

Mediational effect of basic and intermediate reading skills on the relationship between first year Compulsory Secondary Education students' comprehension and academic performance

Efecto mediacional de las habilidades lectoras básicas e intermedias en la relación comprensión y rendimiento académico de estudiantes de primero de Educación Secundaria Obligatoria

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Abstract

The study of skills needed to access knowledge is presently of recurring scientific interest due to their capacity as promoters of social mobility. Within this framework, procedural knowledge that unfolds during the reading comprehension process is comprised of cognitive factors that determine the ability to learn from texts, and therefore may constitute predictors of academic achievement. The paper presents the results of a study of first-grade high school students in Catalonia (Spain) (n=196), which explores simple mediational models in search of the indirect effect that basic and intermediate skills have in predicting changes in students' results, through reading comprehension. Our findings show that part of the total effect is based on skills underlying reading fluency, occasionally on lexical skills displayed during word identification, and never in the domain of the alphabetic principle. These results are discussed with reference to studies that have related reading and academic performance variables, and specifically contrasted with previous studies that do not report the presence of an indirect

effect. Our findings pave the way for scientific testing on the empirical effect of teaching strategies that focus on lexical reinforcement and increasing fluency in the quality of understanding, and consequently, on academic results as well as representative values of school learning.

Keywords: Comprehension, Reading fluency, Lexical and sublexical skills, Mediation analysis, Academic performance

Resumen

El estudio de las habilidades necesarias para el acceso al conocimiento es hoy en día un tópico científico recurrente por su calidad de promotoras de la movilidad social. En este marco, los conocimientos procedimentales que se despliegan durante el proceso de comprensión lectora constituyen factores cognitivos que determinan la capacidad de aprender desde los textos, por lo tanto, podrían constituir predictores de los logros académicos. Se presentan los resultados de una investigación con estudiantes de primero de Educación Secundaria Obligatoria de Cataluña (España) (n=196), que explora modelos mediacionales simples en búsqueda del efecto indirecto que ejercen habilidades básicas e intermedias en la predicción de cambios en sus resultados escolares a través de la comprensión de textos. Se halla que parte del efecto total se apoya en las habilidades subyacentes a la fluidez lectora, ocasionalmente en las habilidades léxicas desplegadas durante la identificación de palabras y nunca en el dominio del principio alfabético. Se discuten estos resultados con estudios que han relacionado variables lectoras y de rendimiento académico y, más particularmente, se contrastan con indagaciones precedentes que no reportan la presencia de efecto indirecto. Los hallazgos abren camino hacia la experimentación del efecto empírico de estrategias didácticas centradas en el refuerzo léxico y en el incremento de la fluidez en la calidad de la comprensión y, en consecuencia, en los resultados académicos en tanto que valores representativos de la calidad del aprendizaje escolar.

Palabras clave: Comprensión, Fluidez lectora, Habilidades léxicas y subléxicas, Análisis de mediación, Rendimiento académico

Introduction

Reading competence has become one of the primary objectives of current educational systems for its capacity as a cognitive, affective and sociocultural motor of learning, and consequently, a set of essential

skills for social participation in equal opportunities. Procedural reading skills, including in the alphabetic principle domain, automatic lexical recognition, reading fluency, and comprehension at the base text and situation model level, are key factors for learning that transcends language classrooms.

Scientific evidence on this subject emphasizes the need to observe the extent to which adolescents' reading skills condition teaching and learning processes and therefore, academic results. The present investigation focuses on this binomial.

Reading skills based on the interactive model

Twenty years after the report of the National Reading Panel (2000), which called for scientific attention to reading fluency as a determining factor in the progressive mastery of reading as a vehicle for learning, there is well-founded evidence that its components -speed, precision and prosody - are reliable indicators as to quality of comprehension (Archer et al., 2013; Barth, et al., 2014; Calet, et al., 2017; Paige and Magpuri-Lavell, 2014; Schwanenflugel and Benjamin, 2017). However, whether fluency is also a precursor to comprehension remains to be clarified (Basaran, 2013). Samuels (2012) defines fluency as the ability to recognize words accurately and at an appropriate pace, while simultaneously processing the content of the text. In line with this approach, there exist two modes of fluency: reading aloud and reading silently.

When trainee readers use superficial reading strategies, such as rereading or slowing down - due to lack of lexical resources, reading skills that allude to linguistic knowledge of a low procedural level (Alexander, 2005) come into operation. Progressive mechanical control of the alphabetic and morphosyntactic structures of the language allow the reader to devote all conscious attention to the service of interpreting the complete meaning of the word chain. The lexical efficiency hypothesis is based on this principle (Perfetti, 2007; Perfetti et al., 2005), whose effect increases as students grow (Pfoest et al., 2014) and is empirically manifested in the ability to read more and more accurately and at an appropriate pace. However, fluency is not just a phenomenon that concerns orality. Since reading is an act that is typically performed in

silence, automaticity and precision in silent reading, and not oral reading, should be the main goal of reading education in school (Hiebert, 2006).

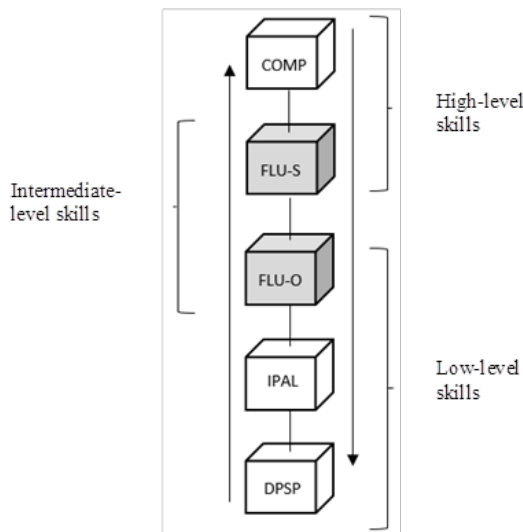
Given the current evidence that reading fluency continues to develop throughout adolescence (Álvarez-Cañizo et al., 2020), there is a need to conduct research after Primary Education, taking into account comprehension and not merely precision and oral reading speed. Research among adolescents has shown that both types of fluency are directly related to comprehension, in addition to correlating highly with each other (Denton et al., 2011; Seok and DaCosta, 2014). There is a degree of agreement around the idea that a fair number of the cognitive processes deployed in oral fluency also operate in silent fluency (Paige et al., 2012), making them two pragmatically inseparable reading processes (Hiebert et al., 2012). Placing all didactic attention on exclusive training in agility and correction in reading would therefore be unproductive as it has been shown that such training does not yield spontaneous improvements in understanding (Hudson et al., 2009; Hudson et al., 2005), although credit should be given to the fact that oral fluency turns out to be an accurate indicator of progress in comprehension, both in primary and secondary schools (Hale et al., 2007; Piper and Zuilkowski, 2015).

For Paige and Magpuri-Lavell (2014), the interaction of precision in word identification and automaticity results in a construct they term 'accumaticity' (accuracy + automaticity). This evaluates precision in the reading of a chained text, generally of narrative structure, in the space of one minute (Deno, 1985; Rasinski, 2003).

Measures of automatic and correct oral fluency from the Curriculum Based Measurement (CBM) initiative, when administered to students from 4th to 8th grades (4th of Primary Education to 2nd of Compulsory Secondary Education - henceforth ESO - in the Spanish system) usually reveal an important correlation with understanding as both a process (*on line* with *cloze-type* tests, which assesses comprehension by sentence completion to make content coherent), and as a product (reading and subsequent question solving) (Miura et al., 2007). However, when using this method, it is neither possible to directly observe if superficial comprehension is being generated (at the base text level), nor even shallower comprehension (at the mental model level). Tests of silent fluency in the verification of sentences partially remedy this deficiency, since they evaluate the agility of the reader in the internal process of

representation of the propositional base text, or what has been called functional fluency (Yovanoff et al., 2005).

FIGURE 1. Theoretical disposition of reading skills measured in the study



COMP: text comprehension, FLU-S: silent fluency, FLU-O: oral fluency, IPAL: word identification, DPSP: non-words decoding
Source: own design

According to Kintsch and Rawson (2005), the base text represents the literal meaning of its content which, given the limitations of human cognition and memory systems, cannot be fully kept in the reader's mind. The present study extrapolates this level of comprehension to the interactive reading model (see Figure 1), in which silent fluency (FLU-S) is the ability to interpret the superficial meaning of strings of propositions. This occupies a basal position for the consolidation of high-level reading skills, that is to say, it is located at an intermediate level between oral fluency (FLU-O) and comprehension (COMP), understood in our study as the ability to generate the mental model (Kintsch, 1998; Nation, 2005).

The relationship between reading skills and academic performance

For this study, student grades represent a reliable empirical criterion on which to assess the quality of school learning (Krumm et al., 2008). These grades are the immediate theoretical result of school performance, as well as being a mediate empirical reflection of the level of academic results achieved. According to González-Pienda (2003), grades are prefixed by internal and external school standards and confirmed by the professional criteria of the teacher. A student's pass grades in subjects and progress through the system depend on such marks (Rodríguez et al., 2004). In this research, the expression 'academic performance' is chosen to refer to it.

It may well be the case that so-called reading science does not use school grades as they are considered too biased to establish reliable associations between reading processes and school learning. This lack of confidence in grades is due to the incidence of assessor subjectivity in assigning a grade that represents how much a student has learned (Allen, 2005). On the other hand, it has been shown that students' grades, in addition to representing a reliable empirical criterion for assessing school performance (Vicente, 2000), are predictors of academic performance at university (Hoxby and Turner, 2013). Recent research has demonstrated that the effect of comprehension and fluency skills in situations in which there is a risk of academic failure can be of great or immense importance (Arenas and Ambrós, 2019).

Other studies have established that the correlational links - sometimes predictive - between reading skills in the mother tongue and students' grades in primary and secondary education are always significant, regardless of the construct underlying the comprehension measure in each case (Bastug, 2014; Bigozzi et al., 2017; Elosúa et al., 2012; Hakkarainen et al., 2012; Keskin, 2013; Meneghetti et al., 2006; Pascual-Gómez and Carril-Martínez, 2017; Savolainen, et al., 2008).

Bearing in mind that fluency is nowadays recognized as the true cognitive bridge between alphabetic decoding and comprehension (Pikulski and Chard, 2005; Rasinski et al., 2011), our research hypothesis is as follows: improvement in reading comprehension skills, oral and silent fluency, and lexical and sublexical recognition, will lead to significant increases in the academic performance of first-year ESO students in six curriculum subjects. This presumption is supported by the educational

and scientific conviction that reading domain is an essential condition for the achievement of meaningful learning across the curriculum (Blaabæk, 2020; Dockrell et al., 2011; Hulme and Snowling, 2011; Snow and Biancarosa, 2003).

The two specific objectives that we propose to validate or refute this hypothesis are:

1. to identify the significant bivariate relationships between academic performance and reading skills theorized in the proposed interactive model (see Figure 1);
2. to determine the mediating influence of lexical and sublexical recognition and of reading fluency (oral and silent) as it relates to comprehension and academic performance.

Our research data will contribute to the scientific debate as to the impact that pedagogical initiatives could have, including mechanical decoding activities, broadening of the lexical repertoire and increasing oral and silent fluency in the training of the adolescent reader who knows how to understand in order to learn.

Method

Participants

The valid sample is made up of 196 students from six Catalan Junior High schools in the 1st year of ESO in the province of Barcelona (101 girls, 95 boys). As shown in Table 1, 62.2% of the students attend public centers (n=122) and 37.8%, state-subsidized schools (n=95). At the time of data collection, all subjects were 12 years old, as required by Organic Law 2/2006 (May 3).

TABLE I. Sample synthesis and sociodemographic features

School	Location	Type	Subjects (n=196)	Municipal population	Population density	Gross disposable household income (Cat = 100)
1	Barcelonès	State-subsidized	26 (one class).	120.443	17.206,1	81,1
	(Santa Coloma de Gramenet)					
2	Garraf	Public	17 (one class)	29.553	674	119,9
	(Sitges)					
3	Baix Llobregat	Public	16 (one class)	67.197	3.294	96
	(Viladecans)					
4	Barcelonès	Public	52 (three classes)	120.446	17.206,1	81,1
	(Santa Coloma de Gramenet)					
5	Garraf	State-subsidized	48 (two classes)	67.733	1.993	96,2
	(Vilanova i la Geltrú)					
6	Vallès Occidental	Public	37 (three classes)	216.520	5.730	98,6
	(Sabadell)					

The students were chosen via causal or incidental sampling (Delgado 2014), as the schools belong to the network of signatories of the Binding / ApS Project on academic performance of 1st year ESO students in Catalonia (Ambrós y Arenas, 2016).

Regarding the sociodemographic breakdown of families, participating centers display middling socio-economic and cultural profiles: gross disposable household income is situated at values close to the average for Catalonia, except in Santa Coloma de Gramenet (20% lower) and Sitges (20% higher).

All schools are located in metropolitan urban environments in the province of Barcelona, with the exception of the school in Sitges, a small city. Metropolitan areas which are characterized by their high population density - Santa Coloma de Gramenet and Viladecans - account for 48% of the sample. The remaining 52% represent schools located in districts

in the metropolitan area (Garraf and Vallès Occidental) which are very close to Barcelona and highly and functionally interconnected with the Catalan capital.

Additionally, the selected schools represent current diversity as regards type (state-subsidized and public). It should be noted that some public schools in the municipalities of Santa Coloma and Sabadell are highly complex centers with high rates of absenteeism. This has affected results, in that the largest number of subjects discarded from the study due to lack of data come from these schools. Originally, 216 students authorized their participation. The difference with respect to the valid sample corresponds to excluded students not meeting all of the following conditions:

- a. not having repeated a year (ideal students);
- b. being resident for more than three years in the Autonomous Community of Catalonia (not a newcomer);
- c. having agreed to participate, both individually and with the agreement of their legal guardians, by signing an informed consent form;
- d. having been assessed in all the reading skills measures that were administered;
- e. having all current academic year course grades up to date (first term grades);
- f. not having been diagnosed with any type of learning disorder (reading or otherwise).

As regards the final condition, the recommendations of the *National Joint Committee on Learning Disabilities* (2007) were followed to ensure that all students in the sample were, hypothetically, normal readers: beyond students' results in the measures that we apply, all theoretically have the same opportunity to achieve good reading results, any difficulty in ability to learn from reading being attributable to lack of training rather than neurolinguistic handicaps.

Materials

The tests applied, their respective sources and the language in which they were administered are described below (Table 2).

TABLE 2. Reading skills present in the different tests (HL)

Tests	Reading skills measured	Code variable	Administration/ Language
Batería III Woodcock-Muñoz: Achievement Tests Muñoz-Sandoval et al. (2005a, 2005b)	Reading fluency (silent, of sentences)	FLU-S	Collective/Spanish
	Text comprehension	COMP	Collective/Spanish
	Word identification	IPAL	Individual/Spanish
	Non-words decoding	DPSP	Individual/Spanish
Adaptation of Easy CBM, Oregon University (app.easycbm.com)	Reading fluency (oral, of a narrative passage)	FLU-O	Individual/Catalan

COMP: text comprehension, FLU-S: silent fluency, FLU-O: oral fluency, IPAL: word identification, DPSP: non-words decoding
Source: own design

Silent fluency

This test measures a person's skill in the task of quickly reading simple sentences and deciding whether the proposition is consistent with everyday reality (Y for Yes, it is) or not (N for No, it is not). It does not measure fluency from the perspective of lexical recognition with accuracy and agility, but rather appeals to a higher level of reading in which the content of the given sentences must be understood. Poor performance on this test may indicate that basic word identification skills in context are limited, or that the subject has comprehension difficulties, as they are not able to automatically recreate the base text in their mind and / or are unable to stay focused. The test reports a reliability coefficient of .97.

Text comprehension

The subject has to read a short text and complete its meaning with missing words (*cloze* format). The items require a response during the process of forming the model in the situation provided by the texts to give continuity to the meaning conveyed, so the test also indicates an *on-line* understanding process. Poor performance on this test may point to limited skills in these two areas. Difficulty increases as semantic and

syntactic indicators become more complex. The test reports a reliability coefficient of .91.

Word identification

This test measures a subject's skills in identifying words of different frequencies, evaluating cognitive efficiency in the lexical retrieval process. Subjects are required to correctly pronounce each of 41 given words. The instruction is to first read the word silently, then say it, doing this unhurriedly with each word (the process is not timed). It is an individual application test and difficulty increases as the word list progresses. An adolescent with well-developed word recognition skills on first sight, and an age-appropriate lexicon is able to recognize most given words with little effort. The test reports a reliability coefficient of .95.

Non-words decoding

This test measures phonic and structural analysis skills that are displayed when pronouncing syllables without lexical meaning and non-words of increasing difficulty. The items require the individual to read aloud graphemic combinations which are phonetically congruent with the spelling regularities of Spanish, thus evaluating the sublexical pathway. The items consist of only 12 syllables and 18 non-words. Internal calibration of the subtest reports a reliability coefficient of .91.

Reading fluency (oral, of a narrative passage)

A fluency test in oral reading of a narrative passage in Catalan was adapted to include a test that demonstrated achievement level in a reading variable designed in the school's vehicular language. It was carried out following the guidelines proposed by Muñiz et al. (2013) for the adaptation of cognitive assessment instruments, and recommendations made by Rasinski (2003) regarding the specific conditions that a fluency instrument for reading texts should meet. In order to verify narrative

complexity accessible for a 7th grade student (1st year of ESO, 12 years old), we used the Lexile® system, just as Yovanoff et al. (2005) did, to ensure consistent semantic difficulty for students at this age.

TABLE 3. Lexile® analysis result

• Lexile® Measure: 900L - 1000L
• Mean Sentence Length: 18.95
• Mean Log Word Frequency: 4.87

An appropriate text for students in 6th grade of Primary Education should report a Lexile measure higher than 870. As Table 3 shows, ours is in the 900 and 1000 range, and thus considered to be of adequate complexity for 12-year-old students. The final text, entitled *La història d'en Pere*, was reviewed by psychometric experts from the ApS project. As in the Anglo-Saxon version, our accumaticity test marked omissions, insertions, substitutions, hesitations and mistakes as errors, and deducted them from the total count of words read in one minute.

Procedure

In January 2015, a pilot test was carried out in two classes (n = 24) of students in the first year of ESO at a school in the Maresme region (Premià de Mar). All tests were administered, corrected, and some adjustments made. In February 2015, the tests were administered in the six Junior High schools mentioned in Table 2. Two days were reserved for each school. On the first day, group tests (FLU-S and COMP) were carried out in the class group. The second day was devoted to individual tests (IPAL, DPSP and FLU-O), with a duration of approximately 15 minutes for each student. In both cases the tests were applied randomly to avoid rank order as an incidence factor in the results. In December 2015, a report on group and individual results was sent to the technical teams of all Junior High schools.

Academic performance dimension

The academic results compiled correspond to the average marks obtained in six core subjects of the Catalan curriculum for our entire sample valid in the first quarter of the academic year 2014-15 (Table 4).

TABLE 4. Academic performance dimension variables (RA)

Variables (subjects)	Code
Catalan language	CAT
Spanish language	CAST
English language	ING
Mathematics	MAT
Natural sciences	NAT
Social sciences	SOC

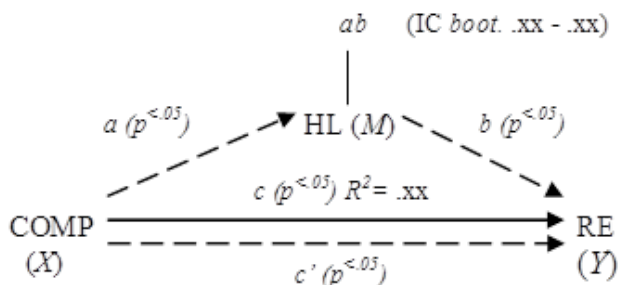
Results

Results analysis perspective

This study follows a quantitative paradigm and attempts to establish possible causal links between reading skills and academic performance, not the causalities themselves. The estimated models tested will form part of a restricted repertoire of possible results (Elster, 2006) regarding the problem of the effect of reading skills on school learning, obtained through a correlational and mediational study.

The diagram in Figure 2 is a graphic representation of simple regression models with mediational effect (Hayes, 2013). The horizontal dash line reveals the direct coefficient (c') of comprehension when the effect of the reading variable included as mediator (M) is controlled for. As each model is analyzed, the difference between c and c' is expressed. This is interpreted as the portion of the total effect that corresponds to the variable M in the statistical prediction of the changes produced by both variables when the grade also changes.

FIGURE 2. Diagram of a simple mediational model



Indirect effect of X on Y through M=ab

Direct effect of X on Y= c'

Source: Adapted from Hayes (2013)

The coefficients a (relationship between the predictor variables X and M) and b (change in the grade when M increases by one unit) must be shown to be significant, since their product expresses the indirect coefficient. In turn, this is accompanied by the *bootstrapping* confidence intervals (IC boot.) to assess the significance of the mediating effect of the reading ability included in each model (Fernández-Muñoz & García-González, 2017).

The value obtained from ab corresponds to the difference between the total effect and the direct effect and thus expresses the portion of the total effect that is attributable to the mediational effect. In order to carry out the estimate of statistical significance through the *bootstrapping* technique (5000 repetitions), we used the Macro PROCESS, a free access interface that comes with the SPSS statistical package.

We drew up a prediction model of school results for each reading ability, which from observation of the bivariate correlations, we suspect may play a mediating role between comprehension and grades. According to Cohen and Manion (1990) only a significant link within the .35 and .65 range can offer correct predictions (moderate intensity). In each simple regression model with mediational effect, we entered the mean of the school results in six subjects as variables to predict (Y).

Descriptive and normality statistics

Table 5 displays the descriptive and dispersion statistics for the reading skills dimension. The only reading variable that did not present atypical cases is oral fluency. The other four variables presented nine atypical cases which required modification. Without discarding them, we carried out a monotonic transformation process (Kline, 2001) so as not to alter the inferential statistical results, given the cautionary note that parametric statistical calculations are particularly sensitive to outliers.

TABLE 5. Descriptive and dispersion statistics for the reading skills dimension (HL)

Variable	Min.	Max.	Media	Median Mode	SD	As K	OUT. inf.	OUT. sup.
DPSP (S O)	18,9	30	24,84	25 26	2,54	-.493 -0.317	0	0
IPAL (S O)	43,99	71	60,15	61,5 65	6,1	-.638 -0.257	0	0
FLU-S (S O)	21	91,3	56,3	55 56	13,8	.402 -0.066	0	0
COMP (S O)	17,99	33	25,69	26 26	3,14	-.193 -0.348	0	0
FLU-O	76	236	156,97	155ppm	32.03	-.124 -0.255	0	0

n= 196. Without lost values.

OUT. Inf. and OUT. Sup= inferior and superior outliers.

Standard error of Asymmetry (As)=.174. Standard error of Kurtosis (K)=.346.

S|O= variable without outliers. ppm=words per minutes.

Subsequently, all grades were normalized on a 0-10 scale. This was to ensure that observation of expected increases in grades when reading skills rise by one point in the mediational models can be interpreted from direct beta values instead of standardized ones.

Correlational and mediational analysis

As Table 6 shows, the low-level skills (DPSP and IPAL) only report correlations in the .35 and .65 ranges, in Natural Sciences, and with a slight downward margin in Spanish Language. The remaining bivariate links between these two basic skills and the other subjects are low or very low. Intermediate (FLU-O and FLU-S) and higher (COMP) skills

show significant correlations, of moderate intensity within the suggested ranges, with the exception of the correlation between FLU-S and Social Sciences, which is low.

TABLE 6. Correlations: reading (HL) and academic performance (RA) dimension variables

<i>r</i>	CAT	CAST	ING	MAT	NAT	SOC
DPSP	,19**	,25**	,23**	,16*	,22**	,10
IPAL	,29**	,34**	,30**	,23**	,36**	,18*
FLU-O	,48**	,49**	,50**	,42**	,45**	,35**
FLU-S	,34**	,43**	,45**	,36**	,45**	,26**
COMP	,42**	,48**	,50**	,46**	,51**	,40**

** The correlation is significant at the 0,01 level (2-tailed).

* The correlation is significant at the 0,05 level (2-tailed).

n=196 (without lost values)

With these data we know, *a priori*, that although there is a direct and significant bivariate link between sublexical ability (SPD) and all subjects at the .01 and .05 level (except in Social Sciences), it fails to mediate the relationship between comprehension and school results due to low values. We thus ruled out inclusion of non-words decoding in all the mediational models reported below, since the condition that *b* regression coefficients should report statistical significance was not met. This does not occur with lexical ability (IPAL), which, as we will see, indirectly confirms academic results in Languages and Natural Sciences. This report meets objective 1.

TABLE 7. Synthesis of statistically significant mediational models

Model			Total effect (c)			Direct effect (c')		Indirect effect or mediator (ab)			% of c which corresponds to ab	
								IC Boot. (95%)				
Subject			R ²	b	p*	b	p*	b	Inferior	Superior		
CAT		COMP	.18	.97	.00							
	1	FLU-O				.62	.0001	.35	.18	.55		36,1%
	2	FLU-S				.77	.00	.20	.06	.35		20,6%
	3	IPAL				.84	.00	.13	.0012	.28		13,4%
CAST		COMP	.24	1,15	.00							
	1	FLU-O				.79	.00	.35	.18	.55		30,4%
	2	FLU-S				.87	.00	.28	.13	.43		24,3%
	3	IPAL				.98	.00	.17	.03	.32		14,8%
ING		COMP	.26	1,34	.00							
	1	FLU-O				.95	.00	.39	.20	.61		29,1%
	2	FLU-S				1	.00	.33	.17	.53		24,6%
MAT		COMP	.21	1,26	.00							
	1	FLU-O				.93	.00	.33	.14	.55		32,4%
	2	FLU-S				1	.00	.25	.08	.43		26,1%
NAT		COMP	.27	1,4	.00							
	1	FLU-O				1,07	.00	.34	.17	.54		24,3%
	2	FLU-S				1,06	.00	.34	.17	.55		24,3%
	3	IPAL				1,20	.00	.20	.04	.39		14,3%
SOC		COMP	.16	.91	.00							
	1	FLU-O				.80	.00	.29	.09	.51		31,8%

*All values are significant at the .05 level.

As can be seen in Table 7, the models in rows 1 show oral fluency as the main reading skill regarding its connecting effect between comprehension and all grades: from 24.3% of the total effect in Natural Sciences, to 36.1% in Catalan Language. In the models in rows 2, it can be seen that silent fluency acts as a mediating variable between comprehension and grades: between 20.6% (in Catalan) and 26.1% (in Mathematics) of the total effect of comprehension is supported by silent

fluency. Social Sciences is the only subject in which this type of fluency does not mediate the effect that comprehension has on it. The models in rows 3 show that the mediating incidence of word identification is only observed in Catalan Language (13.4% of *c*), Spanish (14.8% of *c*) and Natural Sciences (14.3% of *c*). The statistical significance of indirect effect was verified through *bootstrapping* confidence intervals (IC *boot*), among which no 0 values were found. This report meets objective 2.

In summary, we have made a preliminary determination of the mediational contribution of reading skills at basic and middle cognitive levels regarding the predictive relationship of school results with respect to text comprehension, given that:

- a. the alphabetic principle domain is related to, but does not determine or mediate the relationship between comprehension and academic performance dimension variables;
- b. the ability to retrieve words from the lexicon only sometimes appears to mediate the effect of comprehension on grades, particularly in Spanish, Catalan and Natural Sciences;
- c. the two types of reading fluency, oral and silent, mediate the relationship between comprehension and student grades, except in Social Sciences.

Discussion

The first contribution of this research is to confirm the direct and significant correlation between reading skills and academic performance, regardless of the type of reading construct measured or school year (Bastug, 2014; Bigozzi et al., 2017; Elosúa et al. 2012; Hakkarainen et al., 2012; Keskin 2013; Meneghetti et al., 2006; Pascual-Gómez and Carril-Martínez, 2017; Savolainen et al., 2008). However, a significant bivariate correlation, albeit very low between sublexical skills and results, could be evidence that few changes in comprehension can be explained by alphabetic skills in higher years.

Comprehension and oral fluency are the only two skills that respectively explain and measure significant variance in all school results. If we take into account the text comprehension construct measured by this study, our finding that the skill of constructing a mental model of the textual

situation is the main component of the models tested coincides with results from studies by Meneghetti et al. (2006) and van Gelderen et al. (2004). Furthermore, without approaching comprehension from that construct, it is also the main variable that explains the grades in studies by Bigozzi et al. (2017), Hakkarainen et al. (2012), Keskin (2013) and Savolainen et al. (2008).

Taking a similar mediational perspective, Bigozzi et al. (2017) do not find that oral reading fluency has such an effect, since the *ab* coefficients of their multiple regression models with mediating effect are not significant in predicting the grades of any of the subjects, either in primary or secondary. They observe that comprehension and fluency promote independent changes in the subjects, without being able to prove that the former has influence over lexical precision and reading speed. Although the present study does succeed in arousing suspicion that part of the total effect of comprehension on the grades of all subjects is mediated by oral and silent fluency, we cannot speak of contradictory findings given the difference between the underlying constructs in other researchers' tests and in those applied in the context of the current research. This is the second contribution of this study, as it calls for the design of experiments that revisit this issue with a view to obtaining empirical information on the impact of both types of fluency - not solely oral - on the quality of comprehension, and consequently, on the academic performance of ESO students.

While it is true that the impact of comprehension is above all direct, explaining up to 27% of the variance in grades, when oral fluency is added, it turns out to be a mediator in up to 36% of the changes that text comprehension explains about the grades. Silent fluency, meanwhile, mediates up to 26%. Thus, both types of fluency are seen as the skills most indicative of quality of comprehension. Underlying these results is the third contribution of this study, since the results validate the question as to whether they could, therefore, become precursors of this same quality of comprehension (Basaran, 2013; Paige et al., 2012; van Gelderen et al., 2004 and 2007).

These results validate the observation that the transition from Primary to Secondary Education could be characterized by a lack of progressive continuity in the formation of reading processes that underlie deep comprehension. Instead, the inferential and reflective interpretative work of written discourse, the strategies of which are anchored in metacognitive

processes, attract particular or sometimes exclusive pedagogical attention. The transition outlined requires a rapid capacity for cognitive adaptation to which not all students adjust successfully. This empirical suspicion - experienced by the authors as language teachers - opens up a theoretical and pragmatic line of inquiry in the field of language and literature didactics. All in all, the study presents limitations that should be resolved in such cases. On the basis of these results, empirical and longitudinal experimental or quasi-experimental studies, with large samples and with randomly chosen subjects, would allow researchers to derive contrasted evolutive results which would solve the static and pre-experimental qualities that underlie the sample and current results, respectively.

Conclusions

Our working hypothesis has been partially verified given that we have found evidence for increases in academic performance as a function of reading comprehension skills, oral and silent fluency and, to a certain extent, in lexical recognition. Sublexical skills, on the other hand, are significant, but not particularly relevant in this relationship.

We have thus shown that the direct, indirect and statistically significant relationship between reading variables at lexical, propositional and textual levels of almost all adolescents' grades is related to the thesis that the ability to learn from texts is also supported by skills that are perhaps being taken for granted in ESO. While it is undoubtedly vitally important to take into account the minimum scores in text comprehension that students must attain in order to be considered competent readers, so is continuous training in reading strategies underlying reading fluency, both oral and silent. Those adolescent students whose basic and intermediate skills are still in the process of consolidation are not able to use them as subconscious props for the development of deep reading skills that influence meaningful learning from texts.

In this regard, as is so often evident in Primary Education, consolidation of basic reading skills that are necessary for text comprehension and subject learning must be achieved for each and every student. In saying "each and every student", we declare that if only one student - and there may be many more - does not achieve automation of such skills, they are likely to underperform academically. Despite the fact that ESO teachers

are called upon to make up for these shortcomings, in an ideal world they would not need to attend to them.

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