The role of reading engagement in improving national achievement: An analysis of Chile's 2000–2009 PISA results

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A R T I C L E   I N F O

A B S T R A C T

Chilean students achieved the greatest improvements in reading scores among OECD countries according to 2000–2009 PISA results. The present study aimed to analyze both systemic and individual variables behind Chile's achievement, with emphasis on analyzing the roles that reading attitudes and strategies can play. Results, obtained through Oaxaca–Blinder decomposition and multilevel models, were consistent with earlier literature. Furthermore, attitudes explain up to 25% of Chilean improvement and 8% of the variance within schools. In contrast, learning strategies are unrelated to achievement changes. These findings provide a more comprehensive understanding of reading development in the context of an emerging educational system.

1. Introduction

Currently, educational investigations focused on quantifying the effectiveness of educational reform or the impact of public politics on educational outcomes do not discuss to the same extent or with the same emphasis individual and cognitive aspects. Similarly, various studies that focus on particular components related to learning do not consider the nuances that a wider and more systemic perspective might reveal. Taking these tendencies into account, the present study aimed to analyze both the systemic and individual factors impacting reading comprehension levels in the Chilean educational system.

1.1. The educational system in Chile

The Chilean educational system has become internationally recognized, especially in recent years, for being widely privatized, and this situation has brought with it many consequences. Intensification of the policy of privatization was implemented under a military dictatorship that lasted until 1990, but even twenty years on, the system is still unregulated, private market share gains are permitted, and public schools are constantly and consistently losing their relevance. However, since the return of democracy, authorities from each government have introduced educational reforms, including the following significant initiatives: extending the length of school day; expanding compulsory education from primary (8 years) to secondary (12 years) education levels; redistributing the curriculum and placing greater relevance on subjects such as language and mathematics; bettering the conditions and equipment available to schools; and increasing teacher salaries and opportunities for continued training.[1] In financial terms, the percent of public spending allotted to education has increased from 2.7% of the gross domestic product (GDP) in 1995 to 3.9% in 2000 and 4.6% in 2009 (OECD, 2011b, p. 254).

When analyzing the effectiveness of these reforms, Chile ranks well compared to other Latin American countries, but this result is not maintained when Chile is compared against countries with an analogous level of development. In fact, the only measure in which Chile has presented significant advances during the last decade is in reading comprehension, making this subject key for any investigations. The first evidence for this significant improvement was from increased 2006 Program for International Student Assessment (PISA) test scores as compared to scores from 2000. In the 2009 PISA, Chile's scores again improved, and from the 2000 to 2009 PISA, reading comprehension scores improved by 40 points, equivalent to 40% of the standard deviation (SD) in test scores

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[1] In the years following those considered by this study, new measures have been taken to combat the socioeconomic inequalities that affect the Chilean educational system. These include banning student admission selectivity for primary education, prohibiting for-profit schools, and introducing the Preferential School Subsidy to economically support schools where the poorest 40% of students attend.

(2009 PISA average = 500, SD = 100). This same trend in improvement has been found in comparative regional studies (Duarte et al., 2010; Costilla, 2008) and in national assessments (UCE, 2011).

To explain the 2000–2009 PISA results and to generally explain problems in the effectiveness of the Chilean educational system, previous analyses have focused on systemic aspects. These aspects include socioeconomic status (Treviño et al., 2009; Costilla, 2008), source of institutional funding and control (private/public, voucher, etc.) (Bellei, 2007; Mizala and Torche, 2012), grade repetition (Treviño et al., 2010), and schools' selection methods (Contreras et al., 2010). Other characteristics commonly presented by researches are parental education, the availability of resources at home, school management, and school climate. A frequent conclusion revealed by this kind of research is that systemic aspects of the Chilean education system have a high impact on individual performance. Indeed, the most relevant factor of this dynamic is the relationship between socioeconomic origin and students' achievement and this has resulted in Chile being one of the countries in the world where socioeconomic status most strongly determines academic success (OECD, 2010a). This final point explains the relevance given to the systemic approach. However, research has also shown that the influence of these factors is complex and that controlling them does not mean students will automatically improve their performance.

When considering the difficulty behind deepening a systemic approach to one that can consider individual aspects, the Chilean model presents additional challenges given that, due to its particularities, a great amount of effort has been concentrated on the systemic perspective. One possible analogy for understanding the Chilean model is to picture it as a hierarchal structure. It is a system in which higher variables, such as socioeconomic class, school administration or school selection methods, or administrative dependence decidedly determine individual results, and, as a consequence, these have received a large part of the investigative interest. However it is known that just as the system can affect individual results, individual factors can also affect the system. Consequently, the question analyzed in the current investigation is valid – *What is the contribution of individual characteristics and attitudes in an educational system highly determined by systemic aspects?*

Given the nature of this question, it was necessary to deeply analyze individual characteristics and abilities. Due to its widely noted key role as an indicator of success within the framework of the Chilean educational system, reading comprehension in relation to student characteristics was used in the present study. In more definitive terms, the present study examined the aspects involved with the act of reading, such as the motivation of students when approaching texts, students' learning strategies, the types of reading material that students use, and the time students dedicate to reading. All of these elements comprise what is called reading engagement. The following section will detail this concept before presenting the basis behind the present study.

1.2. Reading engagement as a determinant of reader performance

Baker et al. (1996) proposed the concept of reading engagement as follows: "Engaged readers are viewed as motivated, strategic, knowledgeable, and socially interactive. They read widely for a variety of purposes and capitalize on situations having potential to extend literacy" (p. XIII). Thus, reading engagement is an individual component that approximates the underlying process at work in the development of reading comprehension (Guthrie et al., 1996). It should be mentioned that the concept of reading engagement takes many more factors into consideration than those present in PISA (Guthrie et al., 2007; Taboada et al., 2009). However, PISA provides a sufficient number of elements to enable the analysis of

two dimensions in reading engagement – attitudes and reading strategies (OECD, 2011a). Studies hypothesize that the influences of these two elements on reading comprehension are interdependent (Guthrie and Wigfield, 2000; Wigfield et al., 2008).

Wigfield and Guthrie (1997) distinguish between two central concepts pertaining to attitude. The first one refers to the image that individuals have about their self-efficacy as readers. Much like the more general concept of attitude, a positive perception of self-efficacy will influence both reader engagement and achievement (Marsh and Martin, 2011). The second concept refers to the desires that motivate a young person to read. The referenced authors, as well as other researchers, distinguish between an interest in reading, or intrinsic motivation, and reading-related goals generated by an external reward, or extrinsic motivation. Intrinsic motivation depends on factors such as liking the content of the material, an interest in fulfilling personal goals, and an enjoyment of learning in itself (CERI, 2000). Other factors related to motivation, and which are also elements of reading engagement, include the amount of time that is dedicated to reading and the variety of materials that are read (Baker et al., 1996). Regarding the latter, both the amount and breadth of extra-curricular reading materials are factors that determine reading achievement (Wigfield and Guthrie, 1997). In particular, the concept of breadth is significant because it highlights the importance of reading a variety of texts as a value to promote instead of early specialization. Finally, it is important to note once again that PISA data only allow for the consideration of certain aspects of motivation, which is characterized by multidimensionality. The diverse aspects of motivation can each play a distinct role in relation to the diverse aspects of learning (Guthrie et al., 2007), and research suggests that there is a mutual dependence between motivation and achievement (Valentine and DuBois, 2005).

Different types of learning strategies can be determinants of reading comprehension if the active role of the reader in the process of accessing the meaning of a text is taken into consideration (Iser, 1997). In this context, learning strategies can be understood as comprehension strategies. Duke et al. (2004) argue that one of the most consistent findings in research about teaching reading comprehension is that instructing students in the use of such learning strategies directly impacts reading performance. Likewise, Bissonnette et al. (2010) argue that explicit instruction in strategies is the second most important factor in remedial reading instruction programs. According to the model developed by Bråten and Anmarkrud (2011), it is possible to distinguish between surface-level processes, which are equivalent to memorization, and deeper-level processes, which are equivalent to learning strategies of elaboration and control. Surface-level processes involve privileging activities such as repetition, reciting phrases, or memorizing content. In relation to reading, Bråten and Anmarkrud (2011) emphasize that memorization strategies correspond to the surface-level processing of text. An interpretation that centers on the surface of the text and focuses on memorization could be valid for certain types of reading. In general, however, if the goal is comprehension, then emphasizing memorization strategies is the wrong method to teach (Alonso Tapia, 2005). In contrast, elaboration strategies, which are capable of connecting academic content to the real world, are related to the contextualization of learning. Elaboration is significant as much for achievement as it is for maintaining the motivation to learn (Cordova and Lepper, 1996). Finally, control strategies involve the student's ability to self-regulate his or her own learning, distinguish what has been learned from what has not been learned, recognize what is central and what is not central, and search for additional information when necessary. Supervision and self-regulation of reading are crucial for achieving a deep comprehension of the text (Alonso Tapia, 2005).

1.3. Purpose of the present study

To summarize, the general aim of this research was to estimate the contribution that factors directly related to the student had on learning in an educational system highly determined by structural and socioeconomic factors. In this context, Chile is a particularly interesting case because it is one of the countries with the highest association between social condition and academic performance, in addition to being one of the most socially segregated school systems in the world (OECD, 2010b; OECD, 2013). This means that students normally attend schools where the greater portion of their classmates come from very similar socioeconomic and cultural backgrounds, a characteristic which is present from the first years of schooling and lasts throughout primary and secondary education (Valenzuela et al., 2013). All of these circumstances are external to the components of learning, while the factors that comprise reading engagement directly point to the comprehension process. In previous studies of Chile, the analyses have tended to focus on the external circumstances. Due to this, the objective of this study was to assess the contribution of individual factors to reading achievement in the context of the Chilean educational system, particularly of those factors associated with reading engagement.

In order to achieve this objective, the core data used for analyses was provided by studies focused on reading comprehension from the Organization for Economic Co-operation and Development (OECD) and from 2000 and 2009 PISA reports. The data provided by PISA facilitated the study of reading engagement within the framework of educational systems because it is nationally representative and incorporates a rich background of information concerning individual characteristics, schooling conditions, and reading engagement itself. Between the years 2000 and 2009, the Chilean educational system underwent various reforms, and by comparing the 2000 and 2009 PISA results, it was possible to analyze if the estimations and models varied across time. The present study simultaneously considered systemic and individual aspects. The first aspects had the purpose of representing the system and of controlling the possible incidence of individual aspects, and these included characteristics of the school as well as institutional elements, some of which have varied between 2000 and 2009, such as with the implementation of a full school day and the amount of hours dedicated to language lessons. Variations were expected to be found between the analyzed periods. Regarding individual aspects, socioeconomic aspects of the student were considered in addition to factors associated with reading engagement. With these aspects, it was not possible to confirm a priori if there had been changes between 2000 and 2009, but it was possible to form postulations due to the extent of changes which had been implemented into the Chilean educational system during the studied decade, changes which could have directly impacted student results. To quantify the impact that this group of variables and their variations had on reading comprehension results, two analytical models were used – Oaxaca-Blinder decomposition and multilevel models. These additionally quantified the possible temporal evolution of any observed impacts.

2. Data and methodology

As mentioned previously, the specific objective of the present study was to analyze the role that reading engagement can play in achievement in the context of an educational system where systemic factors can highly determine individual results. As a consequence of this, the methodology necessarily considered a detailed representation of each of the elements to be analyzed. In addition to describing the diverse aspects of the Chilean education system, it was also necessary to fully characterize the role that individual aspects played in relation to learning and the development of reading comprehension, particularly for those aspects associated with reading commitment. Research was carried out in two stages – (i) variable selection and description and (ii) analytical modeling.

2.1. Variable selection and description

From the questionnaires that accompany PISA, factors that represent reading engagement, in addition to other contextual characteristics, were identified. Variables were chosen only if they were available and in the same form in both, the 2000 and 2009 PISA databases and were relevant according to the collected evidence and hypothesis of this study. Taking into consideration that the educational system is based on a hierarchical structure (Raudenbush and Bryk, 2002), the factors were separated into two categories, those that characterized the students and those that characterized the schools. The first category was separated into three subcategories, including socioeconomic status, attitudes toward books and reading, and learning strategies. The final two subcategories represent central themes associated with reading engagement and were therefore the principal objects of analysis and interpretation, whereas socioeconomic status was considered so as to control for non-cognitive individual aspects. The second category was divided into school factors and institutional aspects. In considering these characteristics, it was important to note that in the time period being studied (2000–2009), there still existed in Chile the liberty of selecting students according to socioeconomic background and/or learning capacity (legally forbidden nowadays for 6th or lower grades' students). Therefore, the selected factors represented aspects that could vary between schools, regardless of institutional ones. Institutional variations were represented by factors such as the type of school (public, private, voucher, technical) and the corresponding responsibilities regarding resources and curriculum administration. Table 1 presents all of the factors used in the models, including characteristics of the schools, the student, and reading engagement. The main goal of the multivariate of the model was to accurately represent the Chilean education system while taking its complexity into account. A detailed description of variable properties and composition can be found in Appendix A, Tables A1 and A2.

Due to the reforms that occurred between 2000 and 2009, it was assumed that there could be variations in data, particularly in relation to school characteristics. Special care was taken to maintain comparability between both versions of PISA by using only analogous variables. It was verified that the same questions were used in the 2000 and 2009 PISA versions, questions which in large part concerned the central themes of this study. One important aspect that could not be assessed due to changes in the questionnaire was the use of digital media in learning, where the 2000 PISA only treated subject in a general way while the 2009 PISA dedicated a separate section to this theme. Regarding the variables measuring reading engagement, it must be taken into consideration that the study involves self-reported data; since students provide self-evaluations and statements about their personal motivations and learning strategies (Bråten and Samuelstuen, 2007) it is necessary to remember that the source of information was the same student under evaluation. Another issue associated with self-reported data was that these variables tended to have higher rates of missing values. In these cases, an imputation methodology was used to maintain the representativeness of the samples and to conserve comparability. This method involved calculating the median from a group of cases formed by similar subgroups associated with diverse control variables, therefore ensuring that the calculated data reflected relatively similar subgroups (Valenzuela et al., 2009).

Table 1
Mean and standard deviation (SD) of PISA Chile 2000 and 2009 results.

	2000		2009	
	Mean	SD	Mean	SD
Students				
1. Characteristics				
Gender	0.54	(0.5)	0.50	(0.5)
Enrolled in 10th grade	0.64	(0.5)	0.71	(0.5)
Enrolled in 11th grade	0.00	(0.0)	0.05	(0.2)
Parents' education	11.86	(3.2)	12.38	(3.2)
Grade retention	0.27	(0.4)	0.20	(0.4)
Books (1 = >100 books)	0.20	(0.4)	0.19	(0.4)
2. Attitudes				
I read only if I have to	0.50	(0.5)	0.35	(0.5)
Reading is a favorite hobby	0.37	(0.5)	0.32	(0.5)
Reading time (in minutes)	43.99	(36.1)	29.32	(30.6)
Fiction	0.51	(0.5)	0.61	(0.5)
Nonfiction	0.43	(0.5)	0.44	(0.5)
Newspapers	0.72	(0.4)	0.76	(0.4)
Teachers	0.02	(1.0)	0.00	(1.0)
3. Strategies				
Memorizing	0.45	(0.5)	0.50	(0.5)
Reciting	0.32	(0.5)	0.29	(0.5)
Figuring out what I need to learn	0.67	(0.5)	0.72	(0.4)
Figuring out which concepts I haven't understood	0.69	(0.5)	0.66	(0.5)
Looking for additional information	0.60	(0.5)	0.51	(0.5)
Relating to prior knowledge acquired in other subjects	0.50	(0.5)	0.43	(0.5)
Schools				
1. Characteristics				
Parental education of peers	11.86	(1.9)	12.38	(1.8)
Discipline index	0.02	(1.0)	0.01	(1.2)
Language class time (3–5 h)	0.61	(0.5)	0.55	(0.5)
Language class time (>5 h)	0.12	(0.3)	0.35	(0.5)
Class size	36.36	(7.4)	36.58	(7.2)
School size	1086.16	(587.4)	1155.42	(843.1)
K-12 school	0.41	(0.5)	0.53	(0.5)
Single-sex school	0.17	(0.4)	0.04	(0.2)
Full school day	0.38	(0.5)	0.79	(0.4)
2. Institutional factors				
Resource administration index	0.04	(1.0)	0.00	(1.0)
Curriculum responsibility index	0.01	(1.0)	−0.03	(1.0)
Academic tracking	0.75	(0.4)	0.81	(0.4)
Technical school	0.32	(0.5)	0.26	(0.4)
Public school	0.50	(0.5)	0.39	(0.5)
Voucher school	0.40	(0.5)	0.53	(0.5)
Private school	0.09	(0.3)	0.07	(0.3)

2000: $n = 4255$ students, 179 schools; 2009: $n = 4929$ students, 200 schools.

2.2. Regressions and decomposition

To understand the impact that the selected factors had on achievement, two methods were proposed. First, linear regressions were developed to decompose the explanatory power of the model, thus allowing for a quantification of the influence of each factor and of the possible changes between 2000 and 2009. Second, a multilevel model was implemented that considered schools to be a larger unit within which individual students were clustered. This model permitted studying the roles that reading engagement and individual characteristics play in the context of explaining reading achievement, considering the hierarchical and segregated structure of the Chilean educational system.

To quantify the explanatory capacity of the identified factors, three procedures were performed – a linear regression, a decomposition of the estimates of the regression, and a multilevel model. For every calculation, the complex design of PISA and the stratified structure of the sample were taken into consideration (Kreuter and Valliant, 2007; Jann, 2008; OECD, 2012). The estimated

parameters based on the linear regression are displayed in Table 2. Linear regression was used to test Eq. (1), where reading performance (Y) of the student (i) for each PISA version (t = 2000, 2009) was determined by the characteristics of the student and his or her family (A); the student's motivation for reading (M); the learning strategies that the student reported applying (E); the combined characteristics of the school that the student attends (S); and elements of institutional organization (I). This equation was used as a reference to explain differing scores, as based on a decomposition method.

$$\gamma_i^t = \beta_0^t + \beta_1^t A_i^t + \beta_2^t M_i^t + \beta_3^t E_i^t + \beta_4^t S_i^t + \beta_5^t I_i^t + u_1^t \qquad (1)$$

The Oaxaca–Blinder decomposition method (Oaxaca, 1973; Blinder, 1973) is able to explain differences between groups by making use of the averages and coefficients of linear regressions. In

Table 2
Linear regression coefficients (Coeff) and standard error (SE) estimated for PISA Chile 2000 and 2009.

	2000		2009	
	Coeff	SE	Coeff	SE
Students				
1. Characteristics				
Gender	0.27	(2.6)	4.63	(2.1)
Enrolled in 10th grade	19.29***	(3.0)	38.76***	(4.3)
Enrolled in 11th grade	44.06	(24.7)	60.32***	(6.1)
Parents' education	2.24***	(0.4)	1.57***	(0.4)
Grade retention	−37.48***	(4.0)	−13.60**	(5.1)
Books (1 = >100 books)	10.11***	(2.7)	11.31***	(2.4)
2. Attitudes				
I read only if I have to	−19.53***	(2.3)	−13.16***	(2.0)
Reading is a favorite hobby	6.62**	(2.4)	5.25*	(2.0)
Reading time (minutes)	0.06	(0.0)	0.15***	(0.0)
Fiction	0.98	(2.5)	6.16**	(2.0)
Nonfiction	3.80	(2.2)	5.51*	(2.2)
Newspapers	9.13***	(2.4)	6.57**	(2.5)
Teachers	−1.60	(1.1)	1.30	(0.9)
3. Strategies				
Memorizing	−3.75	(2.3)	−1.34	1.8
Reciting	−17.77***	(2.5)	−6.88**	2.4
Figuring out what I need to learn	3.85	(2.3)	3.02	2.0
Figuring out which concepts I haven't understood	17.63***	(2.4)	10.49***	1.8
Looking for additional information	−0.31	(2.4)	−0.27	2.1
Relating to prior knowledge acquired in other subjects	6.00***	(2.0)	0.83	2.0
Schools				
1. Characteristics				
Parental education of peers	10.49***	(2.1)	12.19***	1.2
Discipline index	4.29***	(1.3)	2.33**	0.9
Language class time (3–5 h)	17.53***	(2.5)	11.39***	3.8
Language class time (>5 h)	16.94***	(5.4)	8.91*	4.1
Class size	0.36*	(0.2)	0.75***	0.2
School size	0.01*	(0.0)	0.00	0.0
Primary level at school	10.60*	(4.8)	0.03	4.3
Single-sex school	11.75*	(5.8)	41.28**	14.4
Full school day	3.73	(5.4)	−0.79	5.6
2. Institutional factors				
Resource administration index	4.59	(4.1)	13.40*	6.5
Curriculum responsibility index	−1.72	(1.6)	−2.20	2.1
Academic tracking	10.15	(6.0)	14.18**	5.4
Technical School	−1.43	(5.2)	0.80	4.4
Public school[a]	0.07	(7.4)	21.16	12.1
Private school[a]	10.40	(10.8)	30.99***	5.1
Constant	199.4***	(24.7)	170.6***	18.8
R^2	0.49		0.45	
F	(34.46) = 45.3		(34.46) = 64.7	

2000: $n = 4255$ students, 179 schools; 2009: $n = 4929$ students, 200 schools.
* $p = <0.5$.
** $p = <0.01$.
*** $p = <0.001$.
[a] Ref: Voucher Schools.

this study, the results from the regression model were used to estimate the differences in scores between the two versions of the PISA test. This methodology was used to calculate the following: (a) how much of the difference in reading performance between 2000 and 2009 was due to differences in the influence of the predictors (i.e., student and school characteristics); (b) how much of the difference in reading performance was due to differences between coefficients (returns); and (c) how much of the difference in reading performance was due to interactions (O'Donnell et al., 2008; Valenzuela et al., 2009). Eq. (2) represents the decomposition method, where the difference in PISA score between 2000 and 2009 was the result of the sum of the differences for all factors considered in Eq. (1).

$$\gamma^{09} - \gamma^{01} = (\beta_0^{09} - \beta_0^{01}) + (\beta_1^{09} A_i^{09} - \beta_1^{01} A_i^{01}) + (\beta_2^{09} M_i^{09} - M_2^{01} A_i^{01}) + (\beta_3^{09} E_i^{09} - \beta_3^{01} E_i^{01}) + (\beta_4^{09} S_i^{09} - \beta_4^{01} S_i^{01}) + (\beta_5^{09} I_i^{09} - \beta_5^{01} I_i^{01}) \quad (2)$$

As Eq. (2) shows, data from 2009 were used as a reference. This choice indicated that the expected change in achievement in 2009 was calculated to account for the possibility that the predictors in 2009 (A^{09}, M^{09}, E^{09}, S^{09}, and I^{09}) had the same mean values as predictors in 2000 (characteristic effect) or that the coefficients based on 2009 data (β^{09}) had the same values as those based on 2000 data (coefficient effect). In addition to evaluating predictors and coefficients, their interaction was studied, as depicted in Eq. (3). Eq. (3) presumed that the difference in PISA reading scores between 2000 and 2009 derived from differences between the mean values of predictors (E), differences between coefficients (C), and from the interaction between these (CE).

$$\gamma^{09} - \gamma^{01} = \Delta X \beta^{01} + \Delta X \beta^{09} + \Delta X \Delta \beta = E + C + CE \quad (3)$$

Finally, the multilevel model allowed for some of the deficiencies of linear regression, in relation to the sample, to be corrected. Literature regarding multilevel models aided in operationalizing what was underlined in the previous discussion, that is, that an educational system is a structure in which units cluster, or 'nest', within larger units. In this sense, it was more likely that two students from the same school resembled each other than if compared to students from another school (Bressoux, 2008; Rumberger and Palardy, 2004; Snijders and Bosker, 1999). This hypothesis contradicts one of the assumptions upon which linear models are based, which is the assumption of independent observations (Steele, 2008). As previously stated for the case of Chile, taking the structure of the educational system into account is highly necessary due to the system's marked inequality and segregation (Elacqua, 2012; Valenzuela et al., 2010). Following the literature, a second level was added to the models representing the schools, since Chilean schools function as units and because student performance is framed in terms of school characteristics such as dependency, selectivity, and the attributes of classmates. These factors tend to be more homogeneously distributed within schools than between schools (Elacqua and Martínez, 2011). To summarize, multilevel models permitted the assessment of individual and school factors, both in the same context and separately, therefore measuring how these aspects were related to achievement in reading comprehension.

3. Results

Table 1 shows the averages for each variable from the 2000 and 2009 PISA groups, therefore allowing observations of variation and symmetry to be made. Regarding the components of reading engagement, there were some positive changes, with the number of students claiming to read only out of obligation decreasing in

2009 not only as compared to 2000 but also as compared to the OECD international average (41%) and with a 10% increase between years in the number of fiction works read per month. In regards to strategies, the only two factors which increased in 2009 were memorizing and the self-control strategy: "*Figuring out what I need to learn*". Negative changes in reading engagement from 2000 to 2009 were a decreased mean of "*Reading is a favorite hobby*" and the time given to reading for pleasure. Elaboration strategies were less common in 2009, however, the OECD claims that elaboration strategies do not impact reading achievement (OECD, 2010c, p. 51). The models used in the present study, as shown in the following pages, confirmed this to be true in the case of Chile. In relation to student characteristics, some positive tendencies included a reduction in grade repetition and a rise in parental education level. Moreover, this category presented no signs of negative change. Concerning school characteristics, it was more difficult to classify changes as either positive or negative. However, variations were observed. Measured individually, the average parental education of peers increased, and there were also increases in the length of the language class and school day.[2] Finally, in relation to institutional factors, there was a rise in academic selection and enrollment in the private-subsidized system, while the public and technical schools lost enrollment.

3.1. Oaxaca–Blinder linear regression and decomposition

In order to make deductions concerning the effect that the wide set of variables had on reading comprehension and the magnitude of the change between assessments, interpretive models were developed. A first approach toward determining the effects was a linear regression model, with the results presented in Table 2. The overall value of R^2 found that the model explained almost 50% of the variance in achievement in 2000, whereas in 2009, the model was slightly less effective in explaining achievement. On the other hand, in 2009, more variables had significant estimated parameters (17 in 2000 vs. 22 in 2009). When comparing the distinct categories of variables, the greatest differences were found in the number of variables representing attitude toward reading (2-fold increase in significant parameters in 2009) and in the variables representing institutional factors (3 significant factors in 2009 vs. 0 in 2000). Deeper interpretations of these results were not performed given the necessity of taking into consideration multilevel components, which was incorporated into the third model used for analyses.

The results from the regression analysis were the input for the decomposition procedure presented in Table 3. The model clustered variables into the five categories previously described and presented in Eq. (1). The results indicated that between 2000 and 2009, there was a 34.6 point difference in student reading scores, which was in line with the improvement observed in OECD reports. The estimations showed that nearly 60% of the total difference (19.74 score points) can be attributed to changes in characteristics. Meanwhile, the effect of coefficients and interactions (the returns) explained the other 40% of differences. These results were similar to estimates found in previous studies (Valenzuela et al., 2009).

The last column in Table 3 is the sum of the characteristics, coefficients, and interactions. This column can be interpreted as the contribution of each subset of factors in explaining the difference between both scores. According to this model, it is possible to assert that student characteristics contributed up to 20 points of the score difference, with attitudes toward reading

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[2] It could be interpreted that both variables measure the same situation, but curricular changes took place which led to a redistribution of instruction time within the day in addition to extending the overall school day.

Table 3
Oaxaca–Blinder decomposition.

	Characteristics	SE	Coefficients	SE	Interactions	SE	Sum
Students							
Characteristics	7.41***	1.8	13.70	8.7	−0.17	1.3	20.94
Attitudes	2.35**	0.9	8.26	4.3	−1.90	1.1	8.71
Strategies	−0.25	0.4	−3.48	3.2	0.27	0.4	−3.46
Schools							
Characteristics	9.92**	3.4	21.35	29.3	−8.03*	4.0	23.24
Institutional factors	0.31	1.3	16.67	9.8	−2.97	1.9	14.01
Constant			−28.84	28.9			−28.84
Total	19.74***	4.8	27.64***	4.4	−12.8**	4.5	34.6

Scores: 2000 = 419.13 (3.6); 2009 = 453.71 (3.1). Difference = 34.58 (4.5).
* $p = < 0.5$.
** $p = < 0.01$.
*** $p = < 0.001$.

also contributing, albeit with a contribution less than half that of characteristics. Similar to the result observed in the linear regression, student learning strategies did not contribute to the difference since these had low and negative values. School characteristics contributed toward explaining the score differences in a way similar to that of student characteristics. The institutional factors also had a positive impact.

A deeper understanding of these estimations[3] can be achieved by interpreting the *characteristics* column as the input that each subset contributes to the educational system, while the *returns* (*coefficients + interactions*) columns are the advantages and disadvantages that the system obtains from the inputs once they have been operationalized. In other words, the input is what the system receives at the beginning, and the returns represent how the system treats them, with the returns therefore representing the efficacy of the system (O'Donnell et al., 2008). The high and negative values of the constant represented differences in reading performance that were not explained by the fixed model, either due to its particular design or because it was associated with intrinsic differences in both samples. According to this, close to two-thirds of student characteristics and attitudes were related to returns of the system (13.7 + −0.17 and 8.26 + −1.9). The school factors, on the other hand, were more related to returns than to the inputs, since half of the contribution for school characteristics came from the *coefficients* column. As was expected, the institutional factors were totally concentrated in returns, which confirmed the validity of the estimations since these factors were, in fact, representing operational conditions. In brief, the decomposition process showed that attitudes toward reading, along with the control factors, played a role in the differences between reading scores in 2000 and 2009. Since the model showed that attitudes were related to differences in reading scores, it can be deduced that this factor is related to the efficacy of the Chilean educational system.

3.2. Multilevel regression

While the aforementioned deduction was central to the initial approach taken by this study, a deeper analysis was still needed to assess the relationship between the determinants and reading achievement. As such, a multilevel regression model was fit with students at the first level and schools at the second level. Tables 4 and 5 present the 2000 and 2009 estimates, respectively. Model 1 (null) served as a reference for the subsequent models, which progressively incorporated the subsets of previously described variables. The intra-class correlation coefficient (ICC) measures what percentage of the variance can be explained by similarities among group members, which, in the present case,

were the schools. The coefficient was high for both years (ICC = 0.54 in 2000; 0.49 in 2009), and it can therefore be asserted that almost half of the variance in achievement was due to variations between schools. This estimation confirmed the high segregation of the Chilean educational system. Likewise, a similar estimation calculated for the rest of the PISA 2009 sample showed that of the 66 participating countries, Chile ranked 47th in regards to the ICC. In contrast, the ICC of Finland is only 0.07, indicating that achievement levels are no more similar among students within the same school than on a national level.

Model 2 incorporated all of the variables from the school and individual categories excluding attitudes and strategies variables. Its composition and explanatory power resembled earlier findings from multilevel models using Chilean data (e.g., Willms and Somer, 2001). The 2000 PISA model fit explained 80% of the variance between schools, and this increased to 84% in 2009. Besides this, both models were very effective in reducing the intra-class correlation, meaning that the selected set of variables was fit to explain not only test scores, but also the segregation of the system. On the other hand, the variance within schools remained in mostly unexplained, and this therefore became the focus of the following three models. Model 3 presented estimations fit to explain achievement according to student attitudes variables. As a whole, this model only explained a very small proportion of the variance at the school level (7% in 2000 and 5% in 2009), and it did not reduce the intra-class correlation from the null model. Its main gain was in the 7% explained by the variance within schools. If compared to Model 2, Model 3 had a similar explanatory value in terms of individual variance. Model 4 explained achievement according to student learning strategies, and it showed a pattern similar to the previous model. The intra-class correlations did not decrease in comparison to the null model, and this model only explained a small percentage of the variance between schools, which was even smaller in 2009 (6%) than in 2000 (10%). The same occurred at the individual level, with its explanatory power being 2% lower in 2009 than in 2000.

Model 5 analyzed possible interactions between student attitudes and learning strategies. This is an important aspect to control because, as was previously discussed, both subsets belonged to the greater concept of reading engagement, and these aspects can influence each other. Concerning reading attitudes, in both models most of the variables held estimated parameters similar to those of Model 3, indicating that these factors were not significantly affected by the new design. In the 2009 model, two small exceptions were found for the subgroups of "*Fiction*" (number of fiction books read per month) and "*Teachers*" (positive teacher-student relationship), both of which lost significance. However, both the linear models and the 2000 multilevel model estimated that the parameters of these variables were not significant. In contrast, student attitudes similarly affected three learning strategies in 2000 and 2009, specifically in regards to the

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[3] A deeper interpretation can be found in the disaggregated estimation of each variable presented in Appendix table A2.

Table 4
Multilevel models from PISA Chile 2000. Att.: Attitudes; Coeff: Coefficient, SE: Standard error.

Fixed effects	Model 1 Empty		Model 2 School/student		Model 3 Attitudes		Model 4 Strategies		Model 5 Att./Strategies		Model 6 TOTAL	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Intercept	**406*****	5.2	**199*****	21.7	**396*****	5.6	**390*****	5.3	**389*****	5.7	**198*****	20.8
Students												
1. Characteristics												
Gender			**5.14***	2.1							−1.32	2.1
Enrolled in 10th grade			**18.28*****	3.4							**18.80*****	3.3
Enrolled in 11th grade			**57.39****	18.7							**50.42****	18.0
Parents' education			**2.51*****	0.4							**2.35*****	0.3
Grade retention			**−26.46*****	3.8							**−23.05*****	3.6
Books			**11.35*****	2.5							**6.29***	2.4
2. Attitudes												
I read only if I have to					**−19.01*****	2.2			**−17.85*****	2.2	**−16.07*****	2.1
Reading is a favorite hobby					**6.33****	2.3			**6.30****	2.2	**8.05*****	2.2
Reading time (minutes)					**0.11*****	0.0			**0.08***	0.0	**0.08***	0.0
Fiction					0.18	2.2			−0.91	2.1	−0.15	2.1
Nonfiction					**5.36***	2.1			4.08	2.1	2.78	2.0
Newspapers					**14.34*****	2.2			**13.03*****	2.2	**8.80*****	2.1
Teachers					0.51	1.0			−0.15	1.0	−0.43	0.9
3. Strategies												
Memorizing							**−5.24***	2.1	−3.77	2.1	−2.52	2.0
Reciting							**−19.28*****	2.3	**−17.09*****	2.2	**−15.03*****	2.1
Figuring out what I need to learn							**4.36***	2.1	4.01	2.1	3.23	2.0
Concepts I haven't understood							**20.02*****	2.3	**16.69*****	2.3	**14.04*****	2.2
Looking for additional information							**5.67***	2.1	0.89	2.1	0.01	2.0
Relating to prior knowledge							**9.74*****	2.1	**6.15*****	2.0	**6.50*****	2.0
Schools												
Parental education of peers			**9.45*****	1.8							**9.03*****	1.7
Discipline index			**4.21*****	0.9							**2.34****	0.9
Language class time (3–5 h)			**17.40*****	2.2							**15.04*****	2.1
Language class time (>5 h)			**11.97*****	3.7							**8.86***	3.5
Class size			0.27	0.2							0.29	0.2
School size			**0.01****	0.0							**0.01****	0.0
K-12 school			19.23***	6.4							**18.78*****	6.0
Single-sex school			**17.00***	7.0							**16.44****	6.6
Full school day			6.40	6.1							6.97	5.8
Resource administration			7.05	4.2							6.28	3.9
Curriculum responsibility			−1.00	2.6							−1.01	2.5
Academic tracking			**15.34***	6.8							**13.64***	6.4
Technical school			3.44	6.4							3.87	6.1
Public school[a]			1.63	8.2							0.16	7.8
Private school[a]			14.09	11.9							15.15	11.2
Random effects												
Intra-class correlation	0.54		0.21		0.54		0.53		0.53		0.20	
Level 2 (school) variances	4476		895		4151		4027		3816		796	
Variance explained			**0.80**		**0.07**		**0.10**		**0.15**		**0.82**	
Level 1 (Students) variance	3807		3449		3533		3618		3426		3155	
Variance explained			**0.09**		**0.07**		**0.05**		**0.10**		**0.17**	
-2 log V	47,967		47,311		47,648		47,741		47,510		46,927	
Δ			656		318		226		457		1039	

n = 4255.
The bold values are the estimated parameters that are statistically significant at *p* = <0.5.
[a] Ref: Voucher Schools.
* *p* = <0.5.
** *p* = <0.01.
*** *p* = <0.001.

control strategy "*Figuring out which concepts I haven't understood*" and the elaboration strategies of "*Searching for additional information*" and "*Relating material with what has been learned in other disciplines.*" These three variables showed decreases in their estimated parameters. In 2009, the two elaboration strategies went from a high level of significance to insignificance. This implies that these strategies are correlated with attitudes, given that their significance level changed when both elements were combined. Regarding the proportion of variance explained, Model 5 could not be compared to Model 2 since its explicative power was considerably smaller at the school level. However, finding that the proportion of variance explained at an individual level was similar in both sets of models is still noteworthy. This could imply that the variance of achievement within schools is determined to a comparable extent by socio-demographic characteristics and by reading engagement separately.

To confirm this possibility, the final model included the total set of variables. As in Model 5, Model 6 analyzed the possible interactions between parameters, specifically between control variables (student and school characteristics) and factors related to reading engagement. Of the variables that represented individual characteristics, two were particularly affected by their interaction with attitudes and learning strategies. These were "*Gender*" (proportion of females) and "*Books*" (availability at home). The parameters estimated for both variables lost significance in the 2000 and 2009 models, implying an interaction between these

Table 5
Multilevel models from PISA Chile 2009. Att.: Attitudes; Coeff: Coefficient, SE: Standard error.

Fixed effects	Model 1 Empty		Model 2 School/students		Model 3 Attitudes		Model 4 Strategies		Model 5 Att./Strategies		Model 6 Total	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Intercept	440[***]	4.7	**205**[***]	19.3	**424**[***]	5.1	**424**[***]	4.9	**417**[***]	5.2	**194**[***]	18.8
Students												
1. Characteristics												
Gender			**13.14**[***]	1.8							**6.83**[***]	1.9
Enrolled in 10th grade			**35.49**[***]	4.3							**33.65**[***]	4.2
Enrolled in 11th grade			**56.54**[***]	5.7							**53.69**[***]	5.6
Parents' education			**1.64**[***]	0.3							**1.56**[***]	0.3
Grade retention			**−13.67**[***]	4.7							**−13.26**[***]	4.5
Books			**13.26**[***]	2.3							**9.56**[***]	2.2
2. Attitudes												
I read only if I have to					**−15.42**[***]	2.0			**−14.16**[***]	2.0	**−13.17**[***]	1.9
Readingis a favorite hobby					3.97	2.2			3.78	2.2	**5.01**[*]	2.1
Reading time (minutes)					**0.18**[***]	0.0			**0.18**[***]	0.0	**0.14**[***]	0.0
Fiction					**6.83**[***]	2.0			**6.39**[***]	2.0	**4.53**[*]	1.9
Nonfiction					**4.84**[*]	2.0			3.80	2.0	3.01	1.9
Newspapers					**10.80**[***]	2.1			**9.86**[***]	2.1	**7.93**[***]	2.0
Teachers					**2.31**[**]	0.9			1.70	0.9	1.06	0.8
3. Strategies												
Memorizing							−2.29	1.9	−1.85	1.8	−1.08	1.7
Reciting							**−7.49**[***]	2.1	**−8.99**[***]	2.0	**−7.67**[***]	1.9
Figuring out what I need to learn							**5.46**[**]	2.1	**4.84**[*]	2.0	3.86	1.9
Concepts I haven't understood							**14.96**[***]	2.0	**10.12**[***]	2.0	**8.16**[***]	1.9
Looking for additional information							**6.59**[***]	1.9	1.99	1.9	0.70	1.8
Relating to prior knowledge							**5.85**[***]	1.9	2.72	1.9	2.06	1.8
Schools												
Parental education of peers			**11.09**[***]	1.4							**10.99**[***]	1.4
Discipline index			**2.14**[**]	0.7							0.95	0.7
Language class time (3–5 h)			**9.26**[**]	3.1							**8.70**[**]	3.0
Language class time (>5 h)			**6.97**[*]	3.3							**6.89**[*]	3.2
Class size			**0.36**[*]	0.2							**0.38**[*]	0.2
School size			0.01	0.0							0.00	0.0
Primary level at school			4.27	5.2							4.06	5.1
Single-sex school			**41.50**[***]	11.9							**39.81**[***]	11.6
Full school day			−0.92	5.4							−0.35	5.2
Resources administration			**11.87**[*]	5.7							**11.53**[*]	5.5
Curriculum responsibility			−1.26	2.2							−1.29	2.1
Academic tracking			**18.02**[***]	5.4							**17.64**[***]	5.2
Technical School			1.30	5.6							2.43	5.4
Public school[a]			18.15	11.9							17.51	11.5
Private school[a]			**31.82**[***]	9.1							**32.58**[***]	8.8
Random effects												
Intra-class correlation	0.49		0.15		0.50		0.48		0.49		0.15	
Level 2 (school) variances	3661		580		3462		3437		3345		541	
Variance explained			**0.84**		**0.05**		**0.06**		**0.09**		**0.85**	
Level 1 (Students) variance	3782		3354		3530		3685		3489		3159	
Variance explained			**0.11**		**0.07**		**0.03**		**0.08**		**0.16**	
-2 log V	55,448		54,590		55,111		55,314		55,049		54,294	
Δ			858		337		134		399		1155	

n = 4929.
The bold values are the estimated parameters that are statistically significant at *p* = <0.5.

[a] Ref: Voucher Schools.

[*] *p* = <0.5.
[**] *p* = <0.01.
[***] *p* = <0.001.

factors and reading engagement. In the case of gender, previous research on reading in Chile has noted an important correlation between being female and having positive attitudes toward reading (Rivera and Riveri, 2011). On the other hand, the estimations for the factors related to reading engagement did not seem to be affected by its interaction with other parameters, with the exception of one variable related to attitudes and one variable related to strategies. The only exception in attitudes was "*Reading is a favorite hobby*," which gained significance in both versions of the model. On the other hand, the control strategy "*Figuring out what I need to learn*" obtained a non-significant estimation in the 2009 model, thereby reducing the number of strategies determining achievement to only two as compared to

the 2000 model which presented three determinant strategies with similar estimations. Regarding school-level variables, besides some small variations, the only variable that lost its significance due to this possible interaction was "*Discipline index.*" The estimation for this factor reached nearly zero in the 2009 model, and it lost half of its estimation in the 2000 model. This finding possibly implies a positive connection between individual attitudes or learning strategies and the level of discipline at the school.

In relation to achievement variance, the six models presented represent better predictors than previous models for three main reasons. In the first place, the distance between the null model and the ideal model was reduced (Δ > 1000) to a greater extent.

Secondly, an important part of the intra-class correlation was minimized, with 37% in 2000 and 31% in 2009. Finally, a high proportion of between school variance was explained, with 82% in 2000 and 85% in 2009. These results imply that the models effectively represented the factors related to differences between schools in the Chilean PISA sample over different assessment years. This is supported by previous literature and analyses concerning the Chilean educational system. The contribution of the new models presented in this study is in the proportion of variance explained at the student level, which reached 16% in 2000 and 17% in 2009. In short, the final models represented the strong effects that school and contextual factors have on reading achievement, in addition to permitting observations between factors related to the role that student reading engagement plays in achievement.

4. Conclusions

In the first part of this study was discussed about how educational research could be enriched by simultaneously taking into account systemic and individual elements, and this study has accordingly aimed to demonstrate that both views can be enhanced by applying a common approach. With this in mind, the Chilean educational system presented unique particularities, being recognized within the research field as a system in which contextual and institutional variables can have a significant impact on outcomes (such as with institutional funding and control, grade retention, and academic tracking). The PISA data from 2000 and 2009 were used as sources of information since both focused on reading comprehension while also presenting vast data on the educational system being studied and on cognitive aspects of the academic subject. Appropriate measures were taken to maintain comparisons between both versions of the study, thus permitting the possibility of perceiving changes in the system over a decade. The procedures that were implemented for this research included linear regression, decomposition, and multilevel models that ultimately attained estimations consistent with and in support of previous research. This confirms that the chosen procedures were pertinent to the sample set and to the objective of this research.

The principal finding of this research was that even if contextual and systemic determinants played a main role in explaining achievement in reading comprehension, a model that additionally considers determinants related to reading attitudes and engagement will provide a more accurate fit for explaining outcomes. In other words, the analyses confirmed that systemic aspects do not exclusively explain achievement variance, a model that, in addition, takes into account individual factors, as reading engagement, is a better fit. The multilevel models used in this study made it possible to observe the interdependencies among different individual- and school-level factors. In regards to reading performance improvement among Chilean students, this study has provided a better understand on the complexity of the multiple factors associated with changes in reading achievement levels over the past decade. Concerning the improved achievement that was experienced at the national level between 2000 and 2009, the decomposition procedure deduced that not all reading engagement aspects were involved. While attitudes toward reading seemed to play a role in improvement, learning strategies did not obtain significant estimations. This result can be related to the positive changes that were observed between 2000 and 2009 in relation to attitudes, with a decrease in the number of students claiming to read only out of obligation and an increase in voluntary reading. As for learning strategies, the

multilevel models were also minimally related to variance in achievement. Rather, multilevel models revealed that the relevance of learning strategies in reading achievement diminished between 2000 and 2009. Overall, the multilevel models in this study explained an additional part of the variance within schools and between schools by incorporating factors related to reading engagement. Given that the models showed that an important part of achievement variance occurred between schools, it becomes at once more complex and more necessary to determine which elements mark differences between students within schools. This research has demonstrated that reading engagement, and particularly a student's attitude toward reading, is a significant contribution to this aim.

However, it is necessary to keep in mind that the present study included a set of factors that are highly subjective and scarcely studied, particularly in Chile. Consequently, all interpretations should be performed with precaution. On the other hand, the models included some of the more classically studied school-level factors related to student achievement, such as grade repetition, parental schooling, and school funding and management. Additionally, at an individual level, gender, number of books at home, and the level of schooling attained by parents are widely studied determinants. As a result, it can be stated that the additional explicative power of the final procedures, including reading engagement, is a significant finding.

From a broader perspective, these findings concerning reading engagement in a particular educational system have several implications. First, it is important to emphasize that the present study took into account all of the attitudes corresponding to reading activities that students claimed to do for pleasure, that is, separate from the time that they dedicated to obligatory reading for school. Consequently, policies that tend to improve motivation and attitudes may have a positive impact in the students general achievement (Wolters et al., 2013), since reading is essential for general learning and positive attitude to reading can affect results in other contents areas (Guthrie and Klauda, 2014; Bråten et al., 2013). In addition, Chi-Hung et al. (2013) have stated that a focus on motivation can be of particular benefit for socioeconomically disadvantage students. Secondly, in addition to the learning strategies lacking explicative power, it is important to take into account that Chilean students obtained averages equal to or higher than OECD averages for memorization, control, and elaboration indexes. In other words, Chilean students claim to use learning strategies. Therefore, the problem may be in how they understand these strategies or in how the school system works with this input to incite better performance. This finding poses a challenge for public policies because, on an international level, learning strategies, and particularly those that account for deep-level processing, are considered key elements in reading development (Bissonnette et al., 2010; Bråten and Anmarkrud, 2011).

Acknowledgements

Appendix A

See Tables A1 and A2

Table A1
Variables derived from the PISA 2000 and 2009 questionnaires.

Variable	Definition
Gender	Bin. 1 = female
Enrolled in 10th grade	Bin. 1 = student assist to 10 grade
Enrolled in 11th grade	Bin. 1 = student assist to 11 grade or higher
Parents' education	Highest level of completed education for parents as expressed in years
Grade retention	Bin. 1 = Student has been retained a school grade[a]
Books	Bin. 1 = >100 books at home
I read only if I have to	Bin. 1 = always or almost always
Reading is a favorite hobby	Bin. 1 = always or almost always
Reading time (minutes)	0 min, 30 min, 60 min, 90 min, 120 min
Fiction	Bin. 1 = more than once a month
Nonfiction	Bin. 1 = more than once a month
Newspapers	Bin. 1 = more than once a month
Teachers	Bin. 1 = most of my teachers really listen what I have to say
Memorizing	Bin. 1 = always or almost always
Reciting	Bin. 1 = always or almost always
Figuring out what I need to learn	Bin. 1 = always or almost always
Figuring out which concepts I haven't understood	Bin. 1 = always or almost always
Looking for additional information	Bin. 1 = always or almost always
Relating to prior knowledge acquired in other subjects	Bin. 1 = always or almost always
Parental education of peers	Mean of the highest level of completed education for the parents of peers as expressed in years
Discipline index	Discipline reported during language classes
Language class time	Bin. 1 = >3–5 h per week
Language class time	Bin. 1 = >5 h per week
Class size	Number of students in the language class
School size	Number of students enrolled
Primary level at school	Bin. 1 = establishment with primary and secondary education
Single-sex school	Bin. 1 = the school only accepts students of one gender
Full school day	Bin. 1 = full school day[b]
Resource administration index	School's degree of responsibility over resource allocation
Curriculum responsibility index	School's degree of autonomy over curriculum
Academic tracking	Bin. 1 = the school applies academic selection criteria for admitting new students
Technical school	Bin. 1 = vocational or technical school[b]
Public school	Bin. 1 = public school
Voucher school	Bin. 1 = voucher school
Private school	Bin. 1 = private school

[a] Since PISA 2000 did not directly ask about grade repetition, this was estimated for both cases using the following student data: year and month of birth and grade level.
[b] Information retrieved from the Ministry of Education of Chile.

Table A2
Detail of decomposition effects for characteristics, returns, and their interactions, PISA Chile 2000 and 2009.

	Effects associated with						Total
	Characteristics		Coefficients		Interactions		
Students							
1. Characteristics							
Gender	−0.01	(0.1)	2.36	(1.8)	−0.18	(0.2)	2.17
Enrolled in 10th grade	1.29***	(0.4)	12.51***	(3.4)	1.31**	(0.5)	15.11
Enrolled in 11th grade	2.25	(1.3)	0.04	(0.1)	0.83	(1.3)	3.12
Parents' education	1.16**	(0.4)	−7.91	(6.6)	−0.34	(0.3)	−7.09
Grade retention	2.78***	(0.7)	6.46***	(1.8)	−1.77***	(0.6)	7.47
Books (1 = >100 books)	−0.06	(0.1)	0.24	(0.6)	−0.01	(0.0)	0.17
Sum	7.41		13.70		−0.17		20.94
2. Attitudes							
I read only if I have to	3.03***	(0.5)	3.19	(1.6)	−0.99	(0.5)	5.23
Reading is a favorite hobby	−0.30*	(0.1)	−0.51	(1.1)	0.06	(0.1)	−0.75
Reading time (minutes)	−0.87	(0.5)	4.00	(2.1)	−1.33	(0.7)	1.8
Fiction	0.09	(0.2)	2.64	(1.7)	0.50	(0.3)	3.23
Nonfiction	0.02	(0.0)	0.73	(1.4)	0.01	(0.0)	0.76
Newspapers	0.35*	(0.2)	−1.85	(2.6)	−0.10	(0.1)	−1.6
Teachers	0.02	(0.1)	0.05	(0.1)	−0.05	(0.1)	0.02
Sum	2.35		8.26		−1.90		8.71
3. Strategies							
Memorizing	−0.17	(0.1)	1.10	(1.3)	0.11	(0.1)	1.04
Reciting	0.60*	(0.2)	3.48***	(1.1)	−0.37*	(0.2)	3.71
Figuring out what I need to learn	0.19	(0.1)	−0.56	(2.1)	−0.04	(0.2)	−0.41
Figuring out which concepts I haven't understood	−0.44	(0.2)	−4.91*	(2.1)	0.18	(0.1)	−5.17
Looking for additional information	0.03	(0.2)	0.03	(1.7)	0.00	(0.3)	0.06
Relating to prior knowledge acquired in other subjects	−0.46**	(0.2)	−2.61	(1.3)	0.40	(0.2)	−2.67
Sum	−0.25		−3.48		0.27		−3.46
Schools							
1. Characteristics							
Pears Parents' education mean	5.40***	(1.7)	20.16	(27.0)	0.88	(1.2)	26.44

Table A2 (*Continued*)

	Effects associated with						
	Characteristics		Coefficients		Interactions		Total
Discipline index	−0.02	(0.2)	−0.03	(0.1)	0.01	(0.1)	−0.04
Language class time (3–5 h)	−1.10*	(0.4)	−3.75	(2.5)	0.38	(0.3)	−4.47
Language class time (>5 h)	3.83***	(1.2)	−0.96	(0.8)	−1.81	(1.5)	1.06
Class size	0.08	(0.2)	14.23	(11.3)	0.08	(0.2)	14.39
School size	0.51	(0.7)	−7.36	(4.4)	−0.47	(0.7)	−7.32
Primary level at school	1.28*	(0.6)	−4.29	(2.4)	−1.27	(0.8)	−4.28
Single-sex school	−1.58	(0.9)	5.07	(2.7)	−3.98	(2.3)	−0.49
Full school day	1.52	(2.2)	−1.73	(2.9)	−1.84	(3.1)	−2.05
Sum	9.92		21.35		−8.03		23.24
2. Institutional factors							
Resource administration index	−0.19	(0.3)	0.36	(0.6)	−0.37	(0.7)	−0.2
Curriculum responsibility index	0.08	(0.2)	−0.01	(0.1)	0.02	(0.2)	0.09
Academic tracking	0.55	(0.6)	3.05	(6.0)	0.22	(0.5)	3.82
Technical school	0.09	(0.3)	0.71	(2.1)	−0.13	(0.4)	0.67
Public school	−0.01	(0.8)	10.62	(7.4)	−2.30	(1.6)	8.31
Voucher school	−0.21	(0.2)	1.93	(1.1)	−0.42	(0.3)	1.3
Sum	0.31		16.67		−2.97		14.01
Constant			−28.8	(28.9)			−28.8
Total	19.74***	(4.8)	27.64***	(4.4)	−12.8**	(4.5)	34.6

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