Cross-sectional Study of the Contribution of Rhetorical Competence to Children's Expository Texts Comprehension between Third- and Sixth-Grade

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Abstract

Readers' rhetorical competence is related to reading comprehension and moderates the impact of rhetorical devices in expository texts. In this cross-sectional study, we examine the differences in four measures of rhetorical competence (knowledge of anaphors, organizational signals, refutations, and a total score) in grades three through to six, we determine its contribution to expository text comprehension after controlling the effect of a wide set of linguistic and cognitive variables, and we study whether this contribution is moderated by grade or any of our control variables. First, although we found evidence for some level of rhetorical competence at early ages, data suggest that rhetorical competence development takes many years. Second, we found that knowledge of some rhetorical devices is acquired before knowledge of others. Finally, rhetorical competence was a unique predictor of expository text comprehension, and its influence was evident regardless of grade and all of the control variables.

1. Introduction

Expository texts describe or explain complex and often unfamiliar topics. This type of text entails a significant challenge for younger readers, because it relies on specific knowledge and skills beyond those needed to comprehend narrative and simple descriptive texts (Best, Floyd, & McNamara, 2008; Duke & Roberts, 2010; Meyer, 1975; Snow & Uccelli, 2009). One of these is identifying and understanding how to use rhetorical devices such as connectives and organizational signals, which signal author's communicative intentions. Studies to date have shown that (a) the inclusion of these devices in complex and unfamiliar content expository texts tends to result in better text comprehension, (b) readers' ability to interpret and use these devices (hereafter rhetorical competence) correlates with and predicts reading performance, and (c) the effectiveness of rhetorical devices depends on a reader's sensitivity to them, or rhetorical competence (Brooks, Dansereau, Spurlin, & Holley, 1983; Goldman & Rakestraw, 2000; Lemarié, Lorch, Eyrolle, & Virbel, 2008; Sánchez & García, 2009). These findings support the view that rhetorical competence may be a relevant component skill in expository text comprehension.

Most research on rhetorical competence concerns students at the end of the primary school or older. This is surprising given that, typically from third grade, children are expected to learn from expository texts across a wide range of subject matter (Best et al., 2008). For this reason, we conducted a cross-sectional study of Spanish students to determine how rhetorical competence develops and its role in the comprehension of expository texts during the elementary school years. The aims of this study were: (1) to describe Spanish students' rhetorical competence from grade three (8-9 years) to six (11-12 years), (2) to determine whether rhetorical competence makes a unique contribution to children's comprehension of expository text in this age range,

above and beyond variables known to be strongly related to comprehension (namely word decoding, integration/inference skills, prior knowledge, and working memory), and (3) to examine whether the contribution of rhetorical competence to expository text comprehension was moderated by grade, or the other variables outlined above.

1.1. Rhetorical devices and rhetorical competence

Rhetorical devices are signals that work as ‘‘potential processing instructions’’ for understanding the meaning of a discourse without affecting its organization or content (Britton, 1994; Gernsbacher, 1996; Givón, 1992; Goldman & Rakestraw, 2000; Lemarié et al., 2008). They can be grouped according to the specific comprehension processes that they may promote (with respect to these processes, see, for instance, Graesser, Millis, & Zwaan, 1997; Kintsch, 1998; Mayer, 1996). In this study we focus on rhetorical devices that support connecting ideas within the text and those that support integration of information from the text with previous knowledge[1].

The rhetorical devices that help readers to connect ideas within a text include local cohesive ties, such as connectives and anaphors, and organizational signals, such as phrases like “a solution for this problem” or ‘‘the first reason’’. Whereas local cohesive ties link one idea with other, organizational signals help readers to create a representation of the main ideas and structure of the text. The inclusion of these devices improves text comprehension, results in faster processing of text, and results in a more coherent representation of a text’s meaning (Britton & Gülgöz, 1991; Degand & Sanders, 2002; Kintsch & Yarbrough, 1982; Meyer, Brandt, & Bluth, 1980; Sanders &

[1] There are also rhetorical devices that support monitoring of comprehension, but they are less common in Spanish academic texts (see the analysis from García, Montanero, Lucero, Cañedo & Sánchez, 2018).

Noordman, 2000). The benefits arise because readers use these devices when processing a text to guide interpretation (Givón, 1992). For example, an anaphor informs readers which referent in the existing text representation must be activated in order to integrate the new incoming information, and organisational signals help readers to activate a structural map about the text to support its interpretation.

The rhetorical devices that encourage integration of information from the text with stored knowledge include evocations to draw on shared knowledge, such as, "it is well known that"; and refutation cues to indicate that prior knowledge must be altered, such as, "many people think that… but…". A refutation cue may be considered a rhetorical device because, in refutation texts, it provides an explicit processing instruction about how to integrate prior knowledge (activated by the explicit statement of an incorrect belief) and the explanation of the correct belief (Kendeou & van den Broek, 2007; Tippett, 2010). A body of work demonstrates that refutation texts can facilitate knowledge revision, valid inference generation, and conceptual learning (e.g., Braasch, Goldman, & Wiley, 2013; Diakidoy, Kendeou, & Ioannides, 2003; Diakidoy, Mouskounti, Fella, & Ioannides, 2016; van den Broek & Kendeou, 2008). But the impact of just the refutation cue on comprehension has not been studied[2].

Despite the body of evidence showing the positive effects of rhetorical devices, not all studies find a facilitating effect (Brooks et al., 1983; Linderholm et al., 2000; McNamara, Kintsch, Songer, & Kintsch, 1996). This has led researchers to consider

[2] Refutation cues are not common in academic texts (García et al., 2018). Nevertheless, we wished to track when knowledge about them emerges because some prior studies suggest that fifth- and sixth-grade students may be able to interpret and take advantage of texts with this cue.

whether certain reader characteristics might moderate the effect of rhetorical devices on text comprehension. For instance, students with poor background knowledge for a given domain benefit from clear anaphors, cohesive ties, headings, and organizational signals more than readers with good prior knowledge (Beck & Dole, 1992; Britton & Gülgöz, 1991; Roller, 1990; McNamara et al., 1996; McNamara & Kintsch, 1996). Further, the benefits of overviews, connectives and refutation cues, are most apparent when texts present a certain level of difficulty and/or counterintuitive scientific concepts (Linderholm et al., 2000; Lorch & Lorch, 1985). Thus, prior topic knowledge is a critical reader characteristic that we consider in this study.

Another critical reader characteristic that is related to the ability to profit from rhetorical devices is rhetorical competence: the ability to detect, interpret and follow the processing instructions provided by rhetorical devices. Someone with good levels of rhetorical competence will recognise that an expression such as, for instance, "a second cause" (an organisational signal) refers to the discourse itself, not the world described by the discourse; she/he will interpret the expression in relation to the author's intentions (in this example, to expound an additional reason for the phenomenon being explained); and she/he will use this information as a processing guide for the next piece of text (in this example, to find and understand the other cause and connect it with the previous causes and the phenomenon explained). Thus, rhetorical competence is different from other important reading comprehension skills. Rhetorical competence is simply the ability to identify and process cues in the text, although this processing could result in the activation of other processes and skills for instance, summarize or inference making. In this sense, rhetorical competence can be understood as an auxiliary skill that can enhance the use of reading strategies. Rhetorical competence moderates the impact of rhetorical devices for sixth and seventh grade readers: those with good levels of

rhetorical competence benefit more from the presence of rhetorical devices to understand a challenging expository text relative to those with poor rhetorical competence over and above the influence of word decoding, working memory, general comprehension skills, and prior knowledge (Sánchez, García, & Bustos, 2017).

1.2. Rhetorical competence throughout primary school and its influence on text comprehension

Our first objective was to describe Spanish students' rhetorical competence (defined here as the processing of anaphors, organizational signals, and refutation cues) from grade three (8-9 years) to six (11-12 years). This built on (and goes beyond) previous research in three ways. First, prior studies have established that an understanding of concrete anaphors such as pronouns develops between 8 to 13 years (e.g., Borzone, 2005; Ehrlich, Remond, & Tardieu, 1999; García, Bustos, & Sánchez, 2015; Oakhill & Yuill, 1986; Uccelli et al., 2015). In contrast, we focused on an understanding of conceptual anaphora or hypernyms ("this process", "this phenomenon") which are characteristic of expository texts (Uccelli et al., 2015). Second, previous research demonstrates that sixth-grade students have some awareness of expository text structures (Richgels, McGee, Lomax, Sheard, 1987) and this awareness improves between the ages of 8 to 12 years (Englert & Hiebert, 1984). However, research to date has not investigated the development of knowledge of the rhetorical devices that signal these structures. To address this gap, we assessed students' ability to detect and correctly interpret organizational signals. Third, previous research has shown that fifth- and sixth-grade students who read a refutational text learn more from it than students who read an ordinary expository science text (Diakidoy et al., 2003; Mason, Gava, & Boldrin, 2008). But we tested directly whether the students could understand and use refutation cues. In addition, we assessed rhetorical

competence through a wider range of elementary school years than that considered in previous research. Understanding the extent of this competence in the early grades is important to inform the appropriate design of textbooks and classroom instruction.

Our second objective was to determine whether rhetorical competence makes a unique contribution to third through to sixth graders' comprehension of expository text, above and beyond variables known to be strongly related to this skill (namely word decoding, integration/inference skills, prior knowledge, and working memory). Knowledge about each of the rhetorical devices that we studied is related to reading comprehension (Ehrlich et al., 1999; Engelen, Bouwmeester, de Bruin, & Zwaan, 2014; García et al., 2015; Megherbi & Ehrlich, 2005; Yuill & Oakhill, 1988, 1991). Teaching students about these devices improves the amount and quality of information remembered from a text (Hebert, Bohaty, Nelson, & Brown, 2016; Meyer & Poon, 2001; Wijekumar, Meyer, & Lei, 2013, 2017; Williams et al., 2007; Williams, Stafford, Lauer, Hall, & Pollini, 2009). However, these studies do not speak to the extent to which knowledge and use of these devices contributes to expository text comprehension across the primary school years: typically a single age group has been studied, or scores from the measures of rhetorical competence have been combined with those of other measures when predicting reading comprehension, or other important variables of expository reading comprehension have not been controlled to examine whether knowledge of rhetorical devices explain unique variance in reading comprehension.

We chose to control for the influence of four critical factors on expository text comprehension on both theoretical and empirical grounds: two general reading skills (decoding and integration/inference skills) and two skills more related to the specific comprehension of expository texts (prior knowledge and working memory). Basic word decoding skills are strongly related to text comprehension, particularly in younger

children (Garcia & Cain, 2014). Integration/inference skills are also predictive of text comprehension (Tarchi, 2015; Cain & Oakhill, 2014) and can be considered as a critical foundation for constructing a text representation (McNamara & Magliano, 2009). Prior knowledge and working memory are considered critical for the integration and assimilation of new information from expository texts (Best et al., 2008). Previous research shows that rhetorical devices benefit text comprehension only for readers with low prior knowledge of the text content (e.g., McNamara et al., 1996), thus it was essential for us to ensure that the content area was relatively unfamiliar. Working memory supports the ability to integrate information within a text (García-Madruga, Vila, Gómez-Veiga, Duque, & Elosúa, 2014). Because rhetorical devices signal text integration, it was necessary to control for individual differences in working memory to determine the specific contribution of rhetorical devices on text comprehension.

Although we assume that rhetorical competence facilitates readers' expository text comprehension, it is possible that not all readers benefit to the same extent from rhetorical competence. For example, Crosson and Lesaux (2013) found that language background moderated the influence of connectives on text comprehension and the influence was lower from fifth grade second language learners of English compared to their monolingual peers. Welie, Schoonen, Kuiken, and van den Bergh (2017) found that the relationship between knowledge of connectives and text comprehension was moderated by metacognitive knowledge with higher metacognitive knowledge associated with a stronger relationship between knowledge of connectives and text comprehension. We do not know of any similar work exploring the moderators of the relationship between processing of anaphors/organizational signals/refutation cues and expository text comprehension. Thus, our third objective was to examine whether the contribution of rhetorical competence to expository text comprehension was moderated

by grade, or the other reader characteristics outlined above: word decoding, integration/inference skills, prior knowledge, or working memory.

First, we consider grade (as an indirect indicator of age) and word decoding ability. According to the simple view of reading, reading comprehension is the product of a reader's decoding (or word reading) skill and linguistic (or listening) comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). As word decoding improves, language and listening comprehension skills explain greater variance in reading comprehension (García & Cain, 2014; Language and Reading Research Consortium, 2015). Thus, we predicted that rhetorical competence, a linguistic skill, would show an increasing influence with grade and decoding ability. Working memory, which is predictive of reading comprehension in this age group (Borella & de Ribaupierre, 2014; Cain & Oakhill, 2004; Nouwens, Groen, & Verhoeven, 2016), might also moderate the relationship between rhetorical competence and expository reading comprehension because readers who act on the instruction contained in the rhetorical device will need to sustain information in working memory in order to establish connections or manipulate ideas. Poor working memory capacity can constrain an individual's ability to represent more than the current sentence in a text, so poor working memory might limit the ability to benefit from rhetorical devices in text.

Whereas grade, decoding, and working memory may be prerequisites for readers to benefit from rhetorical competence, integration/inference skills and prior knowledge may share a different relationship. Readers with good integration/inference skills and those with good prior knowledge of a text may rely less on the processing instructions provided by rhetorical devices because of these other areas of strength (e.g., McNamara et al., 1996). As a result, high integration/inference skills and prior knowledge might yield a weaker association between rhetorical competence and text comprehension.

1.3. The present study

We examined rhetorical competence and its relation to expository text comprehension in children from third grade through to sixth grade. There were three aims. First, to characterize how rhetorical competence increases by grade. In line with our review above, we had four hypotheses: (1.1) we expected that the youngest group (grade three) would have some knowledge about anaphors, but not about organizational signals and refutation cues because the later rhetorical devices are found mainly in expository texts with which they would have little experience (Best et al., 2008); (1.2) we expected that rhetorical competence would increase across this age range; (1.3) we expected that, for the whole sample, some rhetorical devices would be more salient than others: for instance, we expected anaphors to be easier than organizational signals (because the distance between ideas which must be activated and integrated influences text processing: e.g., Cook & O'Brien, 2014[3]) and the two former devices be easier than refutation cues (because refutation cues have an adversative meaning and adversative relations are more challenging to understand than others: e.g., Crosson & Lesaux, 2013); and, (1.4) because of differences in the salience of these devices, we anticipated non-parallel development of their knowledge across this age range.

The second aim was to specify the unique contribution rhetorical competence makes to comprehension of expository texts in these grades, over and above word decoding, integration/inference skills, prior knowledge, and working memory. There was a single hypothesis (2.1) for this aim: for the whole sample, each measure of

[3] For instance, detection of coherence breaks may become more difficult when the textual distance between the contradicting information increases (Helder, van Leijenhorst, & van den Broek, 2016).

rhetorical competence (jointly and alone) would contribute to expository reading comprehension above and beyond all the control variables.

The third aim was to determine whether the relationship between rhetorical competence and expository text comprehension is moderated by grade, or these other reader characteristics. In line with the research and arguments reviewed above, we had five specific hypotheses: we expected a stronger relationship between rhetorical competence and text comprehension amongst older readers (3.1), amongst those with good decoding abilities (3.2), and amongst those with good working memory (3.3); in contrast, we expected a weaker relationship between rhetorical competence and text comprehension amongst readers with good integration/inference skills (3.4) and more prior knowledge (3.5).

2. Method

2.1. Participants

Five hundred and eighty-six students (46% boys) from third- to sixth-grade across 25 classes from three primary schools in Salamanca (Spain) participated: 156 in grade three (8-9 years old), 152 in grade four (9-10 years old), 155 in grade five (10-11 years old), and 123 in grade six (11-12 years old). One school was a state school and the other two were supported by both public and private funds. All students were native Spanish speakers or had a good level of Spanish, the language of all the materials used (checked with the narrative comprehension subtest of the standardized Spanish PROLEC-R battery: Cuetos, Rodríguez, Ruano, & Arribas, 2007). We collected data on expository text comprehension for only 410 students, because of time constraints in one school. For other variables, some test scores were lost due to absence or technical problems with the computer tasks. The final sample size for each variable is reported below.

2.2. Variables and instruments

To enable comparisons between grades, all students were assessed in the same variables and with the same materials. Full details of all tasks, scoring protocols, inter-rater reliability and Cronbach's alpha are shown in Appendix 1.

2.2.1. Expository text comprehension.

Students read an experimental text of five paragraphs and 337 words (in the original Spanish version): *"The destruction of soil"* (see Appendix 2). This text was inspired by a textbook from third-grade but, based on a pilot study, was rewritten to make it more difficult for our age range (an important condition for the utility of rhetorical devices: see above). The final version explains three causes of the destruction of soils (excessive farming, deforestation by fire, and contamination), their consequences, and solutions. This text includes rhetorical devices to clarify its aim and organization (e.g., organizational signals as "These changes are due, at least, to three causes. The first cause is the following"), to connect ideas within text (e.g., conceptual anaphors such as "these disasters"), and to revise prior knowledge (a refutation cue: "It is common to think that… However…").

To create our measures of comprehension of this text, we first isolated a total of 40 statement nodes or propositional schemes in the text (Kintsch, 1998) and analysed its organizational structure (e.g., Meyer et al., 2002). The structure was a combination of cause/effect and problem/solution and we identified 14 main ideas. Other statements were details, rhetorical devices, or paraphrases of the main ideas.

After reading, participants completed three written tasks presented in a booklet in a set order to assess their understanding. First, they wrote a summary: all participants were invited to write what they would say about the text to an absent classmate (we adopted this instruction because the youngest readers may not know what a summary

is). We obtained two variables from the summary: number of main ideas and organization. Second, students answered two open-ended questions that tapped two of the macro-propositions that could be generated from the text. Finally, students read a hypothetical summary of the text with some gaps and were required to supply some information to fill in each blank.

Participants completed the three assessment tasks without being allowed to refer back to the text. These tasks were designed to evaluate the text-based comprehension: the type of text understanding that is supported most by the rhetorical devices included in our experimental text (Kintsch & Yarbrough, 1982). For further analyses, we calculated a composite score by computing the average of the *z* scores from main ideas, organization, open-ended questions and the gap-filling task. Significant concurrent validity of the composite measure was found with a standardized measure of reading comprehension (The Comprehension Strategies Test: Vidal-Abarca, Gilabert, Martínez, & Sellés, 2007) administered at two groups ($r = .51$, $p < .001$, $n = 46$), and with one teacher's judgment about how well her students learned from texts ($r = .58$, $p < .001$, $n = 52$).

2.2.2. Rhetorical competence

We developed three scales: one with anaphors, one with organizational signals, and one with refutation cues. All words were of suitable frequency even for third-graders (using the dictionary from Martínez & García, 2004). Scale 1 assessed processing of anaphors. It comprised texts with one introductory sentence, two content sentences with two proposition units by sentence, and a conclusion sentence preceded by a conceptual anaphor or hypernym. Participants read the text and wrote the answer to a question designed to assess whether they had grasped the connection between the anaphor and its antecedent.

Scale 2 assessed processing of organizational signals. Participants read five passages each with an introductory sentence, a sentence with a global organizational signal, and one with a local organizational signal. After reading the text, students had to write a continuation showing whether they had grasped the overall relation established by the global and local organizational signals. Two texts were structured as cause/effect, one as problem/solution, one as sequence, and one as comparison.

Scale 3 assessed processing of refutation cues. Participants read passages with an introductory sentence, a content sentence, and a sentence with two proposition units: the first one contained an incorrect belief and the refutation cue, and the second one anticipated the topic of a hypothetical text arguing in favour of the correct belief. Participants read the text and wrote what they thought the text would continue talking about (just the topic). We assessed whether participants understood that the author of the text believes readers are somehow wrong and is going to correct this misconception. Thus, the test and scoring were designed to capture readers' sensitivity to the refutation cue and not whether they have understood other contents of the text.

As a requirement for another related study, three alternate forms of each scale were created that were equal in the number of rhetorical devices included, structure, type of content of the texts, and number and frequency of words. There was a total of 45 items (15 to assess each type of rhetorical device) but each student completed a single set of 15 items/passages (five with anaphors, five with organizational signals, and five with refutation cues). The three forms were randomly assigned to the participants in the four grades and the order of completion of the three scales was counterbalanced. When conducting correlations and regression analyses, raw scores on the three forms were equated for difficulty through linear equating (Muraki, Hombo, & Lee, 2000).

The items used to assess rhetorical competence were presented to students on a

PC computer using *Reading and Answer* software (Vidal-Abarca et al., 2011), which registered participants' off-line answers and the time taken to process each item and critical segments. Only off-line data are considered here. Each item was presented on its own. Students worked at their own pace, advancing to read each new segment of text. After reading the text, students advanced to a question/answer screen, and then to the next item using the links at the bottom of each page. They could review the text before advancing to the question/answer screen, but not after seeing the question.

2.2.3. Decoding skills

We assessed the accuracy and speed of decoding with the Word Reading and Pseudoword Reading subscales of the Spanish PROLEC-R battery (Cuetos et al., 2007). Children were tested individually. Each student was asked to read aloud a list of words and a list of pseudowords as fast as he/she could, trying not to make mistakes.

2.2.4. Integration/inference skills

Integration/inference skills were assessed using two short texts from the standardized Spanish PROLEC-R battery (Cuetos et al., 2007). Both are simple descriptions without a complex organizational structure nor organizational signals or refutation cues. Therefore, the task assesses the comprehension skills that are needed for understanding every text, but which are not sufficient to support deep comprehension of extended expository text. Participants worked through a booklet. They read the texts and answered four open-ended questions for each, without referring back to the text. The correct response to each question required readers to draw on a coherent mental representation of the text's meaning and to make an inference about information that was not stated explicitly. The questions were similar to the ones tapping inferences in other published works (Cain & Oakhill, 2014; Tarchi, 2015).

2.2.5. Prior knowledge

A lexical sorting task was administered to provide an indirect measure of prior knowledge about the target text and its domain of knowledge without activating specific ideas in the text that could influence its comprehension (see McNamara et al., 1996 and McNamara & Kintsch, 1996 for previous uses of this kind of task). Students were given a list of words from the text or the same domain of knowledge and some distractors (all words were low-frequency words according to Martínez & García, 2004). They were asked to link each word with a maximum of four other words that shared a relation.

2.2.6. Working memory

The Semantic Updating Test (García-Madruga et al., 2013) was used to assess the ability to update and monitor the contents of working memory. Students were assessed individually. After three practice trials, they completed up to nine experimental trials grouped in three levels of difficulty with three trials at each level. Each trial comprised a list of eight names of concrete highly familiar objects, vegetables, or animals. Each word was presented visually on a separate sheet and read aloud by the experimenter at the rate of approximately two seconds per word. After presentation of each list, students were required to recall a specified number of the largest objects.

2.3. Procedure

Consent for the study was obtained from the head teachers and, when the school required it, also from parents. We followed the policy for Spanish research at the moment of the research, which did not require scrutiny by a specific ethics committee for studies of this nature, and all procedures performed in the study were in accordance with the local ethics policy.

Each student took part in three assessment sessions: one individual session (to assess word and pseudoword decoding, and working memory), one group session in the school computer lab (to assess the prior knowledge pencil-and-paper-task first, followed

by the rhetorical competence computer task with the order of the scales counterbalanced), and one group session in the students' usual classroom to assess expository text comprehension, followed by the integration/inference task (order counterbalanced). On average, the individual session lasted 20 minutes and the group sessions 50 minutes each. Tasks were not time limited and students were given sufficient time to complete the tasks. All tasks were preceded by specific instructions and examples to explain the procedures. To minimise tiredness, the sessions were distributed over a period of one to two weeks (depending on each school and group timetable) at the end of the academic year (May/June). Graduate students of Pedagogy, Psychology or Teaching administered the individual tests after appropriate training. The group tasks were administered by the same team plus two of the authors.

3. Results

Participants with scores greater than 2.5 standard deviations from the mean at their grade level on any variable were removed (16 in third-grade: 5 below the mean and 11 above the mean; 24 in fourth-grade: 14 below the mean and 10 above the mean; 13 in fifth-grade: 8 below the mean and 5 above the mean; and 12 in sixth-grade: 8 below the mean and 4 above the mean). The rejection level for all analyses was set at .05. We conducted analyses of variance (ANOVAs) with grade as the between subjects factor, regressions, and moderated analyses. In ANOVA post hoc analyses, Type I error due to multiple testing was controlled by using Bonferroni or Games-Howell (when Levene's test of homogeneity was significant). In regressions and moderation analyses, Type I error was controlled applying the Bonferroni correction factor to each significant *p*-value.

We present the results in four sections. First, we report the descriptive statistics of the control and dependent variables and compare performance between grades. The

other three sections are dedicated to the results related to each of our three objectives. In section two we compare the different measures of rhetorical competence by grade. In section three we report the correlations between all variables and the multiple regression analyses to determine whether each measure of rhetorical competence (jointly and alone) contributed significantly to the reading comprehension of the expository text beyond our control variables. In section four, we explore if grade and/or any of the control variables moderated the relation between rhetorical competence and expository text comprehension.

3.1. Descriptive statistics and cross-sectional comparisons of control and dependent variables

The descriptive statistics of the control and dependent variables at each grade are presented in Table 1. We compared these data with those collected by other researchers with some of the same instruments and for similar samples. We found very similar results for word/pseudoword reading and general comprehension skills in all grades (Cuetos et al., 2007), and for working memory in third-grade (García-Madruga et al., 2013). Consequently, these data seem to be representative of Spanish students' reading and cognitive skills at these ages. As intended, the target text was not familiar for participants: even the oldest students' score for prior knowledge measure (8.05) was not close to the maximum (12).

PLEASE, INSERT TABLE 1 ABOUT HERE

There were statistically significant differences between grades for all variables (see right columns in Table 1). Post hoc analyses yielded statistically significant differences between each of the four grades in four of the six variables contrasted: correct words per minute, correct pseudowords per minute, integration/inference skills, and prior knowledge. For expository text comprehension, group differences were not

significant between third- and fourth-grade, and for working memory between fourth- and fifth-grade.

3.2. Comparisons between the different scales of rhetorical competence

Our first aim was to examine and describe the developmental pattern of rhetorical competence. The descriptive statistics of the three scales of rhetorical competence and the composite measure, at each grade, are presented in Table 2. There were statistically significant differences between grades for all three scales and the composite measure (see right columns in Table 2). Post hoc analyses yielded statistically significant differences between each of the four grades only for processing of anaphors. For processing of organizational signals, group differences were not found between third-, fourth-, and fifth-grade. For processing of refutation cues, group differences were not found between third- and fourth-grade and between fifth- and sixth-grade. For the composite measure, post hoc analyses yielded statistically significant differences between all grades except between third- and fourth-grade.

PLEASE, INSERT TABLE 2 ABOUT HERE

A 4x3 repeated measures ANOVA (grade x rhetorical competence scale: anaphors, organizational signals and refutation cues) revealed a main effect of grade, $F(3, 468) = 37.83$, $p < .001$, partial $\eta 2 = .19$, with higher scores associated with increasing grade. There was also a main effect of the rhetorical competence scale, $F(2, 936) = 63.87$, $p < .001$, partial $\eta 2 = .12$. Pairwise comparisons showed that processing of anaphors was easier than processing of organizational signals ($p < .05$) and processing of refutation cues ($p < .01$); and that processing of organizational signals was easier than processing of refutation cues ($p < .01$). These two variables were involved in a significant interaction, $F(6, 936) = 3.41$, $p = .002$, partial $\eta 2 = .02$, which means that differences between scales were not equal in all grades. Post hoc comparisons showed

significant differences between the three scales of rhetorical competence in third- and fifth-grade and between processing of refutation cues and the other two measures in all grades (all *p*s < .05), but no differences between processing of anaphors and processing of organizational signals in fourth- ($p = .12$) and sixth-grade ($p = .16$).

3.3. Correlations and fixed-order hierarchical multiple regressions for expository text comprehension

Our second aim was to determine whether rhetorical competence makes a unique contribution to third through to sixth grade children's comprehension of expository text, above and beyond variables known to be strongly related to this skill (namely word decoding, integration/inference skills, prior knowledge, and working memory). First, we conducted a set of correlations. Each of measures of rhetorical competence and the other variables were correlated with the dependent variable: expository text comprehension (see Table 3). These correlations were *medium* to *large* (.35 < *r*s > .51). The variables rhetorical competence (total) and integration/inference skills were the most strongly correlated with expository text comprehension. The four measures of rhetorical competence showed significant correlations with all the other variables. The two measures of decoding were highly correlated, and also the three scales of rhetorical competence with their composite measure. These correlations were higher than .70, the level at which concerns regarding multicollinearity arise (Tabachnick & Fidell, 2007). Therefore, special care was taken in the regression analyses to avoid multicollinearity problems. It should be noted that correlations between the three scales of rhetorical competence were not very high (between .33 and .39) which justifies the examination of

the contribution of each scale alone (and not only the composite measure) to expository text comprehension[4].

PLEASE, INSERT TABLE 3 ABOUT HERE

To determine whether rhetorical competence makes a unique contribution to comprehension of expository text, we conducted two regressions. The first was to determine which of our control variables (correct words per minute, correct pseudowords per minute, integration/inference skills, prior knowledge, and working memory) accounted for any significant variance in expository text comprehension. The measure of correct pseudowords per minute did not make a significance contribution to the expository text comprehension ($p > .10$) and was excluded from further analyses.

The second was a fixed-order hierarchical multiple regression to determine whether each measure of rhetorical competence (one for each scale plus the composite measure) explained unique variance in expository text comprehension above and beyond the influence of all the control variables with a significant effect (Table 4). In the first step, we entered correct words per minute and integration/inference skills, because they represent basic reading skills involved in the comprehension of all text types. In the second step, we entered prior knowledge and working memory, because they represent those skills especially important for expository reading comprehension. In the third step, we entered the four measures of rhetorical competence separately: that is, we repeated the analysis four times changing only the variable introduced in the third

[4]Confirmatory factor analysis results from each version of the scale also suggested that the rhetorical competence data supported a three factors solution (goodness-of-fit indexes = .93, comparative fit indexes ≥ .96, root mean square errors of approximation < .05).

step in order to obtain four models (one for each rhetorical competence measure). For these regressions, the tolerance values were over .65, and all variance inflation factors (VIFs) were well under 10. In Step 2, the combination of prior knowledge and working memory accounted for significant variance over and above the significant contribution made by decoding and integration/inference skills. Each measure of rhetorical competence accounted for significant additional variance in expository text comprehension when entered in Step 3, over and above the significant contribution of the control variables.

PLEASE, INSERT TABLE 4 ABOUT HERE

3.4. Moderation analyses

Our third aim concerned the moderating influence of grade and each of our reading-related variables on the relation between rhetorical competence and expository text comprehension. To test our specific hypotheses, we conducted moderation analyses using the PROCESS macro developed by Hayes (2013) for SPSS. Five models were constructed with expository text comprehension as the dependent variable, rhetorical competence (total) as the independent variable and each of the five possible moderators: grade, correct words per minute, integration/inference skills, prior knowledge, and working memory (see Table 5). At the same time, grade and the significant control variables were introduced as covariates when they were not being testing as moderators. No effect of the interaction term between rhetorical competence and any of the potential moderators was found. We can therefore conclude that the significant relation between rhetorical competence and expository text comprehension was always significant and was not moderated by any of the variables considered.

PLEASE, INSERT TABLE 5 ABOUT HERE

4. Discussion

This study of rhetorical competence in young readers and its contribution to expository text comprehension provides three novel findings. First, we demonstrated that rhetorical competence is evident in third graders, but continues to develop across the primary school grades. Second, we demonstrated that young children's rhetorical knowledge is not uniform: mastery of some devices is acquired before mastery of others. Finally, we found that rhetorical competence made a specific and similar contribution to expository reading comprehension, regardless of grade, decoding ability, integration/inference skills, prior knowledge, and working memory.

Our first aim was to characterize how rhetorical competence develops by grade. We tested four hypotheses. According to the hypothesis 1.1, we expected that the youngest group (grade three) would have some knowledge only about anaphors, but not organizational signals and refutation cues. This hypothesis was not wholly confirmed. With respect to anaphors, our data add to the extant literature by showing that third graders not only have some knowledge of concrete anaphoric elements such as repeated nouns, general nouns, pronouns or adverbs (e.g., Borzone, 2005; Ehrlich et al., 1999; Oakhill & Yuill, 1986), but also knowledge about conceptual anaphora or hypernyms ("this process", "this phenomenon"). Uccelli et al. (2015) have demonstrated this knowledge in fourth grade. In contrast to our expectations, the youngest age group was also aware and able to use organizational signals and refutation cues[5], albeit to a limited extent. Educators should note that some 8- to 9-year-olds can follow some of the processing instructions from rhetorical devices in expository texts in order to search for

[5]It is important to notice that this research only shows that primary students can understand the instructions of refutation cues, which is different to taking advantage of refutational texts in comparison to non-refutational ones.

a referent (in the case of conceptual anaphors) or to connect current content with prior text or prior knowledge (in the case of organizational signals and refutation cues).

We expected that rhetorical competence would increase across the age range (hypothesis 1.2) and this hypothesis was confirmed. Our data show that the development of rhetorical competence is far from being complete even by sixth grade. This finding is coherent with previous research that reports variability at 11 and 13 years in students' ability to detect, interpret and use the same rhetorical devices assessed here (García et al., 2015), and with studies showing that knowledge of the global structure of a text consolidates only around high school age (Berman & Nir-Sagiv, 2007; Meyer et al.,1980). The extended period of acquisition of rhetorical competence is in contrast with the development of other reading abilities assessed in our sample (for instance, word reading accuracy). This suggests that the development of rhetorical competence is a big challenge and/or that teachers do not explicitly promote this skill.

In line with our expectations, for the whole sample, some rhetorical devices were more salient than others (hypothesis 1.3). Children found the anaphor tasks easier than those involving use of organizational signals, and the refutation cues tasks were most difficult. Of course, these results may simply be due to differential sensitivity in our materials. However, we do not believe that this is a complete explanation because anaphors and organizational signals are more widely used than refutation cues (see the analysis of rhetorical devices in academic text from García, et al., 2018), distance between ideas which must be activated and integrated influences text processing (Cook & O'Brien, 2014), and adversative relations (as the ones implied in refutation cues) are challenging to understand (e.g., Crosson & Lesaux, 2013).

Nevertheless, we note that these findings differ from those reported by García et al. (2015) who found the highest scores in a refutation cues task. We believe that

response formats may have influenced performance differences between these studies: in García et al. (2015) participants had to complete a multiple-choice test for the refutation cues but were required to produce written responses in the assessment of knowledge and use of anaphors and organizational signals. By using the same response format for each rhetorical device in the present study, we have minimised differences that might arise through the production of a response. In doing so, our actual measure more accurately targets understanding and use of these devices. We acknowledge that there are content differences and length differences between items used to assess different aspects of rhetorical competence that future studies should aim to control.

Finally, in relation to our first objective, we anticipated non-parallel development of the knowledge of the different rhetorical devices (hypothesis 1.4). This was confirmed: differences in the knowledge of the three kinds of rhetorical devices were strongest for the youngest students and reduced with increasing age, such that, by sixth-grade, students performed equally in the anaphor and organizational signals tasks.

Our second aim was to specify the unique contribution that rhetorical competence makes to comprehension of expository texts between grades three to six. Our data confirmed our hypothesis (2.1): rhetorical competence made a statistically significant contribution to expository text comprehension over and above decoding, working memory, integration/inference skills, and prior knowledge. This is in line with other research that has shown how knowledge about anaphors, organizational signals (or text structure) and refutation cues are related to reading comprehension (e.g., Cain, Oakhill, & Bryant, 2004; Ehrlich et al., 1999; García et al., 2015; Meyer & Poon, 2001; Yuill & Oakhill, 1988, 1991). Importantly, this study goes further by demonstrating that a broad measure of rhetorical competence, assessing three central aspects of this skill, contributes to expository text comprehension in the early stages of reading to learn.

Although the specific variance explained by rhetorical competence was small, this does not detract from its importance in expository text comprehension because its contribution was evident over and above both word reading and our measure of integration/inference skills, both significant predictors of reading comprehension performance in this age group (Cain et al., 2004; Language and Reading Research Consortium & Logan, 2017). In particular, our findings show that organizational signals and refutation cues (not only anaphors) can be used to promote comprehension and learning from texts even in young readers, extending knowledge gained from studies of older participants (Alvermann & Hague, 2001; Diakidoy et al., 2003; Kendeou, Muis, & Fulton, 2011; Kendeou & van den Broek, 2007; Sánchez et al., 2017).

The third aim was to determine whether the relationship between rhetorical competence and expository text comprehension was moderated by grade, or the other critical reader characteristics assessed in this study. This aim generated five hypotheses (one for each possible moderator). None of these hypotheses was supported: the analyses demonstrated that the influence of rhetorical competence on expository text comprehension was stable regardless of grade, or the control variables (decoding skill, integration/inference skills, prior knowledge, and working memory). Other studies with older participants have found that the relationship between one aspect of rhetorical competence (knowledge and use of connectives) is dependent on other reader characteristics such as language background (Crosson & Lesaux, 2013) or metacognitive knowledge (Welie et al., 2017). Future research should consider whether moderation is found only for older readers or for some aspects of rhetorical competence.

In addition to the limitations and suggestions for future research noted above, some others should be highlighted. First, although we included several theoretically valid control variables, other reading influential competencies were not assessed,

including vocabulary, general intelligence, and metacognitive strategy knowledge. The inclusion of additional variables would most probably have enabled us to predict a greater proportion of variance in expository text comprehension. Second, participants were nested within classrooms (N = 25), classrooms within grades (N = 4), and grades within schools (N= 3). A sample size of 30-50 classrooms is recommended for multilevel modelling (e.g., Hox, Moerbeek, & van de Schoot, 2010); thus, our analyses were conducted at the student level. Our moderation analyses showed that the relationship between rhetorical competence and expository reading comprehension was not affected by grade. A posteriori analysis with PROCESS demonstrated that this relation did not depend on the school (interaction p = .845) or the group within each grade (interaction p = .050 in grade third, .558 in grade fourth, .876 in grade fifth, and .071 in grade sixth). Nevertheless, we are aware that nested structure of the data was not accommodated in the analysis. Third, our study was conducted with just one expository text experimentally controlled to include the three rhetorical devices tested. Studies with other texts are required to test the generality of our results. Fourth, a posteriori analysis showed that our experimental text was suitable for fifth graders (Crawford Index 5.4: Crawford, 1984), but could be very difficult for third and fourth graders, which might have affected their self-efficacy and motivation. Future research should measure these variables to determine any influence on the relationship found between rhetorical competence and expository text comprehension. Nevertheless, the standard deviations of the measures used to assess expository reading comprehension showed sufficient variability, even in the youngest students, to permit examination of whether rhetorical competence had some role in explaining such differences. Finally, we examined reading and understanding of a single text. It would be informative to determine if rhetorical competence is equally important when integrating information across several texts,

particularly those presenting different views of an argument (Britt & Rouet, 2012).

In sum, we have extended our understanding of rhetorical competence in young readers and its contribution to expository text comprehension in the following critical ways. First, we have shown that children have some rhetorical competence even in the very early stages of reading, although this skill is not fully developed by the end of the primary school grades. Second, rhetorical knowledge covers a range of different rhetorical devices and knowledge of some is acquired before knowledge of others. Finally, rhetorical competence is a unique predictor of expository text comprehension, and its influence is evident regardless of grade, decoding ability, integration/inference skills, prior knowledge, and working memory. As a result, educators should be aware of the importance of rhetorical competence and foster its development in young readers to enhance their potential to learn from expository text.

Appendix 1: Details of variables and instruments

Expository text comprehension (Cronbach's alpha across all items included in the composite measure =.70)

*a) Summary (*Pearson's *r* between two independent judges = .92)

- Main ideas: each main idea was awarded one point (maximum = 14). Because we were not assessing verbatim memory, students were not penalised for using different words to refer to these ideas and links.
- Level of organization: 0 (the ideas were reported without any link between them), 1 (the ideas were reported with sequential or descriptive links), 2 (there was some causal link to introduce some of the problems affecting soils), 3 (there was a causal link anticipating the global causal structure of the text), and 4 (there was a causal link anticipating the global causal structure of the text and a causal link to introduce each problem affecting soils).

b) Two open-ended questions (Mean Kappa agreement for scoring = .71)

- "What would happen if soils became impoverished?". One point was awarded if the answer contained both the idea that "living beings could not

live" and "nothing could be cultivated"; and 0.5 points if the answer included only one of those two ideas.

- "How is it possible to improve a poor soil?". One point was awarded for the correct answer "fertilizing the soil".

c) Gap-filling task (Pearson's *r* between two independent judges =.98) There were seven gaps. Six had to be filled with important information (main ideas) and one with details. One point was given for each correct answer. Scores for the six gaps related to the main ideas were summed (maximum = 6).

Rhetorical competence (Cronbach's alpha for the composite measure of the three scales = .78, .76 and .74 for form A, B and C respectively)

a) Scale 1: processing of anaphors (Pearson's r between two independent judges = .87. Cronbach's alpha = .59, .63 and .68 for form A, B and C respectively). Item example:

"Isabel and Ana play in a soccer team. Isabel always runs to the centre of the field and shoots forward. Ana always positions herself in the area and gets the goal by heading the ball into the net. This action is a copy of a move of the Argentinian team". *What is a copy of a move of the Argentinian national team?*

Each correct antecedent of the anaphor mentioned in the answer was awarded 0.25 points. The maximum score in each item was one point. The maximum score in the scale was 5.

b) *Scale 2: processing of organizational signals* (Pearson's r between two independent judges = .81. Cronbach's alpha = .48, .63 and .60 for form A, B and C respectively). Item example:

"Sport is a healthy and fun activity. Everyone should do sport once a week for two reasons. One reason is that sport makes the heart work hard and so it becomes stronger". *How could this text continue?*

One point was awarded if the participant's continuation indicated that they had grasped the overall relation (in the example, cause/effect) established by the global and local organizational signals. The semantic and grammatical quality of the continuation was not assessed: only whether participants detected and correctly interpreted the rhetorical devices to continue the text. The maximum score in the scale was 5.

c) Scale 3: processing of refutation cues (Pearson's *r* between two independent judges =.94. Cronbach's alpha = .82, .64, and .72 for form A, B and C respectively). Item example:

"Prehistory is a very important period in the humanity History. Men lived in caves, hunted wild animals in small groups and wore their skins as warm clothing. It is common to think that prehistoric men and dinosaurs coexisted, but some evidence show that men could not have met dinosaurs" *What will this text continue to talk about?*

One point was awarded when the answer indicated that the student understood that the author believes readers are somehow wrong and had generated an expectation about how the text had to continue to correct this misconception. The maximum score in the scale was 5.

Decoding skills. Participants read a list of 40 words and a list of 40 pseudowords from the Word Reading and Pseudoword Reading subscales of the Spanish PROLEC-R battery (Cuetos et al., 2007: the reliability reported for in the manual was = .74 for Word Reading and .68 for Pseudoword Reading). Two scores were calculated: correct words per minute and correct pseudowords per minute.

Integration/inference skills. (Pearson's *r* between two independent judges =.96. Cronbach's alpha = .58). Participants read two short texts from the standardized Spanish PROLEC-R battery (Cuetos et al., 2007): "Okapis" (a mammal closely related to the giraffe) and "The Apache Indians". They read the texts and answered four open-ended questions for each text like ''Why do African farmers get angry with okapis?''. One point was given for each correct answer (maximum = 8).

Prior knowledge. (Cronbach's alpha = .69.) Students were given a list of 31 words.18 words were chosen from the text ''The destruction of soil'' or the same domain of knowledge, and 13 were distractors. They were asked to link each word with a maximum of four other words that shared a relation. For instance, "forest" could be linked to "logging". Antonyms should not be linked. To develop the scoring system, the task was first completed by 46 university students. Children were awarded one point for each relationship chosen by at least 50% of the university students (maximum = 12). If the same word was related at the same time with one correct word and some incorrect words, we discounted the total score by 0.25 points.

Working memory. (Cronbach's alpha = .68). Semantic Updating Test from García-Madruga et al. (2013). After the presentation of lists of eight concrete and highly familiar words that referred to objects, vegetables, or animals, students were required to recall the largest two objects (for the three trials of level 1), three objects (for the three trials of level 2), or four objects (for the three trials of level 3). Students had to recall all target words in a trial to receive a score. They were awarded 1 point for each word remembered in its correct order and 0.5 points for each word in the wrong position (maximum = 27). Testing ceased if a student did not provide a correct response for the three trials at a given level.

Appendix 2: Translation of ''The destruction of soil''

It is common to think that soils that we set foot while walking or that we see when looking at one landscape will be there forever, without great modifications. However, it is known that soils suffer changes that can be dangerous to living beings. These changes are due, at least, to three causes.

The first cause is the following. Normally, a fertile soil is grown for years and years with the same type of plant, just as it happens with wheat, corn or beet in the surrounding fields of Salamanca. Because of this intensive cultivation, that soil is slowly losing its minerals, and it becomes less and less fertile. To avoid this, soil must be fertilized every so often providing the lost substances.

There is also a second known cause. Forest fires are becoming more frequent in our country when extreme heat arrives, as we see almost every day on television news when we are on vacation in the summers. A consequence of these fires is that they destroy the vegetation and, when heavy rains fall, the waters drag along a good part of the unprotected soil. To avoid the consequences of these disasters, we must replant those soils as quickly as possible.

Finally, here we have a third cause. Human activity in the industry, at home or in the city generates polluting substances, such as car oil, plastics, the remains of paints and

detergents and other similar things. The consequence is that these products end up in the soil and, when they accumulate for a long time, the soil decreases its quality and vegetation do not grow. In this case, there is no other solution than to take measures to avoid contamination.

In short, the soils are not eternal, and it seems necessary that we consider the importance of taking care of them, since if we destroy or damage the soil in an area, we will not be able to grow it, no plants will grow, and the other living beings will not be able to live there either.

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Variables		*Third-grade*		*Fourth-grade*		*Fifth-grade*		*Sixth-grade*		*F*-value (df_1;df_2)	*p*	*η2* partial	Pairwise comparisons between grades
		N	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)				
Expository reading comprehension	% of success on main ideas (summary)	134	8.47 (9.19)	80	5.08 (8.28)	85	11.17 (14.30)	46	13.50 (10.12)	30.77 (3;341)	<.001	.21	$3^{rd} = 4^{th} < 5^{th} < 6^{th}$
	% of success on level of organization (summary)	134	23.88 (37.53)	80	15 (23.39)	85	22.35 (30.62)	46	41.30 (37.34)				
	% of success on open-ended questions	134	16.60 (26.36)	80	17.81 (23.93)	85	37.94 (32.87)	46	50.54 (38.90)				
	% of success on gap-filling task	134	12.25 (14.62)	80	24.27 (21.51)	85	34.21 (24.22)	46	46.73 (17.95)				
Correct words per minute		132	65.17 (17.90)	122	81.41 (17.40)	126	88.03 (21.80)	99	100.29 (16.34)	72.31 (3;475)	<.001	.31	$3^{rd} < 4^{th} < 5^{th} < 6^{th}$
Correct pseudowords per minute		132	34.30 (9.75)	122	42.79 (9.64)	125	48.41 (13.99)	99	53.04 (11.56)	59.81 (3;474)	<.001	.28	$3^{rd} < 4^{th} < 5^{th} < 6^{th}$
Integration/inference skills		135	3.75 (1.87)	121	4.85 (1.62)	127	5.47 (1.56)	97	6.00 (1.33)	41.90 (3;476)	<.001	.20	$3^{rd} < 4^{th} < 5^{th} < 6^{th}$
Prior knowledge		134	4.13 (1.86)	121	5.33 (2.07)	128	6.91 (2.27)	97	8.05 (1.74)	85.52 (3;476)	<.001	.35	$3^{rd} < 4^{th} < 5^{th} < 6^{th}$

Working memory	132	8.31 (5.77)	122	12.02 (6.81)	127	12.70 (6.34)	99	14.84 (5.40)	23.28 (3;476)	<.001	.12	$3^{rd} < 4^{th} = 5^{th} < 6^{th}$

Table 1. Scores and contrasts for control and dependent variables by grade. The contrast of the dependent variable (expository reading comprehension) has been made only with the composite measure.

Variables	*Third-grade*		*Fourth-grade*		*Fifth-grade*		*Sixth-grade*		*F*-value (df_1;df_2)	*p*	*η2* partial	Pairwise comparisons between grades
	N	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)	*N*	Mean (SD)				
Rhetorical competence (anaphors)	133	1.62 (.83)	121	2.14 (.86)	127	2.64 (1.03)	95	3.10 (.96)	54.69 (3;472)	<.001	.26	$3^{rd} < 4^{th} < 5^{th} < 6^{th}$
Rhetorical competence (organizational signals)	134	1.93 (1.40)	120	1.86 (1.40)	126	2.22 (1.36)	96	2.79 (1.35)	9.75 (3;472)	<.001	.06	$3^{rd} = 4^{th} = 5^{th} < 6^{th}$
Rhetorical competence (refutation cues)	134	1.08 (1.47)	119	1.04 (1.39)	128	1.83 (1.72)	96	2.31 (1.72)	16.70 (3;473)	<.001	.10	$3^{rd} = 4^{th} < 5^{th} = 6^{th}$
Rhetorical competence (total)	133	4.65 (2.80)	118	5.07 (2.40)	126	6.68 (3.06)	95	8.25 (2.83)	37.83 (3;468)	<.001	.20	$3^{rd} = 4^{th} < 5^{th} < 6^{th}$

Table 2. Scores and contrasts for rhetorical competence measures by grade.

	1	2	3	4	5	6	7	8	9	10
1. Expository text comprehension		.42**	.35**	.37**	.49**	.45**	.38**	.51**	.46**	.36**
2. Rhetorical competence (anaphors)			.33**	.39**	.70**	.41**	.36**	.39**	.34**	.34**
3. Rhetorical competence (organizational signals)				.35**	.71**	.25**	.20**	.33**	.27**	.20**
4. Rhetorical competence (refutation cues)					.83**	.23**	.22**	.30**	.33**	.24**
5. Rhetorical competence (total)						.37**	.34**	.43**	.42**	.33**
6. Correct words per minute							.80**	.41**	.44**	.39**
7. Correct pseudowords per minute								.36**	.40**	.38**
8. Integration/inference skills									.44**	.38**
9. Prior knowledge										.32**
10. Working memory										

Table 3. *Intercorrelations for all variables in the study.* ** $p < .01$, * $p < .05$

Regression analysis predicting Expository Text Comprehension	R^2 *(corrected)*	ΔR^2	F	df	Final ß
STEP 1. Correct words per minute and Integration/inference skills	.31	.31	76.21**	334	_
STEP 2. Prior knowledge and Working memory	.36	.04	13.29**	332	_
STEP 3. Rhetorical competence (anaphors)	.37	.01	8.50*	331	.15
STEP 1. Correct words per minute and Integration/inference skills	.31	.31	76.21**	334	_
STEP 2. Prior knowledge and Working memory	.36	.04	13.29**	332	_
STEP 3. Rhetorical competence (organizational signals)	.37	.01	9.91**	332	.15
STEP 1. Correct words per minute and Integration/inference skills	.31	.31	76.21**	334	_
STEP 2. Prior knowledge and Working memory	.36	.04	13.29**	332	_
STEP 3. Rhetorical competence (refutation cues)	.38	.02	12.76**	330	.17
STEP 1. Correct words per minute and Integration/inference skills	.31	.31	76.21**	334	_
STEP 2. Prior knowledge and Working memory	.36	.04	13.29**	332	_
STEP 3. Rhetorical competence (total)	.39	.03	21.00**	329	.23

Table 4. *Summary of Fixed-Order Hierarchical Regression Analyses on Expository Text Comprehension to Analyse the Impact of each Measure of Rhetorical Competence* $^{**}p < .01$, $^{*}p < .05$. *Bonferroni correction factor for each significant p value = 3*

	Grade			Correct words per minute (CWM)			Integration/inference skills (I/I)			Prior knowledge (PK)			Working memory (WM)		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*P*
Constant	-1.291	.169	<.001	-1.332	.219	<.001	-1.206	.170	<.001	-1.344	.177	<.001	-1.445	.145	<.001
Grade	-.058	.072	.419	.036	.038	.339	.028	.038	.477	.032	.038	.405	.038	.038	.309
Rhetorical competence	.015	.023	.518	.021	.036	.560	-.008	.027	.778	.024	.026	.347	.041	.021	.441
CWM	.004	.001	.045	.003	.003	.339	.005	.002	.045	.005	.002	.054	.005	.002	.054
I/I	.084	.019	<.001	.083	.020	<.001	.021	.033	.512	.085	.020	<.001	.083	.020	<.001
PK	.044	.015	.045	.046	.016	.036	.048	.016	.027	.021	.029	.481	.046	.016	.036
WM	.007	.005	.200	.007	.006	.209	.007	.005	.205	.007	.006	.238	.002	.011	.841
Rhetorical competence x Grade	.014	.009	.114												
Rhetorical competence x CWM				.000	.000	.418									
Rhetorical competence x I/I							.011	.005	.216						
Rhetorical competence x PK										.004	.004	.294			
Rhetorical competence x WM													.001	.002	.660
Model summary	*F(7*, 327) = 32.30, *p* <.001, R^2 = .41			*F*(7, 327) = 31.85, *p* <.001, R^2 = .41			*F*(7, 327) = 32.92, *p* <.001, R^2 = .41			*F*(7, 327) = 31.96, *p* <.001, R^2 = .41			*F*(7, 327) = 31.74, *p* <.001, R^2 = .41		
R^2 increase due to interaction	.004			.001			.009			.002			.000		

Table 5. *Summary of Moderation Analyses. Dependent variable: expository text comprehension (composite). Independent variable: rhetorical competence (total). B = unstandardized beta weight. SE = standard error. Bonferroni correction factor for each significant p value of the predictors = 9*