isolated. In first place, there were two variables indicating the economic level of the student's homes. This can be interpreted following the same line that we already did, in connection to the students index of home resources, in which case a low availability of materials to improve reading was related to an advantage in reading informative texts. Here, a high proportion of homes which were economically affluent and a low proportion of homes which were economically disadvantaged were related to a literary advantage. Again, a correlational interpretation can

¹As a side note, it must be remembered that is the principal who answer this questionnaire.

be made, if literary reading was easier for these children it was because their daily life context was affluent economically; inversely, if they daily life contexts were more affluent, this was a consequence of having developed this kind of reading. In others words, the literary reading was, at the same time, cause and effect of the home resources related to the literacy habits. This kind of reading was more present in the family and parents' work may be related to reading, because, as Lahire pointed out in connection with professional situation: “[elle] joue comme une sorte de filtre permettant de laisser ‘passer’ certaines compétences et réduisant considérablement la probabilité d’apparition de telles autres compétences” (Lahire, 1993, p. 57–58). Moreover, we can add that the children educated in these kind of schools had already developed a literary reading advantage; they will have a greater chance of building affluent homes in the future.

The variable noPSS2, which indicated a high proportion of schools with more than half of the students coming from affluent homes, was correlated to two other significant variables: the *students regard for school property* (r with noPSS2 of .35**), and the *good school environment* (r = .42***). The connection among these three variables did not seem strong enough to create an index, as the first was purely economic, the second referred to students' behavior and the third was it–self an index based on other variables. However the connection can be a consequence of this economical advantage, as this can improve the general environment.

Table 5.6: Correlation Coefficients: Variable TEX - School Index

<i>SUBm_high, Wishes</i> : High teacher job satisfaction and expectation about students, high parental support and students desire to do well.	.51***
<i>CDAS_high, curriculum development at the school</i> : At the school there are : programs for teachers to improve reading instruction, ones own written statement of reading curriculum, different programs implemented for different levels, and an influence on curriculum of national standards.	.39**
<i>EREL_l, Early learning of reading skills</i> : Schools where before fourth grade is done the instruction of aspects of the reading process: letter identification, letters-sound connections, generalization and description of the style of the texts.	.38**

The first school index considered totally subjective aspects as wishes, expectation

and desires. In table 5.6 this factor shows the higher correlation to TEX, favorable to literary advantage. Moreover, a low result in this index, which means low expectation and wishes, was related to an informative advantage ($r=-0.44^{***}$). SUBm_high can be connected with the expectations of teachers (GOOD) about their students, which was the variable having greater correlation to TEX in the teachers' questionnaire. In fact, it was also highly correlated to this index: GOOD_high and SUBm_high $r=.59^{***}$. Just like the teachers' variable, this index has had no connection with the total score. Finally it must be mentioned that this index only takes 34 countries into account, because Israel and England did not answer those questions.

Another group of variables, apparently connected to each other, was that of the questions regarding the curriculum and programs organization, also favorable to literary advantage. They were translated into an index of involvement of the school members in tasks of curricula and programs development. The students had read better literary text when their school had created their own statement of reading curriculum, implemented programs differentiated by levels, when there were programs for teachers to improve their quality and if there was also a concern about national and regional standards. As it can be observed, the correlation was not as high as the previous index but it is still significant, moreover the correlation with the total score was also absent.

The last index included four variables representing different literacy skills, and the moment in which they were learned at the school. The skills were very different in level of complexity, as to know letters and to describe style. Yet, it must be remembered that, depending on methodology, a simple task like knowing letters and connecting them with sounds can be the first priority in a phonemic approach. Although here, the early development of reading skills lead to literary advantage, they had in common the fact of having been learned before the year of testing. Moreover, the questions about these aspects of reading were organized by order of complexity, therefore, it is not irrelevant that the two first and the last two variables of the list were the ones correlated to TEX. The cause can be that they represent opposite limits of this complexity or that the answers were more explicit than the others. In any case, the explicability of this factor will be reconsidered later. Finally, it must be mentioned that there was a positive correlation with the total score: $r=.37^{**}$.

On the other side of the tendencies, the score was higher in reading informa-

tive texts, if at the school, more than 50% of the children were not speaking the language of the test as first language, if the school organized classes based on students' abilities and the same program was implemented for all students at the same level; if there was only a few students receiving remedial reading instruction in the language of the test. In connection to the materials used in teaching reading, the texts books were basic for instruction, such as newspapers and children' magazines. On the contrary, reading series and material from other areas were not used. Regarding the reading competencies, the only one related to an informative advantage was to learn to make predictions about texts in the same year of the test. Finally, it was connected with an informative advantage the factor *parents' wishes having a lot of influence in curriculum* and a low index of *home-school involvement*.

These results did not show enough regularity to create indexes. However, there were some aspects already mentioned in describing the previous questionnaires, which occurrence here is interesting.

First of all, in the student questionnaire, there was a series of linguistic variables: the percentage of students speaking a second language before the beginning of school and three variables describing the frequency of speaking the language of the test at home. Here, there was a variable indicating a high percentage of children that did not speak the language of the test as their first language. These four variables were all correlated: the early learning of a second language was correlated to having another language as first language ($r=.49^{***}$), this last was correlated to never speak the language of the test at home ($r=.83^{***}$), if the children had declared speaking this language only sometimes the correlation was $r=.86^{***}$. In analyzing the student's questionnaire, index LNGsec was created, combining these two variables. Now this new variable can be included in the index to improve it.

Another variable that described the factor of *second language*, was the question asking for the *percentage of students receiving remedial reading instruction in the language of the test*. However, it did not indicate if this was or not the first language of the students. Later, in 2006 questionnaires, this question was discarded.

The use of newspapers was also a significant variable in the teacher's questionnaire, as the absence of this kind of reading in the student's questionnaire, consequently it can be concluded that the use of this reading material made a difference

in connection to informative reading. Although likely, as the teacher and school variables showed, the high frequency of this media was related negatively to the general score. Different explanations can be supposed for this last result, for example, maybe there was no other media available apart from newspapers and magazines, or this was a more common reading among struggling readers, or this media simply did not have impact on general reading learning. In any case, a deeper study is necessary.

5.1.1.d Linear regression model

The study of correlations and the inference indexes is only a first step to describing interactions among the reading processes and the factors that can explain its aspects. Nevertheless, even if this is a very general and wide-ranging point of view, this part of the analysis would not be complete if we did not try to explain the way in which those factors were related to our dependent variables.

Following the hypothesis presented in section 3.4.4.c, an ideal model should consider at least one linguistic family as predictor, along with factors representing aspects of the student, the teacher and the school. Since, at the moment, 36 countries are the observations, only a simple linear regression can be tested. Obviously, the range of any interpretation will be very limited, but it will allow us to establish some orientations to more accurate descriptions.

To elaborate a model, the first step was to study the connections among TEX and the linguistic families that were previously determined. There, only the Slavic and the Anglo families were significantly correlated to TEX (around 40%), the correlation of the Slavic family was favorable to informative advantage while the correlation of the Anglo family was favorable to literary advantage. Two regressions were created using those families as the only predictors, the models were significant and the Slavic family fit to explain a slightly bigger proportion of the variance (R^2 .19 compared to the R^2 .17 of Anglo) and it had, also, a bigger F value (F test = 7.99 compared to 6.74). Thus, statistically the Slavic family was a better candidate to be part of a model.

Secondly, the possibility of including one of the indexes derived from the students' questionnaire was considered. MSoc_high, The factor that represented the *oral activities developed during learning*, was not significant, in joining it to both models, its estimated parameter was not different from zero, and a reduction of the

F value indicated that the simpler model was better. On the contrary, LNGsec the *second language experience of the students*, had a parameter estimate different from zero in both models and explained better the variance, but, in both cases, it supposed a reduction of the difference in sum-of-squares, and had reduced its F value, this was related to a decrease of the degrees of freedom, because this index had only data for 32 of the 36 observations. However, as it will be show in the next paragraphs, this is a common problem that can not be avoided in explaining this difference.

Finally, this last regression, confirmed the advantage of the family *Slavic* as predictor, it was a better predictor in combination with both students' parameter. This linguistic family was definitely chosen as the reference for the next steps.

Table 5.7: Linear regression results: TEX 2001 - Indexes and Language

Variable	Parameter Estimate	t statistic
Intercept	-13.10	-0.80
Slavic (linguistic family)	-6.29*	-2.00
CAAS_high (Concern about assessment)	-0.24***	-2.90
CDAS_high (Curriculum development at the school)	0.19*	1.81
EREL_1 (Early learning of reading skills)	0.19**	2.25
F value =		8.89***
R-Square =		.58
Adjusted R-Square =		.51

$n = 31$, $DV = TEX$, difference between literary and informative purposes of reading PIRLS score 2001

In the third place, models including the linguistic families and one of the indexes from the teachers' questionnaire were tested, they did not fit to explain better the differences. From the schools' indexes, one was a significant parameter to include in the model: EREL_1, the index of *early learning of reading skills*. The regression made considering those two factors, fitted to explain the R^2 .37 (Adj R^2 .33) of the variability of TEX, this represented a gain in explicability of a 20%. Moreover, the F test = 9.53 indicated that this model fitted to explain TEX better than the model with only one predictor.

In terms of interpretation, it was very interesting that a predictor was directly

describing reading learning. However, this was not the ideal predictor because it was derived from dichotomous variables, indicating the position in connection to the international average. To find another regressor was necessary, not only in searching a gain in explaining the variance of TEX, but also in terms of the significance of this model.

Consequently, the possibility of adding a third predictor was tested, from the rest of the indexes, four of them could be part of significant models: VOC_high, SUBm_high, MSoc_high, and CAAS_high, this last index was the only one that implied an increase of the F value (F test = 9.92), it also produced an important increment of the determination coefficient R^2 .52 (Adj R^2 .47). However there were two questions to take into account, on one hand, in using CASS, the index of *teachers' concern about assessment*, the problem of missing data reappeared, since this model used only 31 observations. On the other hand, the explicability of the model was very significant, and a study of the Student Residuals and the Cook's D values confirmed the viability of this model: none of the 31 observations surpass the standard parameters. Accordingly, this was a valid model which explained the variability of TEX better than the previous tests.

Finally, a last stage was to study the possibility of adding another regressor to the model, the result is presented here in table 5.7. As can be observed, there was a reduction of the adequacy of the model, indicated by the F test, however, because of the change in degrees of freedom generated by the index CASS_high, this model can be still considered valid.

$$\begin{aligned} TEX_{predicted} &= -13.10 \\ &+ \\ &(-6.29 \times Slavic) + (-0.24 \times CAAS_high) \\ &+ \\ &(0.19 \times CDAS_high) + (0.19 \times EREL_1) \end{aligned}$$

This regression equation allow to observe closely the role played by each regressor. The variance of TEX is explained here with a linguistic family, an index coming from the teachers' questionnaire and two other indexes coming from the schools' questionnaire. The regressors $x_1 = Slavic$, and $x_2 = CAAS_high$ (Concern about assessment) are both related to and advantage in the informative score, while the factors $x_3 = CDAS_high$ (Curriculum development at the school) and $x_4 = EREL_1$

(Early learning of reading skills) are related to a difference favorable to the literary score. Looking now to the contribution of each parameter to the explicability of the model, it can be observed that the *Slavic* family has the smallest influence, since it is a dichotomous factor, values 1 or 0. However, its significance cannot be neglected, the estimated for the constant is negative and the most influential parameter, *CAAS_high* is also negative. In the sample, the minimal and maximal values of $b_2 \times x_2$ are $-13.82/-32.82$. On the other hand, the two positive regressors have the minimal and maximal values: $14.06/26.45$ and $14.32/22.74$.

It must be mentioned that all the indexes have been standardized to have a mean of 100 and a standard deviation of 15, therefore, they are easier to compare. Since the difference among the sum of *Slavic* + *CAAS_high* and the sum of *CDAS_high* + *EREL_1* is not big, the results of the equations can vary widely.

Taking this model as reference, if a change in the students' achievement is sought, since the indexes were related to organizational and curriculum aspects, they could be modified to reduce differences in reading one or the other type of text.

Finally, it is interesting to observe the distribution of the predictors in the country sample. First, the Slavic countries had a *concern about the assessments* slightly higher than the average (102.95), and they were characterized by a low average in *curriculum development at the school* (88.30). It can be deduced that those countries had a more centralized education system, because the curriculum was developed outside the school.

On the other hand, among the non Slavic countries, an interesting case to look at is Iceland, because the value of *CAAS_high* was particularly low = 57.57 and, at the same time, *CDAS_high* was almost one standard deviation over the average = 111.36. Consequently, it can be deduced that in Iceland the development of the curriculum within the school was fundamental, on the contrary, the assessment, as part of the educational processes, was not very emphasized.

Obviously, it is important to remember that this, and all other assumption from this sample and modelization, must stay only in a very hypothetical level, because of the reduced extend of the country data sample.

5.1.2 Processes of Comprehension 2001

This process of analysis follows the same logic as the previous section. In this case, a positive difference represents an advantage in the low order processes of comprehension and a negative value represents a high order advantage.

5.1.2.a Student Questionnaire

The questions taken into account to construct our data set were the same used in analyzing the objectives of reading, however in this case the variables correlated to COM were only 21, derived from 10 questions.

It is important to mention that since many variables were representing two sides of the same question, in describing them, we tended to choose “positive” variables, in others words, those variables showing the high presence of the studied fact. In other cases the two conditions, high and low are presented depending in the significance of each variable and the factor represented. The aim of this description is simply make an interpretation that can help the comprehension of these aspects of reading learning.

Now, following these criteria, on one hand, there were more variables related to an advantage in high order processes, all are shown in table A.4. On the one hand, the variables related to an advantage in low order processes were: to *read frequently comics* and *not watch television often*. There was also a correlation between this advantage and the fact of having parents born in the same country.

On the other hand, a student responded more efficiently to high order cognitive processes if he accomplished the following characteristics: *having parents not born in the country*, to *watch television very often* and to *frequently borrowing books from the local library*. Moreover, at school, *reading frequently in silence*, *not follow others students reading* and to *often choose the books to read*. Finally there was a correlation between COM and the student self concept: low ratio of *I do not read as well as other students in my class*.

One last variable, that was in fact an index, was the proportion of independent reading. Both high and low frequency of this index was correlated to COM. The coefficients indicate that a student reading frequently in an independent way, was a student that had an advantage in high order processing and the one not devel-

oping this kind of reading responded better to low order processes.

From those variables, it was difficult to make generalizations, although some inferences were made. As they represent a large spectrum of the students' habits, characteristics and instruction methods. First, there were two variables describing television watching habits, one indicated that to watch television every day was associated with an advantage in high order process, the other indicated that a low amount of hours per day watching TV was related to an advantage in lower order processes. Since this media depends a lot on image reception, it could be deduced that a connection exists between image and reading processing, particularly to high order process as generalizations and associations. Because, in understanding images, and specifically television images, the focus is on the generalities and not in the details of what is seen on the screen. However, even if this seems to be an interesting subject, there was not more information available in these questionnaires about it.

Secondly, there was one variable indicating if parents of the children born in the country, this information looks difficult to interpret, as there were no other aspects related to this fact among the correlated variables, as was the case of second language variables in the analysis of TEX difference.

In third place, there were three variables also correlated to TEX, that showed the same structure, they were correlated to the literary reading advantage and to the high order processing. They described the fact of *never following along others students reading* (that was part of an index describing the oral interaction as part of reading learning), *to choose frequently the books read at school* (also related to total score), and *not thinking to read less well than others*. These variables can be related to the factor which will be described in the next paragraphs about independent and individual reading.

Table 5.8: Correlation Coefficients: Variable COM - Student Indexes

<i>InLe_high, Individual activities: the students do not use to listen to classmates reading, they frequently read silently on their own and choose the books they read at school.</i>	-.48***
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Individuality in reading was also the subject of an index (GTIC2), as was mentioned above, this fact brought to search variables that could represent a similar tendency. Three of them were associated to reading without the interaction or

help from other people (schoolmates, teachers, family): *to read silently frequently on their own, to never follow along while other students read and to choose lectures every day at school*. These three characteristics were related to an advantage in high order processes and were the source for an index. As table 5.8 shows, a high value of this index was related to an advantage in developing high order processes and was correlated to the total score as well ($r=.51^{***}$). Consequently this factor can be considered as a desirable characteristic, if the high order processes achievement needs to be improved. These assertions will be subject of revision again because other similar connections will be described.

5.1.2.b Teacher Questionnaire

In quantitative terms, the number of correlated variables and questions was comparable to those of TEX (54 variables derived from 24 questions), as it can be observed in appendix A.5. However, the factors and characteristics described by these variables were not similar. The types of text used to teach were less present, (e.g. there were other kind of class activities and the assessment methods were also different). In the analysis of TEX the reading strategies were totally absent, on the contrary they were very significant here.

Table 5.9: TEX and COM compared correlations

Variable	TEX	COM
RES4_low: never use computer software	-.41	.30
noRES5: never use "on-line" reading materials	-.31	.44
RES6_high: frequently use a variety of children's books	.43	-.37
RES6_low: never use a variety of children's books	-.33	.29
RES6: frequently use a variety of children's books	.40	-.32
TXT3_high: frequently have the students read longer books	.45	-.30
RA6_high: students frequently read books of their own choosing	.31	-.36

Moreover, some variables were correlated with both differences TEX and COM, their values confirmed what was found in the analysis of the students' questionnaire: the connection between literary reading and high order processes, moreover, there were also several variables showing a connection between informative

and low order. As table 5.9 shows, there was no variable differing from these two tendencies. This means that, at least, for this case and this particular analysis, this is an empiric confirmation of the theoretical connection among these aspects of reading.

In regards to the mean of the variables, a subject already mentioned can be quoted here as a common factor: the *variety*, in this case of reading materials, all these variables were describing the use of materials, and particularly the fact of the use (or not use) of materials others than the usual ones. The connection among this factor, and the aspects of reading considered here, will be a subject that must be studied in deep.

Now, to describe the variables correlated to high and low order processes, it will be necessary to make a general description first, because of the significant amount of variables. Three group of variables can be differentiated, according to the tendency of the correlation: to one, the other or both processes.

First, in correlation to the low order processes we found one characteristic related to the formation of the teacher: *having studied special education*. It must be mentioned that this was the only variable which had a significant correlation with COM (none with TEX) and represented the subjects of emphasis in the teacher professional training, this is remarkable because there were eight other areas considered by the questionnaire (like literature, reading theory, psychology, second languages, etc.) and none of them showed a connection with our dependent variables.

Another general characteristic of the teacher was his negative opinion about the professional opportunities at the school, particularly in connection to teaching reading. Furthermore, this negative tendency was present in others results.

The rest of the variables were focused on teachers' class activities and presented the same negative tendency. There were related to organization: *to not organize same ability groups and preferring mixed ability groups, to not model reading for the students*; related to materials that were *not used to teach*: workbooks, computer software, and online resources; it was related the *low amount of homework given to the students*; and there was some type of assessment to evaluate reading progress: *to use written tests, oral reading and to not judge based on professional opinion*. This last variable also had an important and negative correlation with the total score; this can be interpreted as insecurity in the teachers own capacities, which will be a negative factor in students learning to read.

5.1. PIRLS 2001

Secondly, there was a group of variables, that were correlated to both low and high order processes, all those variables described activities to develop reading skills, as they were defined in the questionnaire, they asked directly about the teaching of processes of reading comprehension, like: *To help develop reading comprehension skills or strategies, how often do you ask students to explain their understanding of what they have read?* or *To help develop reading comprehension skills or strategies, how often do you ask students to make generalizations and inferences based on what they have read?*. In connection to COM, what was remarkable, was that even if there were strategies theoretically associated to low and high order processes, it was the fact of *teach* or *not to teach* them what determined their correlation. The variables correlated to low order processes were: the absent in instruction of *identify the mains ideas* and *comparison among texts*, while, the variables correlated to high order processes were *to frequently make prediction and generalizations*, *the description of style* and *to teach decoding strategies during reading instruction*. In conclusion, even the learning of a very basic comprehension process like decoding could be favorable to the development of high order comprehension, if it is teach frequently by the teacher.

The third and final group, were the variables whose correlation was favorable to the high order processes. There were some organizational aspects as: *language and reading instruction not developed as separate subjects*, and *daily frequency of reading instruction*. Two teaching methods: *to ask the students to read aloud in small groups* and *to read silently*. The rest of the variables were all related to books: *to frequently use a variety of books*, *to let the students choose the books they read*, *to ask them to read long books*.

Now, the next step of analysis was the creation of indexes, because of the long amount of variables, this questionnaire might offer many possibilities, however we encountered a difficulty: there were several implicit factor represented only by two variables. This was the case of a hypothetical index of assessment methods (oral or written), an index of computer use (software and online reading), an index of reading interactions among students (read silently or in small groups) and an index related to the ability groups organized by the teachers. Like in the case of *time* in the previous section, in all those cases the two variables were only a small proportion of the total variables related to those subjects, that is why, as we did before, we avoided the construction of an index not representative enough of the described factor.

Table 5.10: Correlation Coefficients: Variable COM - Teacher Indexes

<i>DEV_low, Emphasis in Strategies</i> : The teacher never asks or almost never asks for the main ideas of texts, to compare text with experience, for making predictions, generalizations or inferences, and he never asks the students to describe style or structure of texts, (N=33).	.50***
<i>VATY2_high, Variety in materials</i> : Teachers propose texts of different kind to the students during reading instruction: textbooks, computer software, on-line reading materials, and a variety of children's books.	-.43**

In contrast, the variables allowed the creation of two indexes with sufficient data support. First of all, one index considering the processes of comprehension emphasized or not by the teachers. Summarizing the frequency of all the processes, the assertions previously done were confirmed: to develop strategies every day, even if those were low order strategies, were always correlated to an advantage in high order processing. The most important correlation is presented in table 5.10, however *DEV_high* has also a significant correlation to COM ($r = -.33^*$). However, none of them have a correlation with the total score.

The second index had two qualities, first of all, it described a factor correlated to COM: the variety in the material used during reading instruction, its high and low frequency were correlated. Secondly, in section 5.1.1.d, *Teacher Questionnaire*, there was an index related to this factor: *VATY*, that index and this new one: *VATY2* were both created from variables indicating the use of: *computer software*, *online reading* and *variety in books*; the *use of textbooks* was literary related, here it showed the same tendencies as the other variables and it was put into the index to add more variety. As we did in analyzing *TEX*, we did not count in this index the variable about *reading longer books* because there was an explicit indication about the content: fiction.

The results of correlating *VATY2* with the dependent variables were significant in several areas, first of all, as table 5.10 shows, there was a correlation favorable to high order processes in the high frequency of *VATY2_high* (*teachers declaring to use those materials frequently during reading instruction*). However, this was not the higher correlation, *VATY2_low* (to not use the materials) showed a more significant result: $r = .51^{***}$. It was better to refer the high correlation because

is equivalent to the one used before (VATY_high); moreover, this confirms a tendency previously commented: the daily use of a variety of material had a positive correlation with the literary tendencies. The same variety showed a correlation with the high order processes. Moreover, the low frequency, related to low order processing, was related with informative reading. A final aspect to remark, is that both high and low frequency of this index were correlated with the total score, from this point of view, VATY2_high, the frequent use of a variety of materials will be a recommendable activity as it improves the high order comprehension processes and, at the same time, is correlated with an improvement of the total score $r=.50^{***}$. The low frequency of variety was in the opposite situation: $r=-.41^{**}$.

5.1.2.c School Questionnaire

This was the shorter questionnaire considered in this analysis, however, the amount of questions from which correlated variables were derived is not very different from the teacher questionnaire (the bigger one). As appendix A.6 shows, from the original 59 questions, 41 variables were correlated to COM from 23 questions. From these 41 variables, 21 had a positive correlation and 20 had a negative correlation.

To describe the correlations obtained from this questionnaire, some isolated variables will be mentioned, then, a group of variables having a common factor will be reported. Finally, it will be described a mayor group referred to the moment when the reading processes and tasks were learned.

In first place, three variables were mostly isolated from the rest of the sample, whose correlation to COM was favorable to low order processing. They were the low amount of *immigrant students* (less than 10%), the preference of the school for *forming classes based on students ability* and the high importance given in curriculum to the *students wishes*. The variables had in common that they were related to students' characteristics, however they did not imply a common factor. Another variable related to low order advantage, was the absence of *reading series in instruction*, it could be linked with the absence of textbooks during instruction, but this was favorable to high order advantage, those two variables were the only ones describing instructional material preferred at school.

Secondly, there were also variables mostly isolated, but having a difference favorable to the high order processes of comprehension. Two variables were the

frequency of *informal initiatives to improve reading instruction* and the existence of *programs to improve the quality of teachers in reading instruction*. Even if it was interesting that the organizational aspects were related to this difference, there were too many other organizational aspect not correlated, which prevent from deducting an implicit factor. Finally, two other aspects can be mentioned: a school where the teacher had *high expectations for students' achievement* and, at the same time, *the students were highly supported by their parents*; which performed better in high order comprehension processes.

Table 5.11: Correlation Coefficients: Variable COM - School Indexes

<i>WRIT_high, high focus in writing instruction</i> : High percentage of letter recognition and word reading in beginning school, writing emphasized in curriculum and speaking listening not emphasised.	-.32*
<i>EMCOM_less, Emphasis in complex tasks</i> : The schools declare to emphasise before four grade the teaching of the following reading tasks: reading connected text, to identify the main idea, to explain and support understanding of texts, to compare text with personal experience and with different texts, to make predictions about what will happen next, to make generalizations and inferences and to describe style and structure.	-.53***

The first factor inferred from the correlations was the *goal of the instruction provided at the school*. There were two possibilities writing or orality. On one hand there were variables indicating that the school was putting more emphasis in writing over other aspects of language, specifically, there was the importance given to writing language together with an early instruction of the basis of reading-writing. On the other hand, there were schools where the oral interaction was first emphasized, and the knowledge of writing – reading components, as letter and words, were learned later by the students.

However, the correlation of the index, presented in table 5.11, was the only one to be significant. This means that only the high frequency of writing emphasis was correlated to COM. Moreover, the value of the coefficient was not very elevated, in fact, it was the smallest of all the indexes created until now. Consequently, the representativity of this index can be questioned, also the validity of the influence of this factor.

In contrast, the most important group of variables from this questionnaire, were related to questions about the principal moment in which a certain process or aspect of reading was emphasized during instruction. An example of this question is: *At which <grades> prior to <fourth grade> does knowing letters of the alphabet first receive a major emphasis in instruction in your school?*. There were five possible answers: *three grades Earlier than the present year (first year), two grades earlier, one grade earlier, during fourth grade or not in these grades.*

To analyze these questions three derived variables were constructed, depending on time: before fourth grade (first three alternatives), during fourth grade or after fourth grade (last alternative). From those variables, this analysis emphasized the results referred to *before* and *during* fourth grade, as the last alternative *not in these grades*, is not explicitly referred to an instruction “after” fourth grade. Moreover, in the database, many schools did not selected this alternative at all, so there was many countries with null values.

Nevertheless, the correlations showed that the only instruction that matters in relation to COM was the early instruction of the more complex processes. Moreover, it was significant that the first variable showing a significant correlation was referred to *reading connected text*; this significance increased in parallel with the augment of the complexity of the tasks.

More precisely, to formalize these tendencies, an index regrouping all these variables was created, and it is showed in table 5.11. The proportion of this tasks being emphasized before fourth grade was negatively correlated to COM, which means, that it was favorable to high order processing. In addition, if those task were emphasized only in fourth grade, there were also correlated to COM: $r = .54^{***}$. It is important to mention that both variables were correlated to the total score as well, and those correlations were the most elevated found in this analysis: $r = .65^{***}$ for early emphasis and $r = -.59^{***}$ for instruction during fourth grade. This allows us to deduce that the early teaching of the considered tasks of comprehension will improve the general reading achievement and specifically the high order skills. On the contrary, do not consider these tasks in the instruction will be negative to the general reading achievement, and in particular, it will establish a difference favorable to low order processes.

5.1.2.d Linear regression model

These last paragraphs of PIRLS 2001 analysis will reproduce the strategy used with the difference TEX, to create a model using the derived indexes and the linguistic families as regressors.

First, there were two families being correlated to COM: *Anglo* ($r = -.51^{***}$) and *Germanic* ($r = .33^*$). Consequently, this case is very different from the previous regression, where two families were correlated in a similar way to TEX. In this case, the higher correlation of the first family, made of it the best candidate to explain the variation of COM. Moreover, two regressions were made, having each one of these families as the single predictor; the determination coefficient and the result of the F test, were considerably better in the regression made with *Anglo*: $R^2 .26$ (Adj $R^2 .23$), F test = 10.96, than in the regression made with *Germanic*: $R^2 .11$ (Adj $R^2 .08$), F test = 4.03.

But, if this last statistic is compared with the result of the model explaining TEX difference, since the extension of the data is the same, it becomes uncertain that the adequacy of the model could be improved in adding more regressors besides *Anglo*. To resolve this problem, since our interest is to study the explicability of the individual and scholar factors, the solution will be plainly to reverse the explicative process: to search first a stable model beginning with the indexes and later, to include one or more linguistic families.

Now, a search was developed among the predictors, combining two indexes. Among them, two not represented in the tables: *low variety in materials* and *low emphasis in complex tasks*. *Low variety in materials* had the second higher correlation with COM, the first was the correlation between COM and *low emphasis in complex tasks*. There were exactly those two variables that fitted to explain better the variation of COM. This model presented a determination coefficient of $R^2 .41$ (Adj $R^2 .37$) and a F statistic of = 10.57, all the parameter estimates were significantly different of 0 ($p > .05$). In comparing with the model with *Anglo*, The F test indicated that this model was satisfactory and, in addition, it explained better the variance of COM.

Besides the statistical explicability of the model, those two predictors were interesting from the point of view of interpretations. There was an index coming from the teachers' questionnaire and another coming from the schools' questionnaire. Moreover, VATY represented a factor also correlated to the TEX difference, which

Table 5.12: Linear regression results: COM 2001 - Indexes and Language

Variable	Parameter Estimate	t statistic
Intercept	-9.67	-0.69
Germ (linguistic family)	8.45***	2.85
VATY2_low (Variety in materials)	0.27***	3.59
EMCOM_less (Emphasis in complex tasks)	-0.18**	-2.01
F value =		11.36***
R-Square =		.53
Adjusted R-Square =		.49

$n = 34$, $DV = COM$, difference between low and high order of comprehension processes PIRLS score 2001

allowed us to observe the connections between informative reading and low order processes that was already described. In addition, the importance of the early instruction of the processes of comprehension was represented by the variable *EMCOM_less*.

Any other indexes can be added successfully to this model as regressor, but linguistic families were incorporated. To complete the model, two families were plausible predictors: *Other*, and *Germanic*. Besides the improvement of the model, the inclusion of families different from *Anglo* reduced the possibility of thinking that the explicative power related to the English speaking countries was not a linguistic factor but rather economic or socio-cultural. The fact that other linguistic families were significant predictors proves the validity of this criterion.

Now, as it is shown in the table 5.12, the final model included the two indexes already mentioned, along with the *Germanic* family as linguistic factor, it was the model that was able to best explain the variance of COM. Looking in the first place at the *F* statistic, it is remarkable that its value was higher than all the other possible models; better than *Anglo* alone, better than the model with two indexes, and particularly better than the model where of only *Germanic*. This last model can be taken as a reference to compare the gain in explicability; the determination coefficient indicated a gain of a 40%.

In addition, the meaning of the indexes and the model it-self can be interpreted

by studying the following regression equation.

$$COM_{predicted} = -9.67 + (8.45 \times Germanic) + (0.27 \times VATY2_{low}) + (-0.18 \times EMCOM_{less})$$

The first remark that must be done concerns the *Germanic* regressor (x_1), that has a positive value, favorable to low order processes, and is a dichotomous variable. Then, for Germanic countries the sum of the parameter estimated of the constant (-9.67) and the family (8.45×1) approach to 0 the result. Consequently, for *Germanic* countries, the final tendency of the COM difference will depend on their estimations for the two other estimated, the indexes: *variety in the materials used in learning to read*, and emphasis that the school puts on *early instruction of the more complex processes of comprehension*.

By example, a *Germanic* country could have had a better result in developing low order processes, if the variety of materials used to teach is low, in other words, if only a reduced number of different materials are used. It will be also favorable, if the schools did consider in their scholar programs an early instruction of high order processes of comprehension, and, if this instruction was only developed during the fourth grade of after. If this interpretation is translated into the sample, only one of the *Germanic* countries was over the average in the index *VATY2_low*: Germany, which means that, among those countries, the variety of text is not particularly reduced. Germany was also the only country over the average in the early instruction of higher order processes.

The country where there was a greater contrast between the two indexes, was Sweden, where $VATY2_{low} = 80.55$ and $EMCOM_{less} = 100.64$, if we developed the equation for this two parameter, the result of $(0.27 \times VATY2_{low}) + (-0.18 \times EMCOM_{less}) = (21.75 + -18.11) = 3.63$. If this result is summed with the parameter estimated for *Germanic*, the result is positive and higher than the constant. This explains why this country had a difference favorable to low order processes. Following the model, what further explains the COM results in Sweden, is the use of a *Germanic* language, added to the absence of a particular concern for teaching early the high order processing.

On the contrary, in a non Germanic country, like the U.S.A., and in correlation with the phonology of the language, there were many schools where higher order

5.1. PIRLS 2001

processing was studied since the beginning ($EMCOM_less = 118.88$), one standard deviation over the average; on the other hand there was not a significant amount of teachers declaring to not use a variety of material, the value of this variable was, in fact, one of the lowers in the sample ($VATY2_low = 68.84$), two standard deviation under the average. These characteristics explains why this was one of the countries where the difference COM was more favorable to high order comprehension processes.

5.2 PIRLS 2006

5.2.1 Reading objectives 2006

There were two great changes from 2001 to 2006: the enlargement (and variation) in the sample of countries and the adjustments in the distribution of the items. Consequently, it can not be expected to find the same phenomena that were previously recognized. However, the principal aim of this new section is to discover new factors. It can be factors been explicative of both assessments, but they can be working in a different way. In other words, this second section of analysis is not yet a comparative procedure; it is an independent examination. The comparison will only be accomplished when all the preliminary precedents are compiled, and to obtain it, this study of 2006 data becomes fundamental.

The structure of this subsection follows the same order that the analysis of TEX difference in 2001. First of all, variables and factors derived from each questionnaire will be described : students, teachers and schools, later a linear modelization will be tested, trying to incorporate linguistics factors as well. The dependent variable TEX represents exactly the same as for 2001; it is: the tendency to have a better score in one category of texts than the other.

As section [5.1.2.d](#) showed, in 2001 this trend was explained by a model using the languages spoken in the country along with other factors such as the student reading habits and performance, the task difficulty, and their knowledge of other languages and vocabulary.

5.2.1.a Student Questionnaire

The student sub-set was made up of 42 questions, related to students' home habits, reading concepts and attitudes, language practice, types of books read and school activities about reading. From this selection, 28 derived variables were significantly correlated, the larger part (17) were literary related, as it can be observed in appendix [A.7](#). It is very interesting to compare these quantities with those of 2001 sub-set, there was a more important number of questions that were taken into account, however, the number of variables correlated to TEX was similar (33) and also the amount of variables showing a literary advantage (21).

5.2. PIRLS 2006

Now, the next step was to do an interpretation based on the correlated variables. In first place, students showed better results in answering literary items when they accomplished one or several of the following conditions: to have a *negative attitude towards reading, to not enjoy reading, to not like to talk about books, or to not like to receive books as presents*.

Just as it was observed in 2001, even if the attitudes were very negative, the self concept indicators were favorable: *to feel able to understand the lectures, not being slower than others, and to think than reading is not boring*. Other variables were: *to do homework alone and to not read often for homework*. Outside school work, there was correlation for activities like *to not read comics, directions or instructions, to always speak the language of the test at home and to have many books available at home (over one hundred)*.

In second place, better results in informational reading where related to: *not reading aloud outside school, to not read subtitles on TV, to read on the internet and to read often (daily) for homework*. As in 2001, other positive factors for informative lectures was *the learning of a second language before starting school and to not often speak the test language at home*. The internet reading was an interesting new variable, which, along with reading subtitles on TV, were probably related to the fact of having access to this medias, an economic factor.

Table 5.13: Correlation Coefficients: Variable TEX - Student Indexes

<i>ATTn_low, negative attitudes towards reading: The students do not like to talk about books, do not like to receive a book as present and do not enjoy reading.</i>	.32**
<i>LNGsec, second language experience: The students declare to have learned a second language before starting school and to speak the language of the test at home only sometimes.</i>	-.42***

The more significant correlation was found between TEX and the absence of books at home (*over the international average of students who declared to have twenty five or less books at home*), the coefficient was $r = -.51 * **$, as in 2001, student with no access to books at home did better in informational reading. Additionally, the second highest coefficient came from the time spent reading for homework, particularly the low or total absence of this kind of reading. Therefore, a student who did not spend more than half an hour reading diary, was a student for whom

it is easier to read a literary text than an informative one. This correlation has a r value of .45***.

Starting from this information, another step in the analysis was done, that is, to create tendency indexes representative of factors. The most significant results are presented in table 5.13.

The first factor, *children's attitudes*, have involved variables related to aspects also identified in the 2001 data. Concretely, it corresponded to a PIRLS derived index included in the data: SATR, *students index of attitudes toward reading*. However, the SATR 2006 was not correlated to TEX, even if it was highly correlated to our index ($r = -.59***$).

Among the correlated variables, we were also able to identify some variables related to the other PIRLS index mentioned during the 2001 analysis: *reading self-concept*. However, it was not possible to put them together to create an index, the coefficients indicated some contradictions: apparently a student that did not think that reading is easy could, at the same time, have declared to understand everything when reading and have declared to read slower than others. That is why we omitted this possible interrelation.

The second index represented a linguistic tendency, already mentioned in 2001 results as well. The variable described the role of the language used at school in children's everyday lives. Specifically, less experience at home with the official language was related to an informative advantage, on the contrary, to use exclusively the same language at school and at home resulted in a literary advantage. Following the same procedure as in 2001, an index was created considering the variables indicating an early learning of a second language, and a low proportion of school language at home; the two variables were highly correlated ($r = .77***$). On the other hand, in spite of its interesting meaning, this index was not able to be used as a factor in a model because of missing data. In this case, the amount of missing data was over the acceptable number: there were too many countries (6) where those questions were not part of the questionnaire.

Following this information from the students' variables, it is possible to affirm that the reading activities and purposes, the evaluation methods, and all the other aspects of the learning practice have had no influence in the performance of students in comparing these two objectives of reading. What did have an influence was the home activities, linguistic practices, and the students' personal opinion

about reading.

Finally, if we come back to compare these correlations with those of 2001, a last aspect to be taken into account were the variables that were present in both analyses, correlated in both cases. They were few, only 8 variables (derived from 4 questions), the subject to which they were referred were:

- Self-concept about reading in comparison to the other students in the class.
- Amount of books available at the student's house.
- Students speaks another language at home.
- Students learned a second language before starting school

However, even if there were not many, the persistence of those subjects could be considered as an interesting clue. The first subject, for example, was related to the factor *students attitudes* and allows the creation of a variable to test its explicability in the comparative analysis. The same thing can be said about the factors related to language use.

On the contrary, the factor that were absent from this second analysis must be mentioned as well. Comparing the two groups of significant variables, there were three factors which were present at the first analysis and not in the second: school work, oral interaction and security. Concerning the first factor, even if they were few, in 2001 two explicative variables were related to the school activities described by the students, while, in 2006, the schools aspects were completely absent. In relation to the second factor, in 2001 a particular activity related to reading was identified: the possible effect of *read aloud and to express aloud*, now, there were no references to this factor; the reason was probably that there were changes in the questionnaire concerning this aspect and several questions were omitted. Finally, concerning the third factor, no question regarding bullying and feelings of safety were correlated to TEX, moreover, only the answers to this last question were related to the total score.

5.2.1.b Teacher questionnaire

In term of quantity, even if the data considered was as large as the obtained from the student questionnaire, only a dozen of variables were significantly correlate to TEX (see appendix A.8). Half of them explained a tendency towards the informative objectives, the other half showed a tendency to the literary purpose. This was a great change if it is compared to 2001 questionnaire, where a total of 49 variables were correlated to TEX. In consequence, we can already deduce that the factors of 2001 will not necessarily be found here, but in a partial way.

Firstly, Concerning the two tendencies, on one hand, the teachers whose results showed a positive tendency to the literary lecture, were those who *always use a workbook during reading instruction, read short stories with the students as part of the reading instruction, frequently help the students to understand new vocabulary, ask the student to answer oral questions about what they read and ask the students to explain their understanding of what they have read.*

On the other hand, the informational reading was better when teachers declared to organize reading activities by *creating mixed-ability groups, to allow the students work independently on a goal they choose themselves, to not use children books during reading instruction, and to use instructions or manuals as part of teaching reading material.*

Among these variables, the higher coefficient of the correlation was related to the creation of *mixed-ability groups*. This means that the students from a country where teachers tend to organize the instruction in this way, had more probabilities of getting an informative advantage, in this case, the correlation was $r = -.39^{**}$.

In the second stage of our analysis, two factors were considered for the creation of tendency indexes, for the fist (IND)², related to informational advantage, we kept the variables which described a learning process not focused on the interaction of the students with the teachers but within them or in an individual way. Then, for the second index (DEP) a selection of variables showing a direct interaction between the teacher and the students was done where the instruction depended greatly on this interaction. This index contrasted with independent work or peer interaction. Besides the correlations presented in table 5.14, the variable DEP_low

²In general, we avoid to present two level categorical variables in our index, since they are artificially dichotomized from averages. In this case, we make an exception because is the only variable whit a significant correlation coefficient.

is also significant, in fact, the coefficient is slightly higher than that exposed here ($-.34^{**}$), therefore, it will be taken into account in the development of the regression to explain TEX.

Table 5.14: Correlation Coefficients: Variable TEX - Teacher Indexes

<i>IND</i> , Students work autonomously during reading instruction: Teacher creates mixed-ability groups, allow the students to define their goals, do not use books to guide reading instruction.	-0.36^{**}
<i>DEP_high</i> , Instruction depends on teacher – student interaction: Teacher uses workbooks, have students read short stories, and control learning through oral questioning.	0.32[*]

The great difference between these two tendencies was related to the teaching techniques and organization. On one hand, connected to the literary advantage, there was a more guided system where a closed teacher-student relationship was established: with books guiding the work, given stories to read, and immediate control of learning. On the other hand, if the student worked by themselves, choosing their goals without books, this method was favorable to an informative advantage. In contrast, this autonomous work factor was negatively correlated to the total score: r coefficient was $-.36^{**}$. Thus, if the incidence of this factor was augmented, there was a decrease in the total score. This negative condition implied that there was probably not a choice in methodology; on the contrary, if students did not use books it was because they were none available, and if they work by themselves it was probably because of an absence of teachers or time allowed to each student. This possibility will certainly need a deeper analysis.

Finally, concerning 2001, the 2006 teachers' results were less coherent than the students' results; only three questions were almost equivalent. First, the effect of *reading instructions or manuals during reading instruction*, which was consistent in both samples: if this informative material was not present during instruction there was a literary advantage, on the contrary if it was often used, there was an informative advantage. Secondly, another repeated variable was the question about the frequency of the use of *a variety of children's books*, this was an important find since, in 2001 analysis an index was developed with the concept of *a variety of materials used to teach*.

If compared to 2006, the reading materials correlated to TEX were not the same but there were materials, this means that at least the factor itself could be recognized. Finally, the last variable present in both data sets was the frequency of help given by a teacher to the students to understand new vocabulary in texts, in this case the result were contradictories, whereas in 2001 a high frequency of this activity was associated to an informative advantage, now in 2006 data, it was associated to a literary advantage, there were no changes that can explain this contradiction. That was the reason why this variable was not considered for the construction of the index DEP.

5.2.1.c School questionnaire

From this questionnaire, only fifteen derivative variables were significantly correlated to TEX, yet the number of questions taken into account were similar to the previous ones (47 questions). Besides that, the explicability of these variables revealed more correlations between TEX and informational factors (10), between TEX and literary factors there were only five correlations. A deduction can be made from these numbers, even if in this plain analysis with countries as units, no finer interpretations can be made, but when developing a more comprehensive work, this fact must be taken into account: the literary tendency could be explained with more student-related factors, in contrast, the informational tendency of TEX could be more related to school factors.

Now, to describe the tendencies of the correlation, a better result in literary reading was related to these two conditions. First, the use of languages at school, that was mentioned previously: *To have few students receiving instruction in their home language* (when different from the school language) and secondly, if the school had high resources (following principal's perception of them), that was a literary aspect as well.

On the contrary, a higher informative score was correlated to the *high enrollment of fourth grade students in the school* (the bigger the school, more informational the tendency). Moreover, it was correlated to informative reading a *low safety sensation at the school* (following principal's perception of it). In accord with previous results about the effect of a second language in the school, another informative factor was a *high percentage of students whose first language is not the language of the test* (over 50%). It was correlated to informative reading as well, the ab-

sence of material from different curricular areas in reading instruction, in fact this was the higher coefficient of correlation: ($r = -.39^{**}$). This is interesting because it confirmed a previous result from the teacher questionnaire, there, an informative factor was also the choice of not using children's books during reading instruction.

As in 2001, from the schools' questionnaire, the more important correlated variables were related to the period in which a series of aspects of reading were first introduced. The TEX difference, positive to literary lecture, was increased if one or several reading aspects were already learned at the school before 4^o grade:

- To identify the main idea of texts
- To explain or support understanding of texts.
- To compare text with personal experience.
- To make predictions about what will happen next in text.

This series of variables were related to the complexity of the instruction given during these first years of learning. Regretfully, in this questionnaire, many of those variables had a lot of missing data, which made the creation of an index very difficult. However, this was tested, and there were not significant correlations with TEX, there was only a correlation between the index AFT4_less (from the answers *the school have thought those strategies before 4^o grade*) and the total score ($r = .72^{***}$), another possible index: AFT4_equal (from the answers *the school teaches those strategies during 4^o grade*) was also correlated but negatively ($r = -.73^{***}$). Those discovers indicated that the early learning of reading comprehension techniques was particularly positive to the total score, and so to the reading learning it self, while only teaching these techniques during four grade influenced negatively the reading competences of the students.

In reference to the 2001 results, as in the teachers' questionnaires, there was a great reduction of the quantity of correlated variables. But, in this case there was a reason for this change, because this questionnaire had being considerably modified, the subject of the questions were changed and also the way of asking some questions. In contrast, there was a repeated factor, which was one of central importance: the same variables related to the instruction gave during first years of learning. Even if the only question about *making predictions* was present in both correlation tables, in general terms, all the variables related to this factor showed

the same tendency favorable to a literary advantage. It can be deduced that this could be an important explicative factor in more general terms.

5.2.1.d Linear regression model

By means of the explicative variables already created, it was possible to produce a linear regression model explaining TEX. However, in contrast to the 2001 analysis where some of the linguistic families were significantly correlated to TEX, now they are not an option to begin with the construction of the model. As we did in constructing the explicative model of the variable COM in 2001, we searched a reference among the indexes. As was mentioned before the index LNGsec had too many missing data to be used as reference, that is why we preferred to test the other index ATTN_low, *low presence of negative attitudes*. Moreover, this was one of the most interesting factors founded during the analysis, because it was present in both analysis and it had a corresponding PIRLS index. A model where ATTN_low was the only explicative variable fitted to explain 8% of the variance of TEX (Adj $R^2 = .08$), the F statistic indicate that this model was a valid predictor (4.15).

Then, to be able to study the variation of TEX in considering different aspects of the reading instruction, it was important for this model that the next regressor, came from the teachers sample. It was possible to successfully add DEP_high, *instruction depends on teacher – student interaction* to the model; its addition, gave a gain in explicability of almost a 15%, being $R^2 0.26$ (Adj $R^2 0.22$). Moreover, this was a better model in explaining the variation of TEX, because the F test has increased its coefficient to 6.11***.

Still, even if this result seems to gives us important clues to understand how this tendencies work, it was also suitable to try to demonstrate the possible incidence of linguistic factors. As it was done before, now, the procedure was simply to test those linguistic families as an extra factor in our different trials models. Models including *Anglo, Latin, Germanic, Slavic* and *Others* as linguistic families were tested. Finally, only one linguistic variable could be added to the model, without losing stability and with an increase of its explicative power.

Table 5.15 shows the estimated coefficients for a linear regression model that fit to explain the difference between the two reading objectives. Here, as well as the variables mentioned above, the linguistic family *Slavic* was added to the equation.

Table 5.15: Linear regression results: TEX 2006 - Indexes and Language

Variable	Parameter Estimate	t statistic
Intercept	-52.75	-4.23
ATTn_low (negative attitudes towards reading)	0.18**	2.26
DEP_high (instruction depends on teacher – student interaction)	0.37***	3.73
Slavic (linguistic family)	-8.34**	-2.36
F value =		6.47***
R-Square =		.36
Adjusted R-Square =		.31

$N = 38$, $DV = TEX$, difference between literary and informative purposes of reading PIRLS score 2006

This incorporation implied a gain of a 10% of the variance explained, being the determination coefficient R^2 .36 (Adj R^2 .31). The F test was 6.47.

Consequently, the model can only explain a third of the variation, 20% left than the model created to explain 2001 TEX difference (see 5.1.1.d).

To finish this analysis it is interesting to develop the regression equation:

$$TEX_{predicted} = -52.75 + (0.18 \times ATTn_low) + (0.37 \times DEP_high) + (-8.34 \times Slavic)$$

Interpreting this equation, it is possible to observe the relationship of the independent variables with TEX. It is known that ATTn_low and DEP_high has standardized values (mean = 100 std = 15) and Slavic is a binary variable, in addition, to being a part of the Slavic family will increase the tendency towards the informative advantage, while the parameter estimates for ATTn_low and DEP_high, are favorable to literary advantages. Regarding the importance of each parameter, as the value of Slavic is coded 0/1, it provides the minor increase in TEX difference; whereas the minimal and maximal values of x_1 ATTn_low are 71.2 – 132.38, if multiplied by the estimated (0.18) = 12.82 – 23.83, this means that this coefficient, in its minimal value, can reverse the effect of being part of the Slavic family (ceteris paribus). The situation is even clearer in the case of DEP_high, whose coefficient has the higher incidence in the variation of TEX, solely its means (37) doubles the

values of *ATTn_low* and it is four times greater than *Slavic*. Since *DEP_high* is a positive coefficient, it can reverse the effect of the highly negative value of the constant.

Examining how this equation could work in the country sample, it is possible to explain some tendencies of *TEX* by the incidence of those factors. For example, the case of a Slavic country, like Poland, where there were many teachers declaring to work in direct interaction with the students (*DEP_high* = 130.3), this was two standard deviations over the average, at the same time, the Polish students had average negative attitudes towards reading (101.93). Those results can explain why this particular country had a *TEX* difference favorable to literary reading, which was the contrary of the general tendency of the Slavic countries. In contrast, an opposite example is the case Hong Kong where the proportion of students having negative attitudes and dependent work were one s. d. under the average (88.11, 85.33), this could explain the informative tendency of the *TEX* difference (-11.31), a similar behavior, with even lower regressors was noticed in Taipei data, another country where Chinese is the language.

Finally, a valid question is if *Slavic* is a real linguistic factor, and not an economic or geographic one. A first assertion favorable to this hypothesis is that there were other countries in the region such as Georgia and Romania, whose results were higher in reading literary texts, unlike the Slavonic block, those countries participated in this block in geographic terms but not in linguistic proximity. Secondly, we must mention the PIRLS 2001 results, already commented here, where the *Slavic* family was also the referential predictor of the model. Moreover, it was the only factor that was able to be part of both models.

5.2.2 Processes of Comprehension 2006

This is the last analysis of individual variables obtained from the assessments, as it was announced before. Then, the next step will be a comparison of the two PIRLS surveys. To finish with this previous stage, it is fundamental to describe how this other component of the lecture process has functioned. The methodological procedure will be the same already applied in the previous sections.

5.2.2.a Student Questionnaire

The student sub-set was made up of the same 42 questions used for the analysis of TEX. From there, 37 derived variables were correlated to COM, even if this quantity was very significant to this research, many of these variables came from the same source, specifically from the high and low value of the factors described by the questions. As a result, if only each question was counted, instead of the variables, the amount was only 21; the difference in connection to the previous analysis was that a higher quantity of variables “by question” was correlated (see appendix A.10). This tendency has been constant in the rest of the questionnaires. So is a particular property of COM 2006.

First, reading those results, there are positive and negatives factors related to low order processes. The negative variables were the following home activities: *not reading or listening aloud reading, never talk with the family about reading, never read to find out things wanted to learn, never read magazines, explicative books or directions and instructions*. Other negatives factor that also contribute to a better score in low order process were: *the students think they are not reading as well as other*, and some class activities: *never read aloud to small groups, to have teacher that do not read aloud and do not talk with other students about what they read*. In contrast, there were only two positive home activities: *reading comic books and subtitles on television*.

Secondly, concerning high order processing, the advantage was related to school activities like: *reading silently on their own*, and *following others lecture*, there were some variables describing evaluation procedures: *to answer questions aloud, in a workbook or to write something about the reading*. Regarding individual factors, self concept about reading was again correlated: *thinking to not understand almost everything*, and, contradictory, *believing to read as fast as other students*. In

this case, this contradiction could be related to the difference between depth and speed, this last is an objective of the first steps of learning but should be overcome later to focus in comprehension. In contrast, this same insecurity in own comprehension capacities, could be a consequence of being aware of the existence of those deeper levels.

In connection to the correlations, the higher coefficient from this questionnaire was found in the correlation between COM and the percentage of students whose teacher never read aloud to the class ($r=.50^{***}$). Additionally, other highly significant correlation was related to the absence of informative readings: to read directions or instructions ($r=.48^{***}$)

Table 5.16: Correlation Coefficients: Variable COM - Student Indexes

<i>SOC_low, Sociability of reading learning:</i> the students do not read or listen to someone reading, do not talk with their family about reading or read aloud at school to the class or to small groups.	.40**
<i>IFCH_low, Reading with informative purposes:</i> the students do not read explicative books, magazines and directions, or to learn things at home.	.48***
<i>RIND_high, Individual reading learning:</i> the students frequently read silently at school, they answer to questions in a workbook or write something about their readings.	-.45***

Those home and school conditions coming from the answers of the student questionnaire, led to think that the difference between high and low order processes was related to two principal concepts in this questionnaire: the *social sharing of knowledge* and the *individual reading learning*.

The first factor was founded in the incidence of learning helped by other people listening or reading (family, teacher and other students), to interact often with others during reading was related to an improvement of low order score, whereas a more individual and silent work (read and being evaluated alone), improved the higher ones. This was translated into indexes (see table 5.16) and this tendency was indeed confirmed.

In second place, concerning the individual reading learning, it was related to some activities that were done individually at school. It is necessary to remember that

the incidence of individuality was already mentioned in analyzing TEX (see Table 5.14), thus it could have been interesting to find some correlation between this new variable RIND and the ancient variable IND. However, this correlation did not exist, and either RIND was related to TEX or IND was related to COM. However, this was not surprising, because the ancient variable was constructed from information coming from the teacher questionnaire, and was describing their particular point of view of the school work; moreover, the variables were not combined in the same way, since the objectives of analysis were different.

Finally, a third index was created, it characterized informative reading and was related to an advantage in lower order processes. This tendency was already recognized in the 2001 analysis, accordingly, it is possible to affirm that there was a deeper connection between this purpose of reading and low order COM. The reason could be related to the fact that a text whose purpose is to inform, is a text that expresses its meaning in the superficial levels, in an explicit and direct way. This does not imply that an informative text can not reach other levels of complexity, but it makes a greater use of explicit information, which a literary text can omit.

From those three indexes, the first and the third were correlated to the total score. In fact, the positive correlation between SOC_low and the score was very important, $r = .61^{***}$, whereas there was a negative correlation between RIND_high and the score, $r = -.45^{***}$. These correlations proved that it would be a mistake to associate directly the development of the high order processes and the improvement of the total scores, as the interactions between the processes and the score are more complex and pluridimensional.

In regards to the connection of those results and the results obtained during the 2001 data analysis, it must be mentioned that, only taking into account the original questions, the quantity of variables correlated was now twice as big (10 in PIRLS 2001, 21 in 2006). However, this increment was not linked with an increment in coherence between both questionnaires; only 3 questions were correlated in both data sets. These three variables were:

- Read silently in school.
- Believing on not reading as well as other students.
- To read comics books at home.

As it can be observed, those variables were not very related either among them or with the factors identified. However, there was a factor that was correlated to both COM differences. In 2001, the *Individual Activities* (InLe_high) was the only factor that could be inferred from the data, then, in 2006 there were two factors that were also related to individuality and socialization. Even if the indexes were not constructed from the same variables, in both cases the tendencies indicated that a high individuality was related to better results in high order processing, in contrast, a high socialization indicates the contrary. Individuality was also the subject of an index presented in both data sets, it was correlated to COM in the same way as reported, the principal difference was that, in 2001, this index was highly correlated with the total score while now there was not a correlation.

Coming back to the 2006 description, two final variables were related to the use of language, even if the correlations values were not particularly high, it is important to our research to mention that this was the only linguistic factor correlated to COM: the fact of *to speak or not speak the language of the test before starting school*, it was related to a higher processes advantage.

To conclude, a general remark about the percentage of correlation, that was 44% average, which was higher than the one from the indexes explaining the TEX difference (39%). It will be seen in the next indexes, that in general the correlations are higher for this difference than for TEX.

5.2.2.b Teacher Questionnaire

The questions coming from the teacher questionnaire were largely the most significant data set in terms of correlations. From the forty questions taken into account, 92 derived variables were related to COM, coming from 32 questions. As it was saw in the students results, there were many variables that represent several aspects of an answer to a unique question, in this case the ratio of correlations were even bigger: 2.9 correlated variables per each question.

The teacher questionnaire had multiple topics on which the teachers were interrogated, yet the correlated variables were related to only a few subjects, as appendix [A.11](#) shows, the *frequency of reading and language teaching*, the *supports used to teach reading*, the *teaching and evaluation methods*. They will now be described directly in connection to the indexes created since these four subjects embrace the 92 variables.

Table 5.17: Correlation Coefficients: Variable COM - Teacher Indexes

<i>TIME_high, Instruction amount of time:</i> The teacher spent many hours per week on reading and language instruction or activities with the students and had reading instruction every day.	-.35**
<i>MAT_high, Teaching Material:</i> The teacher used a high variety of material that comes from different sources (series, workbooks, students creations) and have different objectives (short stories, poems descriptions, explanations, instructions, manuals, chats, diagrams and graphs).	-.52***
<i>METH_high, Teaching Methods:</i> The teacher used a variety of methods to teach reading, he reads aloud or ask student to do it to the class, in small groups, or silently. The teacher model different reading strategies, teach decoding strategies, new vocabulary and helps students to understand new vocabulary in texts.	-.53***
<i>DEV_high, Emphasis in Strategies:</i> The teacher emphasized a high variety of strategies, such as identifying the main ideas, explaining their understanding, comparing the reading with their experience or other readings, making predictions about the development of the subject, generalizations, and describing the style.	-.51***

First, as was done in studying the 2001 teacher questionnaire and TEX difference, a time factor was tested. Regretfully there were some contradictory results: a variable representing the minutes explicitly designated to reading instruction, which was positively correlated to COM, in addition, there were other time variables which were negatively correlated to COM.

The problem seemed to be related to the distinction made about time expressed in *hours* or *minutes*, the same questions expressed in minutes and hours were not correlated between them: the answer to *minutes per week spent on language instruction* was not correlated to *hours per week spent on language instruction*. Moreover, there was a negative correlation between: *time explicitly for reading instruction* measured in minutes and hours. Obviously there were some issues in data collection, maybe the questions were not clear or well translated, these irregularities seemed to affect specifically the measure made in minutes, on the

contrary, the *hours* variables were all correlated positively among them, which was not the case of the *minutes*.

Consequently, an index was developed but only considering *hours: hours per week spent in language instruction, reading instruction, the explicit hours dedicated in the curriculum to reading instruction* and the *frequency (expressed in times per week) of reading instruction*. Two remarks must be made about these variables, first, it must be remembered the distinction between *qualitative* and *quantitative* time (see 5.1.1.b), the official amount of teaching time can play a different role in learning than the real, effective amount of teaching time. In this case, since variables representing both aspects were correlated, it was valid to create an index merging them.

In second place, the distinction between reading and language teaching must be mentioned, because, in fourth grade, if there was still an explicit time dedicated to learn reading, it could be different from the time dedicated before. At present grade, the basic reading and writing teaching was done, in most cases, it was common that children continue to learn reading through language and literature instruction, but not explicitly *reading* lessons.

In both cases, the amount of time used to teach language or reading, was positively correlated to the advantage in high order processes; even if the value of this correlation was the smallest among the created indexes. The countries with the higher values for this variable, those who dedicate more time to language and reading teaching were France, Trinidad and Tobago, the Russian Federation and the United States.

The second factor identified were the supports, the materials used to teach reading. In some cases, there are *supports* that can be directly related to specific purposes of reading, (for example, a *poem* is a structure conceived with a literary objective, as a description or a graph is the support to inform about someone or something). However, this connection is not always that obvious, the notion of *supports* is more clearly related to the material presentation of a text, consequently is a more general classification.

This generalization about supports was necessary since there were texts with diverse objectives showing an equal tendency in connection to the COM difference. Therefore, the common point was the *variety* of supports. This variety was associated with an increment in difference favorable to the complex processes, even if

the supports to teach were as diverse as a poem and a graph. Was the increment in variety what promoted higher order processes.

In third place, there were two indexes that were created following the same reasoning; on one hand, METH_high was referred to the different interaction among the teacher and the students during reading instructions. The students worked *alone, with others students, or interacting with the teacher*, while the teacher read and *taught strategies or helped with vocabulary*. This index was the most correlated of all with the advantage in high order processes. In table 5.17 the positive variable is represented, but it is important to mention that not using these methods (noMETH) was even more correlated to COM (.62***). On the other hand, the strategies index, DEV_high, also included in 2001 analysis, was related to the emphasis of teachers in developing the mentioned reading strategies. Again, as was said in 2001, even if the index included tasks associated with low order processes like *to identify the main idea of texts*, all those variables were correlated to an advantage in high order processing when the task was frequently done.

These last three indexes were also highly and positively correlated among them, having a r coefficient of over .60 (the index of time was also correlated but slightly lower), the most correlated indexes were DEV_high and METH_high, strategies and methodology, having a $r = .84 * **$. Consequently, if the teacher used to work with a long selection of materials and asked the student to use strategies during reading, this variety is favorable to the development of high order processes. However, even if the correlation coefficients with COM were very significant and the indexes were also correlated among them, none of those indexes were correlated to the total score.

Finally, a particularity of the correlations derived from teachers' questionnaire was the great quantity of variables that were correlated in both assessments 2001 and 2006. Firstly, there were some variables unrelated among them:

- Frequency of reading instruction.
- To use workbooks or worksheets.
- To ask the students to read aloud in small groups.
- To ask the students to read silently on their own.
- To model different reading strategies.

- To teach strategies for decoding sounds and words.

Then, there were several variables derived from questions about the reading strategies and competences emphasized:

- To identify the main idea.
- To compare the lecture with their experiences.
- To make predictions about what will happen next in texts.
- To make generalizations and inferences.
- To describe style or structure of the text.

In all the cases the correlations were similar in both data sets. Among the unrelated variables, there were two pairs of variables describing similar phenomena: *interactions during reading learning* and *instruction of strategies*. Both pairs were part of the factor identified as *teaching methodology*, the first pair was also related to *oral interaction* factor or with organizational aspects. In addition, the second pair was related to the factor unifying the second group of variables: the role given to the reading strategies during instruction. The repetition of this last factor is another reason to consider it a fundamental aspect of our results and to infer that it can also play an important role in a more complex analysis.

5.2.2.c School Questionnaire

From the school subset, 31 variables derived from 14 questions, were significantly correlated to COM. Regarding the tendencies of the correlation, some school activities related to low order processes were: *to employ news-papers and/or magazines and computer programs in their reading instructional program*. Those two variables had been used in previous indexes in relation to the variety of materials. It is interesting that they have reappeared in the school correlations. However, it is not possible to create a new *variety* because there were only two variables.

In contrast, the opposite of these two isolated variables was a group of 16 variables related to the period in which the learning of a certain aspect of reading was first emphasized. They are presented in appendix [A.12](#) under the code *ME***, being **

a numeric code that ordered the task from the simpler to the more elaborated. As was already mentioned during the analysis of 2001 schools' questionnaire, those questions were divided depending on when the students started the study of each aspect: before, at, or after fourth grade.

It is significant that in both analysis the correlations started to appear only in an intermediate level of complexity. This means that the learning of simpler tasks, as *knowing the letters of the alphabet* or *knowing letter sound relationships*, were not correlated to COM. This was the opposite of the situation described about similar variables in relation to TEX 2001 and 2006, where independently of the complexity level all variables were favorable to a literary advantage.

Table 5.18: Correlation Coefficients: Variable COM - School Indexes

<i>EMCOM_less, Emphasis in complex tasks</i> : The schools declare to emphasize before fourth grade the teaching of the following reading tasks: to explain and support understanding of texts, to compare text with personal experience and with different texts, to make predictions about what will happen next in the text, to make generalizations and inferences and to describe style and structure of texts. (n=36)	-0.50***
<i>FEEL_high, Feelings of the actors</i> : The teachers are satisfied with their job, high parental support and students' desire to do well. (n=37)	0.38**

Using those variables it was possible to create an index, connecting the period of first emphasis and the difference COM. As a result, table 5.18 shows that the early instruction of those complex tasks was related to COM. In fact, all the possible indexes that were derived (*less, equal* and *more*) were correlated, we present here the most significant. In addition, to teach complex aspects before fourth grade is highly correlated with the total score, the early instruction had a r coefficient of 0.67***, one of the higher observed here. On the contrary, to teach those processes only during fourth grade was also highly and negatively correlated: $r = -0.62^3$.

³A small remark must be done in relation to those indexes, there were, in the sample, two countries having no data available for the question that generate the variables, Hong-Kong and Luxembourg, in the case of the former, not all the questions from the school questionnaire were answered, and in the case of the last, since there were no principals in the Luxembourgish schools, and this questionnaire was usually answered by them, there was not data for the entire sample of this country. So, the correlations considered only the other 34 countries.

Finally, there was another group of variables related to a subject already mentioned in analyzing 2001 data set: the incidence of *expectations and wishes*, the most subjective aspects. Previously, a connection between literary advantage and personal notions was identified, as *desired to do well* and *satisfaction of the teacher*. What was also particular was the total absence of correlation among those variables and the total score. Here, there was a similar situation, five variables were derived from three questions describing subjective aspects and they were not linked with the total score. If those variables are used to create an index, the result was correlated to COM, even if the coefficient is one of the lowest found. Nevertheless, the incidence of a subjectivity factor was recurrent and will be studied more in depth.

5.2.2.d Linear regression model

The last step of the analysis was to construct a model to explain the variation of the difference between the two orders of processes. First, an index from the student sample was selected, since the correlations were already known, the most suitable candidate was the most correlated to COM: IFCH_low, which represents a low proportion of students declaring to *read with informative purposes at home*. A linear regression where the variation of COM was explained only by this index, produced a determination coefficient of $R^2 .23$ (Adj $R^2 .21$). Being this value significant in accord with the F test (10.76***).

The next step was to add to the model a teacher regressor, after several tests, MAT_high, the *index of teaching material*, was the best option. A regression considering these two factors was made, the model fitted to explain the $R^2 .35$ (Adj $R^2 .32$) of the variability of COM, the F test (9.58***) was still being valid. Consequently, this factor added a 10% to the explicability of the model. The combination of these two factors in the explanation of COM, seemed coherent in terms of interpretation, since they shared common characteristics as the use of informative material. What was also important was that one represented a home habit, and the other a scholar factor.

Following the analysis, as in the previous models, the languages were also considered here. Several regressions including combinations of indexes and one linguistic family were tested, even if there were other significant combinations, with *Germanic* and *Slavic* families, the best alternative was the one presented here (see

Table 5.19: Linear regression results: COM 2006 - Indexes and Language

Variable	Parameter Estimate	t statistic
Intercept	12.59	0.77
Anglo (linguistic family)	-11.9***	-3.07
IFCH_low (Reading with informative purposes)	0.19**	1.92
MAT_high (Teaching Material)	-0.30***	-3.15
F value =		11.08***
R-Square =		.49
Adjusted R-Square =		.45

$n = 38$, DV = COM difference between low and high order of comprehension processes PIRLS score 2006)

table 5.19), which includes the *Anglo* family as a binary predictor along with the other two regressors. The statistics indicate that this model fits to explain a half of the variation of the measured variable. The determination coefficient continued to be valid (F test = 11.08), with a value of R^2 .49 (Adj R^2 .45), giving a significant gain in explicability of almost 15% in relation to the previous model. Moreover, a study of the residuals, Student Residual and Cook's D, confirms the viability of this model, being none observation surpassing the standard parameters (considering that with only 38 observations any abnormal behavior can be determinant).

Besides, another linguistic variable might have been added to the model: *Latin*, the model would still be significant, and there will be a gain of 3 points of explicability (Adj R^2 .48), however, in this model, the probabilities of the *Latin* regressor were to low to be taken into account ($p < .10$).

Focusing now in the presented model, its equation is developed to observe how its works in the sample:

$$COM_{predicted} = 12.59 + (-11.9 \times Anglo) + (.19 \times IFCH_low) + (-.30 \times MAT_high)$$

It is already know that the factors IFCH_low and MAT_high were standardized, and that *Anglo* is a binary variable, in addition, MAT_high and *Anglo* have negative values. That is, the *use of a variety of teaching material* and the fact of *English* being the language of the test, were both factors related to the advantage in higher

processes. On the contrary, the parameter estimated of IFCH_low is positive, that is, a low amount of *home lecture with informative purposes* was related to the advantage in lower-order comprehension processes.

In relation to the contribution of each parameter to the explicability of the model, the smallest was *Anglo*, which can have a value of 0 or -11.9 , however, this is not insignificant, because, it can almost revert the effect of the intercept's estimated parameter, approaching it to 0. On the other hand, in the sample, the minimal and maximal values of IFCH_low were 70.40/139.42, being $.19 \times IFCH_low = 13.34/26.49$, this means that this estimation, in its minor amount, can annul the effect of being *Anglo*, or even duplicate its value. In a non *Anglo* country where students aren't used to reading with informative purpose, the tendency will be the lower-order processes advantage.

This tendency can be completely reversed with the last parameter: MAT_high, since it was standardized as IFCH_low, the parameter estimated indicates that its incidence was one third greater, and could be more determinant than the linguistic factor, the minimal and maximal values of $-.30 \times MAT_high$ were 23.78/41.54, this was from 3 to almost 4 time bigger than $-11.9 \times Anglo$. This is a very important fact, because the methodology of teachers can be more easily controlled or modified than habits, thus it can improve the achievement in the high-order processes.

To conclude, it can be observed how these factors were distributed in the country sample. Looking at the members of the *Anglo* family, it is remarkable that none of those countries were over the average in relation to IFCH_low, which means that they did not have an elevated amount of students not reading with an informative purpose (this is all the information that this variable gives, which does not reveal anything about what they were actually reading). Those countries showed higher values in the index of teaching material, even though there were not among the maximal values of the sample.

Among the countries under the average in the index of *Low Informative Reading at home*, there were only three countries that were also under the average in the index of *Teaching Material*: Indonesia, Macedonia and England; on the other border of the list, the countries which are above the average in IFCH_low index, are generally not over the average in the *Teaching Material* index. This shows clearly the opposite relation that is present between them.

Finally, looking at the case of a non English-speaking country, the Netherlands was a good example of the last statement. It had the maximal value of *IFCH_low* (139.42), thus the bigger proportion of students not reading with informative purposes and, in contrast, it had one of the 6 lower values in the index *MAT_high* (86.36). That is, the less flexible teaching methodology. Moreover, in developing the equation: $b_1(0)$, $0.19 \times IFCH_low = 26.49$ and $-0.30 \times MAT_high = -25.91$; adding the constant to this values, the predicted value of COM is 13.17. This shows how, even being the $-0.30 \times MAT_high$ almost equally elevated than $0.19 \times IFCH_low$, the incidence of the constant and a value 0 of the linguistic factor finally incline the tendency to the low order advantage.

At this point of the research, it is not possible to go further in explaining the linguistic incidence and the contextual factors in relation to the aspects of reading learning in PIRLS. The explicated variances were a highly significant proportion, but they are only talking about countries, that is, in very general terms in comparison to the complexity of PIRLS results. Consequently a deeper analysis will be done in the next chapter. But before it is necessary to organize and resume the factor identified.

5.3 Description of the findings

To finish this chapter, a review of all the findings must be done. The purpose is not only to synthesize the work already done, but principally to connect it with what will be done in the next chapter. Consequently, general assertions will be done first; secondly, findings discovered during the analysis of both aspects of reading will be presented. But more than just mentioning them, it is necessary to think about their pertinence as predictors: it will still be possible to consider them as factors determining reading achievement if a more complex scenario is established? Some hypothesis about the answer will be elaborated.

First, following the amount of correlated variables, and taking into account the different quantities of questions used from each questionnaire it seems that the TEX difference is more related with students' aspects than COM. Moreover, the coefficients of correlations were, both, 2001 and 2006, more positive than negative, that is, literary related. However, in the regression step, the student's factors were not more present than the other components; on the contrary, they were not able to be part of the model created to explain TEX 2001 variation. Consequently, even if there are some indications that let to infer a particular connection between students' aspects and the difference TEX, it is far from being confirmed, but it will be noticed if it is present again in later analyses.

In contrast, the informational tendency of TEX is more related to school factors, and particularly negative school factors. As it was discussed, the informational advantage appeared more among disadvantage students: immigrants, homes with low incomes and schools where the conditions of learning were difficult.

It will be necessary to study if this is really an informative advantage or a literary *disadvantage* instead. In that case, literary advantage will become a property of good learning conditions, because the contrary tendency to all these negative factors. However, at least at country level, there is not a clear tendency related to literary reading among countries with the best scores. On the contrary, if the best five scores of each study are examined (see tables 5.2 and 5.3), it can be observed that only two countries had a literary advantage in 2001 and none in 2006, moreover there were two countries with a clear informative advantage among those first five scores (Hong Kong and Singapore).

Regarding the process of comprehension, if the low and high order scales are

5.3. Description of the findings

regarded separately, it is possible to see that the correlations found in the first case were focused in individuals, and how they socialized their reading habits. On the contrary, the high order processes were related to school factors, there was almost a total absence of home factors in this area, this lack, implies that this difference may be more determined by school or teacher factors.

Finally, there were variables that were correlated with both differences TEX and COM. On one hand, a connection was found between literary and high order processes advantages. On the other hand, there were also several variables showing a connection between informative and low order advantages.

Consequently, the relation among the difference, the contextual factors and the total score must be closely studied. There are two possible explanations to these findings, this relation may be complex and only describable in a most sophisticated setting, as the one that will be developed, or, the advantage or disadvantage may simply play no part in final results, which is also a possible result of modelling those variables.

5.3.1 Factors related to the purposes of reading

From the factors identified during this analysis, what follows is a list of these possible determinants, which will be taken into account in the next chapter, during the modelling process. As the objective of this research pointed out (see 3.4.3), the final goal will be a general model including all factors, this is why in the next section, the variables that will be implemented will be part of another kind of analysis. Consequently, the original correlations described in this chapter will be only a general reference. However they were organized here according to the correlations that were their source because this allows a clear image of their origin and could be a reference for later analysis.

5.3.1.a Factors related to the literary purpose

Attitudes toward reading: from the significance of the index SATR in 2001 and some separate variables in 2006, it is possible to infer that the degree of positivism or negativism of the students' attitudes can play a role in literary score. Specifically, a favorable tendency to literary reading was observed when those attitudes were positives.

Reading self concept: a similar situation was the case of the index SRSC of PIRLS 2001 and some of the variables forming it that were correlated to TEX in 2006. But, in contrast, a student declaring to think that it is difficult to read was a reader showing a literary advantage as well.

Economic resources at home: this factor was represented by two variables, the first, an index created from some answers to the students' questionnaire, the second the principal's perception of the school resources. In both cases high resources were linked to an advantage for literary reading. However, the relevance of this factor is not yet confirmed since both variables were mostly correlated to 2001 data.

Instruction depends on teacher–student interaction: Several variables indicated that a more continuous presence of the teacher during reading instruction was linked to a literary advantage. However, it will be particularly important to test this possibility with more accurate instruments, and better defined variables, particularly if it is connected to the results of the variable describing the autonomous work.

Time: some significant correlations indicated a connection between the quantity of time devoted to reading instruction and a literary advantage. But, as was pointed out previously (see 5.1.1.b), this results were very partial and contradictory with other variables describing the same factor. We expect that a deeper analysis will allow a better appreciation of the role played by this factor.

Availability of books at home: This is a single variable in the PIRLS data, and it will be also used here independently of other variables. The reason is its potential significance as predictor because of the correlation shown in both 2001 and 2006 previous analysis. The variable indicating the absence of books at home had the higher coefficient of correlation with TEX in 2006 students' questionnaire. In both cases those variables were also correlated to the total score in more than a 70%. Consequently, this factor can be a significant predictor of both scores, informative and literary. It must be mention that this factor was also studied in both PIRLS reports (see [Mullis et al., 2003](#), pp 104–111) and (see [Mullis et al., 2007](#), pp 114–118) as part of a Educational Resources index. The only difference between them is that while in 2001 the report point the five possible answers to the questions about the amount of books at home, PIRLS 2006 reduce them to the tree principal ones (More than 100 Books 51–100 Books 26–50 Books). In creating the variables

5.3. Description of the findings

for this research, a more simple presentation was also preferred.

5.3.1.b Factors related to the informative purpose

Mother tongue and the use of the school language: After the finding done during the previous analysis, everything seems to indicate that the proportion of *using other languages in daily life* plays a different role in reading literary or informative texts. Several variables related to this subject were present in both analyses showing similar tendencies. Those variables were part of the students' and the schools' questionnaire; consequently a factor combining that information can be conceived. It will be interesting to study if this is really an informative advantage or rather a literary disadvantage.

Oral activities in reading learning: only present in 2001 correlations, this is an aspect that can be an interesting subject of analysis. Following the results, a great amount of oral interaction during the learning process was linked to an informative advantage. This can raise further questions about other aspects as its connection with the total score and the exactitude of what we are describing as *oral*. Those topics must be resolved in order to create a more significant variable that can represent this factor.

5.3.2 Factors related to the comprehension processes

5.3.2.a Factors related to the low order processes

Reading with informative purposes: As was mentioned in the introduction of this section, a connection between purposes of reading and processes of comprehension was noticed. In developing a variable that represent one of those aspects, this connection could be studied, among them, the best candidate was informative reading because more variables were found correlated in studying COM differences, consequently it is possible to affirm that there is a deeper relation between this factor and the studied difference.

5.3.2.b Factors related to the high order processes

Independent reading and social sharing: These two factors were presented together because the concepts that they represent are connected, the *social sharing of knowledge* and the *individual reading learning*. The first is founded in the incidence of students learning with other people listening or reading to them around (family, teacher and other students), this seems to improve the lower-processes scores, whereas a more individual and silent work (read and being evaluated alone), improve the higher ones. The individuality is also a subject of an index present in both data sets, in both cases it was correlated to COM, the only difference is that, in 2001, this index was also correlated with the total score. Sociability, on the other hand, besides its relation to COM, also showed a correlation with informative reading.

Emphasis in Strategies: in both assessments, the subject of several variables was directly related to the processes of comprehension, some of them were theoretically associated to low processing, others to high processing, but it was the fact of teaching them or not, that showed a correlation. In other words, to frequently study strategies, even if those are low order strategies, was always correlated to an advantage in high order processing. Then, its relation with the reading achievement must be taken into account in an explicative model.

Variety of instruction methods: similarly to the variety of reading supports, the variety of methods of teaching was also identified as a factor. By this concept a connection among several variables is established, variables that described how

5.3. Description of the findings

the teacher organizes the class and what he/she does during reading instruction. More variety was related to high order processing advantage. This tendency was more clearly present in the 2006 analysis but there were some isolated variables describing organization in 2001.

5.3.3 Factors related to both aspects of reading

Early learning of reading skills: In relation to TEX, the literary advantage was increased if some aspects were learned at the school before fourth grade. They were very different in complexity levels, indicating that it was the early learning that was particularly positive. In relation to COM, not all the tasks were related, just those representing a complex process. This factor was also related to the total score, if these techniques were taught only during the fourth grade, there was a negative influence in the reading results of the students.

Expectations and wishes: in correlation to TEX, this factor was only present in 2001 data, but there were isolated variables that pointed to this same idea in 2006. In relation to COM, the factor was connected to high order processing. Taking into account the importance of the variables representing this factor (teacher and parents expectations, the students' desire to do well) it will be included in our later analysis. In addition, what is particularly interesting about those variables is that they were not correlated at all with the total score. This indicates that the variables describing this factor could help to test the subjectivity of those differences.

Variety in reading materials: This factor describes a variable created from several different kinds of texts, independently of their purpose. The variable represented a high or low diversity in the stimuli proposed to the students during reading instruction. In the 2001 analysis the presence of this factor was related to a literary advantage and also to a high order processing advantage. In 2006, the variable could not be put into practice and correlated to TEX, but a certain variety among the materials was recognized. In relation to COM 2006, it was found that a more variety of supports was related to an advantage in high order processing. In both studies this factor was also positively correlated to the total score.

Chapter 6

Factor that influence reading in PIRLS

In this chapter the reading achievement will be explained by the contextual variables identified in the previous chapters. The same model will be used to explain the total score and the partial results of each aspect of reading considered by PIRLS. This will allow for the comparison of those results and the influence of each variable in explaining those different results.

To keep continuity with the previous chapter, the following section will present the variables derived from the analysis of PIRLS questionnaires in accord to the factors that were previously identified. Then, the second section will describe the sample which considered only those countries present in both data sets.

Table 6.1 shows the number of observations that will take part in this analysis. The quantity is a fraction of the total PIRLS sample because it only counts the 28 countries that take part in both assessments (see table 4.1). The subject here will not be countries but students, then, as was mentioned in the methodology section (see 3.4.4), a modelization will be developed, which takes into account the hierarchical structure of educational systems. From table 6.1 it can be inferred that this structure will not show important differences between classes and teachers, since they are almost equivalent (one teacher-one class); moreover, teachers may not influence achievement in a different way from schools because of their similar distribution. Nevertheless, all the levels: students, classes, teachers, schools, and even countries, will be considered in the development of the explicative model, because that will help to explain not only the scores but also the influence of the

organization of educational systems in learning to read.

Table 6.1: Number of observations in PIRLS dataset

	Level	n	rate of students	rate of teachers	rate of classes
2001	Students	111,229			
	Teachers	5,257	21.16		
	Classes	5,261	21.14	0.999	
	Schools	4,323	25.72	1.22	1.22
2006	Students	123,634			
	Teachers	6,404	19.30		
	Classes	6,410	19.29	0.999	
	Schools	4,603	26.86	1.39	1.39

6.1 General Description

6.1.1 Variables and Factors to be incorporated in the analysis

6.1.1.a Independent Variables

Table 6.2: Individual factors, variables included and Cronbach's alpha values

Factor	PIRLS variables included	α 2001	α 2006
(BOOK)	Availability of books. Students: About how many books are there in your home?	–	–
Resources at home (HER)	Availability at home of: own study desk or table, own books, daily newspaper, PC and other country-specific indicators of well-being	.64	.59
Oral interaction, socialization (ORAL)	Outside school, students: 1) read aloud to someone; 2) listen to someone at home read; 3) talk with friends about reading; 4) talk with family about reading. In school, 5) teachers read aloud to the class; 6) students read aloud to the whole class; 7) students read aloud to a small group. After having read in class, students: 8) answer questions aloud; 9) talk with other students	.78	.78
Informative reading (RINF)	Students read outside school: 1) books that explain things; 2) magazines; 3) newspapers; 4) directions or instructions; 5) to find out things to learn	.61	.62
Attitudes towards reading (SATR)	Students: 1) read only if they have to (reversed values); 2) like to talk about books; 3) like books as presents; 4) think that reading is not boring; 5) enjoy reading	.69	.72

According to the work of the previous chapters, there are going to be two kind of explicative variables, those describing linguistic properties and those describing contextual factors. The former was already developed in chapter 4. The only change is that linguistic families are now adapted to the present sample, reduced to those countries that have participated in both assessments.

In contrast, the variables describing home and schools factors must be constructed now, because what was done before was only to identify the notions that were implicit in the general analysis of the studies. It is necessary to implement variables that can be comparable in both assessment and that adequately stand for the recognized factors. In this section the focus will be the description of the process of

6.1. General Description

elaborating the variables, stressing those last two aspects: their internal coherence and their comparability.

Each of the variables will represent one of the factors identified in the previous chapter, the variables will become standardized indexes (mean=0 std=1) that sum up the values of PIRLS answers to the questions related to the subject of the index. Consequently, a positive value will represent a high presence of the factor and a negative value its absence. Regarding the internal coherence, it is necessary to ensure that the PIRLS questions chosen to represent a factor are effectively intercorrelated among them. Cronbach's alpha statistic has been used as a measure of internal consistency. This calculation is better known for been used to measure the reliability of tests items, it is valid in this case because the problem is the same: the goal is to evaluate if a set of variables is related to a latent construct, which is supposed to be the identified factor.

Tables 6.2 and 6.3 show the value obtained for each index. The high correspondence between the α coefficients of each year is remarkable, in many cases was exactly the same. Since some students, teachers, schools or even entire countries did not answer certain questions, particular attention was paid to avoid the inclusion of missing data in calculating this statistic, which is not robust against it. Regarding the comparability, from the questions that were taken into account in this analysis, most of them were present in both assessments with almost no variation; but there were some exceptions. To assure comparability, only those variables that were equivalent were tested to be part of the indexes. In the presentation, there are two factors that represent PIRLS variables, BOOK and VATY, they directly describe the factor of interest. In contrast, there were not other variables to be liked with them, this is why they do not have a α value.

The variables were separated into two tables in accord to the database from where the data was taken. On one hand, individual factors were inferred from questions directly answered by the students; on the other hand, among school factors, only one variable combined successfully the variables from student and school questionnaires: LGN, one variable was derived from the schools' questionnaires: CHA, and the six other variables were derived from teachers' questionnaires. It is important to mention that, since the model will be a hierarchical structure, it will be possible to try to study separately the explicability of each of these levels (student-teacher-school).

Table 6.3: School factors, variables included and Cronbach's alpha values

Factor	PIRLS variables included	α 2001	α 2006
Variety in evaluation methods (ASK)	Teachers ask students to: 1) answer reading comprehension questions in a workbook or on a worksheet; 2) to write something about what they have read; 3) answer oral questions about what they read; 4) talk with each other about reading; 5) do a project about what they have read; 6) take a written quiz or test about reading	.68	.68
Expectation and wishes (CHA)	1) teachers' job satisfaction; 2) expectations for student achievement; 3) parental support for student achievement; 4) students' regard for school property; 5) desire to do well	.80	.82
Emphasis on Strategies (DEV)	Teachers ask students to: 1) identify the main ideas; 2) explain their understanding of what they have read; 3) compare what they have read with their experiences; 4) compare what they have read with other things they have read; 5) make predictions about what will happen next; 6) make generalizations and inferences; 7) describe the style or structure of the text	.88	.89
Variety of instruction methodology (INT)	During reading instruction, teachers: 1) read aloud to the class; 2) ask students to read aloud to the whole class; 3) ask students to read aloud in small groups or pairs; 4) ask students to read silently on their own; 5) ask students to read along silently while other students read aloud; 6) teach or model for students different reading strategies; 7) teach students strategies for decoding sounds and words; 8) teach students new vocabulary; 9) help students understand new vocabulary in texts	.69	.68
Mother tongue (LNG)	1) Students did not speak the language of the test before they started school; 2) they speak one or several other languages (four country-specific alternatives); 3) at the time, students spoke sometimes or never the language of the test at home; 4) at school 11% or more students did not speak (language of the test) as their first language; 5) 11% or more students receive some instruction at school in their home language	.64	.64
Early learning of reading skills (ME)	Before fourth grade student have learned: 1) reading connected text; 2) identifying the main idea of the text; 3) explaining or supporting understanding; 4) comparing text with personal experience; 5) comparing different texts; 6) making predictions about what will happen next; 7) making generalizations and inferences; 8) describing style and structure	.92	.92
(TIME)	Hours spent on: 1) language instruction; 2) reading instruction. 3) hours explicitly scheduled for reading instruction	.65	.62
Var. books (VATY)	Teachers use a variety of children's books	–	–

6.1. General Description

Finally, as it was mentioned, not all the factors were able to be represented, the reasons were related to issues of internal coherence or comparability: in some cases, the variables that were believed to be related showed a weak or non-existent relation with the others. In this case the specific variable was put apart, keeping only those variables having an internal coherence over 60% in accord to the calculation of the Cronbach's alpha. In other cases, the questions have changed in the questionnaires, from the first assessment to the second, becoming impossible the creation of analogous indexes. The factors that were unsuccessfully tested were:

- Instruction depends on teacher-student interaction
- Reading self concept
- Emphasis in writing instruction
- Individuality
- Curriculum development

6.1.1.b Dependent Variables

In the previous analysis, the difference between reading aspects were used as dependent variables to help identifying those factors that were influencing reading in specific ways in accordance to each reading type and process of comprehension. Now, that a series of factors have been developed from this work, it is time to focus on the final objective: to study reading achievement. However, since, apart from the total score, the scores representing each aspect are available, it will be an improvement to this analysis to be able to compare how the factors react in explaining each of those scores. Consequently, there will be several models containing individual, school, and linguistic factors as explicative elements, and having the total score, along with each partial score, as dependent variables. In addition, since this stage also has a comparative goal, by repeating the same model in the 2001 and 2006 dataset, a comparison of the behavior of the determinants will be achieved.

In summary, the model will be replicated five times for each PIRLS dataset, including the partial and total scores as dependent variables. The results between both versions of the study will be compared.

Table 6.4: Correlation Matrix: scores PIRLS 2001

N = 111229	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Total	1						
(2) Literary	.95	1					
(3) Informative	.95	.91	1				
(4) TEX01	.02	.22	-.20	1			
(5) Low Order Pro.	.96	.94	.93	.02	1		
(6) High Order Pro.	.97	.94	.94	–	.95	1	
(7) COM01	.09	.10	.07	.05	.27	-.05	1
MEAN	523	522	522	0.66	522	523	-0.67
SD	80.3	79.7	79.4	33.2	81.4	78.6	25.7

Two important questions are *how different are those scores* and *what is the relation among them*. Table 6.4 shows Pearson's correlation coefficients among the aspects of reading and the total score for PIRLS 2001. The differences TEX and COM were also presented here. But, more significant than looking at table 6.4 alone, is to comparing it to table 6.5.

Table 6.5: Correlation Matrix: scores PIRLS 2006

N = 123634	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Total	1						
(2) Literary	.96	1					
(3) Informative	.95	.93	1				
(4) TEX06	.06	.25	-.14	1			
(5) Low Order Pro.	.96	.94	.94	.07	1		
(6) High Order Pro.	.96	.94	.94	.05	.95	1	
(7) COM06	.09	.10	.08	.06	.26	-.06	1
MEAN	529	528	528	-0.24	527	530	-3.29
SD	77.8	77.1	75.5	29.6	78.0	75.4	25.2

As the number of observations indicated, these correlations were calculated using the total sample of students in the assessments. Because of this great quantity of observations, all the correlations were significant, even when the coefficient was

6.1. General Description

as low as .05. The only uncorrelated values were high order process scores with TEX 2001.

Regarding the means of both samples, it can be observed that in 2006 the scores were all better by only a few points, a lot less than one standard deviation. Moreover, the means of all 2001 scores and 2006 scores are almost equal among them. This could be considered as a consequence of standardization of the scores. Concerning standard deviations, in 2006, they were similar or lower than in 2001 in all cases. The variable COM shows a particularly similar SD between the samples. In 2001, the greater correlation with the total score was the high order processes. This is not surprising if one remembers that they represent an important part of the questions. In 2006, when the proportion of variables of high and low orders was equilibrated, the difference disappeared.

Keeping in mind the tendencies reported during the questionnaires analysis, it could have been expected to see some correlations between the low order score and the informative score, or the high order and literary score. This was not the case in any of the samples, and they share all similar correlations. Low order processes were equally correlated to informative and to literary reading in both datasets, the same occurred to the high order score. Even if there were only 2 points of difference, the processes were more correlated to the total score than to the aspects of reading.

As it can be expected, the higher correlation of TEX was with the literary score, and then with the informative score. In addition, the higher correlation of COM was with low order score, its correlation to the high order score was considerably lower. However, these correlations are feeble, indicating that the differences are mostly an independent fact.

To summarize, great stability can be observed between the two samples. The resemblance between the coefficients indicate that each score is reacting in a similar way to the influence of the others scores and that the relations among them are comparable. It is certainly the important amount of observations that help to improve comparability. The question about the real need of creating these four scales arise, as was mentioned in section 3.3.1, when it was mentioned how difficult is to empirically prove the existence of different dimensions in PISA assessments.

6.1.2 Comparative sample

6.1.2.a Linguistic variables in the comparative sample

The general resemblance of samples and scores start to show variations if specific scores, according to factors, are calculated. Since the main interest of this analysis was linguistic variables, it is important to take into account the information provided in table 6.6. There, the scores of each linguistic family are shown.

Table 6.6: Linguistic Families, Scores and differences in 2001 and 2006

	Linguistic Family	Total	Lit	Inf	Tex	Low	High	Com
2001	English	543	547	537	10	537	547	-10
	Slavic	522	518	525	-7	523	520	3
	Germanic	533	536	528	8	536	531	5
	Latin	518	515	522	-8	516	521	-5
	Others	514	514	513	1	515	513	1
2006	English	537	536	536	0	530	542	-12
	Slavic	538	536	538	-3	534	539	-5
	Germanic	521	522	518	4	524	516	7
	Latin	519	517	520	-3	514	522	-8
	Others	527	527	526	1	527	526	1
2006 - 2001	English	-6	-12	-1	-10	-7	-5	-2
	Slavic	16	18	14	4	11	19	-8
	Germanic	-13	-15	-10	-4	-12	-14	2
	Latin	1	2	-2	4	-2	1	-3
	Others	13	13	13	0	12	13	0

In regards to the total score, the comparison of both results shows how, for 3 of the families, the scores were higher in 2006. The *Latin* family kept a similar result and the *Anglo* has lost its advantage. It can be observed that the *Anglo* family almost always gets better scores than the rest of the families. Its only lost its advantage in 2006, when the *Slavic* family reached similar results. In contrast, *Anglo* lost its literary advantage in 2006, when it got the same score in both aspects of reading; in contrast its high order advantage was maintained.

The *Latin* family, on the other hand, shows a surprising stability in all its results

6.1. General Description

from one assessment to another. This family also gets constantly an informative and high order processing advantages. The *Others* family (all those languages not related to the main linguistic families) has constant results in each assessment, showing no difference between aspects of reading or the total score. As the last part of the table presents, in 2006, all its scores were 13 points higher than in 2001. At the bottom of the table it can also be observed that the *Slavic* was the family that most improved its scores. On the contrary, *Germanic* family suffers a consistent decline in all the scores.

In summary, what this table indicates is that there are some tendencies and distinctions among the scores that seem to be related to the family used during PIRLS assessment. In other words, it is not the same to pass the test in Russian as in Icelandic, because the mean score is more than a 15 point difference between both families. Now, the next step is to analyze how this distinction determines reading achievement. These 15 points seem to be important, but it is necessary to include in a model other determinants, such as the individual and school variables, to obtain more realistic conclusions.

Table 6.7: Orthographic depth, scores and differences in 2001 and 2006

	Opacity	Total	Lit	Inf	Tex	Low	High	Com
2001	Shall	516	516	513	3	516	514	2
	Opaque	528	522	533	-11	526	529	-3
	Very opaque	543	547	537	10	537	547	-10
2006	Shall	521	522	519	3	519	521	-2
	Opaque	541	537	543	-6	539	540	-1
	Very opaque	537	536	536	0	530	542	-12
06-01	Shall	5	6	6	0	3	7	-4
	Opaque	13	15	10	5	13	11	2
	Very opaque	-6	-11	-1	-10	-7	-5	-2

The same conclusion can be applied to the scores obtained for each degree of orthographic opacity, shown in table 6.7. What is remarkable here is how systematically transparent languages get lower scores. The opaque languages were also under the very opaque (English) in 2001 but by improving their scores they reach English in 2006.

In relation to the aspects of reading, *Shallow* languages did not show important

differences between their scores, *Opaque* languages had better informative readers, while obtaining similar scores in the processes of comprehension. The *Very opaque* languages obtained a better high order score (as *Anglo* family before), while they scores between purposes changed from 2001 to 2006. As the last part of the table shows, the improvement of the scores from 2001 to 2006 were equal for *Shallow* and *Opaque* languages, having no difference between aspects of reading or the total score. *English*, however, did not improve consistently in its scores, only improving some points in informative reading. If this last result is related to the results of the other participants, it is probable that this stability is mostly an effect of the improvement of the rest. In other words, they were not the English speakers that kept their score, but the others that have improved. This deduction is based on the fact that there were non-English countries (Russia, Hong-Kong) that improved their results the most, reaching the top of the classification (see tables 5.2 and 5.3).

In summary, among aspects of reading, the scores obtained by degree of opacity did not show significant variations. In contrast, there was a difference between depths that was constant among the scores. As for the case of linguistic families, it was not the same to pass the tests in English as it was to pass it in Italian, the speakers of this complex language obtained better results. This found is opposite to what the literature about orthographic comparisons have carried to suppose, it was established that, in beginning acquisition, English readers were slower and have more troubles in learning to read than readers from more regular languages. Consequently, if this situation had been remained in time, there should be the readers from transparent languages those having better results. It can be inferred that conditions of learning at beginning reading are not the same at this stage where comprehension is the main purpose of accessing a text.

6.1.2.b Bilingual countries

A final linguistic aspect that must be described, is the case of countries which have two languages of teaching, and where the test was translated to these two languages. As was described in chapter 5, and exemplified in table 5.1, the scores differ between students from the same country but working in different languages. This gives rise to the question of how recurrent these linguistic differences are in bilingual countries. Now, this information is showed in table 6.8 and the results of

6.1. General Description

the 2006 sample was added. This allows the observation of the evolution in time of these countries.

The first interesting detail is the resemblance of the results in Norway, where there was not a significant difference between the scores of Bokmål and Nynorsk, this affirms the choice of to define them as variations of the same language (see section 4.3.1.q). The Norwegian scores were equivalent, being the bigger variation of only 6 points.

Latvia, Moldova, and Macedonia have also had very similar results in comparing 2001 and 2006 objectives of lectures: a TEX difference was favorable to informative reading in both assessments. Slovak republic also showed no difference between Slovak and Hungarian and both languages reduced their informative tendencies of 2001 to positive values in 2006. Comparing the processes of comprehension, the four countries have had differences between languages in 2001 (Latvia the smaller and Macedonia the bigger), however, all of them erased these differences in 2006 sample. If the scores of each of these countries are observed and compared more closely, it can be found that there were divers reasons for the changes, but that they had all had a relation to language: in Latvia, the change affected the low order processes (improvement in Latvian score and fall in Russian score), the high order score was almost the same. In Moldova, there was an important fall of a quarter of an SD in the low order score of the second language, and an equivalent increment of the high order score in the first language. In Macedonia, all the Macedonian scores had fall, while the Russian speakers had lost some points in the lower order score and gained a third part of a SD in the high order score.

The Slovakian students also presented changes directly linked to language. They have improved scores in 10 points in low and 20 in high order processes, while Hungarian speakers have lost 40 and 35 points each, more than half SD. In this particular case, a possible explanation is the variation of the dimensions of the sample, in 2001, the Hungarian speakers represented a very small sample of 170 students, while in 2006, the quantity increased to 566, due to a general enlargement of the sample of this country. In addition, from a more general point of view, a valid factor is the connection of all these countries with the Slavic world, even if in Latvia and Moldova, Latvian and Romanian do not share the same linguistic origins, Russian does, which allow to conclude that at least one of the languages spoken in these countries is part of the Slavic family.

Table 6.8: Scores and differences in bilingual countries

Country	Language	%		2001				2006				2006				2006			
		01	06	Lit	Inf	Tex	Lit	Inf	Tex	Low	High	Com	Low	High	Com	Low	High	Com	
Norway	Bokmål	81	84	507	493	14	501	495	7	506	496	10	502	495	8				
	Nynorsk	19	16	500	487	13	501	493	9	500	492	8	500	497	3				
Latvia	Latvian	69	76	535	544	-9	537	537	0	539	543	-4	530	543	-13				
	Russian	31	24	543	554	-11	546	548	-2	554	550	3	545	551	-6				
Moldova	Romanian	82	82	474	497	-23	489	503	-14	483	487	-4	481	512	-31				
	Russian	18	18	510	543	-33	507	529	-23	527	526	2	508	531	-23				
Macedonia	Macedonian	68	63	466	472	-5	477	486	-9	470	467	3	483	477	5				
	Albanian	32	37	388	388	-1	373	389	-16	378	400	-22	383	373	10				
Israel	Hebrew	74	68	541	532	9	552	544	8	532	541	-9	544	552	-9				
	Arabe	26	32	420	433	-13	440	429	11	420	434	-14	430	439	-9				
Romania	Romanian	97	97	511	512	-1	493	486	7	508	514	-5	488	489	-1				
	Hungarian	3	3	536	536	0	507	523	-16	518	550	-33	506	522	-16				
Slovak	Slovak	94	93	511	520	-10	535	528	7	520	511	9	531	532	-2				
	Hungarian	6	7	538	550	-12	510	510	1	546	550	-4	506	515	-10				
Ontario	Anglais	96	96	554	543	10	558	554	4	541	556	-15	545	564	-19				
	Français	4	4	486	497	-11	507	511	-4	483	504	-20	499	519	-20				
Quebec	Anglais	10	11	547	539	8	534	528	6	537	549	-12	525	537	-11				
	Français	90	89	532	541	-8	529	534	-5	534	540	-6	534	530	3				

6.1. General Description

Another remarkable case is the change in Israel's results. In the Hebrew sample, all their results fall from 2001 to 2006. On the other hand, the Arabic sample also falls but not in informative reading and the value is only significant in literary reading and low order processes. What is more notable in this country is that the second language speakers have passed from a negative tendency in TEX difference to a positive one. This is the only country showing this kind of variation (compare with tables 5.2 and 5.3).

Finally, Canadian provinces were also included in this table even if their particularities have been well described in previous sections (see 4.1.1.c).

Table 6.9: Scores and differences in New Zealand 2006

	Language	%	Lit	Inf	Tex	Low	High	Com
New Zealand	Anglais	98	530	536	-6	526	541	-14
	Maori	2	360	387	-26	364	388	-24

Only one country has become bilingual: New Zealand, mainly English country which in 2006 translated the test to Maori too. As table 6.9 shows, the two languages have had better informative and better low order scores, the differences of the Maori sample being more accentuated. These accentuations correspond to a tendency found among the countries having low scores, where the differences were higher. As a consequence, it can be concluded that there is a difference between English and Maori speakers, but not in relation to objectives and processes of reading but in relation to the general achievement, which is systematically lower among the Maori students: two standard deviations in average.

6.2 Hierarchical Models

In the previous chapters, from the original databases, a comparable sample was taken, languages were studied to infer linguistic parameters, and the context was deeply analyzed to infer possible determiners of reading. Moreover, observations that were not comparable (such as Morocco or those not indicating the language) were left out and the case of bilingualism was studied to eliminate a possible incidence of this phenomenon. To summarize, at this point of the research, it is possible to affirm that the main aspect concerning language and context of PIRLS study have been taken into account. As a result a series of variables have been created that, according to the hypothesis, may explain reading achievement. In the following pages the focus will be the development of a statistic model capable of include these factors and determine how they are related to reading achievement. The chosen modelling technique was the implementation of a multilevel model to put emphasis on the hierarchical structure of the educational system.

6.2.1 Structure of the model: the null model

The first step will be the defining of the structure that will be the base of the model. Since education has been defined as a nested phenomenon, it is necessary to define what are the levels that play a role in determining PIRLS results. The method is to set up an *unconditional* or *null model*, that is, a model that has no predictor variables.

6.2.1.a Two level model

Concretely, what the null model does, is to estimate the distribution of the variance of scores among the levels believed to be part of the structure, If a two levels structure is the starting point, its equation can be represented as follows (Adapted from [Rumberger & Palardy, 2004](#), p. 241) :

$$\begin{array}{ll}
 \text{Level 1 model:} & READscore_{ij} = \beta_{0j} + r_{ij} \quad \text{where } r_{ij} \sim N(0, \sigma_r^2) \\
 \text{Level 2 model:} & \beta_{0j} = \gamma_{00} + \mu_{0j} \quad \text{where } \mu_{0j} \sim N(0, \sigma_{\mu_0}^2) \\
 \text{Combined model:} & READscore_{ij} = \gamma_{00} + \mu_{0j} + r_{ij}
 \end{array}$$

6.2. Hierarchical Models

In this equation, level 1 is the base of the structure where students were found to be the simplest element of the educational system. Level two can be teachers, classes, schools or any other element of the structure that can be under analysis; because of the similarity of teachers and classes pointed out in table 6.1, schools are a more stable level to start the hierarchy. Consequently, level 1 of the model state that the achievement of a student i in a school j is a function of the average achievement of the school $j(\beta_{0j})$ plus an error term. In addition, level two of the model represents this school average j as a function the total average of all the school means (γ_{00}) and the errors. In summary, the combined model states that student's achievement is a function of a fixed effect: the grand average γ and two kinds of random effects, those related to students and those related to schools, these are believed to have a mean of 0 and a variance = σ^2 . These errors can be used to estimate the distribution of variance between different levels, that is, "how much of the total variance is accounted for by students and schools" (Rumberger & Palardy, 2004, p. 241).

Table 6.10: PIRLS 2001 total score Null Model

	Parameter	Estimated	(s.e.)	ICC
Fixed effects				
Intercept	γ_{00}	522.30	(0.82)	
Variance components				
Between school (Level 2)	$\sigma_{\mu 0}^2$	2,703.18	(62.19)	0.42
Within school (Level 1)	σ_r^2	3,666.06	(15.86)	

In the sample, using SAS procedure MIXED (see appendix C.2, Bressoux 2008, pp. 337–338, 420–422, and Singer 1998.), the estimations presented in table 6.10 are obtained, the estimated values for the intercept ($\sigma_{\mu 0}^2$) and the residual (σ_r^2) can be used to determine the intraclass correlation ($\rho = \sigma_{\mu 0}^2 / (\sigma_{\mu 0}^2 + \sigma_r^2)$), this coefficient represents the portion of the total variance that occurs between schools.

The intraclass correlation (ICC) indicates that in this sample, 42% of the total variance takes place at the school level. Consequently the role played by schools in PIRLS reading achievement is undeniable, and it also underlines the importance of all schools' variables that can determine reading. This percentage did not vary when repeating the calculation on the partial scores: on literary and informative

scores, 42% of the variance occurs between schools, 40% of the variance of the low order and a 44% of the high order processing scores occurs between schools. In addition, in the total score of the 2006 sample, 42% of the total variance takes place at the school level as well. This is an important result since it proves that the role of the school was stable through time.

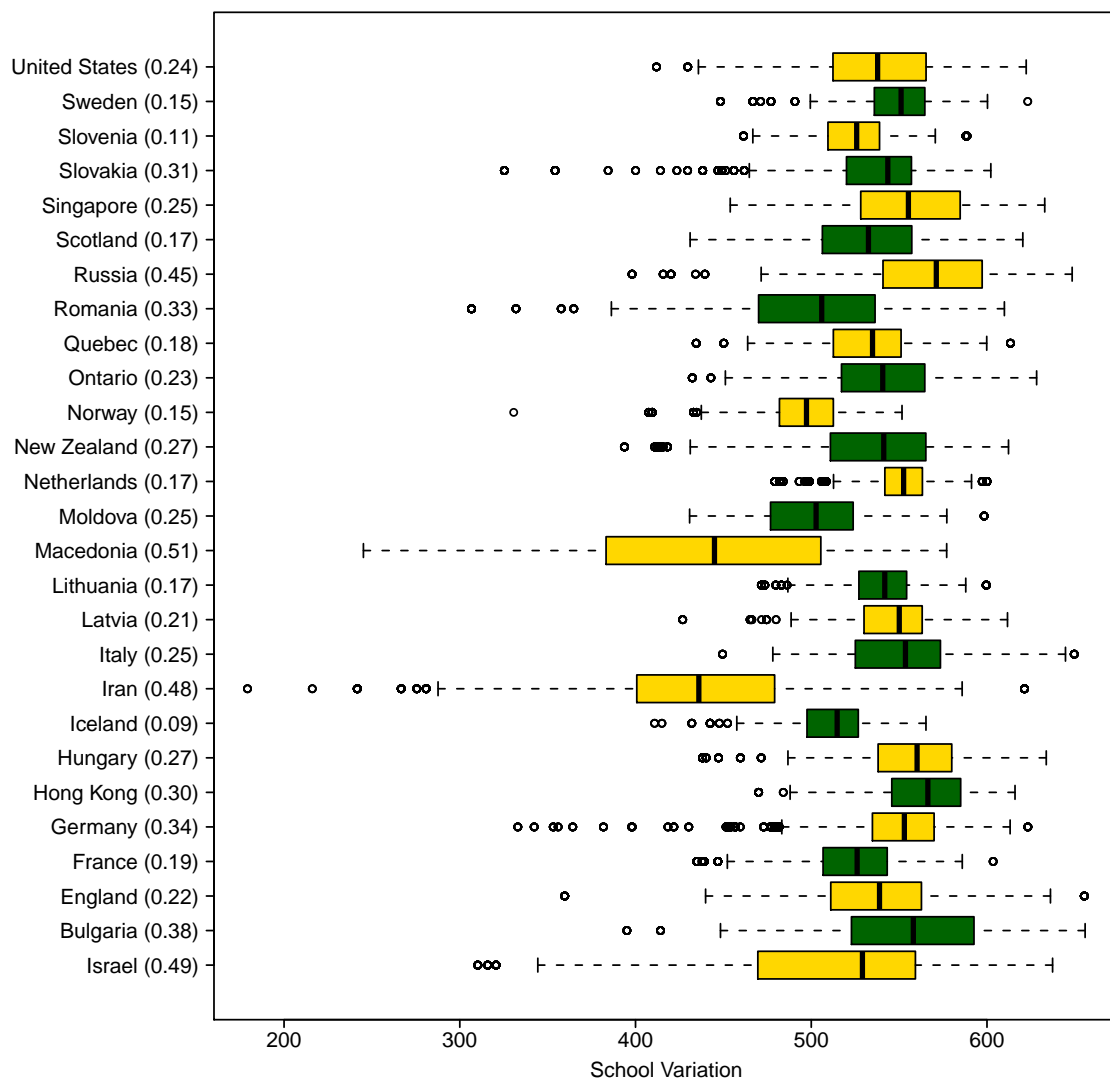
This proportion is very important, but it is also unusual in relation to studies of school effectiveness, as Rumberger & Palardy (2004) points out, the percentage of the variance that occurs at the school level in different studies is close to 25%, depending on the sample. However, since PIRLS includes several educational systems, the bigger proportion of variation is certainly related to the cross-country variation. It is easy to imagine how different the schools could be among the many educational systems that participated at this survey. To visualize this variety, the 2006 average score of each school was calculated, its distribution at the country level is represented in figure 6.1. There it is possible to observe how much the school average can vary, the higher school's score is 656 in Bulgaria, while the lower is 179 points (an Iranian school with only 5 students taking the test), between them, there is almost 9 standard variations.

Besides this graphical representation, two experiments have been done to study the relation between school and country variance. In first place, the addition to the model of a *country* level was tested, keeping students as the first level of the model. If countries are the second level, only 14% of the total variance in 2001 and 17% in 2006 occurs at this level. In other words, the total variance is less explained by this level than by a school level, being the difference in the variance explained more than 20%. Moreover, as will be explained later, the values of Δ indicate that this model is farther from a perfect fit than the two level school model. In summary, countries explain a lower proportion of achievement than schools; it could be assumed that most of country variation is already explained by school variation.

The second test was to observe the *within country* school variance, the 2006 values are presented in figure 6.1, next to each country name. It can be observed that the proportion of variance explained is very different when the model is used to explain scores variance in each country separately. The school in which a student is enrolled can be as important as in the Republic of Moldova, or it can be as insignificant as in Iceland where the schools are very similar. The importance of schools in student achievement is also graphically represented by the distance

6.2. Hierarchical Models

Figure 6.1: School Variance and ICC within countries 2006



between the minimum and the maximum school average in the box plot. This representation also gives a new way of viewing reading achievement, because the low variance between schools in countries like Lithuania, Norway, or Slovenia, indicates that even if the students did not reach scores as high as in other places, these countries were offering a mostly equal education to all the students in the system, which is also a desirable result, especially when schools have such a global importance as in this study.

To observe school variation from another perspective, it is interesting to note the comparison between France and the United States. In France, *between schools*

variance was only 19%, this similarity between schools is probably related to the importance of the French public system where most of the decisions are taken at a central level. In contrast, in the U.S.A. where local authorities play a major role in educational policy, *between schools* variance reached 24% ¹. If this value is taken as a reference, the sum of this intra-country school variance plus the inter-country variance (24% + 17%) explains the total school variance when considered in cross-country context, this confirms the earlier statement that country variance is already explained by schools.

Finally, coming back to the original model, the single change in ICC values could be the 5% of distance between the schools variance in explaining low order and high order processing, that is constant in the 2006 sample too. Consequently, the low order process of comprehension is 5% more related to schools than low order processing. It should be mentioned too, that the estimated reading score (γ_{00}) is equal to the mean of the 2001 sample, which was 522. In 2006 the mean of the total score was 527, while the estimated of the model was 527 too. This high correspondence could be explained by the important amount of observations that took part in the calculations; moreover, all estimations were significant.

To summarize, in relation to reading achievement in this sample, schools make a difference that is constant in time and highly determinant.

6.2.1.b Testing for extra levels

Now, a structure has been established that is able to estimate the role played by the school in how a student learns to read. The next step is to study if this structure can include other hierarchical levels. However, even before proceeding, it can be expected that it will be difficult to explain a bigger part of the variance, due to the great part already considered by school variation. To estimate the pertinence of including extra levels in the model, it was used an analogous procedure to that of F test, that is, the procedure consisted in testing the global significance of the model and the contribution of each new level.

To test this significance, the measurement of a *double negative deviant of the Log-Likelihood* ($-2 \log L$) was calculated. This value takes away from *the Log-Likelihood of the estimated model* the *Log-Likelihood of a supposed model* (saturated), that is a

¹Quantity that approaches the studies quoted by Rumberger & Palardy (2004), which were probably located in U.S.A. or England.

6.2. Hierarchical Models

fully parameterized model (number of parameters equal to number of data points causing a perfect fit), then the result is multiplied by -2: $D = -2(\log L(\text{estimated}) - \log L(\text{saturated}))$ (see Bressoux, 2008, pp. 240–243, 319–321).

From this equation, the deviance can be calculated, that is, the distance between a perfect fit and the actual fit obtained from our model. Then, hypothetically, a minor distance will indicate a better model. However, the deviance is not a coefficient: it is not standardized and depends on the properties of the sample. It is not significant in its self, although the deviance of a model can be subtracted from that of another model having the same parameters, the value obtained is called the *likelihood ratio test statistic*, named $\Delta = D(\text{model1}) - D(\text{model2})$.

Table 6.11: Deviance between two and tree levels models

PIRLS sample	Student–School	Student–Teacher–School	Student–Class–School	Student–School–Country
2001 $-2\log L$	1,240,692	1,240,771	1,240,691	1,291,036
Δ		-79	1	-50344
2006 $-2\log L$	1,371,292	1,375,979	1,375,979	1,426,385
Δ		-4,687	-4,687	-55,093

Following this procedure, table 6.11 presents the value of $-2\log L$ for four different models, the original model with two levels, students and schools, and tree model having tree levels: student–teacher–school, student–class–school and student – school–country. According to the subtraction of deviances, none of these models was a better fit than the original two level structure. On the contrary, as the negative values of Δ indicate, they were further from a perfect fit. This tendency was equivalent in both assessment and, more over, it underlines the equivalence between classes and teachers, that represent almost the same observations (see table 6.1), that is why their parameters where similar.

In summary, a major number of levels do not fit to better describe the variance of scores, in other words, it does not add significance in explaining reading achievement. Obviously, this only means that this two level structure is valid for this data in this specific sample, it is not valid to obtain any conclusions about the role of teachers or classes not in general, not even in the sample. Moreover, PIRLS

designers explicitly avoid working with a teacher level, because the sample was optimized to represent *students* within a country and not its teachers. However, some interesting analyses have been done using teacher level data (for example [Cheung, Tse, Lam, & Loh, 2009](#)).

6.2.2 Modelling linguistic Variables

Knowing that the students and the schools are the levels that best describe the structure of PIRLS sample in relation to reading achievement, there are now other factors (fixed effects) that can be added to the structure, in first place, linguistic variables.

To be able to read the estimated values, one of the families and one of the orthographical levels were chosen to be the reference, by not including it in the model, it is possible to know how much or fewer score can be obtained by a student because of being part of another family or another degree of opacity. In other words, the model will compare the results of those being part of the family and those not being part of the family and will express the difference in the estimated parameter for each variable. The references will be the *Anglo family* for linguistic families and the *Very deep* orthography, which is, in fact, the same *English* part of the sample, this will allow for the direct measuring of the incidence of this particular language in reading achievement. In addition, the estimations obtained will be comparable.

6.2.2.a Linguistic Families

In relation to linguistic families, as was showed in table 6.6, *Anglo* represents the higher average in 2001 and shares this result with the Slavic family in 2006. Consequently, it can be expected that the parameter estimated will be all negative values, since they will represent the distance between the score of one of the other families and the higher score of Anglo. In addition, because of the proximity of Slavic 2006 scores, they may not be different from zero in some cases.

Model 1 in tables 6.12 and 6.13, represent the result of the multilevel regressions that included linguistic families as explicative factors. In appendix B there are also the tables with results for the partial scores (literary, informative, low and high order). The first important result is that there is no significant difference

6.2. Hierarchical Models

Table 6.12: PIRLS 2001 total score Models

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	540***	1.9	537***	1.7	528.2***	0.7	523***	0.9	530***	2.0
<i>Home Factors</i>										
Books at home					10.7***	0.2			10.5***	0.3
Resources					8.4***	0.3			8.4***	0.3
Oral social					-12.2***	0.3			-12.0***	0.3
Inform. read					-3.2***	0.2			-2.8***	0.3
Attitudes					21.8***	0.2			21.6***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.2***	1.1	-2,3**	1.0
Expect. wishes							9.3***	1.0	4.1***	0.8
Emph. Strateg.							4.3***	0.6	3.7***	0.6
Var. Instruction							n.s.		n.s.	
Early lear skills							7.2***	1.0	5.2***	0.9
Variety of books							9.4***	0.9	4.3***	0.8
<i>ref= Very opa.</i>										
Shallow lang.			-21.8***	2.0					n.s.	
Opaque lang.			-11.2***	2.4					10.2***	3.8
<i>ref= Anglo</i>										
Others	-34.7***	2.4							-15.1***	3.6
Germanic	-7.9***	2.7							n.s.	
Latin	-22.8***	2.7							n.s.	
Slavic	-16.9***	2.6							n.s.	
Variance components										
Between school (Level 2)	2,568	59.4	2,623.2	60.5	1,733	42.0	2,431	65.2	1,538	43.5
Prop. Explain	0.05		0.03		0.36		0.10		0.43	
ICC	0.41		0.42		0.38		0.41		0.36	
Within school (Level 1)	3,665	15.9	3,666	15.9	2,856	13.9	3,540	17.8	2,767	15.5
Prop. Explain	0.00		0.00		0.22		0.03		0.25	
-2LogL	1,240,440		1,240,570		975,008		919,196		729,922	
Δ (1240692)	252		122		265,684	79%	321,496	74%	510,770	59%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

between the parameters of the total score and the partial scores, in other words, linguistic families have the same effect on literary reading (for example) as on global reading.

Concerning the fixed effect, all the values for the linguistic families were negatives, that is, all represent a loss related to be part of the *Anglo* family. As predicted,

Table 6.13: PIRLS 2006 total score Models

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	536***	1.8	539***	1.6	533***	0.6	526.7***	0.8	531***	1.6
<i>Home Factors</i>										
Books at home					11.3***	0.2			11.0***	0.2
Resources					11.5***	0.2			11.2***	0.3
Oral social					-12.9***	0.2			-12.5***	0.3
Inform. read					-4.9***	0.2			-5.3***	0.2
Attitudes					20.1***	0.2			20.3***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.5***	1.0	-2.2***	0.8
Expect. wishes							8.3***	0.8	2.6***	0.7
Emph. Strateg.							2.1***	0.5	2.4***	0.5
Var. Instruction							4.3***	1.0	4.3***	0.8
Early lear skills							8.9***	0.9	6.2***	0.7
Variety of books							2.3***	0.8	n.s.	
<i>ref= Very opa.</i>										
Shallow lang.			-20.9***	1.9					-26.7***	3.2
Opaque lang.			n.s.						-9.7***	3.4
<i>ref= Anglo</i>										
Others	-21.8***	2.3							18.8***	3.3
Germanic	n.s.								23.4***	3.8
Latin	-18.0***	2.5							18.1***	3.8
Slavic	n.s.								32.0***	3.8
Variance components										
Between school (Level 2)	2,510	56.3	2,496	56.0	1,510	36.4	2,359	58.3	1,318	35.3
Prop. Explain	0.04		0.04		0.42		0.10		0.50	
ICC	0.41		0.41		0.35		0.40		0.32	
Within school (Level 1)	3,580	14.7	3,581	14.7	2,752	12.6	3569	16.2	2,756	13.9
Prop. Explain	0.00		0.00		0.23		0.00		0.23	
-2LogL	1,375,819		1,375,818		1,087,036		1,127,277		896,594	
Δ (1371292)	160		161		288,943	79%	248,702	82%	479,385	65%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

the 2006 estimation showed a non significant difference between being part of the *Anglo* family and being part of the *Slavic* family, moreover there was not a significant difference between *Anglo* and *Germanic* either.

Taking into account that all of them are dichotomic variables representing the fact of being or not being part of a family, their incidence can be measured directly

6.2. Hierarchical Models

by the parameter estimated. For example, in 2001, those having a value of 1 in *Others* variable, will obtain as much as $-34.75(\pm 2.4)$ points less in the score in comparison to those being part of the *Anglo* family. Moreover, all the families showed a disadvantage in relation to the reference, the higher was *Others* and *Latin*. These two families, in fact, kept that disadvantage in 2006, whereas *Slavic* and *Germanic* managed to equalize the reference; in general the disadvantage was smaller in 2006. The bigger disadvantage in relation to *Anglo*, was for the *Others* family in relation to the 2001 literary score, being part of this family means $-38.34(\pm 2.4)$ less than *Anglo*.

Another aspect to look at, are the partial scores, because some differences can be observed. Comparing the 2001 purposes of reading (see tables B.1.1 and B.1.2), one can notice that the disadvantage is particularly accentuated in literary reading, particularly for *Latin* and *Slavic* families, the first can lose 22.54 points more in literary reading $(-30.7 \pm 2.6) - (-13.36 \pm 2.6)$, the second can lose 20.99. In 2006 (tables B.2.1 and B.2.2), this literary advantage did not last, which leads one to assume, according to the model, that the advantage for English speakers in the 2001 results was particularly linked with a *literary* advantage, even if they also obtained better informative scores.

In relation to comprehension processes, there were also various results if compared to *Anglo*. In 2001, while in low order processing, *Germanic* was not at a disadvantage (equal to 0), it lost more than 15 points in high order processing. The *Slavic* family had a small disadvantage in low order processing and a much larger one in high order processing. In general, the 2001 results showed more elevated disadvantages in high order processing. In 2006, the situation remains similar; in general the bigger advantages were in high order processing. In addition, it was in 2006 low order processing when the *Germanic* family obtained the only parameter with a positive value (see B.2.3), in other words, this was the only case in which being part of a family different from *Anglo* was not a disadvantage, but an advantage. However, for the rest of the families, particularly for *Others* and *Latin*, the disadvantage was still very important.

In summary, the first important conclusion is that the values confirm that there are variations related to the linguistic family to which a student belongs. In addition, another way to read this result is that *Anglo* students have a preexisting advantage in relation to the rest of the sample by the fact that they speak this particular language; this advantage is more patent in literary reading and high order

processing.

This fact is also supported by the coefficient for the constant, which is higher than what was calculated in the null model, while in 2001 it was 522, now it is almost 20 points higher. The 2006 results indicate 10 points more for the linguistic model, with the *Anglo* family as the reference. Considering that this coefficient is the predicted reading achievement, those results indicates that when all predictors are 0, that is when all the other linguistic families are 0, the students reading achievement is predicted to be higher, since the dichotomic distribution indicates that the families will get a 0 only when *Anglo* will be true. This high score is the reading achievement of *Anglo* students taking into account the hierarchical structure of educational system. These results are similar to the real average of *Anglo* students as was shown in table 6.6.

This situation changes when taking into account variance components. These results put language influence in another perspective, because there is no relation between linguistic family and school or individual variance of scores. If compared with the null model, the level 2 variance (between schools) did not decrease significantly, it only varied from 2703 to 2568 in 2001, and from 2610 to 2510 in 2006. If these coefficients are used to calculate the proportion of variance explained at school level $((2703 - 2568)/2703$ in 2001) the results shown that only 5% of the variance was explained, in other words, the parameters indicate that linguistic families did not explain the school-to-school variation in mean reading achievement. The same situation was found at within-school level where the residual, σ_r^2 , almost did not change from the null model to this one (see 6.10), giving a proportion of variance explained equal to 0.

Moreover, the distance between the model and the ideal fit did not significantly decrease the value Δ . It only showed a diminution of 252, in 2001, and 160 in 2006. Considering that the value of $-2\log L$ is, in both cases over a million (value related to the important quantity of observations); this is certainly too small. In addition, intraclass correlation, that could have been decreased, did not vary; it only lost 1 point in both 2001 and 2006. Finally, if partial scores are compared, there were almost no changes among different purposes of reading or processes of comprehension, the variance components reacted in the same way in every case.

6.2.2.b Orthographical depth

The parameters estimated for orthographic depth are very similar to those for linguistic families. The variance components are equivalent, the proportion of variance explained is almost non-existent too, and the intraclass correlation is also 42%. Similarly, the explicability of the model is very low in accordance with the Δ parameter. Moreover, this is regular among the different scores.

In contrast, the values expressed by the parameter estimated for the fixed effect, indicate an important disadvantage from being or not being part of the most opaque language, which is the reference. This disadvantage is particularly high in the case of shallow languages that lost more than 20 point both in the 2001 and 2006 models; opaque languages, instead, only lost 11 points in 2001, and 0 in 2006. The 2006 disadvantage of shallow languages vary some points across the partial scores, being the most high the parameter estimated for the informative score = -36.1^{**} (see B.2.2), in contrast, the estimation for literary score = -17.4^{***} is the lower (see B.2.1). Processes of reading also indicated variation even if in a smaller proportion. This can indicate a possible connection between shallow orthography and aspects of reading, which was not verified before, but that could be explained in relation to the reference, the English orthography.

As opaque languages also concentrated its disadvantage in literary reading, this confirms the advantage of English speakers in literary reading, since there was also a score loss associated with reading among linguistic families. It can be assumed that this is mostly a literary advantage of English speakers in this assessment more than a disadvantage of the rest of the sample. A similar situation was found in 2006, even if the disadvantage for opaque languages was reduced significantly, on the contrary, shallow languages kept showing a significant disadvantage. In relation to comprehension processes, for both shallow and opaque orthographies, the parameter estimated for high order comprehension was bigger than that of low order, in other words, the scores are closer to those of English in this aspect. Between orthographies, deep languages were closer from English scores, in processing, purposes of reading and the general score.

In summary, there seems to be a language-to-language variation, since the values estimated changes from family to family and between the different degrees of opacity. Moreover, the estimations were constant from one assessment to the other, indicating regularity through time. However, the proportion of variance explained

by these models, which is close to zero, indicated that this is not an explicative factor of score variance not at school, or individual levels, and not in any of the aspects of reading taken into account. In addition, in developing a complete model with all the linguistic factors, home and school variables (see models 5), there will be important changes in the linguistic estimation that will show no consistence with the models discussed here. This variability, indicates that language could be influenced by other factors instead of acting at the same level, so it can not be considered as an equivalent predictor. A preliminary conclusion of this analysis is that languages do not determine reading achievement, but they may play another role, since the parameter estimated did show variations from family to family and between degrees of depth.

To study this option, some models were developed. In first place, a possible explanation is that language is not an effect but a component of the variance itself. However, the 2006 sample was used to test a null model including language as the secondary level of the structure. English was the language of reference, creating a structure in which speaking this language divided the sample into two groups. The result was that there was no intraclass correlation ($ICC= 0$), that is, English can not be considered as a level of the structure. This is particularly clear considering that it was tested as the only secondary level, leaving schools, teachers and all others part of the structure out of this model.

In section 4, it was discussed the assumption that language could be determined by countries, that is, by the educational systems. In that case, the categories that were presented here might be under certain influence of this macro-level of the educational structure. To observe this possible interaction, graphics 4.1 and 4.2 represented the scores by country and languages, distinguishing linguistic families and orthographic depth. There, the only groups more homogeneous than the average were those of English countries, but not further conclusions were inferred at that point. Now, through modelling, it is possible to reconsider the interaction between countries and the linguistic categories. However, it is already now that a three level structure: students-schools-countries, does not explain better the school that the simpler two level structure. The question is if this model is capable of a better explicability in relation to linguistic categories. Consequently two models were developed including as fixed effect linguistic families, in the first, and orthographical depth in the second case. The fact of keeping always English as the referential group became more significant when the similarity of scores at

6.2. Hierarchical Models

country level is considered.

As predicted by the three level null model, these two structures are not explaining reading achievement. The explicability for the variance inter-students and inter-schools is always 0.00. Furthermore, the explicability at country level obtains negative values (for example, $-.17$ for 2001 families), indicating that this model is even less explicative than the null model. For both samples, and in both models, the intraclass correlation is the same than in the null model, that is, our categories are not a source of likeness not at school not at country level.

Consequently, it is necessary to think again about the role played by language as reading determinant. In general terms there was some degree of interaction, the students from English countries have a better score than the rest of the sample, but this not explain the variance of scores from the point of view of this hierarchical structure. It is probable that the resemblance among countries having a same language is not representing a linguistic category, at least not as they were defined in this research.

6.2.3 Contextual determinants

6.2.3.a Home factors

A very different situation was found when adding the home factors previously identified to the model (see table 6.2). There were interesting proportions of variance explained and the parameters estimated were consistent across aspects of reading. Fixed effects and variance component will now be described separately.

Fixed effects. In first place, regarding fixed effects in model 3, the importance of these five factors was confirmed. All the variables were represented by significant parameters estimated. Moreover, these estimations were stable through the different aspects of reading, that is, besides some small differences between the estimations, the values were similar.

As predicted, the *availability of books at home* is a positive factor according to the standardization previously done ($m=0$, $sd=1$). The parameter indicates that a SD over the means will add at least 11 score points in 2001 and 2006 samples. In other words, to possess an amount of books over the international average is

related to an improvement in reading achievement that is constant in time. If the possible values of this variable are developed, it can show an estimation of the gain or loss of points related to this factor. In the 2001 data, the lowest value for this variable was $= -1.64$, if multiplied by the sum of the estimate and its standard error, a student having the lowest amount of books at home can lose $((10.68 + 0.2) \times -1.64)$, this is -17.84 score points. In contrast, the model indicates that, a student having the maximum $= 1.52$, can add 16.54 points to the score. In summary, this model confirms that to have books at home is positive in relation to reading achievement, while their absence can play a negative role in reading.

A similar situation was found in relation to the *resources that the student can count on at home*. In 2001 the estimation for this factor was a little smaller than the estimation for *books*, situation that changed in 2006 where both were equal. In other words, the role played by *home resources* in 2001 was a little less important than the *availability of books at home*, however this difference was small and both were factors determining reading achievement. Moreover, both are equally important in explaining the 2006 results. This last change can also be interpreted as an augmentation of the importance of material resources in learning to read, however, since the augmentation is only around 2 or 3 points this conclusion cannot be assumed.

What was called, *oral socialization*, is the most negative factor that was considered in the model. As showed in table 6.2, this index gathered activities like, *reading to others* or *listening others reading*, and *talking with others about reading*. The standardized estimation indicates that, the smaller the proportion of these activities, the better the score can be. As in the previous cases, the estimation for this factor was very stable across aspects of reading, and also from one sample to another, the 2001 and 2006 estimations were analogous. PIRLS included questions about these social activities, hypothesizing that they can improve reading learning, however, this model clearly points in the opposite direction, the more independent the work, the better the reading achievement. Evidently, this result cannot be generalized out of the sample, but it can be supposed that a main proportion of oral interaction can be, reversely, a consequence of difficulties in learning to read. A student who needs more support learning can obtain, at the same time, high proportion of orality and lower reading scores.

Informative reading is also a negative factor, but in a minor degree. In 2006, the parameter was one point more negative than the estimated for 2001. Since a

positive value of this variable, indicated a high proportion of informative reading (explanatory books, magazines, newspapers etc.), it was expected that the estimation could vary between literary scores and informative scores, however, the difference between them was not significant, barely one point in both samples. In addition, it was also expected that a particular relation between informative reading and low order processing would exist, but, again the difference between low and high order processing is too small to be taken into account. It can be assumed that a significant amount of informative reading is equally negative, even if the parameter estimated is one of the smallest in this model.

Students' attitudes toward reading. The last home factor included in the model, is certainly the most important factor in accordance with its parameter estimated. To have a positive attitude toward the act of reading and toward books is related to an improvement of reading achievement. In developing the equation of this parameter using 2001 data, it can be observed that, on one hand, if the maximum value is multiplied by the parameter (1.39×21.79), the gain in score points for a positive attitude can be as much as 30.29 ± 0.2 . On the other hand, the minimum value of this variable is particularly low = -3.05 . Consequently, to have the most negative attitude toward reading, is related to a loss of -66.46 ± 0.2 . This is more than a standard deviation. It can be assumed that, for PIRLS sample, the role played by motivation is particularly important in learning to read.

Because of the important parameter estimated for the variable representing *attitudes toward reading*, a derived question, is how much of the variance can be explained by this particular factor. To explore it, regressions with only this variable as a fixed effect were developed. The first remark is that neither the intercept nor the parameter estimated varied. The last was 20.89 in 2001 and 19.12 in 2006. In 2001, the model fit to explain 4% of the school-to-school variance, and 13% of the variation at student level. For 2006 data, it explained 5% of the school-to-school variance, and 11% of the variation at student level. This proportion clearly shows that this factor depends on the individuals more than the schools; consequently, its subjective constitution is confirmed.

This information leads to a new problem: the most influential parameter in this model can not be controlled or modified since is not part of the educational system itself. A possible way of controlling this variable could be controlling variables related to parents, that may determine positively their children's attitudes. To examine if there is a relation between parents and the variable SATR, the PIRLS

Table 6.14: Student attitudes toward reading, Pearson correlation coefficients with variables from the parents' questionnaire

Description of the variable	<i>r</i>
Parents reading books at home to their children	.11
Parents telling stories at home to their children	.10
Children reading words before starting school	.12
Children reading sentences before starting school	.11
Children writing letters of the alphabet before starting school	.12
Children writing some words before starting school	.11
Parents talk with the child about what he/she is reading	.14
Parents take their children to the library or bookstore	.14
Parents declaring to like talking about books with other people	.14
Parents declaring: Reading is an important activity in my home	.15

Parents' questionnaire was taken as a source of information, searching for other motivational aspects related to students' attitudes. The 2006 data, shown that SATR is correlated with several variables in parents' questionnaire. The main correlations are showed in table 6.14, among them, it is remarkable the importance of *parents' attitudes* and an *early introduction to literacy*.

Regretfully, the results were not significant enough, as is observable, the coefficients are not as high as it would be necessary to determine SATR. This was an expectable result because there were two different individuals that answered the questions, even if there are familiar links. Other direct correlations with the variables that form the SATR index were tested but there were not stronger coefficients. The possibility of improving students' attitudes through a modification of parents' behavior was not confirmed. Consequently, this factor remains a subjective and not easily controllable determinant of reading achievement. In contrast, even if these correlations were small, they can be a starting point for a deeper study of the relation between *reading motivation* and *home reading environment*. It is not irrelevant that the most correlated variables described *parents' attitude toward reading*. Still, from the models and correlations, developed in this research, it is not clear how to control or improve students' attitudes, even if its importance is patent.

Variance components. Coming back to the study of model 3, it is remarkable the stability of the coefficients across the different aspects of reading and between both samples, besides some small differences that will be mentioned in the next paragraph, the models are characterized by a great degree of resemblance. They all fit to explain around 36% to 42% of the explainable variation in school means reading achievement and 22% of the students score variation. Moreover, the degree of dependences among students from schools of the same score means is still very elevated: it only decreases 3% in 2001, and 6% in 2006, in other words, the scores continue to be highly dependent on the school in which a student is enrolled.

Concerning variations among aspects of reading, there was no change between literary and informative purposes, they obtained equivalent parameters in all cases, the proportion of variance explained and the intraclass correlation did not vary either (see tables B.1.1, B.1.2, B.2.1, and B.2.2). In contrast, high and low processes of comprehension did show a little difference, in 2001 (see tables B.1.3, and B.1.4), the model fit to explain 5% more of the variance between schools during low order processing. In addition, this proportion continues to be part of the 2006 models (see tables B.2.3, and B.2.4), where low order score obtain the bigger proportion of school-to-school variance explained by this model: 45%, this is, half of the explicable variance. It must be remembered that there were some changes in the distribution of these processes across the items, which is probably the reason for this small change. The most important result is the general amount of explicability related to school-to-school variance, that is observable in total scores.

In general, it can be conclude that there was not significant difference in explicability from model to model. Besides the mentioned distinctions, what stands out most is the resemblance of all models. Concerning total scores, the proportion of variance between schools explained by these individual factors augmented six points from 2001 to 2006. This small augmentation can be taken as relevant since is one of the few changes in the general resemblance tendency. It can be concluded that the relevance of *home* conditions at school level has increased.

In contrast, the explicability of home factors within schools with the same average stays constant (22%). From this percentage, close to a half is related to the *attitudes towards reading*, because the model were this was the only regressor fit to explain around 12% of variance (see 6.2.3.a). Concerning schools variance, the

proportion explained is certainly exceptional, since the lower proportion was 34%, explaining 2001 informative score (table B.1.2) and the major is the 45% already mentioned (table B.2.3). Consequently, a valid question is how *home factors* get to best explain school variance over the variance related to individuals. A possible answer is that the similarity of school achievement is, in fact, related to the similarity of the individuals that constitute it. In other words, similar individual characteristics are the basis for school choice, which implies a connection between schools and reading achievement. Another possibility, is that it is the international dimension of the sample that emphasizes *home factors* explicability, there are reasons to assume this conclusion since it has already been described how much intraclass correlation among schools can change from one country to another (see 6.1). If an analysis of separate countries is undertaken, the proportions of explicability can vary, this is a possibility that will be discussed later (see 6.2.4.c).

6.2.3.b School factors

Model 4, includes *school factors* as a fixed effect to explain reading achievement variance. It can be observed that not all the variables mentioned in table 6.3 are present. The reason was a significant amount of missing values in two of the variables. In 2001, if variable *time* is added to the model, 57,152 observations are not included because of missing values; if *mother tongue* is included 28,540 observations are eliminated; in 2006 the losses were similar. These amounts are too high to not affect the global significance of the model, in addition, to include the rest of the school variables also implies loss of observations. In 2001, from the original 111,205 observations read, only 82,665 were included in the model without *time* and *LNG*, however, in this case, the missing values are distributed along with the rest of the variables not affecting one of them in particular, as was the case of the two excluded.

Consequently these two variables must be excluded to preserve the general validity of this model, but, it is a valid question, to ask, how much of the variance could have been account by them. In first place, *time* is not a significant loss, because in the models including both language and time, the latter is not significant. In 2001, if *language* is omitted and *time* kept, it only represents a gain of $1.91(\pm 0.64)$ points in average. In contrast, the index of *second language use* is significant and represents a loss of $-15.38(\pm 0.5)$ for an average rang, thus there is an important

6.2. Hierarchical Models

and negative relation between reading achievement and the use of a language different from that of the school. However, this is only valid for 50% of the sample.

Searching to discover where exactly the missing values for *LNG* are, there are some specific countries where there are no observations: in 2001: Hong Kong, Hungary, Iceland Lithuania, Russia, Ontario and Quebec, in 2006 the same countries less Hong Kong, plus Slovenia and New Zealand. These countries did not answer some of the questions related to language. This information was used to test a regression leaving them out, using the 2001 data, it was found that the estimated parameter for language was $-21.73(p < .1)$. If a model not including *LNG* and another including it are compared, the proportion of variance explained at school level change significantly from 14% to 28% compared to the null model. In 2006, the same procedure showed a gain of 9%: from 11% to 20%. Consequently, even if this factor can not be included in a general model explaining this data, the importance of second language is confirmed. For example, a student whose mother tongue is different from that used at school and who speaks the educational language only when he/she is at the school can risk losing 20 score points for each standard deviation over the mean language use. In other words, reading achievement can be better if the first language learned is then used daily at home and at school.

Fixed effects. Now, model 4 excludes these variables and shows the role played by the rest of the school factors in explaining reading achievement. As was the case for the Home Factors, *School factors* are characterized by a great similarity across the models, including different aspects of reading. There were very small changes in the parameter estimated from 2001 to 2006, and all the variance components were constant across process and purposes of reading.

The first factor included was the *variety in evaluation methods* that got a negative relation with reading achievement, that is, the more the activities are declared by teachers, the more the negative results. The parameters estimated for this variable were similar between both samples and aspects of reading. Even if the value is smaller than those of the Home Factors, the negative role played by this *variety* is patent. If 2006 data is used to develop the equation, the maximum value of variable *ASK* is 2.88, which means a loss of score points equivalent to $((-7.51 - 1) \times 2.88 = -24.51)$. In contrast, if teachers chose only one or two of these methods to evaluate reading, the minimum value of the variable is -3.8 ,

developing the equation: $((-7.51 - 1) \times -3.8 = 32, 34)$. What these values indicate is that the variety in evaluation does not improve reading achievement; on the contrary, to apply specific methodologies could help to improve reading. However, the procedure did not help in discovering which exactly those methods are.

The second factor, *expectations and wishes*, is, like *students' attitudes*, a very subjective element. It would have been interesting to find some relation between both variables, however the coefficient of a correlation for 2006 data is equal to .01. The parameter estimated for this variable was constant across the sample of both assessments; consequently, this is one of the aspects that must be taken into account to improve reading achievement.

The low estimated parameter for the third variable: *emphasis on strategies*, was one of the unexpected results, because of the importance of the variable representing these strategies in the previous analysis. In addition, the parameter did not vary between partial scores, which would have been expected since it is particularly related to processes of comprehension. In summary, the *emphasis on strategies* during reading instruction does implies an improvement of reading achievement, but in terms of score points, it represent a small measure.

In contrast with the negative incidence of the *variety of evaluation methods*, already described, the *variety of instruction methods* is related positively to reading achievement. However, this result is only valid for 2006 data. In 2001, all the parameters estimated where not significantly different from 0, in other words, this factor did not improve or diminish 2001 scores. In addition, the estimation for the 2006 models were not very elevated, indicating that the role played by this factor was not as central as other factors.

More important estimations were those related to *early learning of reading skills*. This factor is related to a general improvement of the scores, and not to any aspect of reading in particular. This is also a variation in relation to what could have been expected, because in the preliminary analysis this variable was directly related to high order processing. If the possible score points associated with the estimations are studied, the 2006 data allows one to observe that the minimum and maximum values for this variable are $-2.17/0.89$. This is interesting because the negative values can reach 2 standard deviations while the positive values got only 1 SD. In other words, the distribution of this variable indicates that the 50% low is more variable that the 50% high. In this case, an interesting value is that of the *mode* of

the values, which is equal to the maximum value: 0.89. This means that an important proportion of the sample gets this maximum value, while some observations got particularly low values. In other words, the tendency in the sample is to develop all these skills before fourth grade, in contrast, those schools where these skills are not part of the instruction before fourth grade, will obtain an important penalization in reading achievement close to 7 points by each negative standard deviation.

Concerning the last factor, the use of a *variety of books* is one of the two variables that were directly created from variables present in PIRLS questionnaires, that is, this is not an index summarizing several questions. The other one was the variable describing the *availability of books*, there, the parameters estimated were stable and comparable. In contrast, this variable shows an important change from 2001 to 2006 sample, while 2001 estimations are around a coefficient of 9, in 2006 they are close to a value of 2 and less significant. Because of this change, the comparability of the variables from sample to sample was verified. However it is the exact same question that was answered by the teacher in both questionnaires: *When you have reading instruction and/or do reading activities with the students, how often do you use a variety of children's books?*. Moreover, the alternatives to answer were also exactly the same. Concerning the replies given by the teachers, the 2001 version of the variable had a means of 2.23, and a SD of 0.83, being almost equal to 2006 version, that obtained a means of 2.22 and a SD of 0.82. Since the comparability of the variables between both samples was confirmed, the change in the estimated values can be interpreted as a variation of the role played by this factor. In that case, it is possible to affirm that to use a *variety of books* during instruction played a more important part in explaining 2001 results. However, it is preferable to affirm that a deeper study of this aspect is needed to ensure more definitive conclusions.

Variance components Regarding variance components, because of the hierarchical structure that is being applied, these factors, that are related to the superior level, are not capable of explaining variation from individual-to-individual. This is why the proportion of variance explained between students is only 3% in 2001 and 0 in 2006. In contrast, these insignificant percentages confirm that the model is clearly describing properties of the schools and not merging elements coming from different levels of the structure.

On the contrary, a negative aspect of these findings is that the model fit to explain only 10% of the variance between schools, in other words, most of reading achievement has yet to be explained. However, since it is already known that the significant amount of variance explained at this level is by *home Factors*, it will be necessary to revise the model combining both kinds of factors before drawing definitive conclusions.

As it has been the general tendency among models, the estimations are similar for all the scores, total and partials and there is a remarkable resemblance between the models representing both samples. In other words, the models are valid for all the aspects of reading and constant across time.

A final characteristic to be mentioned about variance components is the general explicability of the model. The Δ value shows that there was a significant reduction of the distance from the ideal model. The last two models, representing Home and School obtained a smaller $2LogL$. In the tables, together with the value of Δ for each model an estimation of the percentage of reduction has been added, this allows for the affirmation that model 3 is 79% closer to an ideal fit than the null model, if this one represent the maximum distance. However, it is necessary to be carefully in interpreting this reduction because the amount of observations has diminished too, and so the degrees of freedom must be taken into account.

6.2.4 Final Models

Model 5 represents the final goal of this research, a model including contextual factors and linguistic elements that are able to explain, at least, a part of the variance in reading achievement. However, because of the findings of the previous models, other better possibilities must be considered. The reason is the lack of improvement in explicability relating to language factors. As it was described, none of the models including linguistic families or orthographic depth was better than the null model in explaining reading achievement. In addition, the variable components of this last model indicate that the proportion of variance explained in both levels is the sum of the proportions explained by models 3 and 4. For example, between schools, the total variance explained was 43% of the variance, a value that is close to the sum of the 36% explained by home factors and the 10% explained by school factors. Similarly, the proportion of variance explained between students from schools with the same average is 25%, which is the sum of

6.2. Hierarchical Models

22% from home and 3% from schools factors.

Another negative aspect of the inclusion of linguistic factor is the contradictory results of their estimated parameters. While only one of them was a positive value before, now, the few significant estimations seem to represent an improvement in scores related to not being part of the English language. This contradicts the previous results and the general results where English achievement averages were above the others. In addition, a big part of the variables obtained non significant estimations, particularly in the 2001 models, which differ from the 2006 estimations, where the highest values are too elevated considering the low explicability of these factors. In summary, the parameter estimated for linguistic variables were contradictory; many of them were not significant, they were not consistent from 2001 to 2006, and did not represent an improvement of the explicability of the model.

6.2.4.a Final Model compared to models 3, 4 and 5

Consequently, since there is no loss in taking off the model of linguistic variables, the final models in table 6.15 propose to explain reading achievement only considering *home* and *school* factors. Since it is already established that the tendencies are equivalent across all the models for partial scores, from now on the analysis will be focused on total scores.

Concerning model 6, if it is compared with model 5, the contrast allows for the study of the possible changes related to the absence of linguistic factors, because, besides their lack of explicability, it is valid to ask if their presence alters the parameter estimated for the rest of the variables and the variance components. Model 6 shows that with the exclusion of linguistic variables, there were only small changes in the estimations for the rest of the variables. What is more remarkable is that these changes were all congregated on *school factors*, while *home* parameters did not vary significantly. Now it is possible to add to the supposition that the resemblance among countries was due to something different than languages (see 6.2.2.b), the idea that this could be more related to school characteristics.

This last result is also confirmed by the proportion of variance explained, decreasing two points in school-to-school explicability, while variance within schools did not change. In other words, even if the inference is based in a very small amount of

Table 6.15: 2001 and 2006 final models

Fixed Effects								
Variable	Null Model 2001		Final Model 2001		Null Model 2006		Final Model 2006	
<i>Intercept</i>	522 ***	0.8	528 ***	0.7	527 ***	0.8	533 ***	0.7
<i>Home Factors</i>								
Books at home			10.5 ***	0.3			11.1 ***	0.2
Resources			8.3 ***	0.3			11.0 ***	0.3
Oral social			-12.0 ***	0.3			-12.5 ***	0.3
Inform. read			-2.9 ***	0.3			-5.2 ***	0.2
Attitudes			21.6 ***	0.2			20.2 ***	0.2
<i>School Factors</i>								
Var. Evaluation			-4.4 ***	0.9			-4.6 ***	0.8
Expect. wishes			4.2 ***	0.8			2.7 ***	0.7
Emph. Strateg.			3.5 ***	0.6			2.6 ***	0.5
Var. Instruction			2.0 **	0.9			5.9 ***	0.8
Early lear skills			6.4 ***	0.8			6.5 ***	0.7
Variety of books			6.1 ***	0.8			n.s.	
Variance components								
Between school (Level 2)	2,703	62.2	1,593	44.8	2,610	57.0	1,418	37.6
Prop. Explain			0.41				0.46	
ICC	0.42		0.37		0.42		0.34	
Within school (Level 1)	3,666	15.9	2,767	15.5	3,580	13.8	2,755	13.9
Prop. Explain			0.25				0.23	
-2LogL	1,240,692		730,040		1,375,979		896,810	
Δ (1,240,692)			510,652	59%			479,169	
observations	111,205		67,092		123,634		82,510	

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

variance and explicability, it consistently proved that, as determinants of reading achievement, language factors were an attribute of schools instead of individuals.

Concerning the relation between models 3, 5 and 6, since the parameter estimated for *Home factors* did not vary, the explicability of these variables was not affected by the presence of the other factors, *school* and *linguistic* determinants. In other words, the explicative power of *home factors* is not related to the other aspects considered in the model.

6.2. Hierarchical Models

A different situation is that of *school* determinants, which did vary. In all the cases, the values change only some points more or less. However, none of them changed from positive to negative or add more than 5 points, as was the case of linguistic factors between models 1, 2 and 5. Among models 4, 5 and 6, there were some variations that are necessary to illustrate.

Describing the model with *schools* factors, it was mentioned that the factor *Expectation and wishes* could have been related to *students attitudes toward reading*, since both represent subjective aspects. Even if this relation was not proved, the diminution of the coefficient estimated for this variable in model 6, indicate that there is a relation between *expectation and wishes* and *home* factors. In addition, since its coefficient did not vary from model 5 to 6, a possible relation with linguistic variables can be rejected.

In contrast, the factor *variety in evaluation* did vary in relation to linguistic factors. It reduced its estimation by more than half in model 5, then, recovered some points in model 6, but not as much as in model 4. These variations imply that there was an interaction between *variety in evaluation*, *linguistic* and *home* determinants. However, the values do not represent a significant change, since they are not much bigger than standard errors. Similarly, *variety of books*, lost some points in model 5, and recovered some others in model 6, but not enough to be significant.

Another different case was that of *emphasis in strategies*, whose variable did not vary from model 4 to 5, or from model 5 to 6. This fact proves that there is not an interaction of this variable with *home factors*, or with *linguistic variables*. The variation of the estimations for *variety in instruction methodology* and *early learning of reading skills* indicates that they are related with *home* and not with *linguistic* factors, because it recovered a few points from model 5 to 6, not from model 4 to 5.

In relation to variance components, ICC has decreased 5% in 2001, some more points in 2006, but in both cases, the degree of dependence among observations within schools is still very important.

Concerning variance between schools, this model fit to explain 41% of the explainable variance in 2001, 5% more than in 2006. These are the most positive results that these procedures were capable of obtaining; that shows how important schools are in student achievement, in other words, in PIRLS reading tests, 40% of the variation in student achievement is due to the schools in which students are

enrolled.

In contrast, the explicability of the model concerning variation between students is less important, but not without significance; 25% of the variance that occurs among students in their respective school means was explained by the model. In summary, PIRLS results are considerably more related to schools than to individuals, however, the determinants that explain this variation came from background characteristics of the students, that is, not controlled by school policies.

6.2.4.b Studding means–and slopes

Final properties of hierarchical models that can improve its explicative power are the inclusions of random coefficients, which allow the fixed effect to vary on each school. The hypothesis behind this technique is to suppose that an average regression equation is not necessarily the best option to explain reading achievement, because it can be very different depending on the average of the school. In other words, two students with a similar background can obtain higher or lower reading achievement depending on the high or low average of their schools, since school average can affect students' outcomes. In the equation, the variables can vary not only at the interception point but also it can obtain random slope equations. This kind of model is called *means–and slopes–as-outcomes model* (see [Rumberger & Palardy, 2004](#), 245–246).

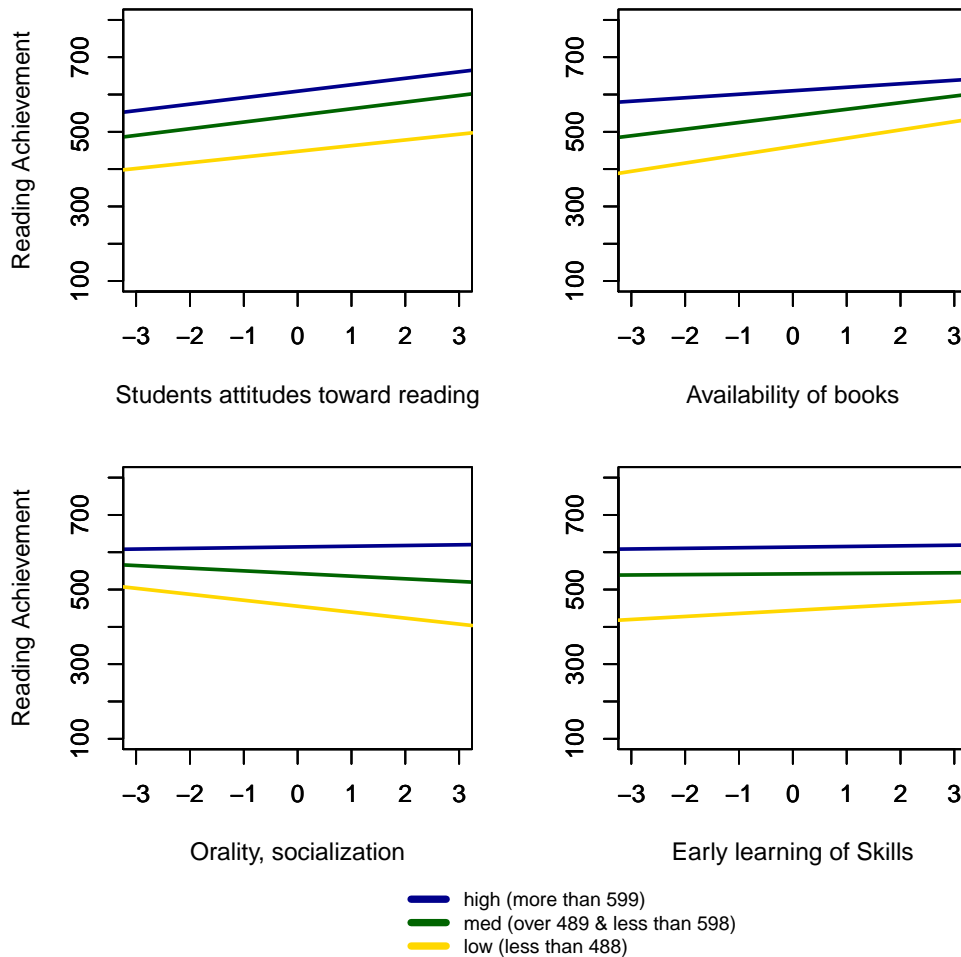
Now, the goal is to discover which factors can vary across schools significantly. Figure 6.2, represents different regression equations for the most determinant variables. To underline possible differences, score averages for each school were calculated using 2006 sample, then linear regressions were calculated for the 95% Quantile (high), the 5% Quantile (low), and the 90% between them (medium), using different variables as determinants.

As the figure shows, the different slopes are not as great as it could be expected. In general there are small differences from high average to medium, being almost non–existent in the case of *students attitudes* and *early learning*. In other words, if the average of the school is high or medium, the effect of these factors will not vary.

The main changes are focused on the low schools average. *Orality* seems to gather most of the variation from low average slope, that is, a high presence of this factor

6.2. Hierarchical Models

Figure 6.2: Variation of the effect of determinant factors across schools of high, medium and low average



will have a stronger effect on students from schools with a low average than on students from schools with high average, being the value of the variable alike. Moreover, students from schools with a high average will not be affected by this variable, since the slope is almost parallel to the determinant. The same situation was found among students from high and medium school averages in relation to *early learning*.

In addition, the figure shows that the positive effect of *students attitudes* is almost equal across different school averages. Similarly, the *availability of books* positively affects all school means, but its effects seems to be stronger for students from low average schools.

Finally, models including these possible random effects were tested; however, there was not a significant improvement of explicative power, not for fixed effect or the variance component. The reason is probably the lack of real difference among slopes, since the few changes that were presented in figure 6.2 represented the 5% more extreme percents of the school average, if the graphic had represented a wider range, such as the 25% percent, the variation among slopes would have been even weaker. In general, it can be said that the variables affected similarly the sample, and this is why it was preferred to keep the simplest structure as final model.

6.2.4.c Countries, applying models to France, USA and Russian samples

The last question left to be reviewed, deals with the relation of intraclass correlation and the country effect, as was mentioned in section 6.2.1.a and shown in figure 6.1. The intra-school correlation is very different from country to country, which leads one to ask what could be the explicability of the models if it is applied in specific countries.

The final model showed that, even controlling home and school determinants, variation between schools remains very high. This lead one to remember what was hypothesized before, that this variance was due, particularly to country-to-country variation. If this is true, and the variables can really explain school-to-school variation, in applying the model to a specific country should show a most significant reduction of this variance.

Three countries were selected to study the explicability of the models in specific educational systems, France, United States of America, and Russia. The first two are countries with similar results in both assessments, with a long educational tradition but with opposing structures. France is characterized by a highly centralized system; while the states that constituted USA, play a mayor role in organizing their local systems. In addition, Russia seemed to be an interesting case to observe closely because of its improvement from 2001 to 2006 and because the very high proportion of intraclass correlation that was detected in figure 6.1, leading to suppose that Russian schools are very diverse in their effectiveness, even if on average they were above the best results of PIRLS 2006. Tables 6.16, 6.17 and 6.18, present models for both 2001 and 2006 data from these countries in comparing a null model to that including Home and Schools factors.

6.2. Hierarchical Models

In general terms, what is remarkable about these models is the low explicability of *school factors*. Their explicability in the model for the entire sample was already low, and then they lost most of that significance, when developing these country models. In contrast, some of the Home factors increase their parameter estimated, but these values are diverse, thus it is necessary to describe them separately. A last general remark is the bigger explicability of the models, that is, the proportion of variance explained is higher to that of the general model, but again it is better to describe that power in each country separately, because of the different proportions that were obtained.

France In first place, the null models in table 6.16, confirms that France has a low intra-school correlation if compared to the rest of the sample, this proportion was equivalent in both samples. Because of this low amount, the decrease of this correlation related to Home and School factors was also small. As a result, the final French model indicated that the degree of dependence among observations within schools with similar parameters for home and schools is only 12%. In other words, if home and school factors are controlled the school in which a student is enrolled only account for a minimal part of his/her achievement. French schools are more similar between them than the international PIRLS average.

Concerning *home* factors, the estimated parameters for *availability of books and orality* are similar to those of the international sample, in contrast, the parameter estimated for *home resources* is lower, which means that it is less important in France than in the international average. On the contrary, the parameter estimated for *informative reading* was some points more negative than the average. This last result can be related to the position of France in the international rank, because the score of *informative reading* is higher than literary score (as shown in tables 5.2 and 5.3). Since it is a negative factor, this informative advantage can be related to a decrease in the general results of France.

Finally, the most important factor, is *attitudes toward reading*, more important in this country than in the international sample and than in the others studied countries. Consequently, from the factors included in this study, the most important determinant of the results obtained by France is the *motivation for reading* that the students have.

In relation to *school* factors, only *expectations and wishes* is a significant deter-

Table 6.16: Models applied to French sample

Fixed Effects								
Variable	Null Model 2001		Final Model 2001		Null Model 2006		Final Model 2006	
<i>Intercept</i>	525 ***	2.6	521 ***	4.0	522 ***	2.3	516 ***	3.3
<i>Home Factors</i>								
Books at home			13.3 ***	1.3			12.1 ***	1.1
Resources			3.9 *	2.0			3.3 **	1.6
Oral social			-11.7 ***	1.6			-9.2 ***	1.3
Inform. read			-4.3 ***	1.4			-8.1 ***	1.1
Attitudes			30.1 ***	1.4			26.5 ***	1.2
<i>School Factors</i>								
Var. Evaluation			n.s.				n.s.	
Expect. wishes			7.9 ***	3.3			9.3 ***	2.2
Emph. Strateg.			n.s.				n.s.	
Var. Instruction			n.s.				n.s.	
Early lear skills			n.s.				n.s.	
Variety of books			n.s.				n.s.	
Variance components								
Between school (Level 2)	775	118.0	394	80.3	746	97.7	344	60.8
Prop. Explain			0.49				0.54	
ICC	0.18		0.13		0.19		0.12	
Within school (Level 1)	3,622	87.9	2,623	82.3	3,204	69.6	2,432	67.6
Prop. Explain			0.28				0.24	
-2LogL	39,273		23,144				29,183	
Δ (1,240,692)			16,129	59%	48,355		19,172	60%
observations	3,538		2,148		4,404		2,728	

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

minant, this reminds of the connection between *motivation* and *wishes* that was supposed to exist. In this case, the parameter estimated is twice the estimation for the international average. This implies that French reading achievement in PIRLS is mostly determined by subjective factors.

Finally, regarding between school variance, the French model fit to explain a larger proportion than the international model, particularly in 2006 where it surpassed the barrier of 50%. Within school variance was also better explained by this model

6.2. Hierarchical Models

but the difference was less important than at school level. For the other countries, the proportion of variance explained at this level will be lower; being that France is the country where the model fit to explain the larger proportion of variance between students from schools of the same average.

United States of America As was verified in figure 6.1, in 2006, United States obtained an intraclass correlation lower than the international but higher than France or several other countries. Moreover, table 6.17 indicated that there was a decrease of this coefficient from 2001 to 2006. The procedures of this analysis do not provide clues about possible reasons for this change, but it could be related to the enlargement of USA sample, because the number of observations has increased in a thousand observations. In addition, the correlation explained by the *home* and *school* factors it mostly stable, in both cases is close to a 10%.

In contrast, both final models obtained similar proportions of variance explained, at level 1, from student-to-student, is similar to the international coefficient; at level 2, between schools, 60% of the achievement variation from school-to-school is explained by the factors included in the model. This last proportion represents the major explicability obtained in this research.

Despite the fact that this is a very positive finding, it is necessary to question the pertinence of these factors in relation to the rest of the sample. As was discussed earlier, research about reading learning is developed mostly in English, this has proved to be a bias since English has a very particular orthography; similarly, taking into account this explicability above the average, it is valid to ask if the factors considered by PIRLS are not mostly related to Anglophones educational systems. In other words, this 60% proves that the factors considered on the questionnaires are more related to North American reality than to the rest of the countries taking part of PIRLS sample.

Two factors are keys in explaining the achievement of United States: *home educational resources* and *expectation and wishes*. The most important finding in the model is the overwhelming importance of *home resources* in explaining USA achievement, twice the international estimation and stable in both samples. In addition, like in the French model, *expectation and wishes* are the only significant school factor, but the parameter estimation indicates that this determinant is much more important here than in all the other models (the international model,

Table 6.17: Models applied to United States sample

Fixed Effects								
Variable	Null Model 2001		Final Model 2001		Null Model 2006		Final Model 2006	
<i>Intercept</i>	546 ***	3.8	535 ***	5.1	538 ***	2.7	530 ***	3.0
<i>Home Factors</i>								
Books at home			6.4 ***	1.3			4.5 ***	1.0
Resources			18.3 ***	1.7			17.4 ***	1.2
Oral social			-10.8 ***	1.5			-17.1 ***	1.2
Inform. read			-7.9 ***	1.3			-7.0 ***	1.1
Attitudes			19.3 ***	1.1			20.2 ***	0.9
<i>School Factors</i>								
Var. Evaluation			n.s.				n.s.	
Expect. wishes			15.4 ***	2.5			12.4 ***	2.1
Emph. Strateg.			n.s.				n.s.	
Var. Instruction			n.s.				n.s.	
Early lear skills			n.s.				4.6 **	2.1
Variety of books			n.s.				n.s.	
Variance components								
Between school (Level 2)	2,327	272.1	891	126.1	1,205	143.4	464	68.9
Prop. Explain			0.62				0.62	
ICC	0.36		0.21		0.24		0.14	
Within school (Level 1)	4,191	98.9	3,328	91.0	3,747	74.9	2,843	67.4
Prop. Explain			0.21				0.24	
-2LogL	42,505		31,275		57,845		40,528	
Δ (1,240,692)			11,230	74%			17,317	70%
observations	3,763		2,832		5,190		3,733	

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

the French and also the Russian models).

The positive influence of *attitudes toward reading* is similar to the international sample. So was the negative influence of *orality* in 2001, while in 2006 it is some points more important. *Informative reading* was some points higher than the international model but not by too many. Finally, the *availability of books* was less important in United States than in the international sample.

Russian Federation Russia was selected for this analysis because of the improvement of its reading achievement from 2001 to 2006 and because of its high proportion of intraclass correlation. This last point indicates that school effectiveness is more diverse in Russia than in France or United States of America. In addition, the model shows that three *schools* factors are more determinant in Russia than in the rest of the sample. However, they were not constant in time; there were changes from 2001 to 2006. Since reading achievement in Russia has improved in this last assessment, the changes can be seen as positives.

Among these factors, there was a negative incidence of *variety in evaluation* in 2001, that was 3 times bigger than the parameter estimated in the international sample. Since this factor became non significant in 2006, it can be inferred that some successful changes in relation to evaluation strategies must have been undertaken by the system.

On the contrary, *expectations and wishes* played no role in 2001, while in the 2006 model they are positively related to reading achievement, its value is three times over the international parameter and similar to the parameter in the French model. As before, it can be also concluded that the subjective concern about learning manifest by this variable is a positive property of educational systems. Similarly, *variety in instruction* obtained a significant estimation only in 2006, moreover, this is the only country–case in which this factor is significant, its estimated parameter is two times the international parameter. In contrast, two factors that lost its validity in the second assessment, the positive estimation of *emphasis in strategies* and *variety of books*, that were important determinants of 2001 achievement, they did play a role in explaining the 2006 results.

What is most remarkable about this model is the high significance of schools factors, since it was almost non-existent in the previous models. This *school* explicability is certainly related to the importance of schools chosen in Russian reading achievement, besides the general importance of selecting the good school, in Russia they are particularly determinant in relation to reading achievement.

In relation to *home* factors, the most remarkable finding is the null or very low effect of *home resource*, giving Russia the total opposite situation of that of the United States of America. Moreover, this low value can be related to the diversity in school effectiveness, since it can imply that this diversity is not a question of high or low incomes, so other possible factors that make schools different should

Table 6.18: Models applied to Russian sample

Fixed Effects								
Variable	Null Model 2001		Final Model 2001		Null Model 2006		Final Model 2006	
<i>Intercept</i>	527 ***	3.2	519 ***	7.7	563 ***	2.9	567 ***	5.2
<i>Home Factors</i>								
Books at home			3.9 ***	1.0			7.4 ***	0.9
Resources			n.s.				3.2 ***	0.9
Oral social			-6.3 ***	1.3			-10.3 ***	1.1
Inform. read			-6.1 ***	1.1			-5.5 ***	0.9
Attitudes			16.7 ***	1.0			18.7 ***	0.9
<i>School Factors</i>								
Var. Evaluation			-12.4 ***	4.4			n.s.	
Expect. wishes			n.s.				9.3 **	3.9
Emph. Strateg.			12.1 **	5.5			n.s.	
Var. Instruction			n.s.				6.6 *	3.8
Early lear skills			n.s.				n.s.	
Variety of books			10.3 ***	3.5			n.s.	
Variance components								
Between school (Level 2)	1,932	203.1	1,428	165.2	1,848	185.9	1,283	138.0
Prop. Explain			0.26				0.31	
ICC	0.50		0.45		0.45		0.40	
Within school (Level 1)	1,963	44.5	1,716	46.1	2,304	48.7	1,964	45.4
Prop. Explain			0.13				0.15	
-2LogL	43,249		30,913		50,585		41,840	
Δ (1,240,692)			12,336				8,745	
observations	4,093		2,960		4720		3,963	

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

be taken into account, such as urban/rural or public/private categories.

The low importance of material resources, is probably the reason why *availability of books* is less important than in the rest of the models. The estimated parameter of these variables increased its value in 2006, but its remains under the international average. Moreover, this average is similar for both *resources* and *books*, while in Russia the *availability of books* obtained higher values that *resources* in both models. The rest of the *home* determinants are not very different from the

international average, particularly in 2006.

Concerning variance components, the model fits to explain close to 30% of variance between schools, which is lower than the international model, and lower than both, French and USA models. In addition, the variance explained within schools is the lowest proportion, 10% under the international explicability and also lower than French and USA models. In summary, the factors explaining Russian achievement are not as well described by the modelization of this research, as it was the international sample.

The question raised in relation to the explicability of USA model can be replicated here. This model is less explicative and more irregular, consequently, there may be other factors not considered either in PIRLS, nor in this research, that fit to better explain Russian results. If this is true, in selecting the factors to be considered as possible reading determinants, PIRLS should pay more attention in local research about reading learning, not only in the characteristics of the educational system, since determining factors seems to vary from one country to another.

Conclusions

Throughout this work, there have been many questions asked about language and reading, not all of them have been answered, in some cases, the answers have not been found, in other cases the answers did not match with what was expected. However, the act of asking these questions is the essential for the development of knowledge on this subject. No question or answer, may be a priori discarded.

This work was started talking about *literariness*, the fundamental question developed by Russian formalist about the essence of texts. Now, as many others studies have done before, it have been proved the role played by external factors in reading, and consequently in texts. This is the way in which the idea of text as an *effect* is explained. Reading is not only an instrument but a key element of texts, which, like a musical score, only finds its sense in performing.

Obviously, this information is not new, on the contrary is has been the subject of consistent research for the last 40 years. The conclusions concerning this particular research refers to more specific facts. The intention of this dissertation has never been to go beyond its own boundaries, which are the three pillars mentioned in the introduction: *language, reading and PIRLS assessment* (see [1.3](#)). Consequently, all conclusions that could be made about language and reading are only valid in describing PIRLS, and vice versa, all conclusions about PIRLS are only valid in relation to language and reading, not to other cognitive process.

In order to summarize the information that has been gathered and the findings of this investigation, two main lines can be identified: the results concerning the role of languages, and the findings about determinants of reading achievement.

Answers to the hypotheses

THE LANGUAGES OF LEARNING DO NOT INFLUENCE READING AT THIS STAGE OF ITS DEVELOPMENT

There are differences among the languages; the most evident case is the many particularities of English. On one hand, the literature review proved that most of the studies about reading and languages take English not only as the language of writing but also as the focus for the experiments. On the other hand, the vast irregularity of this language was also described, putting emphasis in the consequences for reading learning. English children learn to read slower and confronting more difficulties than children using other learning languages. In consequence, the research must be aware of this fact before drawing conclusions about reading in general, from studies about English in particular. Taking this idea into account, our experiments have separated English from the rest of the languages in a special category. The results revealed that even if they had a better score, the hierarchical models showed no advantage or disadvantage related to the use of English.

Two linguistic categories were developed in this research. The first was based on common cultural history of languages, starting from the philological notion of *linguistic family*. The families present in PIRLS assessment were identified, described, and defined as properties of each student and country that take part in the study. The second category was based on their phonological and orthographical properties; it was developed taking into account the degree of regularity of orthographies in the task of translating the language phonology into writing. This offers a framework model to categorize languages in accord to this adequacy, as it was mentioned in section [2.2.2](#).

The first category has shown more significance than the second. Linguistic families have had the possibility of being part of the preliminary analysis, because the classification terms were already known. There, at country level, links between certain families and aspects of reading were identified; for example, the case of English with *high processing* or Slavic with *literary reading*. The results presented here were also in accord with several previous researches that also underlined these tendencies. However, there was not possible to identify traces of these relations in the modelling, not among students or schools. The models that explained specific aspects of reading were not significantly different from those explaining

the total score. This is the reason why, it is preferable to separate the general tendencies expressed by countries behaviours and the reality of student in relation to these linguistic categories.

Concerning the concept of orthographic depth, there was copious bibliography proving that at earlier stages of reading, the orthography of a language plays a determinant role in the reading achievement of children. Moreover, a possible footprint of this initial influence was supposed to be present in later reading. But, it was not the case in this research, the values representing the orthographic complexity were clearly different, but they did not determine reading achievement. Concerning orthographic depth, the most opposing result is related to English speakers.

Our literary review underlined the numerous disadvantage of English orthography in comparison with other less opaque languages; experiments proved that learning to read was a slower and more difficult process among English speakers, because of the many irregularities of the language. Consequently, if the orthography would determine PIRLS results, a disadvantaged average could be expected. On the contrary, English average was better than that of transparent orthographies, being only surpassed by the rest of deep languages in 2006 sample (see 6.7). This result can be explained in relation to the problematic that originally introduced the notion of orthographic depth. In section 2.2.2.a, it was mentioned that *dual route* theory, affirmed that the *style* of decoding can vary in time, experts readers can depend less in phonetic and more in word-level mechanisms, moreover this change can be not a question of simple strategic decision but an inherent property of the orthography of the language. Therefore, speakers of transparent orthographies, which depend only in phonologic decoding, can be in a disadvantage when developing more complex task as accessing to meaning, English speakers that from the beginning of reading acquisition had deal with complex structures can be better prepared to access to meaning, their advantage in high order processes of comprehension, can be related to this fact too.

In summary, it was mentioned in section 2.2.1.a that language are dissimilar, the result obtained in both preliminary and hierarchical analysis confirms that assumption. Using two categories, linguistic family and orthographic depth, the result were in both cases unlike parameters estimated for each component of the categories. That is, the estimations for Germanic family were different from those of Latin family, and the estimations for transparent languages were different from

those of the opaque. The result confirmed that these two are valid categories to classify languages, because there are represented in the sample by different scores, and have estimated parameter that are clearly different.

Concerning the role that these categories play in explaining reading achievement, the categories were not able to explain score variations, either between or within schools. This result has negative and positive consequences. The negative aspect is that a possible source of explicability has been lost. To be able to prove that language was a source of variance would have allowed this research to augment the explicability of the models, introducing a new factor to the debate about reading learning. But, on the other hand, languages are already part of that debate. Much of the debate concerning international comparisons is devoted to translation issues and cultural diversity not been taken into account, as was discussed in section 3.3. This investigation conclude that the linguistic and cultural differences do exist, but also conclude that they do not determine PIRLS reading achievement.

The positive aspect is that PIRLS, being an international comparison, where the translations were made starting from English to other languages, is not affected by this in the hierarchical models here presented. Conclusions concerning reading in this interlinguistic–intercultural context can be extracted without apprehension of linguistic bias. With reference to the hierarchical model presented here, home and school factor are determinants of reading achievement, while language is not.

In section 2.2.2, several approaches to orthography and its relation with phonology were presented. The decision of using orthographic depth as criteria to classify languages was a theoretical choice, explained in the mentioned section. Even if the classification into linguistic families is a category already classical in linguistic, it was also a theoretical choice to incorporate it in this research. Consequently it is important to emphasize the dependency of all conclusions in that choice. Nevertheless, using other criteria based of language could not be more helpful. It is very likely, that the same distance between country and individual would show up again, as two very different categories were used here without success. The use of two criteria in searching determinacy is an argument to believe that other classifications could not better explain reading achievement.

LANGUAGES, HAVE A DIFFERENT INCIDENCE CONCERNING THE ASPECTS AND COMPONENTS OF THE READING PROCESS, BUT ONLY FROM A WIDE-RANGING POINT OF VIEW

Concerning multidimensionality of reading, the research methods used here, did not allow the observation of significant differences between aspects of reading among students, because all the hierarchical models were equivalent. On the contrary, the representation made of countries did shown significant differences. It was possible not only to connect certain aspects to certain countries, but also to discover factors that determine those aspects. Linear models were developed that fit to explain difference between aspects of reading including home and school factors and also linguistic determinants. At country level, there are factors that play a different role depending on dimensions of reading. Consequently, there are differences between informative and literary reading, and also between low and high order processing but only if a very general point of view is taken, for example, using countries as unity of measurement. Comparing both assessments, most of the countries had differences favorable to one aspect; in addition, these differences were constant in time.

Vrignaud (2006) emphasized the high correlation between the three dimensions of reading literacy considered by PISA ($> .89$), thus he questions the validity of considering them as different things: “On peut donc légitimement s’interroger sur le bien fondé de distinguer trois échelles puisqu’un modèle comprenant une seule échelle rend parfaitement compte des données” (p. 37). Equally, tables 6.4 and 6.5 showed that the correlation between aspects of reading was not lower than $> .94$, from this point of view those dimensions are measuring the same thing. Consequently, it is important to underline that these dimensions are a product of the theoretical framework chosen by PIRLS, many are the possibilities of understanding multidimensionality. Consequently it is possible to think about other choices, like putting more emphasis on other purposes of reading, like changing the focus from purposes of reading to purposes of writing, deriving categories from a perspective based of socialization of texts instead of comprehension, or like its reception. In a more experimental path, categories can be conceived to increase their differences and to test this property of texts in order to discover determinant factors with more accuracy. An experiment can be conceived, in which reading achievement is evaluated in order to discover the aspects that constitute it. Aspect

to be incorporated in the analysis could be chosen for been particularly different, such as superficial understanding of information and evaluation of the proposals.

LANGUAGES, AS A FACTOR THAT INFLUENCES READING DEVELOPMENT LOST THEY RELEVANCE THROUGH TIME

How different moments of reading learning were characterized by different task and purposes (see 1.2) was described. As reading determinant, orthographic depth lacks of significance, which can be understood as evidence to confirm the inner change during learning process. The fact that a factor that was a key determinant of reading learning in earlier stages is now without significance in explaining achievement, can be related to the evolution of reading development over time. It was not confirmed the presences of a developmental *footprint* in the results, the supposed trace that the earlier difference can made was not present in the models. These results confirm the difference between decoding and comprehension, which was hypothesized.

This is the only possible answer to the distance between the experiment reported by Goswami et al. (1998) (see 2.2.2.b) and their possible later results. There, Venezuelan children were capable of accomplish the same reading task better that their English and French peers, but this advantage do not persist in time. Even if Venezuela have not take part on PIRLS or other international studies, other similar countries of the region have done it, and the results are not comparable to those of English readers. Despite of the fact of being one of the easier languages to learn, Spanish is certainly not associated with advantages in reading comprehension and achievement.

In addition, there was no difference in the results concerning aspects of reading, the models indicates that the role played by orthographic depth is equivalent across all the presented dimensions of the reading process. Nevertheless, since the results presented here depend on PIRLS theoretical structure, other experiments are needed. In particular, it will be necessary to develop experiment analogous of those applied in beginner readers, using non-words or pseudo-words but taking older children as subject of the experiments. Moreover, comparable test can be made, or a longitudinal study with the same subjects.

Findings about home and school factors concerning PIRLS reading achievement

In the last part of the hypotheses exposition, it was supposed that there could be contextual factors that determine reading together with language. In contrast, the models proved that there are home and school factors that are determinants of reading without the intervention of languages. That is, to drop language out of the model was not beneficial or detrimental to explicability. In other word, there is a set of environmental variables explaining reading achievement by themselves with no relation to languages. That is the reason why more attention must be pay to the conclusions concerning these findings.

Looking at these factors, the conclusion is not such as positive as implied before. The general models 6.12 and 6.13 indicated a major importance of home factors instead of scholar factors. Supposed determinants, such as curriculum, teaching strategies, school environment, or teachers' formation, had low or even no capacity of explaining reading achievement. This result is negative if we take into account that school variables can be controlled by means of curriculum or educational policy. In contrast, home factors imply changes in the environment of each child in order to obtain a behavioral variation, which is more difficult to control.

A positive result of the models is that the variables obtained, in each case, regular results. That is, their explicative power was constant from the 2001 assessment to the 2006, and among the different reading aspects. Positive and negative factors can be identified; the more remarkable of them will be mentioned in the next paragraphs.

During the preliminary analysis, and in the hierarchical models, it was constant the presence of *economic factors*, even if, at the beginning it was out of the scope of this research to take into account this element, it forced itself in the analysis and the results of this study. Several variables were mentioned during preliminary analysis, such as the proportion of affluent homes, and the availability of learning materials at school and at home. The index HER (our variation from *home economic resources*) was one of the most significant determinant of PIRLS reading achievement. However, the models developed with data from specific countries showed that the role played by this factor can vary importantly depending on the educational system taken into account. A study using PIRLS and other datasets,

and focused on economic determinants should be necessary to clarify this point.

An interesting comparison can be the results of [Rocher \(2008\)](#) study about PISA 2003, where a variable called *origine socio-économique (ESCS)* was noticed to explain 19.6% of French score variance, and also a 19.0% of United States score variance (p. 68). In our 2006 PIRLS sample, if a linear regression is used to establish the explicability of *home economic resources* without adding other determinants, the proportion of variance explained for the French sample is still very low (Adj R^2 .03), on the contrary, in United States, this variables explains four time more of the variance Adj R^2 .12; internationally, its significance is Adj R^2 .08. Even if it is not the same variable and not the same sample, this difference can be the starting point to infer that the importance of economic factor can be constant in United State while it increases across time in France. This increased explicability prevent us from underestimate the role played by economic determinants in the achievement of French students (for a comprehensive analysis of economical determinants in french PISA sample see [Duru-Bellat, Mons, & Suchaut \(2004, 2003\)](#)). Obviously, ours are only very general ideas about the potentiality of international comparisons taking as starting point determinants of the supra-national sample, to later describe how they vary across countries.

Availability of books over the international average is related to an improvement in reading achievement that is constant over time. The particular interest of this individual variable is its lack of subjectivity. In opposition to attitudes and wishes, this is a variable that can be controlled by means of national policies more easily. [Figure 6.2](#) graphics clearly the importance of this variable, all students improved their result in accord to the amount of books available at home. Those having an average achievement and a lot of books reached the score of those being above the average but having only few books. In addition, the improvement was particularly remarkable for those being under the average. *Books availability*, together with *attitudes* are the two more important determinants of reading achievement identified by this research.

Oral socialization is a negative element, but it is necessary to be aware of the relative value of this factor. It represents a significant collection of variables related to social activities, particularly oral interaction. [Figure 6.2](#) showed an important property of this factor, its explicative power is inversely proportional to the score. In other words, orality affects more the weaker readers, while the score of those above the average did not vary according to orality presence. To infer valid con-

clusions concerning this factor, more specific experiments and improved variables are needed. In contrast, this is a first step to reconsider the relation of this kind of activities and reading learning.

Early learning of reading skills was one of the factors that repeatedly appear in preliminary analysis. Then, it is the more significant school factor, even if its explicability is only the fifth higher parameter, under four other individual factors. It is interesting that an element, as important in cognitive terms as early learning, was not a main determinant of the achievement. This result support the fact that there are the more individual and behavioral factors that plays a main role in explain PIRLS results, instead of scholar aspects.

A final factor that must be underlined here is the major role played by *Attitudes toward reading*. It was a significant factor during the preliminary analysis and it increases its significance in relation to total reading achievement. This is the key element that confirms that PIRLS reading achievement is more related to subjective aspects than to objective aspects. The regularity of its influence is presented in figure 6.2.

Finally, there are variables that need a deeper and more specific study, because there were signals that showed that they had a relation with reading achievement, but it was not possible to make a deeper analysis by means of this research. There variables are scholar time, individuality, use of vocabulary, writing, and second language use.

This last is, in the context of this research, a particularly interesting subject because is the only linguistic factor that seems to play a role in reading. During the preliminary analyses a negative connection between score and second language use was identified. Later, the hierarchical model also showed that relation even if the data did not allow the inclusion of this variable in final models. It is important to remember that the models considered language as an attribute of the schools instead of individuals. In section 6.2.3.b it was mentioned that a model including that variable is a much better fit to explain schools variation (from 14% to 28%) which is a major improvement. Moreover, the estimated parameter was $-21.73(p < 0.01)$, which could put this variable among the higher of the model. In consequence, this is a determinant that certainly needs a deeper study, these results would need to clearly separate second language use from other determinant with which it could be interacting, such as resources, aspects of reading, or

6.2. Hierarchical Models

writing, for example. In addition, it must be complemented with a best study of the role played by second language in each of the countries studied.

This last point leads us to the last main conclusion of this research. Within country variation is a key element that must be taken into account to a better understanding of PIRLS results. Figure 6.1 showed how different could be the educational reality from one country to another, particularly in relation to the role played by schools. The simple score ranking are the element on PIRLS report that have more impact on public opinion, however, these general reports of achievement do not underline local realities. To put emphasis on identifying determinant factors in each country, instead of score ranking, is a key strategy to a better use of this international comparison.

The French, USA and Russian models give more details about these differences. These models proved that the same variable, being an important determinant of general reading achievement, can play a very different role on each country. Educational resources was, for example, a main determinant of USA score, indicating that it is very different the reading achievement of those having no resources in comparison to those having high availability of resources. In contrast, the influence of this factor in France and Russia was very low, where the most important determinant was *attitudes toward reading*. In the United States the parameter representing this last factor was similar to that representing resources.

However, it is out of the scope of this research to define how well PIRLS reading achievement represent the general reading ability of the students that take part into the test. The presences of environmental and scholar determinants that explain part of the variation can be taken as a prove of the positive value of this achievement. In other words, the fact of being determined by environmental factors means that the score can be enhanced by improving these conditions, which will certainly have an impact in reading ability. In summary, these three country models give a first image of what could be a comparative study of reading determinants. It is possible to develop equivalent models for each of the countries of the sample and compare the role that each determinant plays from this perspective. The results will be certainly an interesting proposal to improve reading achievement in these educational systems. That kind of research could also establish another way of looking at the results of this international assessment, other than the broad perspective that characterizes its reports.

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Appendix A

PIRLS variables derived from Questionnaires

A.1 2001 questionnaires

A.1.1 Pearson Correlation Coefficients with TEX 2001

Table A.1: TEX 2001 and the Student Questionnaire

Name and description of the variable	ALL	TEX
AFR3_high(Percentage of students declaring to frequently answer questions aloud after read something in class)	-.46***	-.31*
AFR3_low (Percentage of students declaring to not answer questions aloud after read something in class)	.39***	.32*
AFR4_high (Percentage of students declaring to talk frequently with other students about what they have read after read something in class)	-.63***	-.29*
AFR4_low (Percentage of students declaring to not talk with other students about what they have read after read something in class)	.58***	.34**
TOC2 (Above the international average of students declaring to listen to someone at home reading frequently)	-.75***	-.36**
noTOC2 (Above the international average of students who declared to never listen to someone at home reading)	.75***	.36**
TOC3_low (Percentage of students declaring to not talk with friends about reading outside of school)	.64***	.33**
noTOC3 (Above the international average of students who declared to never talk with friends about reading outside of school)	.59***	.29*
ROC2 (Above the international average of students declaring to read stories or novels frequently outside of school)	n.s.	.31*
noROC5 (Above the international average of students declaring to never read newspapers outside of school)	n.s.	.36**
noTIC2 (Above the international average of students declaring to never read aloud to the whole class in school)	.44***	.32**
noTIC3 (Above the international average of students declaring to never read aloud to a small group of students in class)	.64***	.29*
TIC5_high (Percentage of students declaring to frequently follow along while other students read aloud in school)	n.s.	-.41***

n=36, except if indicated

Appendix A. PIRLS variables derived from Questionnaires

TIC5_low (Percentage of students declaring to never follow along while other students read aloud in school)	n.s.	.34**
TIC5 (Above the international average of students declaring to follow along while other students read aloud in school)	n.s.	-.40***
TIC6_high (Percentage of students declaring to frequently read books chosen by themselves in school)	.41***	.35**
RAB2_low (Percentage of students declaring to disagree with the statement "I do not read as well as other students in my class")	n.s.	.30*
noRAB2 (Above the international average of students declaring to disagree with the statement "I do not read as well as other students in my class")	n.s.	.38**
LAN2_high (n=32) (Percentage of students declaring have learned to speak a second language before beginning school)	-.45***	-.31*
LANH_ALW (Percentage of students declaring to speak always the language of test at home)	.55***	.35**
LANH_SOM (Percentage of students declaring to speak only sometimes the language of test at home)	-.51***	-.31*
LANH_NEV (Percentage of students declaring to never speak the language of test at home)	-.52***	-.35**
BOOK_FEW (Percentage of students having less than 10 books at home)	n.s.	-.30*
BOOK_LOT (Percentage of students having more than 100 books at home)	n.s.	.39**
FEWBOOK (Above the international average of students having less than 10 books at home)	n.s.	-.40***
GPS_high (High index of home educational resources)	.72***	.37**
GPS_low (Low index of home educational resources)	-.72***	-.37**
GPS (Above the international average of high home educational resources)	.66***	.34**
noGPS (Above the international average of low home educational resources)	-.66***	-.34**
SATR_low (Low index of student attitude to reading)	.52***	.48***
noSATR (Above the international average of low student attitude to reading)	.57***	.38**
SELF_high (High index of student reading self concept)	.39**	.37**
SELF (Above the international average of high student reading self concept)	n.s.	.37**

A.1. 2001 questionnaires

Table A.2: TEX 2001 and the Teacher Questionnaire

Name and description of the variable	ALL	TEX
ATBGRINH (Percentage of time spend on reading instruction in a week. regardless of whether or not it is formally scheduled)	n.s.	.32*
RINH (Above the international average of time spend on reading instruction in a week. regardless of whether or not it is formally scheduled)	n.s.	.30*
FRIN (Above the international average of time explicitly for formal reading instruction designed to develop or enhance reading comprehension skills)	n.s.	.37**
ORG1_high (Percentage of teachers declaring to frequently teach reading as a whole-class activity)	n.s.	-.35**
ORG1 (Above the international average of frequently teach reading as a whole-class activity)	n.s.	-.34**
noRES1 (Above the international average of teachers declaring to not use textbooks or reading series)	n.s.	.31*
RES3_high (Percentage of teachers declaring to frequently teach reading using children's newspapers and/or magazines)	-.52***	-.41***
RES3_low (Percentage of teachers declaring to never teach reading using children's newspapers and/or magazines)	n.s.	.29*
RES3 (Above the international average of frequently teach reading using children's newspapers and/or magazines)	-.41***	-.45***
RES4_high (Percentage of teachers declaring to frequently teach reading using computer software)	n.s.	.31*
RES4_low (Percentage of teachers declaring to never teach reading using computer software)	-.35**	-.41***
noRES4 (Above the international average of never teach reading using computer software)	n.s.	-.41***
noRES5 (Above the international average of never teach reading using on-line" reading materials (web pages))	-.36**	-.31*
RES6_high (Percentage of teachers declaring to frequently teach reading using a variety of children's books)	.38**	.43***
RES6_low (Percentage of teachers declaring to never teach using a variety of children's books)	-.40**	-.33**
RES6 (Above the international average of frequently teaching using a variety of children's books)	.39**	.40**

Appendix A. PIRLS variables derived from Questionnaires

RES7_high (Percentage of teachers declaring to frequently teach using materials from other subjects)	n.s.	.29*
RES7_low (Percentage of teachers declaring to never teach using materials from other subjects)	n.s.	-.32**
TXT3_high (Percentage of teachers declaring to frequently have the students read longer books with chapters (fiction))	.41***	.45***
TXT3_low (Percentage of teachers declaring to never have the students read longer books with chapters (fiction))	-.48***	-.38**
TXT3 (Above the international average of frequently have the students read longer books with chapters (fiction))	.39**	.41*
noTXT3 (Above the international average of never have the students read longer books with chapters (fiction))	-.44***	-.28*
TXT4_high (Percentage of teachers declaring to frequently have the students read poems)	n.s.	-.36**
TXT6_low (Percentage of teachers declaring to never have the students read descriptions and explanations about things, people, or events (non-fiction))	n.s.	-.35**
noTXT6 (Above the international average of never have the students read descriptions and explanations about things, people, or events (non-fiction))	n.s.	-.47***
TXT8_low (Percentage of teachers declaring to never have the students read charts, diagrams, graphs)	n.s.	-.35**
RA1_low (Percentage of teachers declaring to never read aloud to the class)	.34**	-.35**
RA1 (Above the international average of frequently read aloud to the class)	-.29*	.43***
noRA1 (Above the international average of never read aloud to the class)	.36**	-.45***
RA2_high (Percentage of teachers declaring to frequently ask students to read aloud to the whole class)	n.s.	-.37**
RA2 (Above the international average of frequently ask students to read aloud to the whole class)	-.36**	-.31*
RA6_high (Percentage of teachers declaring to frequently give students time to read books of their own choosing)	.32**	.31*
RA9_high (Percentage of teachers declaring to frequently teach students new vocabulary systematically)	n.s.	-.44***

A.1. 2001 questionnaires

RA9_low (Percentage of teachers declaring to never teach students new vocabulary systematically)	n.s.	.30*
RA9 (Above the international average of frequently teach students new vocabulary systematically)	n.s.	-.40**
RA10_high (Percentage of teachers declaring to frequently help students understand new vocabulary in texts they are reading)	n.s.	-.30*
PRO2_high (Percentage of teachers declaring to place major emphasis on classroom tests to monitor students' progress in reading)	-.36**	-.32**
PRO2_low (Percentage of teachers declaring to place little or not emphasis on classroom tests to monitor students' progress in reading)	n.s.	.38**
noPRO2 (Above the international average of teachers declaring to place little or not emphasis on classroom tests to monitor students' progress in reading)	.33**	.43***
PRO3 (Above the international average of teachers declaring to place major emphasis on national or regional examinations to monitor students' progress in reading)	n.s.	-.30*
PFM6_high (Percentage of teachers declaring to frequently use oral questioning of students to assess students' performance in reading)	-.31*	-.32*
GOOD_high (Percentage of teachers expecting most of their students to grow up to be good readers)	n.s.	.61***
GOOD_low (Percentage of teachers expecting few of their students to grow up to be good readers)	n.s.	-.53***
GOOD (Above the international average of teachers expecting most of their students to grow up to be good readers)	n.s.	.43***
noGOOD (Above the international average of teachers expecting few of their students to grow up to be good readers)	n.s.	-.48***

Table A.3: TEX 2001 and the School Questionnaire

PSS1_high (Above the international average of school where less than 10% of students come from economically disadvantaged homes)	.31*	.34**
noPSS2 (Above the international average of school where more than 50% of students come from economically affluent homes)	.47***	.30*
PGS1_high (Percentage of schools where less than 10% of students in grades 1 -4 do not speak the language of the test as their first language)	.33**	.29*
PGS1_low (Percentage of schools where more than 50% of students do not speak the language of the test as their first language)	-.38**	-.35**
PGS3_high (n=35) (Percentage of schools where less than 10% of students receive remedial reading instruction in the language of test)	n.s.	-.32*
SABI* (Above the international average of schools where the fourth-grade classes are formed on the basis of students' ability)	n.s.	-.34**
INF1 (Above the international average of schools where the national or regional standards for teaching and learning have a lot of influence on curriculum or the way that teachers instruct students)	.31*	.31*
INF4 (Above the international average of schools where parents' wishes have a lot of influence on curriculum or the way that teachers instruct students)	-.33**	-.36**
INF5_low (Percentage of schools where students' wishes have little or no influence on curriculum or the way that teachers instruct students)	.33**	.34**
noINF5 (Above the international average of schools where students' wishes have little or no influence on curriculum or the way that teachers instruct students)	n.s.	.29*
RWS_high (Percentage of schools having its own written statement of reading curriculum to be taught in the school)	.29*	.36**
RWS (Above the international average of schools having its own written statement of reading curriculum to be taught in the school)	.30*	.34**
RSP_high (Percentage of schools having school-based programs for teachers geared towards the improvement of reading instruction)	n.s.	.34**

A.1. 2001 questionnaires

noMA1 (Above the international average of schools where reading series (basal readers, graded readers) are not used in reading instructional programs)	-.41***	-.28*
MA2_high (Percentage of schools where use textbooks are basic for instruction in reading instructional program)	n.s.	-.29*
MA4_low (Percentage of schools where materials from different curricular areas are not used in reading instructional programs)	-.49***	-.30*
noMA4 (Above the international average of schools where materials from different curricular areas are not used in reading instructional programs)	-.48***	-.34**
MA5 (Above the international average of schools where children's newspaper and/or magazines are basic for instruction in reading instructional programs)	-.49***	-.33**
ME1_l (Above the international average of schools where knowing letters of the alphabet first receive a major emphasis before fourth grade)	n.s.	.33**
ME2_l (Above the international average of schools where knowing letter-sound relationships first receive a major emphasis before fourth grade)	n.s.	.33**
ME10_equal (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis in fourth grade)	n.s.	-.28*
ME11_less (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis before fourth grade)	.52***	.34**
ME11_equal (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis in fourth grade)	-.32*	-.33**
ME11_e (Above the international average of schools where making generalizations and inferences based on text first receive a major emphasis in fourth grade)	n.s.	-.28*
ME12_l (Above the international average of schools where describing style and structure of text first receive a major emphasis before fourth grade)	.34**	.31*
IMPL_high (Percentage of schools where the reading instructional program is implemented for all students at the same level)	n.s.	-.29*
IMPL_low (Percentage of schools where the reading instructional program is implemented for different levels and different programs)	n.s.	.42***
noIMPL (Above the international average of schools where the reading instructional program is implemented for different levels and different programs)	n.s.	.42***
CHA1_high (Percentage of schools where teacher job satisfaction is very high)	n.s.	.53***
CHA1_low (Percentage of schools where teacher satisfaction is medium, low or very low)	n.s.	-.41***
CHA1 (Above the international average of schools where teacher satisfaction is very high)	n.s.	.46***

Appendix A. PIRLS variables derived from Questionnaires

noCHA1 (Above the international average of schools where teacher satisfaction is medium, low or very low)	n.s.	-.44***
CHA2_high (Percentage of schools where teachers' expectations for student achievement is very high)	n.s.	.39**
CHA2_low (Percentage of schools where teachers' expectations for student achievement is medium, low or very low)	n.s.	-.38**
CHA2 (Above the international average of schools where teachers' expectations for student achievement is very high)	n.s.	.39**
noCHA2 (Above the international average of schools where teachers' expectations for student achievement is medium, low or very low)	n.s.	-.35**
CHA3_high (Percentage of schools where parental support for student achievement is very high)	n.s.	.52***
CHA3_low (Percentage of schools where parental support for student achievement is medium, low or very low)	n.s.	-.51***
CHA3 (Above the international average of schools where parental support for student achievement is very high)	n.s.	.36**
noCHA3 (Above the international average of schools where parental support for student achievement is medium, low or very low)	n.s.	-.50***
CHA4_high (Percentage of schools where students' regard for school property is very high)	n.s.	.45***
CHA4_low (Percentage of schools where students' regard for school property is medium, low or very low)	n.s.	-.29*
CHA4 (Above the international average of schools where students' regard for school property is very high)	n.s.	.36**
CHA5_high (Percentage of schools where students' desire to do well is very high)	n.s.	.45***
CHA5_low (Percentage of schools where students' desire to do well is medium, low or very low)	n.s.	-.34**
CHA5 (Above the international average of schools where students' desire to do well is very high)	n.s.	.44***
noCHA5 (Above the international average of schools where students' desire to do well is medium, low or very low)	n.s.	-.48***
PAR_low (Percentage of schools where the index of home-school involvement is low)	-.40**	-.35**
CHA_high (n=34) (Percentage of schools where the index of principal's perception of school climate is high)	n.s.	.45***
CHA (Above the international average of schools where the index of principal's perception of school climate is high)	n.s.	.29*

A.1. 2001 questionnaires

A.1.2 Pearson Correlation Coefficients with COM 2001

Table A.4: COM 2001 and the Student Questionnaire

Name and description of the variable	ALL	TEX
TOC7 (Above the international average of students declaring to watch television or videos outside of school every day)	.41***	-.30*
ROC1_high (Percentage of students declaring to frequently read comic books outside of school)	-.42***	.39**
ROC1_low (Percentage of students declaring to never read comic books outside of school)	.49***	-.35**
BLIB_high (Percentage of students declaring to frequently borrow books from school or local library to read for fun)	n.s.	-.51***
BLIB_low (Percentage of students declaring to never borrow books from school or local library to read for fun)	-.33**	.55***
BLIB (Above the international average of students declaring to frequently borrow books from school or local library to read for fun)	n.s.	-.40**
noBLIB (Above the international average of students declaring to never borrow books from school or local library to read for fun)	n.s.	.53***
TVDY (Above the international average of students declaring to watch less than one hour of television or videos outside of school on a normal school day)	-.47***	.31*
TIC4 (Above the international average of students declaring to read silently on your own frequently in school)	n.s.	-.35**
TIC5_low* (Percentage of students declaring to never follow along while other students read aloud in school)	n.s.	-.35**
noTIC5 (Above the international average of students declaring to never follow along while other students read aloud in school)	n.s.	-.44***

n=34, except if indicated
 variables' names marked with an * are also correlated with TEX

Appendix A. PIRLS variables derived from Questionnaires

TIC6_high* (Percentage of students declaring to frequently read books they choose themselves in school)	.41***	-.31*
TIC6_low (Percentage of students declaring to never read books they choose themselves in school)	-.39**	.37**
noTIC6 (Above the international average of students declaring to never read books they choose themselves in school)	-.29*	.36**
RAB2_low (Above the international average of students declaring to disagree with the statement "I do not read as well as other students in my class")	n.s.	-.31*
BRN_high (Percentage of students declaring that their parents born in the country)	n.s.	.36**
BRN_low (Percentage of students declaring that their parents did not born in the country)	n.s.	-.37**
BRN (Above the international average of students declaring that their parents born in the country)	n.s.	.32*
noBRN (Above the international average of students declaring that their parents did not born in the country)	.30*	-.30*
GTIC2_high (High index of student report independent reading)	.47***	-.37**
GTIC2_low (Low index of student report independent reading)	-.55***	.32*

A.1. 2001 questionnaires

Table A.5: COM 2001 and the Teacher Questionnaire

Name and description of the variable	ALL	TEX
noTCHL (Above the international average of teachers declaring that they teach language instruction as a separate subject)	n.s.	-.30*
RTCH_low (Percentage of teachers declaring that they teach reading instruction as a separate subject)	n.s.	-.30*
noRTCH (Above the international average of teachers declaring that they teach reading instruction as a separate subject)	n.s.	-.29*
RACT_high (Percentage of teachers declaring that they have reading instruction with the students every day)	n.s.	-.32*
noRACT (Above the international average of teachers declaring that they have reading instruction with the students fewer than three days a week)	n.s.	.33*
HMW2 (Above the international average of teachers declaring that they expect students to spend half hour or less on language homework)	-.60***	.33*
ORG2_low (Percentage of teachers declaring that they never create same-ability groups during reading instruction)	n.s.	.37**
noORG2 (Above the international average of teachers that never create same-ability groups during reading instruction)	n.s.	.52***
ORG3_high (Percentage of teachers declaring that they frequently create mixed-ability groups during reading instruction)	-.29*	.32*
ORG3 (Above the international average of teachers that frequently create mixed-ability groups during reading instruction)	-.63***	.40**
RES2_low (Percentage of teachers declaring that they never use workbooks or worksheets during reading instruction)	n.s.	.37**
noRES2 (Above the international average of teachers that never use workbooks or worksheets during reading instruction)	-.34**	.65***
RES4_low* (Percentage of teachers declaring that they never use computer software during reading instruction)	-.35**	.30*
RES5_low (Percentage of teachers declaring that they never use "on-line" reading materials (web pages) during reading instruction)	-.29*	.53***
noRES5* (Above the international average of teachers that never use "on-line" reading materials (web pages) during reading instruction)	-.36**	.44***
RES6_high* (Percentage of teachers declaring that they frequently use a variety of children's books during reading instruction)	.38**	-.37**

Appendix A. PIRLS variables derived from Questionnaires

RES6_low* (Percentage of teachers declaring that they never use a variety of children's books during reading instruction)	-.40**	.29*
RES6* (Above the international average of teachers that frequently use a variety of children's books during reading instruction)	.39**	-.32*
TXT3_high* (Percentage of teachers declaring to frequently have the students read longer books with chapters (fiction))	.41***	-.30*
RA3 (Above the international average of teachers that frequently ask students to read aloud in small groups or pairs)	n.s.	-.37**
RA4_high (Percentage of teachers declaring that they frequently ask students to read silently on their own)	.44***	-.36**
RA4 (Above the international average of teachers that frequently ask students to read silently on their own)	.42***	-.31*
RA6_high* (Percentage of teachers declaring to frequently give students time to read books of their own choosing)	.32**	-.36**
RA7_low (Percentage of teachers declaring that they never model for students different reading strategies)	n.s.	.30*
RA8_high (Percentage of teachers declaring that they frequently teach students strategies for decoding sounds and words)	n.s.	-.31*
RA8_low (Percentage of teachers declaring that they never teach students strategies for decoding sounds and words)	n.s.	.41**
ASK8_high (Percentage of teachers declaring that they frequently ask the students to take a written quiz or test about what they have read)	-.59***	.39**
ASK8 (Above the international average of teachers that frequently ask the students to take a written quiz or test about what)	-.51***	.44***
noDEV1 (Above the international average of teachers that never ask students to identify the main ideas of what they have read)	n.s.	.44***
DEV3_low (Percentage of teachers declaring that they never ask students to compare what they have read with experience they have had)	n.s.	.34**
noDEV3 (Above the international average of teachers that never ask students to compare what they have read with experience they have had)	n.s.	.41**
DEV5_high (Percentage of teachers declaring that they frequently ask students to make predictions about what will happen next in the text they are reading)	n.s.	-.55***

A.1. 2001 questionnaires

DEV5_low (Percentage of teachers declaring that they never ask students to make predictions about what will happen next in the text they are reading)	n.s.	.51***
DEV5 (Above the international average of teachers that frequently ask students to make predictions about what will happen next in the text they are reading)	n.s.	-.35**
noDEV5 (Above the international average of teachers that never ask students to make predictions about what will happen next in the text they are reading)	n.s.	.45***
DEV6_high (Percentage of teachers declaring that they frequently ask students to make generalizations and draw inferences based on what they have read)	n.s.	-.31*
DEV6_low (Percentage of teachers declaring that they never ask students to make generalizations and draw inferences based on what they have read)	n.s.	.43***
DEV6 (Above the international average of teachers that frequently ask students to make generalizations and draw inferences based on what they have read)	n.s.	-.40**
noDEV6 (Above the international average of teachers that never ask students to make generalizations and draw inferences based on what they have read)	n.s.	.50***
DEV7_high (Percentage of teachers declaring that they frequently ask students to describe the style or structure of the text they have read)	n.s.	-.39**
DEV7_low (Percentage of teachers declaring that they never ask students to describe the style or structure of the text they have read)	n.s.	.46***
DEV7 (Above the international average of teachers that frequently ask students to describe the style or structure of the text they have read)	n.s.	-.29*
noDEV7 (Above the international average of teachers that never ask students to describe the style or structure of the text they have read)	n.s.	.35**
PRO5_low (Percentage of teachers declaring that they place little or no emphasis in their professional opinion to monitor students' progress in reading)	-.63***	.34**

Appendix A. PIRLS variables derived from Questionnaires

PFM4_low (Percentage of teachers declaring that they never listen to students read aloud to assess students' performance in reading)	.29*	-.30*
PFM4 (Above the international average of teachers that frequently listen to students read aloud to assess students' performance in reading)	-.45***	.45***
noPFM4 (Above the international average of teachers that never listen to students read aloud to assess students' performance in reading)	n.s.	-.36**
PFM5_high (Percentage of teachers declaring that they frequently determine oral reading accuracy to assess students' performance in reading)	-.39**	.31*
PFM5_low (Percentage of teachers declaring that they never determine oral reading accuracy to assess students' performance in reading)	.38**	-.42*
PFM5 (Above the international average of teachers that frequently determine oral reading accuracy to assess students' performance in reading)	-.52***	.39**
noPFM5 (Above the international average of teachers that never determine oral reading accuracy to assess students' performance in reading)	.49***	-.38**
noOPP2 (Above the international average of teachers that do not agree with the statement: "This school offers me an active professional development program for teaching reading")	-.36**	.32*
ARE8_high (Percentage of teachers declaring that special education was not a subject of their formal education and/or training)	n.s.	.31*

A.1. 2001 questionnaires

Table A.6: COM 2001 and the School Questionnaire

Name and description of the variable	ALL	TEX
PSS3_high (Percentage of schools where less than 10% of students were born in another country)	n.s.	.41**
PSS3 (Above the international average of schools where less than 10% of students were born in another country)	n.s.	.45***
SABI_high (Percentage of schools the fourth-grade classes are formed on the basis of students' ability)	-.37**	.33**
SABI* (Above the international average of schools where the fourth-grade classes are formed on the basis of students' ability)	n.s.	.37**
INF5_high (Percentage of schools where students' wishes have a lot of influence on curriculum or the way that teachers instruct students)	-.43***	.35**
INF5_low* (Percentage of schools where students' wishes have little or no influence on curriculum or the way that teachers instruct students)	.33**	-.33*
G1GR1_low (n=33) (Percentage of schools where less than 25% of students can recognize most of the letters of the alphabet when they begin first year of schooling)	-.34**	.32*
noG1GR1 (Above the international average of schools where less than 25% of students can recognize most of the letters of the alphabet when they begin first year of schooling)	-.29*	.33*
G1GR2_high (Percentage of schools where more than 75% of students can read some words when they begin first year of formal schooling)	n.s.	-.29*
G1GR2_low (Percentage of schools where less than 25% of students can read some words when they begin first year of formal schooling)	-.30*	.30*
CUR2_high (Percentage of schools placing more emphasis on teaching writing (not handwriting) skills than other areas of the curriculum)	n.s.	-.41**
CUR3_low (Percentage of schools placing less emphasis on teaching speaking/listening (oral language) skills than other areas of the curriculum)	n.s.	-.34**
RII_high (Percentage of schools having informal initiatives to encourage reading among students)	.47***	-.31*

Appendix A. PIRLS variables derived from Questionnaires

RSP_high* (Percentage of schools having school-based programs for teachers geared towards the improvement of reading instruction)	.34**	-.40**
RSP (Above the international average of schools having school-based programs for teachers geared towards the improvement of reading instruction)	n.s.	-.30*
noMA1* (Above the international average of schools where reading series (basal readers, graded readers) are not used in reading instructional programs)	-.41***	.32*
MA2_low (Percentage of schools where use textbooks are not used for instruction in reading instructional program)	n.s.	-.39**
noMA2 (Above the international average of schools where use textbooks are not used for instruction in reading instructional program)	n.s.	-.49***
ME5_less (Percentage of schools where reading connected text first receive a major emphasis before fourth grade)	.63***	-.37**
ME6_less (Percentage of schools where identifying the main idea of text first receive a major emphasis before fourth grade)	.65***	-.37**
ME6_equal (Percentage of schools where identifying the main idea of text first receive a major emphasis in fourth grade)	-.66***	.36**
ME7_less (Percentage of schools where explaining or supporting understanding of text first receive a major emphasis before fourth grade)	.63***	-.46***
ME7_equal (Percentage of schools where explaining or supporting understanding of text first receive a major emphasis in fourth grade)	-.65***	.54***
ME8_less (Percentage of schools where comparing text with personal experience first receive a major emphasis before fourth grade)	.70***	-.48***
ME8_equal (Percentage of schools where comparing text with personal experience first receive a major emphasis in fourth grade)	-.68***	.51***

A.1. 2001 questionnaires

ME9_less (Percentage of schools where comparing different text first receive a major emphasis before fourth grade)	.60***	-.48***
ME9_equal (Percentage of schools where comparing different text first receive a major emphasis in fourth grade)	-.43***	.54***
ME10_less (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis before fourth grade)	.66***	-.44***
ME10_equal* (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis in fourth grade)	-.56***	.44***
ME10_more (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis after fourth grade)	-.61***	.33*
ME11_less* (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis before fourth grade)	.52***	-.52***
ME11_equal* (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis in fourth grade)	-.32*	.52***
ME11_more (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis after fourth grade)	-.50***	.30*
ME12_less (Percentage of schools where describing style and structure of text first receive a major emphasis before fourth grade)	.37**	-.52***
ME12_more (Percentage of schools where describing style and structure of text first receive a major emphasis after fourth grade)	-.44***	.47***
CHA2_high* (Percentage of schools where teachers' expectations for student achievement is very high)	n.s.	-.32*
CHA3* (n=33) (Above the international average of schools where parental support for student achievement is very high)	n.s.	-.34**
noCHA3* (n=33) (Above the international average of schools where parental support for student achievement is medium. low or very low)	n.s.	.37**

A.2 2006 questionnaires

A.2.1 Pearson Correlation Coefficients with TEX 2006

Table A.7: TEX 2006 and the Student Questionnaire

Name and description of the variable	ALL	TEX
noTOC1 (Above the international average of students who declared to not read aloud outside school)	.48***	-.28*
RTO1_low (Percentage of students who declared to never or almost never read comics outside school)	.36**	.27*
noRTO1 (Above the international average of students who declared to never or almost never read comics outside school)	n.s.	.27*
noRTO6 (Above the international average of students who declared to never or almost never read directions outside school)	n.s.	.30*
RTO8 (Above the international average of students declaring read almost every day subtitles on TV outside school)	n.s.	-.29*
TSP3_high (Percentage of students declaring spend time reading in the Internet outside school almost everyday)	-.53***	-.31*
TSP3_low (Percentage of students who declare to never or almost never spend time reading in the Internet outside school)	.41***	.37**
TSP3 (Above the international average of students declaring spend time reading in the Internet outside school almost everyday)	-.31**	-.39**
noTSP3 (Above the international average of students declaring not spend time reading in the Internet outside school never or almost never)	.31*	.33**
HELP_no (Percentage of student who declared to never need help with their homework)	n.s.	.36**
RHT_high (Percentage of students who declared to spend more than one hour diary reading for homework)	-.55***	-.33**

n=38, except if indicated

A.2. 2006 questionnaires

RHT_low (Percentage of students who declared to spend only half an hour or lees reading for homework)	.43***	.40**
noRHT (Above the international average of students who declared to spend only half an hour or lees diary reading for homework)	.30*	.45***
RST2_low (Percentage of students who declared to disagree with the statement "I like to talk about books)	.60***	.29*
RST3_low (Percentage of students who declared to disagree with the statement "I'll like to receive a book as present)	.48***	.30*
RST4_low (Percentage of students who declared to disagree with the statement "I think that reading is boring)	n.s.	.31*
RST6_low (Percentage of students who declared to disagree with the statement "I enjoy reading)	.52***	.30*
RD2_low (Percentage of students who declared to disagree with the statement "I think that reading is easy)	n.s.	.38**
RD3_high (Percentage of students who agree with the statement "When I read, I understand almost everything)	n.s.	.33**
RD4_low (Percentage of students who disagree with the statement "I read slower than others)	n.s.	.48***
noRD4 (Above the international average of students who disagree with the statement "I read slower than others)	n.s.	.42***
LNG2_high (Percentage of students who declared to have learned to speak a second language before start school)	n.s.	-.39**
LNGH_SOM (Percentage of students who declared to speak the language of the test at home only sometimes)	n.s.	-.39**
LNGH_ALW (Percentage of students who declared to speak always the language of the test at home)	n.s.	.32**
BOOK_FEW (Percentage of students who declared to have twenty five or less books at home)	-.70***	-.32**
BOOK_LOT (Percentage of students who declared to have more than one hundred books at home)	.62***	.30*
LOTBOOK (Above the international average of students who declared to have more than one hundred books at home)	.35**	.29*
BOOKFEW (Above the international average of students who declared to have twenty five or less books at home)	-.55***	-.51***

Table A.8: TEX 2006 and the Teacher Questionnaire

Name and description of the variable	ALL	TEX
RAO3 (Above the international average of teachers always organizing reading activities by creating mixed-ability groups)	-.37**	-.39**
RAO6_high (Percentage of teachers always organizing reading activities where the students work independently on a goal they choose themselves)	-.54***	-.28*
RIA3 (Above the international average of teachers always using workbook during reading instruction)	n.s.	.33**
RIA7_low (Above the international average of teachers who almost never use a variety of children's books during reading instruction)	n.s.	-.30*
RTX1_high (Percentage of teachers always having students reading short stories during reading instruction)	n.s.	.28*
RTX1_low (Percentage of teachers who almost never having students reading short stories during reading instruction)	n.s.	-.29*
RTX1 (Above the international average of teachers always having students reading short stories during reading instruction)	n.s.	.32**
RTX6_high (Percentage of teachers always having students reading instructions or manuals about how things work)	-.27*	-.30*
RA10_high (Percentage of teachers always helping students to understand new vocabulary during reading instruction)	n.s.	.28*
RA10_low (Percentage of teachers who almost never help students to understand new vocabulary during reading instruction)	n.s.	-.31*
AFT3 (Above the international average of teachers always asking students to answer oral questions about what they read after reading)	n.s.	.31*
DEV2 (Above the international average of teachers always asking students to explain their understanding of what they have read)	n.s.	.30*

Table A.9: TEX 2006 and the School Questionnaire

Name and description of the variable	ALL	TEX
ACBG4ENR (Total enrollment of fourth grade students in the school)	n.s.	-.31*
PST3_high (Percentage of schools where less than 10% of students do not speak the language of the test as their first language)	n.s.	.31*
PST3_low (n=37) (Percentage of students in the school not speaking the language of the test as first language over 50%)	-.39**	-.37**
PST4_high (Percentage of students receiving some instructions at school in their home language less than 10%)	n.s.	.35**
MA4_low (Percentage of schools not using materials from different curricular areas in reading instruction)	-.52	-.39**
ME06_less (Percentage of schools teaching to identify the main idea of texts before 4 ^o grade)	.62***	.30*
ME06_equal (Percentage of schools teaching to identify the main idea of texts at 4 ^o grade)	-.71***	-.32*
ME08_less (n=36) (Percentage of schools teaching to read comparing text with personal experience before 4 ^o grade)	.71***	.28*
ME10_more (n=34) (Percentage of schools teaching to make predictions about what will happen next in text after 4 ^o grade)	-.50***	-.31*
CHA1_high (Percentage of schools where teacher job satisfaction is very high)	n.s.	.30*
ASR_high (Index of school resources : high resources)	.44***	.32*
PPSS_low (Index of Principal's Perception of school safety: low safety)	-.55***	-.37**

A.2.2 Pearson Correlation Coefficients with COM 2006

Table A.10: Com 2006 and the Student Questionnaire

Name and description of the variable	ALL	TEX
TOC1_low (Percentage of students who declared to never read aloud to someone at home)	.45***	.29*
TOC2_low (Percentage of students who declared to never listen to someone at home reading them)	.68***	.34**
TOC4_low (Percentage of students who declared to never talk with family about reading)	.53***	.35**
noTOC4 (Above the international average of students who declared to never talk with family about reading)	.28*	.44***
TOC6_low (Percentage of students who declared to never read to find out things they want to learn at home)	.40**	.28*
RTO1_high (Percentage of students who declared to read comic books at home)	-.33**	.38**
RTO1_low (Percentage of students who declared to never read comic books at home)	.36**	-.28*
RTO1 (Above the international average of students who declared to read comic books at home)	-.32**	.29*
RTO3_low (Percentage of students who declared to never read books that explain things at home)	n.s.	.41**
noRTO3 (Above the international average of students who declared to never read books that explain things at home)	n.s.	.34**
RTO4_low (Percentage of students who declared to never read magazines at home)	n.s.	.33**
RTO6_low (Percentage of students who declared to never read directions or instructions outside of school)	n.s.	.48***

n=38, except if indicated

A.2. 2006 questionnaires

noRTO6 (Above the international average of students who declared to never read directions or instructions outside of school)	n.s.	.40**
RTO8 (Above the international average of students who declared to read subtitles on television)	n.s.	.28*
TSP2_high (Percentage of students who declared to spend many time playing video or computer games at home on a normal school day)	n.s.	-.29*
TSP2 (Above the international average of students who spend many time playing video or computer games at home on a normal school day)	n.s.	-.29*
THC1_low (Percentage of students who declared that the teacher never read aloud to the class)	.36**	.44***
noTHC1 (Above the international average of students whos teacher read aloud to the class)	.37**	.50***
THC3_low (Percentage of students who do not read aloud to a small group in school)	.57***	.39**
noTHC3 (Above the international average of students who read aloud to a small group in school)	.43***	.35**
THC4_high (Percentage of students who read silently on their own in school)	n.s.	-.46***
THC4 (Above the international average of students who read silently on their own in school)	n.s.	-.38**
AFR1_high (Percentage of students who answer questions in a workbook or worksheet about what they have read in school)	-.48***	-.32**
AFR1_low (Percentage of students who do not answer questions in a workbook or worksheet about what they have read in school)	.44***	.31*
AFR2_high (Percentage of students who, after they have read something, write something about what they read in school)	-.57***	-.31*
AFR2_low (Percentage of students who, after they have read something, do not write something about what they read in school)	.47***	.47***
AFR2 (Above the international average of students who, after they have read something, write something about what they read in school)	-.44***	-.32**
noAFR2 (Above the international average of students who, after they have read something, do not write something about what they read in school)	.37**	.47***

Appendix A. PIRLS variables derived from Questionnaires

AFR3_high (Percentage of students who, after they have read something, answer questions aloud in school)	-.41***	-.27*
AFR3 (Above the international average of students who, after they have read something, answer questions aloud in school)	-.46***	-.28*
AFR4_low (Percentage of students who, after they have read something, do not talk with other students about what they read in school)	.60***	.28*
noRD2 (Above the international average of students who think to not read as well as other students)	n.s.	.30*
RD3_low (Percentage of students who think to not understand almost everything they read)	-.29*	-.29*
noRD3 (Above the international average of students who think to not understand almost everything they read)	n.s.	-.32**
RD4 (Above the international average of students who think to not read slower than other students)	-.31*	-.35**
LNG1_high (Percentage of students who speak the language of test before started school)	n.s.	-.31*
LNG1_nev (Percentage of students who never speak the language of test at home)	n.s.	.30*
DGTHC2_high (High index of student report independent reading)	n.s.	-.34**
DGTHC2_low (Low index of student report independent reading)	n.s.	.40**

A.2. 2006 questionnaires

Table A.11: COM 2006 and the Teacher Questionnaire

Name and description of the variable	ALL	TEX
ACTM (Above the international average of minutes per week spent on language instruction)	n.s.	-.28*
ATBGRINH (hours per week spent on reading instruction)	n.s.	-.36**
ATBGRDH (hours explicitly for reading instruction)	-.32**	-.53***
FRDH (Above the international average of hours explicitly for reading instruction)	-.31*	-.33**
ATBGRDM (minutes explicitly for reading instruction)	n.s.	.32**
FRDM (Above the international average of minutes explicitly for reading instruction)	n.s.	.31*
RACT_high (Percentage of teachers who have reading instruction with the students frequently)	n.s.	-.33**
RACT_low (Percentage of teachers who never have reading instruction with the students)	n.s.	.36**
noRACT (Above the international average of teachers who never have reading instruction with the students)	n.s.	.38**
RIA2_high (Percentage of teachers who use reading series)	n.s.	-.31*
RIA2_low (Percentage of teachers who never use reading series)	n.s.	.35**
RIA3_high (Percentage of teachers who use workbooks or worksheets)	n.s.	-.28*
RIA9 (Above the international average of teachers who use materials written by students)	-.50***	-.29*
RTX1_high (Percentage of teachers who have students read short stories)	n.s.	-.50***
RTX1 (Above the international average of teachers who have students read short stories)	n.s.	-.42***
RTX3_high (Percentage of teachers who have students read poems)	n.s.	-.35**
RTX3_low (Percentage of teachers who never have students read poems)	.36**	.31*
RTX5_high (Percentage of teachers who have students read descriptions and explanations about things, people, events)	n.s.	-.37**
RTX5_low (Percentage of teachers who never have students read descriptions and explanations about things, people, events)	-.27*	.28*

Appendix A. PIRLS variables derived from Questionnaires

RTX5 (Above the international average of teachers who have students read descriptions and explanations about things, people, events)	-n.s.	-.41**
noRTX5 (Above the international average of teachers who never have students read descriptions and explanations about things, people, events)	n.s.	.34**
RTX6_low (Percentage of teachers who never have students read instructions or manuals about how things work)	n.s.	.30*
RTX7_high (Percentage of teachers who have students read charts, diagrams, graphs?)	n.s.	-.33**
RTX7_low (Percentage of teachers who never have students read charts, diagrams, graphs?)	n.s.	.30*
noRTX7 (Above the international average of teachers who never have students read charts, diagrams, graphs?)	n.s.	.31*
RA1_high (Percentage of teachers who read aloud to the class)	-.29*	-.38**
RA1_low (Percentage of teachers who read aloud to the class)	.30*	.40***
RA1 (Above the international average of teachers who read aloud to the class)	n.s.	-.29*
RA2_high (Percentage of teachers who ask students to read aloud to the whole class)	n.s.	-.31*
RA2 (Above the international average of teachers who ask students to read aloud to the whole class)	-.27*	-.29*
noRA2 (Above the international average of teachers who never ask students to read aloud to the whole class)	n.s.	.29*
RA3_high (Percentage of teachers who ask students to read aloud in small groups or pairs)	n.s.	-.34**
RA3_low (Percentage of teachers who never ask students to read aloud in small groups or pairs)	n.s.	.33**
RA3 (Above the international average of teachers who ask students to read aloud in small groups or pairs)	n.s.	-.30*
noRA3 (Above the international average of teachers who never ask students to read aloud in small groups or pairs)	n.s.	.33**
RA4_high (Percentage of teachers who ask students to read silently on their own)	n.s.	-.49***
RA4 (Above the international average of teachers who ask students to read silently on their own)	n.s.	-.36**
RA7_high (Percentage of teachers who teach or model for students different reading strategies)	n.s.	-.45***

A.2. 2006 questionnaires

RA7_low (Percentage of teachers who never teach or model for students different reading strategies)	n.s.	.47***
RA7 (Above the international average of teachers who teach or model for students different reading strategies)	n.s.	-.55***
noRA7 (Above the international average of teachers who never teach or model for students different reading strategies)	n.s.	.45***
RA8_high (Percentage of teachers who teach strategies for decoding sounds and words)	n.s.	-.35**
RA8_low (Percentage of teachers who never teach strategies for decoding sounds and words)	n.s.	.44***
RA8 (Above the international average of teachers who teach strategies for decoding sounds and words)	n.s.	-.38**
noRA8 (Above the international average of teachers who never teach strategies for decoding sounds and words)	n.s.	.49***
RA9_high (Percentage of teachers who teach new vocabulary)	n.s.	-.36**
RA9_low (Percentage of teachers who never teach new vocabulary)	n.s.	.40***
RA9 (Above the international average of teachers who teach new vocabulary)	n.s.	-.45***
RA10_high (Percentage of teachers who help students understand new vocabulary in texts they are reading)	n.s.	-.42**
RA10_low (Percentage of teachers who never help students understand new vocabulary in texts they are reading)	n.s.	.50***
RA10 (Above the international average of teachers who help students understand new vocabulary in texts they are reading)	n.s.	-.33**
noRA10 (Above the international average of teachers who never help students understand new vocabulary in texts they are reading)	n.s.	.52***
AFT2_high (Percentage of teachers who ask students to write something about what they have read)	-.30*	-.48***
AFT2_low (Percentage of teachers who never ask students to write something about what they have read)	n.s.	.32*
AFT2 (Above the international average of teachers who ask students to write something about what they have read)	n.s.	-.54***
noAFT2 (Above the international average of teachers who never ask students to write something about what they have read)	n.s.	.41**
AFT3_high (Percentage of teachers who ask students to answer oral questions about what they read)	n.s.	-.48***

Appendix A. PIRLS variables derived from Questionnaires

AFT3_low (Percentage of teachers who never ask students to answer oral questions about what they read)	n.s.	.43***
AFT3 (Above the international average of teachers who ask students to answer oral questions about what they read)	n.s.	-.40**
noAFT3 (Above the international average of teachers who never ask students to answer oral questions about what they read)	n.s.	.34**
DEV1_high (Percentage of teachers who ask students to identify the main ideas of what they have read)	n.s.	-.43***
DEV1_low (Percentage of teachers who never ask students to identify the main ideas of what they have read)	n.s.	.42***
DEV1 (Above the international average of teachers who ask students to identify the main ideas of what they have read)	n.s.	-.40**
noDEV1 (Above the international average of teachers who never ask students to identify the main ideas of what they have read)	n.s.	.41**
DEV2_high (Percentage of teachers who ask students to explain their understanding of what they have read)	n.s.	-.49***
DEV2_low (Percentage of teachers who never ask students to explain their understanding of what they have read)	n.s.	.49***
DEV2 (Above the international average of teachers who ask students to explain their understanding of what they have read)	n.s.	-.36**
noDEV2 (Above the international average of teachers who never ask students to explain their understanding of what they have read)	n.s.	.46***
DEV3_high (Percentage of teachers who ask students to compare what they have read with their experiences)	n.s.	-.47***
DEV3_low (Percentage of teachers who never ask students to compare what they have read with their experiences)	n.s.	.38**
DEV3 (Above the international average of teachers who ask students to compare what they have read with their experiences)	n.s.	-.55***
noDEV3 (Above the international average of teachers who never ask students to compare what they have read with their experiences)	-.28*	.32**
DEV4_high (Percentage of teachers who ask students to compare what they have read with other things)	n.s.	-.38**
DEV4_low (Percentage of teachers who never ask students to compare what they have read with other things)	n.s.	.48***
DEV4 (Above the international average of teachers who ask students to compare what they have read with other things)	n.s.	-.47***

A.2. 2006 questionnaires

noDEV4 (Above the international average of teachers who never ask students to compare what they have read with other things)	n.s.	.43***
DEV5_high (Percentage of teachers who ask students to make predictions about what will happen next in the text)	n.s.	-.48***
DEV5_low (Percentage of teachers who never ask students to make predictions about what will happen next in the text)	n.s.	.49***
DEV5 (Above the international average of teachers who ask students to make predictions about what will happen next in the text)	n.s.	-.41**
noDEV5 (Above the international average of teachers who never ask students to make predictions about what will happen next in the text)	n.s.	.37**
DEV6_high (Percentage of teachers who ask students to make generalizations and inferences based on what they have read)	n.s.	-.49***
DEV6_low (Percentage of teachers who never ask students to make generalizations and inferences based on what they have read)	n.s.	.35**
DEV6 (Above the international average of teachers who ask students to make generalizations and inferences based on what they have read)	n.s.	-.41**
noDEV6 (Above the international average of teachers who never ask students to make generalizations and inferences based on what they have read)	n.s.	.28*
DEV7_high (Percentage of teachers who ask students to describe the style or structure of the text)	n.s.	-.49***
DEV7_low (Percentage of teachers who never ask students to describe the style or structure of the text)	n.s.	.50***
DEV7 (Above the international average of teachers who ask students to describe the style or structure of the text)	n.s.	-.37**
noDEV7 (Above the international average of teachers who never ask students to describe the style or structure of the text)	n.s.	.44***
ASP5_high (Percentage of teachers who use oral questioning to assess students' performance in reading)	-.27*	-.29*
ASP5_low (Percentage of teachers who never use oral questioning to assess students' performance in reading)	n.s.	.31*
noASP5 (Above the international average of teachers who never use oral questioning to assess students' performance in reading)	n.s.	.34**
ASP6_low (Percentage of teachers who never use oral summaries/reports to assess students' performance in reading)	n.s.	.35**

Table A.12: COM 2006 and the School Questionnaire

ACBGOFIT (Percentage of schools which offer extended instructional time for the fourth-grade students)	n.s.	-.29*
ACU2_high (Percentage of schools who place high emphasis on teaching writing)	n.s.	-.41**
ACU2_low (Percentage of schools who place no emphasis on teaching writing)	n.s.	.41**
ACU2 (Above the international average of schools who place high emphasis on teaching writing)	n.s.	-.44***
noACU2 (Above the international average of schools who place no emphasis on teaching writing)	n.s.	.35**
ACU3_high (Percentage of schools who place high emphasis on teaching speaking/listening)	n.s.	-.33**
ACU3_low (Percentage of schools who place no emphasis on teaching speaking/listening)	n.s.	.33**
ACU3 (Above the international average of schools who place high emphasis on teaching speaking/listening)	n.s.	-.29*
MA5_high (n=37) (Percentage of schools which use children's newspapers and/or magazines in reading instructional program)	n.s.	.28*
MA6_high (n=37) (Percentage of schools which use computer programs in reading instructional program)	n.s.	.31*
ME07_less (n=36) (Percentage of schools where explaining or supporting understanding of text first receive a major emphasis before fourth-grade)	.64***	-.38**
ME07_equal (n=35) (Percentage of schools where explaining or supporting understanding of text first receive a major emphasis after fourth-grade)	-.64***	.35**
ME08_less (n=36) (Percentage of schools where comparing text with personal experience first receive a major emphasis before fourth-grade)	.71***	-.42**
ME08_equal (n=36) (Percentage of schools where comparing text with personal experience first receive a major emphasis during fourth-grade)	-.69***	.38**
ME08_more (n=28) (Percentage of schools where comparing text with personal experience first receive a major emphasis after fourth-grade)	-.63***	.32*
ME09_less (n=36) (Percentage of schools where comparing different texts first receive a major emphasis before fourth-grade)	.65***	-.52***

A.2. 2006 questionnaires

ME09_equal (Percentage of schools where comparing different texts first receive a major emphasis after fourth-grade)	-.57***	.44**
ME09_more (Percentage of schools where comparing different texts first receive a major emphasis after fourth-grade)	-.56***	.48***
ME10_less (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis before fourth-grade)	.69***	-.39**
ME10_equal (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis during fourth-grade)	-.68***	.31*
ME10_more (34) (Percentage of schools where making predictions about what will happen next in text first receive a major emphasis after fourth-grade)	-.50***	.36*
ME11_less (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis before fourth-grade)	.52***	-.49***
ME11_equal (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis during fourth-grade)	-.52***	.39**
ME11_more (Percentage of schools where making generalizations and inferences based on text first receive a major emphasis after fourth-grade)	-.33**	.46***
ME12_less (Percentage of schools where describing style and structure of text first receive a major emphasis before fourth-grade)	.43***	-.47***
ME12_more (Percentage of schools where describing style and structure of text first receive a major emphasis after fourth-grade)	-.36**	.52***
CHA1_high (Percentage of schools where teacher job satisfaction is very high)	n.s.	.31*
CHA3_high (n=37) (Percentage of schools where parental support for student achievement is very high)	n.s.	.30**
CHA3_low (n=37) (Percentage of schools where parental support for student achievement is low or very low)	n.s.	-.39**
CHA5_high (n=37) (Percentage of schools where students' desire to do well is very high)	n.s.	.40**
CHA5_low (n=37) (Percentage of schools where students' desire to do well is medium, low or very low)	n.s.	-.29*

Appendix B

Hierarchical models for partial scores

B.1. 2001 models

B.1 2001 models

B.1.1 PIRLS 2001 literary score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	545***	1.9	540***	1.7	528***	0.7	522***	0.9	534	2.0
<i>Home Factors</i>										
Books at home					10.7***	0.2			10.5***	0.3
Resources					8.1***	0.3			8.2***	0.3
Oral social					-12.0***	0.3			-11.8***	0.3
Inform. read					-3.8***	0.2			-3.4***	0.3
Attitudes					21.8***	0.2			21.7***	0.2
<i>School Factors</i>										
Var. Evaluation							-6.4***	1.1	-2.2**	1.0
Expect. wishes							9.9***	0.9	4.4***	0.8
Emph. Strateg.							3.7***	0.6	3.2***	0.6
Var. Instruction							n.s.		n.s.	
Early lear skills							7.7***	1.0	5.7***	0.8
Variety of books							9.9***	0.9	4.5***	0.8
<i>ref= Very opaq.</i>										
Shallow lang.			-24.8***	2.0					n.s.	
Opaque lang.			-20.6***	2.4					n.s.	
<i>ref= Anglo</i>										
Others	-38.3***	2.4							-17.8***	3.6
Germanic	-11.1***	2.6							n.s.	
Latin	-30.7***	2.6							-8.9***	4.2
Slavic	-25.1***	2.5							n.s.	
Variance components										
Between school (Level 2)	2,500	57.8	2,580	59.4	1,718	41.7	2,364	63.5	1,503	42.6
Prop. Explain	0.07		0.04		0.36		0.12		0.44	
ICC	0.41		0.42		0.37		0.40		0.35	
Within school (Level 1)	3,631	15.7	3,632	15.7	2,875	14.0	3,520	17.7	2,790	15.6
Prop. Explain	0.00		0.00		0.21		0.03		0.23	
-2LogL	1,239,335		1,239,492		975,515		918,654		730,386	
Δ (1371292)	311		154		264,131	79%	320,992	74%	509,260	59%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.1.2 PIRLS 2001 informative score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	535***	1.9	533***	1.7	527***	0.7	523***	0.9	526***	2.0
<i>Home Factors</i>										
Books at home					10.1***	0.2			9.8***	0.2
Resources					7.9***	0.3			8.1***	0.3
Oral social					-11.9***	0.3			-11.7***	0.3
Inform. read					-2.3***	0.2			-2.1***	0.3
Attitudes					20.9***	0.2			20.7***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.7***	1.1	-2.3**	1.0
Expect. wishes							8.2***	0.9	3.6***	0.8
Emph. Strateg.							4.7***	0.6	4.1***	0.6
Var. Instruction							n.s.		n.s.	
Early lear skills							6.5***	1.0	4.6***	0.8
Variety of books							8.4***	0.9	3.9***	0.8
<i>ref= Very opa.</i>										
Shallow lang.			-18.6***	2.0					n.s.	
Opaque lang.			n.s.						13.8***	3.8
<i>ref= Anglo</i>										
Others	-29.7***	2.4							-10.8***	3.6
Germanic	-5.7**	2.6							7.26*	4.3
Latin	-13.5***	2.6							n.s.	
Slavic	-9.1***	2.5							n.s.	
Variance components										
Between school (Level 2)	2,481	57.4	2,499	57.7	1,693	41.0	2,367	63.4	1,497	42.4
Prop. Explain	0.04		0.03		0.34		0.08		0.42	
ICC	0.41		0.41		0.37		0.41		0.36	
Within school (Level 1)	3,601	15.6	3,603	15.6	2,828	13.7	3,440	17.3	2,720	15.2
Prop. Explain	0.00		0.00		0.21		0.05		0.25	
-2LogL	1,238,431		1,238,511		974,069		916,840		728,748	
Δ (1371292)	204		124		264,566	79%	321,795	74%	509,887	59%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.1. 2001 models

B.1.3 PIRLS 2001 low order processes score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	535***	1.9	533***	1.7	527***	0.7	522***	0.9	525***	1.9
<i>Home Factors</i>										
Books at home					11.1***	0.2			10.9***	0.3
Resources					7.9***	0.3			8.0***	0.3
Oral social					-13.2***	0.3			-13.0***	0.3
Inform. read					-3.6***	0.2			-3.3***	0.3
Attitudes					22.4***	0.2			22.2***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.4***	1.1	-2.3**	0.9
Expect. wishes							8.8***	0.9	3.9***	0.8
Emph. Strateg.							4.0***	0.6	3.6***	0.6
Var. Instruction							n.s.		1.64*	0.9
Early lear skills							6.4***	1.0	4.8***	0.8
Variety of books							8.5***	0.9	3.8***	0.8
<i>ref= Very opa.</i>										
Shallow lang.			-17.3***	2.0					n.s.	3.6
Opaque lang.			-8.4***	2.4					n.s.	3.7
<i>ref= Anglo</i>										
Others	-30.1***	2.4							-6.23*	3.6
Germanic	n.s.								17.6***	4.3
Latin	-19.2***	2.6							n.s.	4.2
Slavic	-9.6***	2.5							12.3***	4.2
Variance components										
Between school (Level 2)	2,484	57.86	2,562	59.4	1,633	40.1	2,377	64.1	1,461	41.9
Prop. Explain	0.05		0.02		0.37		0.09		0.44	
ICC	0.39		0.39		0.34		0.38		0.33	
Within school (Level 1)	3,939	17.04	3,942	17.1	3,114	15.1	3,823	19.2	3,034	17.0
Prop. Explain	0.00		0.00		0.21		0.03		0.23	
-2LogL	1,248,061		1,248,241		982,154		925,244		735,691	
Δ (1371292)	259		79		266,166	79%	323,076	74%	512,629	59%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.1.4 PIRLS 2001 high order processes score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	545***	1.9	540***	1.7	528***	0.7	523***	0.9	535 ***	2.0
<i>Home Factors</i>										
Books at home					9.9***	0.2			9.7 ***	0.2
Resources					8.4***	0.3			8.6 ***	0.3
Oral social					-10.8***	0.3			-10.6 ***	0.3
Inform. read					-2.4***	0.2			-2.2 ***	0.3
Attitudes					20.5***	0.2			20.3 ***	0.2
<i>School Factors</i>										
Var. Evaluation							-6.8***	1.1	-2.0**	1.0
Expect. wishes							9.3***	0.9	3.8 ***	0.8
Emph. Strateg.							4.1***	0.6	3.7 ***	0.6
Var. Instruction							n.s.		n.s.	
Early lear skills							7.9***	1.0	5.3 ***	0.9
Variety of books							10.2***	0.9	4.8 ***	0.8
<i>ref= Very opa.</i>										
Shallow lang.			-25.9***	2.0					n.s.	3.6
Opaque lang.			-13.3***	2.4					12.7 ***	3.8
<i>ref= Anglo</i>										
Others	-37.6***	2.4							-19.7 ***	3.6
Germanic	-15.2***	2.6							n.s.	4.4
Latin	-24.9***	2.6							-7.1*	4.3
Slavic	-24.2***	2.5							-7.5*	4.2
Variance components										
Between school (Level 2)	2,508	57.8	2,547	58.6	1,758	42.3	2,389	64.0	1,543	43.4
Prop. Explain	0.06		0.04		0.34		0.10		0.42	
ICC	0.42		0.43		0.39		0.42		0.37	
Within school (Level 1)	3,433	14.9	3,434	14.9	2,695	13.1	3,316	16.6	2,614	14.6
Prop. Explain	0.00		0.00		0.22		0.03		0.24	
-2LogL	1,233,364		1,233,452		970,085		913,935		726,294	
Δ (1371292)	264		176		263,543	79%	56,150	74%	507,334	59%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.2 2006 models

B.2.1 PIRLS 2006 literary score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	535 ***	1.7	537 ***	1.6	532 ***	0.6	526 ***	0.8	530 ***	1.6
<i>Home Factors</i>										
Books at home					11.5 ***	0.2			11.2 ***	0.2
Resources					10.9 ***	0.2			10.6 ***	0.3
Oral social					-13.3 ***	0.2			-12.9 ***	0.3
Inform. read					-5.3 ***	0.2			-5.6 ***	0.2
Attitudes					19.7 ***	0.2			19.9 ***	0.2
<i>School Factors</i>										
Var. Evaluation							-6.8 ***	1.0	-2.2 ***	0.8
Expect. wishes							8.3 ***	0.8	2.7 ***	0.7
Emph. Strateg.							2.2 ***	0.5	2.5 ***	0.5
Var. Instruction							3.6 ***	1.0	4.3 ***	0.8
Early lear skills							9.0 ***	0.9	6.7 ***	0.7
Variety of books							2.5 ***	0.8	n.s.	
<i>ref= Very opaq.</i>										
Shallow lang.			-18.0 ***	1.9					-17.4 ***	3.2
Opaque lang.			-5,1**	2.2					n.s.	
<i>ref= Anglo</i>										
Others	-20.9 ***	2.2							13.7 ***	3.2
Germanic	n.s.								16.6 ***	3.8
Latin	-18.4 ***	2.5							10.3 ***	3.7
Slavic	n.s.								22.6 ***	3.8
Variance components										
Between school (Level 2)	2,404	54.0	2,422	54.4	1,450	35.1	2,231	55.3	1,282	34.4
Prop. Explain	0.04		0.03		0.42		0.11		0.49	
ICC	0.40		0.40		0.34		0.38		0.31	
Within school (Level 1)	3,577	14.7	3,577	14.7	2,789	12.8	3,578	16.2	2,802	14.1
Prop. Explain	0.00		0.00		0.22		0.00		0.22	
-2LogL	1,375,518		1,375,567		1,088,134		1,127,321		897,805	
Δ (1371292)	160		111		287,544	79%	248,357	82%	477,873	65%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.2.2 PIRLS 2006 informative score

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	535 ***	1.72	539 ***	1.54	532 ***	0.6	526 ***	0.8	531 ***	1.5
<i>Home Factors</i>										
Books at home					10.5 ***	0.2			10.2 ***	0.2
Resources					11.4 ***	0.2			11.1 ***	0.3
Oral social					-12.0 ***	0.2			-11.8 ***	0.3
Inform. read					-4.3 ***	0.2			-4.6 ***	0.2
Attitudes					19.2 ***	0.2			19.4 ***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.8 ***	1.0	-2.1 ***	0.8
Expect. wishes							8.1 ***	0.8	2.6 ***	0.7
Emph. Strateg.							2.2 ***	0.5	2.4 ***	0.4
Var. Instruction							4.6 ***	1.0	3.9 ***	0.8
Early lear skills							8.2 ***	0.9	5.2 ***	0.7
Variety of books							1.82*	0.8	n.s.	
<i>ref= Very opa.</i>										
Shallow lang.			-22.7 ***	1.8					-36.1 ***	3.1
Opaque lang.			n.s.						-16.3 ***	3.3
<i>ref= Anglo</i>										
Others	-21.0 ***	2.2							24.6 ***	3.2
Germanic	-3,9*	2.4							30.5 ***	3.7
Latin	-15.7 ***	2.5							27.6 ***	3.7
Slavic	n.s.								41.9 ***	3.7
Variance components										
Between school (Level 2)	2,391	53.5	2,340	52.5	1,462	35.1	2,267	55.9	1,236	33.1
Prop. Explain	0.04		0.06		0.41		0.09		0.50	
ICC	0.42		0.41		0.36		0.41		0.32	
Within school (Level 1)	3,355	13.8	3,355	13.8	2,603	11.9	3,322	15.0	2,591	13.1
Prop. Explain	0.00		0.00		0.22		0.01		0.23	
-2LogL	1,367,851		1,367,785		1,081,583		1,120,140		891,476	
Δ (1,371,292)	152		218		286,420	79%	247,863	82%	476,527	65%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.2. 2006 models

B.2.3 PIRLS 2006 low order processes score Models

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	529 ***	1.7	533 ***	1.5	530 ***	0.6	524 ***	0.8	524 ***	1.5
<i>Home Factors</i>										
Books at home					11.6 ***	0.2			11.3 ***	0.2
Resources					11.2 ***	0.2			11.0 ***	0.3
Oral social					-13.9 ***	0.2			-13.4 ***	0.3
Inform. read					-5.4 ***	0.2			-5.7 ***	0.2
Attitudes					20.3 ***	0.2			20.5 ***	0.2
<i>School Factors</i>										
Var. Evaluation							-7.9 ***	1.0	-2.1 ***	0.8
Expect. wishes							8.4 ***	0.8	2.9 ***	0.7
Emph. Strateg.							2.1 ***	0.5	2.7 ***	0.5
Var. Instruction							2.9 ***	1.0	3.7 ***	0.8
Early lear skills							8.3 ***	0.9	5.9 ***	0.7
Variety of books							1.9**	0.8	n.s.	
<i>ref= Very opaq.</i>										
Shallow lang.			-16.3 ***	1.8					-31.4 ***	3.0
Opaque lang.			n.s.						-14.0 ***	3.2
<i>ref= Anglo</i>										
Others	-16.9 ***	2.2							28.0 ***	3.1
Germanic	9.6 ***	2.3							39.6 ***	3.6
Latin	-14.3 ***	2.4							26.2 ***	3.6
Slavic	n.s.								41.3 ***	3.6
Variance components										
Between school (Level 2)	2,312	52.3	2,343	53.0	1,344	33.1	2,182	54.4	1,149	31.5
Prop. Explain	0.05		0.04		0.45		0.10		0.53	
ICC	0.38		0.38		0.31		0.37		0.28	
Within school (Level 1)	3,766	15.4	3,767	15.4	2,943	13.5	3,755	17.0	2,949	14.9
Prop. Explain	0.00		0.00		0.22		0.00		0.22	
-2LogL	1,381,522		1,381,600		1,093,008		1,131,969		901,488	
Δ (1,371,292)	205		127		288,719	79%	249,758	82%	480,239	65%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

B.2.4 PIRLS 2006 high order processes score Models

Fixed Effects										
Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
<i>Intercept</i>	541 ***	1.7	543 ***	1.6	533 ***	0.6	527 ***	0.8	537 ***	1.6
<i>Home Factors</i>										
Books at home					10.3 ***	0.2			10.1 ***	0.2
Resources					11.2 ***	0.2			10.9 ***	0.2
Oral social					-11.2 ***	0.2			-10.9 ***	0.3
Inform. read					-4.3 ***	0.2			-4.6 ***	0.2
Attitudes					18.6 ***	0.2			18.8 ***	0.2
<i>School Factors</i>										
Var. Evaluation							-6.9 ***	1.0	-2.09*	0.8
Expect. wishes							7.7 ***	0.8	2.1 ***	0.7
Emph. Strateg.							2.2 ***	0.5	2.4 ***	0.4
Var. Instruction							5.4 ***	1.0	4.6 ***	0.8
Early lear skills							9.4 ***	0.9	6.4 ***	0.7
Variety of books							2.5 ***	0.8	n.s.	
<i>ref= Very opa.</i>										
Shallow lang.			-24.8 ***	1.9					-24.6 ***	3.2
Opaque lang.			-7.3 ***	2.2					-8.34*	3.5
<i>ref= Anglo</i>										
Others	-25.8 ***	2.3							11.6 ***	3.3
Germanic	-12.9 ***	2.4							11.9 ***	3.8
Latin	-20.0 ***	2.5							13.4 ***	3.8
Slavic	-5.4**	2.5							24.5 ***	3.9
Variance components										
Between school (Level 2)	2,485	55.4	2,449	54.7	1,587	37.7	2,333	57.4	1,371	36.1
Prop. Explain	0.04		0.05		0.39		0.11		0.47	
ICC	0.43		0.43		0.39		0.42		0.35	
Within school (Level 1)	3,250	13.3	3,251	13.3	2,515	11.5	3,231	14.6	2,513	12.7
Prop. Explain	0.00		0.00		11.54		0.10		0.23	
-2LogL	1,364,253		1,364,215		1,078,625		1,117,528		889,411	
Δ (1,371,292)	169		207		285,797	79%	246,894	82%	475,011	65%

* = $p < .10$, ** = $p < .05$, *** = $p < .01$; standard error is indicated along with the parameters

Appendix C

SAS and R programs

C.1 Programs for preliminary analysis

C.1.1 2006 Linguistic families at country level

```
DATA GE; set GE;
if idcntry = 040 then famili = 3; if idcntry = 956 then famili = 3;
if idcntry = 957 then famili = 4; if idcntry = 100 then famili = 2;
if idcntry = 158 then famili = 9; if idcntry = 208 then famili = 3;
if idcntry = 926 then famili = 1; if idcntry = 250 then famili = 4;
if idcntry = 268 then famili = 9; if idcntry = 276 then famili = 3;
if idcntry = 344 then famili = 9; if idcntry = 348 then famili = 9;
if idcntry = 352 then famili = 3; if idcntry = 360 then famili = 9;
if idcntry = 364 then famili = 9; if idcntry = 376 then famili = 9;
if idcntry = 380 then famili = 4; if idcntry = 428 then famili = 9;
if idcntry = 440 then famili = 9; if idcntry = 442 then famili = 3;
if idcntry = 807 then famili = 2; if idcntry = 498 then famili = 4;
if idcntry = 528 then famili = 3; if idcntry = 554 then famili = 1;
if idcntry = 578 then famili = 3; if idcntry = 616 then famili = 2;
if idcntry = 642 then famili = 4; if idcntry = 643 then famili = 2;
if idcntry = 927 then famili = 1; if idcntry = 702 then famili = 9;
if idcntry = 703 then famili = 2; if idcntry = 705 then famili = 2;
if idcntry = 724 then famili = 4; if idcntry = 752 then famili = 3;
if idcntry = 780 then famili = 9; if idcntry = 840 then famili = 1;
if idcntry = 913 then famili = 1; if idcntry = 914 then famili = 4;
```

```
PROC FREQ ;
TABLES famili;
RUN;
```

```
DATA GE; set GE;
if famili = 1 then anglo = 1; else anglo = 0;
if famili = 2 then slav = 1; else slav = 0;
if famili = 3 then germ = 1; else germ = 0;
if famili = 4 then latin = 1; else latin = 0;
if famili = 9 then other = 1; else other = 0;
RUN;
```

C.1.2 2001 Literary score at countries

```
DATA student; set ar1.asaallr1;

%jackpv (totwgt , jkzone, jkrep, 75, idcntry, asrLIT0, 5, student);

PROC PRINT DATA=final noobs;
    VAR idcntry N totwgt mnpv mnpv_se mnx mnx_se pct pct_se;
RUN;

DATA y; set final;
KEEP idcntry mnpv;
RENAME mnpv = LIT01;
RUN;
```

C.1.3 Example: analysis of a question from teacher 2001 questionnaire

- * ACBGSTST = Length Students stay with the same teacher;
- * jackpv.sas = PIRLS macro to calculate scores by a chosen parameter, here variable ACBGSTST;
- * CONT2_high_low_vars.sas = macro to create STST_high, STST_low, STST, noSTST, see next subsection ;

```
LIBNAME c "C:\PIRLS 2001\";
%include "C:\PIRLS 2001\jackpv.sas";
%include "C:\PIRLS 2001\CONT2_high_low_vars.sas";
RUN;

DATA school; set c.school;
WHERE nmiss(ACBGSTST) = 0;
```

```

SELECT (ACBGSTST) ;
WHEN (2,3) ACBGSTST = 1 ; *ONE SCHOOL YEAR OR LESS:2 - TWO YEARS:3;
WHEN (4,5) ACBGSTST = 4 ; *THREE YEARS:4 - FOUR OR MORE YEARS:5;
OTHERWISE ACBGSTST = . ;
END ;
%jackpv (totwgt, jkzone, jkrep, 75, idcntry ACBGSTST, asrrea0, 5, school);
RUN;

DATA z; set final;
%cont2 (ACBGSTST, STST_high, STST_low, STST, noSTST);
RUN;

DATA sasuser.iea2001; set a;
RUN;

```

C.1.4 Macro to create variables

Macro to create sub-variables representing scores high (&a), low (&b), above (&c) and under (&d) the average

```

%MACRO cont2 (a, b, c, d, e) ;
IF &a = 1 then &b=pct;
ELSE &b=0;

```

```

PROC MEANS DATA=z noprint;
VAR &b; output out=d sum=&b;
BY idcntry;

```

```

DATA z; set z;
IF &a = 4 then &c=pct;
ELSE &c=0;

```

```

PROC MEANS DATA=z noprint;
VAR &c; output out=f sum=&c;
BY idcntry;
RUN;

```


C.1. Programs for preliminary analysis

```
DATA x; merge f d;  
BY idcntry;  
KEEP idcntry &b &c;  
RUN;
```

```
DATA a; merge x p.iea2001;  
BY idcntry;  
RUN;
```

```
PROC MEANS DATA= a mean noprint;  
VAR &b &c; output out = b mean= m1 m2;
```

```
DATA c; merge a b;  
RETAIN mean1 mean2;  
IF _n_ = 1 then do; mean1 = m1; mean2 = m2; end;  
DROP _freq_ _type_ m1 m2;
```

C.2 Models

C.2.1 Null Models

```
DATA a; set p.std2006;
RUN;
```

```
DATA a; set a;
KEEP score2006 school teacher class country;
RUN;
```

```
PROC MIXED DATA=a method=ml covtest noclprint;
  CLASS school;
  MODEL score2006 = /solution ddfm=bw;
  RANDOM intercept/subject=school;
RUN;
```

method=ml: full maximum likelihood estimation
covtest: display tests for the variance components
noclprint: avoid printing of Class Level Information
ddfms=bw: Degrees of Freedom Method Between-Within;

3 Levels null model;

```
PROC MIXED DATA=a method=ml covtest noclprint;
  CLASS school country;
  MODEL score2006 = /solution ddfm=bw;
  RANDOM intercept/subject=school;
  RANDOM intercept/subject=school (country);
RUN;
```

C.2.2 Linguistic Models

```
PROC MIXED DATA=b method=ml covtest noclprint;
```

C.2. Models

```
CLASS school;
MODEL score2006 = ANGLO GERM LATIN SLAVIC /solution ddfm=bw;
RANDOM intercept/subject=school;
ods output SolutionF=z;
ods output CovParms=y;

RUN;

*exporting option to develop tables;

ods output close; ods listing;

PROC EXPORT DATA= Z
      OUTFILE= "C:\MIXEDodd.XLS"
      DBMS=EXCEL REPLACE;
      SHEET="Sol.score2006";

PROC EXPORT DATA= Y
      OUTFILE= "C:\MIXEDodd.XLS"
      DBMS=EXCEL REPLACE;
      SHEET="Cov.score2006";

RUN;
```

C.2.3 School variance by country

```
PROC MIXED DATA=b method=ml covtest noclprint;
WHERE idcntry= 100;
CLASS schoolcount;
MODEL all06 = /solution ddfm=bw;
RANDOM intercept/subject=schoolcount;
ods output CovParms=y;

RUN;

DATA x; set y;
```

```
keep Estimate;  
RUN;
```

```
PROC TRANSPOSE data = x out=w;  
    var Estimate ;  
run;
```

```
DATA w; set w;  
schoolvar = COL1 /(COL2+COL1);  
country= 100;  
RUN;
```

C.3 R. graphics

C.3.1 Boxplot in figure 6.1

```
x <- read.xport ("C:/sasfiles/P01")
summary (x)
oldpar <- par(cex=0.75, mex=0.60, mar=c(6.1, 14.1, 2.1, 1.1))
boxplot (SCM ~ NAMEVAR, data=x, horizontal=TRUE,
xlab="School Variation", col=(c("gold","darkgreen")), las=1)
```

C.3.2 Plots in figure 6.2

```
x <- sasxport.get("C:/sasfiles/OUT.xpt")
summary (x)

med <- subset(x, scm >= 489 & scm
< 598, select=c(all06, zbook, zsatr, zoral, zme))
low <- subset
(x, scm<=488, select=c(all06, zbook, zsatr, zoral, zme))
high <- subset
(x, scm>=599, select=c(all06, zbook, zsatr, zoral, zme))
par(mfrow=c(2,2))

plot(all06~zsatr, data=high, xlab="Students attitudes toward reading",
ylab="Reading Achievement", xlim=c(-3, 3), ylim=c(100, 800), pch='')
abline(lm(all06~zsatr, data=high), col=(c("darkblue")), lwd=2)
par(new=TRUE)

plot(all06~zsatr, data=med, xlab=" ", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
abline(lm(all06~zsatr, data=med), col=(c("darkgreen ")), lwd=2)
par(new=TRUE)

plot(all06~zsatr, data=low, xlab=" ", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
```

```
abline(lm(all06~zsatr, data=low), col=(c("gold ")), lwd=2)

plot(all06~zbook, data=high, xlab="Availability of books",
ylab="Reading Achievement", xlim=c(-3, 3), ylim=c(100, 800), pch='')
abline(lm(all06~zbook, data=high), col=(c("darkblue")), lwd=2)
par(new=TRUE)

plot(all06~zbook, data=med, xlab="", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
abline(lm(all06~zbook, data=med), col=(c("darkgreen ")), lwd=2)
par(new=TRUE)

plot(all06~zbook, data=low, xlab=" ", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
abline(lm(all06~zbook, data=low), col=(c("gold ")), lwd=2)

plot(all06~zoral, data=high, xlab="Orality, socialization",
ylab="Reading Achievement", xlim=c(-3, 3), ylim=c(100, 800), pch='')
abline(lm(all06~zoral, data=high), col=(c("darkblue")), lwd=2)
par(new=TRUE)

plot(all06~zoral, data=med, xlab="", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
abline(lm(all06~zoral, data=med), col=(c("darkgreen ")), lwd=2)
par(new=TRUE)

plot(all06~zoral, data=low, xlab=" ", ylab=" ", xlim=c(-3, 3),
ylim=c(100, 800), pch='')
abline(lm(all06~zoral, data=low), col=(c("gold ")), lwd=2)

plot(all06~zme, data=high, xlab="Early learning of Skills",
ylab="Reading Achievement", xlim=c(-3, 3), ylim=c(100, 800), pch='')
abline(lm(all06~zme, data=high), col=(c("darkblue")), lwd=2)
par(new=TRUE)

plot(all06~zme, data=med, xlab="", ylab=" ", xlim=c(-3, 3),
```

C.3. R. graphics

```
ylim=c(100, 800), pch='')  
abline(lm(all06~ zme, data=med), col=(c("darkgreen ")), lwd=2)  
par(new=TRUE)
```

```
plot(all06~zme, data=low, xlab=" ", ylab=" ", xlim=c(-3, 3),  
ylim=c(100, 800), pch='')  
abline(lm(all06~ zme, data=low), col=(c("gold ")), lwd=2)
```

C.4 L^AT_EX code of text formatting

```
\documentclass[a4paper,12pt,twoside]{report}
\usepackage[english, francais]{babel}
\usepackage[cp1252]{inputenc} %For using accented letters
\usepackage[T1]{fontenc} %Font encoding
\usepackage{textcomp} %Allows the use of extra characters
\usepackage{charter}%Font type
\usepackage{tipa}%International Phonetic

\usepackage
[left=3cm,
top=2cm,
right=3cm,
bottom=2.5cm,
includehead,
includefoot]{geometry}%text margens

\usepackage{amsfonts,subfig,amsmath} %mathematic's utils
\usepackage{appendix} %chapters using letter in numbering
\usepackage{multicol,array,rotating,multirow,booktabs} % improve tables
\usepackage{graphicx} %improve graphics
\usepackage{setspace} %double and one-and-a-half spacing
\usepackage{apacite} %use APA style in references
\usepackage{natbib} %author-year citations
\usepackage{verbatim} % for multi-line comments

\usepackage{hyperref} %links
\hypersetup{
    pdfstartview=FitH,      % page fit to window horizontaly when opened
    colorlinks=true,        % false: boxed links; true: colored links
    linkcolor=blue,         % color of internal links
    citecolor=blue,         % color of links to bibliography
    filecolor=black,        % color of file links
    urlcolor=blue,          % color of external links
    bookmarksnumbered,
```


C.4. L^AT_EX

```
    bookmarksopen=true,
    bookmarksopenlevel=1
  }

\setlength{\parindent}{0pt} %no indentation
\setlength{\parskip}{1.5ex plus 0.2ex minus 0.2ex} % paragraphs separation

\setlength{\footskip}{40pt} %setting page and margin sizes.
\setlength\headheight{15pt}

\usepackage{fancyhdr} %Customized headers and footers
\pagestyle{fancy}
\fancyhf{}
\fancyhead[RO]{\nouppercase\leftmark}
\fancyhead[LE]{\nouppercase\rightmark}
\fancyfoot[CO, CE]{\thepage}
\fancyfoot[LE, LO]{\today}

\onehalfspacing

\let\stdsection\section
\renewcommand\section{\newpage\stdsection}

\makeatother
\setcounter{secnumdepth}{3}
\renewcommand{\thesubsubsection}{\thesubsection.\alph{subsubsection}}

\begin{document}

\input{Title}
\input{acknowledgement}
\input{abstract}
\input{resume}

\begin{spacing}{1}
\tableofcontents
```

```
\listoftables
\listoffigures
\end{spacing}
%\newpage

\input{chapter1/chapter1}%introduction
\part{Theoretical Framework}

\input{chapter2/chapter2}
\input{chapter3/chapter3}

\part{Development of experiments}
\label{part2}
\input{Chapter4/Chapter4}
\input{Chapter5/Chapter5}
\input{Chapter6/Chapter6}
\input{Conclusions}

\cleardoublepage
\phantomsection
\addcontentsline{toc}{chapter}{References}
\bibliographystyle{apacite} %Choose style for bibliography
\bibliography{biblio}

\appendix
\cleardoublepage
\phantomsection
\addcontentsline{toc}{part}{Appendix}

\input{appendix1/appendix1} %pirls
\input{appendix2/appendix2} % models
\input{appendix3/appendix3} %SAS

\end{document}
```


Abstract

The starting point of this research is the question, *may reading acquisition be more or less effective depending on the language in which it is performed?* Two categories for classifying the languages have been developed. First the notion of *linguistic family* is employed to describe the languages from a cultural and historical perspective. Secondly, the notion of *orthographic depth* is used for differentiating the languages according to the correspondence between orthography and phonetic. These categories have been related to the databases PIRLS 2001 and 2006 (international assessment about reading developed by the IEA), the aim being to connect reading achievement to the language in which students answered the test. However, it is clear that the language is not an isolated factor, but part of a complex structure of determinants of reading. Therefore, factors related to students and schools have also been incorporated to this research. Moreover, the multidimensionality of the reading process has been taken into account by distinguishing in the analysis the different aspects that made the process according to PIRLS: informative reading, literary reading, process comprehension of high and low order. To answer to the questions proposed by this research a hierarchical statistical model (multilevel) was developed, it was able to account for the connection between reading achievement, language and other associated factors. As a result, contextual factors (home and school) were more significant than language. Moreover, determinacy may vary if taking into account educational systems.

Keywords: *Reading learning, International comparisons, Multilevel models, Linguistic families, Orthographic depth.*

Résumé

Le point de départ de cette recherche concerne la question suivante : *l'acquisition de la lecture, peut-elle être plus ou moins efficace en fonction de la langue dans laquelle elle s'effectue ?* Deux catégories pour classer les langues ont été définies dans ce travail. Premièrement, la notion de *famille linguistique* est à la base d'une description des langues à partir d'une perspective historique et culturelle. Deuxièmement la notion de *profondeur orthographique* est mobilisée, celle-ci différencie les langues en fonction de la correspondance entre l'orthographe et la phonétique. Ces catégories ont été mises en rapport avec les bases de données PIRLS 2001 et 2006 (étude internationale sur la lecture menée par l'IEA), afin de relier la performance en lecture et la langue dans laquelle les élèves ont répondu au test. Toutefois, il est clair que la langue n'est pas un facteur isolé, car elle fait partie d'un ensemble complexe de déterminants ; ainsi, des facteurs liés aux élèves et au milieu scolaire ont également été incorporés dans l'étude. En outre, il a été tenu compte de la multidimensionnalité du processus de lecture, en distinguant dans les analyses les différents domaines mesurés par l'enquête : lecture d'informative, littéraire, et compréhension des processus d'ordre complexe et simple. Pour répondre aux questions de cette recherche nous avons élaboré un modèle statistique hiérarchique capable de rendre compte de la relation entre la compréhension de la lecture, la langue et les facteurs qui y sont associés. En dernière analyse, les facteurs contextuels (individuels et scolaires) se sont révélés être plus importants que la langue elle-même. En outre, les déterminants du niveau en lecture dépendent des systèmes éducatifs observés dans cette enquête.

Mots-clés : *Acquisition de la lecture, Comparaisons internationales, Modèles multi-niveaux, Familles linguistiques, Profondeur orthographique.*