



Empirical Study of the Effects of Discourse Markers on the Reading Comprehension of Spanish Students of English as a Foreign Language

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ABSTRACT

The aim of this work is to analyse how Spanish readers react to English discourse markers in a text. We carry out an empirical study in which we ask three research questions: (a) if there is any relationship between presence of discourse markers or absence of discourse markers and reading comprehension in English as a foreign language, (b) if there is any relationship between the readers' proficiency in English and the effect of the presence or absence of discourse markers on reading comprehension and, (c) if there is any relationship between the readers' age, sex, competence as learners and as learners of English, and the effect of the presence or absence of discourse markers on reading comprehension. The results obtained show that discourse markers enhance reading comprehension in foreign language reading, and that the more successful students tend to use discourse markers as aids to help their reading comprehension. This latter result is nevertheless limited by the possible effect of the readers' familiarity with the topic of the text and points to a need for further investigation.

KEYWORDS: Discourse markers, reading comprehension, foreign language reading

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I. SCHEMA THEORY AND L2 READING COMPREHENSION

The role of background knowledge in language comprehension has been formalized as schema theory. Schema theory was originally proposed by Bartlett (1932), a follower of Gestalt psychology, to account for how information in stories and events is reconfigured in memory for further recall. In the 1970s and 1980s, schema theory became the theoretical framework within which the structure and the role of knowledge in the mind were described (e.g., Minsky, 1975; Schank, 1982; Schank & Abelson, 1977).

Schema theory was used to explain and interpret a large number of cognitive processes, such as inferencing, remembering, reasoning, and problem solving, and gave rise to a large volume of experimental research in learning, comprehension, and memory (e.g., Adams & Collins, 1979; Anderson, 1984; Anderson & Pearson, 1984; Anderson, Reynolds; Bloom, 1988; Bransford & Johnson, 1972; McDaniel & Kerwin, 1987; Schallert, 1991). This theory recognised the constructive nature of the reading process, and the critical role of the reader and the interaction between the text and the reader's background knowledge, which gave rise to a large volume of meaningful research on the role of conceptual and background knowledge in L2 reading comprehension and instruction (e.g., Alderson & Urquhart, 1988; Barry & Lazarte, 1995; Carrell, 1987, 1992; Carrell & Eisterhold, 1983; Carrell & Wise, 1998; Hudson, 1982; Lee, 1986; Peretz & Shoham, 1990; Steffenson & Joag-Dev, 1984; Tan, 1990).

Schema theory suggests that background knowledge constitutes the main guiding context through which information is interpreted (Schank, 1978; Schank & Abelson, 1977). However, it is now quite established that the comprehension process does not proceed in such a top-down mode. Research in the field of L1 reading comprehension has shown that individual words in a text are processed visually even when they are highly predictable in the context (Balota, Pollatsek, & Rayner, 1985; Pollatsek, 1993; Rayner, 1986; Rayner & Sereno, 1994). Besides, in L2 reading a growing body of research shows the critical role of lower-level processes in L2 reading comprehension (e.g., Haynes & Carr, 1990; Horiba, 1996; Koda, 1992, 1998, 1999; Nassaji & Geva, 1999; Segalowitz, Segalowitz, & Wood, 1998).

As a consequence of these developments, most of the current models of L2 reading comprehension are interactive in that L2 comprehension is considered to be a process consisting of both data-driven and reader-driven processes (e.g., Bernhardt, 1991; Carrell, Devine, & Eskey, 1988; Swaffar, Arens, & Byrnes, 1991).

Within this framework, the aim of this work is to analyse how readers react to discourse markers in a text. According to the interactive view of reading, effective readers will process a text relating their schematic knowledge and the textual clues. These textual clues include discourse markers. Following this view, we can say that readers use the signals (discourse markers) in the surface structure of discourse and their schematic knowledge to interpret the text. This implies a processing of the information which is not flat, just a decoding of words, but implies a capacity to relate linguistic and non-linguistic information adequately.

In the following section we introduce discourse markers and approach them from a Relevance theory perspective.

II. DISCOURSE MARKERS

Discourse markers (hereafter DMs) are linguistic items such as *so*, *because*, etc. They are a set of clues which create cohesiveness, coherence and meaning in discourse. The characteristic figuring most prominently in definitions of DMs is their use to relate utterances or other discourse units (Fraser, 1990, 1999; Redeker 1991; Schiffrin 1987)¹.

Diane Blakemore (1987) puts forward an account of discourse markers (she calls them discourse connectives) based on relevance-theoretic assumptions about communication². The relevantist perspective states that speakers interpret information searching for relevance. According to Blakemore (1987), connectives contribute essentially to the interpretation process. From this theoretical perspective, connectives are considered signals speakers use to guide cooperatively their hearers' interpretative process.

Usually speakers have a specific interpretation of their utterance in mind and expect hearers to arrive at that interpretation. To arrive at the intended interpretation of an utterance hearers must process the utterance in the right, i.e. the intended context³. The selection of context is governed by considerations of optimal relevance. Speakers may have reasons to believe that hearers will choose the appropriate contextual assumptions and draw the appropriate conclusions without any extra help from them, or they may decide to direct hearers towards the intended interpretation by making a certain set of assumptions immediately accessible. DMs is one of the linguistic devices the speaker may use to achieve that effect. Blakemore (especially 1987, 1988, 1989a, 1989b, 1992 and 1993) considers that the essential function of elements like *likewise*, *therefore*, *because*, etc. is to guide the hearer's interpretation process through the specification of certain properties of the context and the contextual effects; more specifically, these elements constrain the relevant context for the

interpretation of an utterance, reinforcing some inferences or eliminating other possible ones and thus help process the information. On the relevance-theoretic approach they play a facilitating role⁴.

III. REVIEW OF THE LITERATURE ON THE USE OF DMs

This study involves the use of DMs by nonnative language readers. It is intended as a contribution to the study of how DMs are used by native speakers of Spanish. To design this study, we have first reviewed the literature on this topic.

Research is more abundant on the effect of L1. We have found early studies that consider the effects of signals on L1 reading comprehension. Meyer (1975) in her study of signal types (structural cues, previews, summary statements, and pointer words) found signals to be of no significant aid to college readers in free immediate and free and cued delayed recall. Meyer, Brandt and Bluth (1980) tested the effects of structural cues or appropriate signals in the text that make the rhetorical structure explicit, on the recall of ninth-grade good and underachieving readers and found that the signalled condition helped only the underachievers. Kintsch & Yarbrough (1982) found significant effects for signals (structural cues and pointer words) and for good rhetorical form in reading comprehension with college readers. However, because they varied both form and signals simultaneously, it is impossible to know whether the form or the signals created the effect. Loman & Mayer (1983) in their study of three signal types in combination (previews, headings and logical connectives), used with 10th-grade good and poor comprehenders, found significant effects with both groups in a problem-solving test. Loman & Mayer maintained that signals helped the good comprehenders use their meaningful reading strategy more effectively than usual, and helped poor comprehenders use a meaningful strategy instead of a rote reading strategy. What is interesting and new in their investigation at the moment of research is that these authors approached signalling from a qualitative consideration of the effects of signalling that shows how signals tend to direct attention towards conceptual information, and in this way they extended earlier studies of signalling. Lorch and Lorch's (1986) study examines two signalling devices, what they define as two particular devices for emphasizing selected information within a text: (a) summary indicators, and (b) importance indicators. This study approaches two questions of interest: (1) how experienced readers respond to these signals while reading; and (2) how subjects who differ in reading skills also differ in their responses to summary and importance indicators. The results demonstrate that experienced readers use text signals to guide their attention to relevant

information in a text. Spyridakis and Standal (1987) analyse the effects of three signal types (headings, previews and logical connectives) on readers' comprehension of technical expository prose. The authors conclude from the results that all three signal types can enhance comprehension, but such facilitation depends on passage length and difficulty. In this study, the passage that was most appropriately challenging for the readers, neither too easy nor too difficult, produced the clearest effect for signals.

In Ohlhausen and Roller's (1988) study there is a comparison between young readers and adults. They manipulated text in ways that reduced the available linguistic clues that would otherwise have facilitated the reader's access to a particular content and structure schemata relevant to the experimental passages. The results show that text signalling appears to help young students (fifth-grade students) and adults in different ways, depending on how well their content and text structure schemata have developed.

Some studies (e.g. Kletzien 1991) show that signalling variables function differently at different levels of familiarity of the text. It seems that they facilitate reading performance in situations where the content of the text is relatively unfamiliar to the reader. According to Roller (1990) because signalling variables highlight or make explicit the relations between ideas in the text, they exert their influence in moderately unfamiliar texts. In this situation, readers know enough about the topic to isolate concepts and to use structural cues to construct the relations between those concepts. However, when the text covers familiar topics, structural cues become redundant, because readers already understand the relations between concepts. Structural cues are also unhelpful in texts about extremely unfamiliar topics, because readers have so much difficulty isolating the basic concepts that they cannot begin to sort out the relations between them. Other research works (Mckeown et al. 1992; Mckeown and Beck 1990; Salager-Meyer 1991) also indicate that moderate knowledge of the topic seems to be of help provided that the text is coherent enough to allow the reader to see the connections between the text information and previous knowledge so that the knowledge can be combined with the text information to create a meaningful representation.

In L2 reading, Carrell (1985) reports a controlled training study designed to answer the question of whether ESL reading can be facilitated by explicitly teaching different types of rhetorical organization and the signals that mark each type. The results indicate that training in rhetorical organization of expository texts significantly increased the amount of information 25 intermediate-level ESL students could recall.

A more complex study is that of Kern (1989) who included the reading proficiency variable. He attempted to determine whether the effectiveness of direct instruction in reading comprehension strategies (the strategies referred to the use of context, signalling cues and background knowledge) was consistent among a group of low, intermediate and high-level French students or whether there were differences in effectiveness according to the L2 reading ability of the students. All subjects in the experimental group showed considerable increases in comprehension, although the subjects who had the greatest difficulty reading L2 texts appeared to benefit the most from reading strategy instruction. This finding suggests, according to Kern, that the middle and high ability readers may have already transferred more of their effective L1 reading strategies to the second language reading task.

A more recent study focuses on the use of discourse markers by students of English as a second language. The study by Demirci & Kleiner (1997) focuses on the use of discourse markers by advanced Turkish learners of English. They conduct a pilot study to answer the question of whether nonnative speakers use discourse markers, whether they use some markers and not others and whether there are nonnative uses of certain markers. They set out to answer these questions by collecting natural language data from interviews to four subjects that had resided in the United States as students for at least three years. The data revealed that discourse markers were used extensively by participants. However, the participants differed from each other in several respects. Although all participants used some discourse markers, some participants employed a wider range of markers than others. Some learners used certain markers extensively, while others used the same markers rarely if at all. Besides, the results suggest that those markers and those markers' functions in the L2 which are also available in the first language will be acquired first with relative ease.

Among the studies on foreign language reading, Lahuerta (2002) analyses the relationship between use of the rhetorical organisation that a text employs, and the comprehension and the reproduction of information of the text by Spanish students of English as a foreign language. This study compares the comprehension and reproduction of a text with no organisation to the same text written with explicit signals of several semantic relations that give different organisations to the text (temporal chronological sequence, causative, comparison and problem-solution). This study shows that foreign language readers' recognition and use of the rhetorical organisation of the text has a positive effect on their understanding and reproduction of the information of the text.

Lahuerta (2003) carries out an empirical study aimed at analyzing the effect of marginal uses of discourse markers on the reading comprehension of texts in Spanish as a foreign

language. Marginal uses are uses of discourse markers that are not orthodox. They include correct but infrequent uses, and incorrect or difficult to produce uses. Some examples are discourse markers used with more than one argumentative sense in a text, superfluous discourse markers, etc. The results obtained in this study indicate that readers of Spanish as a foreign language show difficulties in understanding texts with marginal uses of discourse markers. On the other hand, the orthodox use of discourse markers seems to facilitate the adequate understanding of the text.

IV. OUR STUDY

All the studies above point to the importance of signals in general and discourse markers in particular, in L1 and L2 reading comprehension. They tend to show that discourse markers could be effectively considered aid in reading comprehension. At the same time, they show the need for more research works on the effect of these elements on foreign language reading. Thus, the aim of the present work is to carry out a large scale study on the effect of discourse markers on the reading comprehension of Spanish students of English as a foreign language.

Within the interactive view of reading comprehension exposed in section 1, the processing of the textual information supposes that the reader uses the signals (discourse markers) in the surface structure of discourse and schematic knowledge to interpret texts. According to the Relevance theory, discourse markers constrain the relevant context for the interpretation of an utterance. We can then see how both theories are complementary. Thus, we will consider in this paper DMs aid for interpretation within an interactive view of reading.

The two main contributions of this paper would then be, on the one hand, this Relevance theoretic approach to DMs in reading English as a foreign language and on the other, to meet the need for more research work on the effect of DMs on foreign language reading with a large scale study on the effect of DMs on the reading comprehension of Spanish students of English as a foreign language.

Since DMs facilitate communication, it is logical to suppose that the lack of DMs in an L2, or their inappropriate use could, to a certain degree, hinder successful comprehension or lead to misunderstanding. It is plausible to suppose that those nonnative speakers who are competent in the use of the DMs of the L2 will be more successful in reading comprehension than those who are not.

IV.1. Hypothesis

As we have said, we consider DMs signals writers use to guide cooperatively their readers' interpretative process. Our hypothesis is that discourse markers would enhance reading comprehension in foreign language reading. We compared the comprehension of a text with no discourse markers to the same text written with explicit discourse markers. We constructed a text with no discourse markers because we wanted to compare the effect of DM's presence/absence on comprehension. We hypothesized that efficient readers would use the discourse markers in the text to help their reading performance.

For this experiment we asked the following research question:

Is there any relationship between presence of discourse markers or absence of discourse markers and reading comprehension in English as a foreign language?

We decided to consider the factor of the subjects' proficiency in the language in our study. Some studies have been carried on this factor but there are no studies to our knowledge that specifically approach the possible interrelation between the subjects' proficiency and the effect of discourse markers on comprehension. For this reason we decided to include such interrelation as part of our experimental study. The subjects' proficiency was measured by means of a proficiency test consisting of 40 items⁵. We asked the following research question:

Is there any relationship between the readers' proficiency in English (measured by the results of a proficiency test) and the effect of the presence or absence of discourse markers on reading comprehension?

Many demographic factors affect language learning. Two of these, gender and sex, stand out as particularly important⁶. But there are others also important that refer to the competence of subjects as learners. We intend to know more about the interrelation of these factors and reading. Thus, as part of our study, we also analysed the possible correlation of the variables age, sex, score in University entrance examination and score in English in University entrance examination and the effect of presence of discourse markers on reading comprehension.

Our third research question is formulated as follows:

Is there any relationship between the readers' age, sex, score in University entrance examination and score in English in University entrance examination and the effect of the presence or absence of discourse markers on reading comprehension?

IV.2. The research design of the experiment: experimental research data procedures

IV.2.1. Subjects

For this experiment we recruited a group of 133 Spanish students of English as a foreign language all students of the first year of English for Chemistry at the Faculty of Chemistry of the University of Oviedo. With respect to their sex, 48% were women and 52% were men. Their average age was 19.44.

IV.2.2. Materials

The materials consisted of two expository passages on a technical topic. For each passage we used the original passage as the version without discourse markers and a version with discourse markers (see Appendix for sample passages). The passages were "Nitrates and Nitrites" and "Guinea Pigs in biomedical research". The first one was excerpted from a Federal Drug Administration Consumer memo (undated) and the second one from a U.S. Air Force School of Aerospace Medicine Publication (Obeck, 1974). The passages varied in structure, length and difficulty. The "Nitrates" passage had the rhetorical structure of advantages/disadvantages, and the tradeoff between advantages and disadvantages. The "Biomedical" passage had a classification structure. The nonsignaled version was shorter than the signaled version. The "Nitrates" passage was shorter (574 words) than the biomedical passage (640 words). Difficulty level, presented as a function of grade level, was ascertained through the use of the Berta-Max Reading Level Analysis Program. The difficulty grade of the "Nitrates" passage was 9 and of the "Biomedical" passage 16.

For each nonsignaled version, we constructed one signaled version without significantly changing the syntactic complexity of the nonsignaled texts. We added discourse markers. 10 discourse markers were added in the "Nitrates" passage and 7 in the "Biomedical" passage. We also constructed a 5-question comprehension test. Three questions examined detail information, and one question examined the global comprehension of the passage.

The passages were accompanied by an initial section where students had to provide their name, age, sex, score in their University entrance examination and score in English language in their University entrance examination.

IV.2.3. Procedure

The experiment was run as follows. In the first session⁷ students were given a proficiency test to test their proficiency in the target language. In the second session⁸, the students had to

read the passages and answer the comprehension questions. The teacher read a typed set of instructions to the students instructing them to read the passage at their own speed, then answer the comprehension test. We gave each of the four passages (Biomedical passage with discourse markers, Biomedical passage without discourse markers, Nitrates passage with discourse markers, Nitrates passage without discourse markers) to all the students.

We analysed the data with SPSS statistical software. Specifically, we used a SPSS program version 10.0 for Windows.

V. RESULTS

Before applying the statistical instruments chosen we carried out a normality test of global scores in order to find out if these statistical instruments could actually be applied to our data⁹.

In order to answer our first research question, namely, if there is any relationship between presence of discourse markers and absence of discourse markers and reading comprehension, we first compared the scores of, respectively, Text 1A (“Biomedical” text with discourse markers) and Text 1B (“Biomedical” text without discourse markers) by means of a chi-square test¹⁰. We first calculated the mean score of both texts. The mean score of Text 1A is 5.3578 and that of Text 1B is 4.8952. Thus, Text 1A has a higher score and is consequently better understood than Text 1B.

This difference in score is significant at a 0.000 level, as table 1 shows. That is, the difference found between the global scores of both texts is statistically significant.

	Global score of Text 1A	Global score of Text 1B
Chi-square a,b	87.798	73.903
df	18	14
Sig.	.000	.000

Table 1. Interrelation discourse markers and comprehension (Text 1A and Text 1B)

We can then say that the text with discourse markers (Text 1A) is understood better than the text without discourse markers (Text 1B), and the difference in score between both texts is statistically significant at a 0.000 level.

In the second place, we compared Text 2A (“Nitrates” text with discourse markers) and Text 2B (“Nitrates” text without discourse markers) by means of a chi-square test. The mean

score of Text 2A is 4.6799 and that of Text 2B is 4.2545. We can observe that Text 2A has a higher score and is consequently better understood than Text 2B.

As table 2 shows, this difference in score is significant at a 0.000 level. That is, the difference between the global scores of both texts is statistically significant.

	Global score of Text 2A	Global score of Text 2B
Chi-square a,b	114.286	112.055
df	21	22
Sig	.000	.000

Table 2. Interrelation discourse markers and comprehension (Text 2A and Text 2B).

The text with discourse markers (Text 2A) is understood better than the text without discourse markers (Text 2B), and the difference between both texts is statistically significant at a 0.000 level.

We can conclude from the results of the two empirical studies carried out above that there is a significant correlation between presence of discourse markers and reading comprehension. The difference in comprehension between the texts with discourse markers and those without discourse markers was statistically significant.

We hypothesized that discourse markers would enhance reading comprehension. In order to prove this hypothesis we formulated our first research question intended to provide an answer to the question of whether there is any relationship between presence of discourse markers and absence of discourse markers and reading comprehension. From the results obtained so far we can answer this question affirmatively and confirm our hypothesis since the difference in comprehension of the text with explicit discourse markers and the same text with no discourse markers is statistically significant. Our results seem to indicate that efficient readers use the discourse markers in the text to help their reading performance.

The results of the previous research questions also show an interesting finding, namely that the mean score of Text 1A ("Biomedical" text with discourse markers) is higher than that of Text 2A ("Nitrates" text with discourse markers), which indicates that the former passage was better understood by the subjects.

Faced with this result, we decided to compare the difference in score between both texts and we found that this difference was significant at a 0.000 level, as Table 3 shows.

	Global score of Text 2A	Global score of Text 1A
Chi-square a,b	114.286	87.798
df	21	18
Sig.	.000	.000

Table 3. Comparison of global scores of Text 1A and 2A.

Text 1A is a longer and more difficult text than Text 2A, as we indicated above in the paper, thus this result is quite surprising. This result contradicts Spyridakis and Standal's (1987) finding in L1 reading that the passage that is most appropriately challenging for the readers, neither too easy nor too difficult, produces the clearest effect for signals. In our study the most difficult passage produces the clearest effect for discourse markers.

We think that this result may be related to the readers' familiarity with the content of the text. Text 1A is about the use of guinea pigs in biomedical research. This is a topic our chemistry students are not very familiar with. Text 2A is about a topic subjects are familiar with (nitrates and nitrites). We think that the unfamiliarity of the "Biomedical" text may have influenced the readers' use of discourse markers and their comprehension. This result is in agreement with Kletzien's 1991, Mckeown and Beck's 1990, Salager-Meyer's 1991 and Mckeown et al.'s 1992 studies in L1 reading that show that signalling variables function differently at different levels of familiarity of the text. It seems that they facilitate reading performance in situations where the content of the text is relatively unfamiliar to the reader. In the case of Text 1A the discourse markers made explicit the relations between ideas in the text. Readers knew enough about the topic to use them to construct the relations between those concepts. In the case of the text about nitrates and nitrites, as it covered a familiar topic, the structural cues became redundant, because readers already understood the relations between concepts. This conclusion, however, needs further investigation. It is necessary to carry out a study on the effect of discourse markers on reading comprehension using several texts selected according to how familiar their topic is to the readers.

With respect to the next research question, namely, if there is any relationship between the readers' proficiency in English (measured by the results of a proficiency test) and the effect of the presence or absence of discourse markers on reading comprehension, we compared Text 1A and Text 2A, the two texts with discourse markers, in terms of the effect of the presence of discourse markers on reading comprehension. We used for this purpose the Mann-Whitney test¹¹.

We decided to group our subjects into two groups according to their score in the proficiency test. With this purpose we calculated the median, which was taken as reference for the division. Thus, according to the median (20 answers correct in the proficiency test) our two groups are: up to 20 answers correct, group 0; +21 answers correct, group 1.

Then, we calculated the mean score for each text. In the case of Text 1A, the mean score is 5.25 for group 0 and 5.433 for group 1. In the case of Text 2A, the mean score is 4.583 for group 0 and 4.8478 for group 1. The analysis of the relationship between the readers' proficiency in English and the effect of the presence of discourse markers on reading comprehension showed that this was significant in Text 2A, but not in Text 1A, as table 4 shows.

	Global score of Text 1A	Global score of Text 2A
U of Mann-Whitney	986.00	754.00
W of Wilcoxon	2471.00	2029.00
Z	-1.278	-2.177
Sig (bilateral)	.201	.029

Table 4. Interrelation readers' proficiency in English and effect of discourse markers on comprehension

From the results obtained we can say that in the case of Text 2A the higher the competence in the English language, the higher the effect of discourse markers on reading comprehension. We can then refer to a significant correlation between the readers' proficiency in English and the effect of the presence of discourse markers on reading comprehension but only in the case of Text 2A.

There is no significant correlation between proficiency in the target language and the effect of the presence of discourse markers on comprehension in Text 1A. As we know, this text was better understood by subjects than Text 2A in spite of being longer and more difficult, the difference in scores between both texts being significant (see above). We attributed this result to the readers' unfamiliarity with the content of the text. Readers knew enough about the topic to use discourse markers to construct the relations between those concepts. Now, faced with the result that there is a significant correlation between the readers' proficiency in English and the effect of the presence of discourse markers on reading comprehension but only in Text 2A, we confirm our previous conclusion. We can affirm that relative unfamiliarity of the topic seems to make readers use discourse markers as an aid in their comprehension. As a result,

the text is better understood. This, we guess, prevents other variables, like, readers' proficiency in English from interacting with the effect of the presence of discourse markers on reading comprehension

As part of our experimental study, we also analysed the possible correlations between other variables (sex, age, score in University entrance examination, score in English in University entrance examination) and the effect of the presence of discourse markers on reading comprehension. As we explained in the theoretical section of this paper the literature shows that factors like gender and sex affect language learning. We wanted to analyse these variables with respect to the effect of the use of discourse markers on reading comprehension, and also study factors that refer to the subjects' competence as learners and as learners of the target language (score in University entrance examination , score in English in University entrance examination).

We applied a Pearson correlation test¹². There are no significant correlations for Text 1A for any of the variables analysed. For Text 2A, we observe significant correlations for: (a) subject's age (-0.236). This correlation is significant at 0.05. Thus, the older the subject, the effect of discourse markers on comprehension is lower; (b) score in University entrance examination (0.237). This correlation is significant at 0.05. The higher the score, the higher the effect of discourse markers on comprehension of Text 2A; and (c) score in English in University entrance examination (0.257). This correlation is significant at 0.01. We can say that the higher the score, the higher the effect of discourse markers on comprehension of Text 2A. This is shown in Table 5.

	Age	Score in University entrance examination	Score in English in University entrance examination
TEXT 2A	-0.236*	0.237*	0.257**

**The correlation is significant at 0.01 level (bilateral)

* The correlation is significant at 0.05 level (bilateral)

Table 5. Interrelation readers' age and competence and effect of discourse markers on comprehension

Thus, we observe that there are significant correlations in the case of three factors in Text 2A: score in University entrance examination, score in English in University entrance examination and age, being score in English in University entrance examination the most significant correlation (the correlation is significant at a 0.01 level). The first two are factors

that refer to the subjects' success as learners reflected in their better scores in their University entrance examination and in English in their University entrance examination.

The results show that those students who are more successful students and so have better scores in their University entrance examination and in English in their University entrance examination in particular tend to use discourse markers as aids in their reading. With respect to the factor of the students' age, we observe that the older the students, the lower effect of DMs on comprehension. This result confirms the previous findings since within the Spanish educational system, older students are generally people who are behind in their studies, and thus less successful students. Thus we can conclude that it seems that successful students tend to use discourse markers as aids in their reading comprehension.

As we have indicated, these correlations are again only significant in the case of Text 2A. This partially confirms our previous hypotheses. We stated above that Text 1A was easier for students to understand (the differences in score between Text 1A and 2A were statistically significant), due to the unfamiliarity of its content which made students use discourse markers as a comprehension aid. This prevented a significant correlation between the variable of proficiency and the effect of discourse markers on its comprehension (see second research question). We hypothesize that this also prevents a significant correlation between the variables of score in University entrance examination, score in English in University entrance examination and age, and the effect of discourse markers on comprehension, unlike in Text 2A.

We can conclude that there is something in Text 1A which facilitates its comprehension and makes other variables not be significant. We think that it is the unfamiliarity of the topic of the text. More research work needs to be carried out to confirm this conclusion though, something we intend to do in future research works.

VI. DISCUSSION

We have shown in this paper that discourse markers enhance reading comprehension in foreign language reading, thus confirming our hypothesis. We have found a significant correlation between presence of discourse markers in the text and reading comprehension. The texts with discourse markers were understood better than the texts without discourse markers, this difference in comprehension was statistically significant.

As we made clear in the theoretical section of this paper, we consider discourse markers signals writers use to guide cooperatively the readers' interpretative process, we see them as

elements that play a facilitating role within an interactive reading process. From the results obtained we can say that discourse markers facilitate comprehension, readers use them to help their reading performance.

We can also refer to a significant correlation between the readers' proficiency in English and the effect of the presence of discourse markers on reading comprehension. This correlation is nevertheless significant only in Text 2A.

We also observe that there are significant correlations between a series of factor that refer to the subjects' competence as learners and the effect of discourse markers on reading comprehension in Text 2A.

We observe that these last two findings from research questions two and three are in agreement. We conclude that the more successful students tend to use discourse markers as aids to help their reading comprehension.

Of the two texts with discourse markers (Text 1A and Text 2A) it is Text 1A the one which produces the clearest effect for discourse markers. Moreover, there is no significant correlation in this text between any of the factors above (proficiency and competence as a learner), and the effect of discourse markers on reading comprehension. We conclude that the unfamiliarity of text 1A produces a higher effect for discourse markers, which makes this text easier to understand by subjects. This prevents other factors from interacting with the effect of discourse markers on its comprehension.

The results of our second and third research questions are limited by the possible effect of the readers' familiarity with the topic of the text. We therefore need to analyse this factor through further research work in order to be able to confirm our conclusions. Thus, we intend to undertake a similar experimental study but using as materials texts chosen in terms of the readers' familiarity with their topic, and with students from different academic backgrounds (not only chemistry, but also business and engineering) as subjects of the experiment.

Finally, it seems from the results obtained that it would also be interesting to continue this line of research with more studies that take other factors into account as well. We observe in our study that the correlations referring to the learning competence variable are not very high. This may be due to the fact that there are other factors interacting as well. We believe that one of these factors may refer to the subjects themselves, to their reading capacity in their mother tongue and their use of discourse markers in that language. These factors need to be tackled as well in other research works. All these studies will ultimately help us know more about our readers' reading ability and the use they make of elements like discourse markers in their reading comprehension performance.

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APPENDIX 1

Guinea Pigs in Biomedical Research

Although the number of guinea pigs used in research does not approach the numbers of rats and mice used, the cavy plays an important role in biomedical research. In 1981, there were 646,322 guinea pigs used.

Immunological Research

Guinea pigs are used for the production of complement, a substance found in normal blood serum that destroys pathogenic bacteria, which is *also* used for a multitude of other immunological tests and investigations. *Besides*, guinea pigs are used in studies on anaphylaxis and other allergic manifestations. Catty used the guinea pig to study the immunology of trichinosis. He found that resistance was dose-dependent, long-lasting and acquired only by infection. A strong anaphylactic involvement in the immune mechanism was indicated. A long-term, sensitizing antibody with biological and physiochemical properties analogous to reagin of humans demonstrated in the serum of animals infected with the parasite but not in those immunized with worm extracts. Sensitized guinea pig uterus is frequently used to measure reaction to foreign protein by smooth muscle contractions due to histamine release. Guinea pigs are particularly useful where information is needed on delayed contact sensitisation. Briccetti et al. and Cohen and Sherahama have used guinea pigs in studying both spontaneous and induced amyloidosis.

Nutritional Research

Before the advent of chemical analysis for vitamin C, the guinea pig was one of the major tools in research in that area. *Since they* [They] are extremely sensitive to low levels of vitamin C, [when] used as a bioassay tool they can show deficiency symptoms in 14 to 18 days. *Additionally, unusually* [Unusually] high dietary requirements for folic acid and potassium have prompted their use in these areas of investigation.

Anatomical Research

Much work has been done utilizing the cochlea of the inner ear and the external ear as an experimental model of studies of otitis externa in humans *because the* [The] clinical appearance of the diseased canal is very similar to that in man.

An added benefit for many types of studies is to have an animal that delivers such precocious young. The young are more completely developed than any other commonly used laboratory animal, and they may be weaned as early as 4 or 5 days of age. Oberg stated that the mandibular joint can be the seat of most pathological conditions seen in articulations in general and that the guinea pig mandibular joint was anatomically larger, histologically more differentiated, and more accessible than those of the mouse, rat and hamster.

Moreover, studies [Studies] on the systemic arterial pattern of the guinea pig versus that of mammals showed guinea pig' deviations from normal mammal patterns: a) the origin of the vertebral artery has two rami; b) there is a large dorsoscapular artery as a fifth branch of the subclavian artery; c) the bronchoesophageal artery arises from the right internal thoracic artery or the costocervical trunk instead of from the aorta; d) there is a celiomesenteric trunk

instead of separate celiac and cranial mesenteric arteries; and e) the renal arteries frequently have a double origin.

Disease Research

The guinea pig is very susceptible to mycobacterium tuberculosis, both the human and bovine strains. The course of infection generally resembles that of a primary progressive infection in man. However, the rapidity with which characteristic lesions develop may vary with the strains used. It is the chief animal used for the study of brucellosis, diphtheria and endemic typhus.

Opler's studies indicated a remarkable similarity in the evolution of the acute leukemia in his colony to that observed in humans. The leukemia seen in the guinea pigs is an acute lymphatic leukemia and resembles the striking, rapidly fatal disease of children and young adults. Recently much research has been conducted in the toxicity of aflatoxins. The guinea pig, with the dog and rabbit, has been shown to be almost as susceptible as ducklings to aflatoxin B.

Note: original text that was adjusted for discourse marker addition appears in brackets.

APPENDIX 2

Nitrates and Nitrites

Recently there have been several items in the newspapers about the use of nitrites in processed foods. Some of the reports have been confusing. Nitrates and nitrites are not man-made substances, but natural compounds that are found in many foods, primarily in vegetables. Federal Drinking Water Standards limit the amount of nitrate in water to 45 parts per million *while the* [. The] normal nitrite level in human saliva is about 6 parts per million.

Benefits and uses of Nitrates and Nitrites

Nitrates and nitrites have been used widely in the curing and processing of foods. *For example, nitrites* [Nitrites] prevent red meat from turning brown and give the familiar red color to such meats as ham, bacon, sausage, and hot dogs. Without nitrite, bacon is salt pork, frankfurters are bratwurst, and ham is tough roast pork.

They are added to foods to prevent botulism, a form of food poisoning which is often fatal. There have been no outbreaks of botulism that were known to be caused by processed foods that were treated with nitrates/nitrites. *But a* [A] number of deaths have been caused by foods not treated with nitrates/nitrites. The Food and Drug Administration (FDA) *therefore* believes it is necessary for manufacturers to use these additives to prevent the growth of poisonous substances in canned meat products.

The Risks

Under certain conditions, nitrites and amines, which are the natural breakdown products of proteins, can combine to form chemicals called nitrosamines. Experiments have shown that nitrosamines can cause cancer in animals. There is no evidence, *however*, to indicate what effects nitrosamines have in humans. We do not know at the present time, whether the low amount of nitrates and nitrites now permitted by regulations actually combine with amines in

the stomach to form nitrosamines or to what extent nitrosamines are formed in cured meat and fish.

The U.S. Department of Agriculture (USDA) investigated 48 samples of processed meats, and found that 45 showed no nitrosamines. The USDA *also* sampled cooked sausage which had been purchased at retail stores. Of 50 samples, 3 showed trace amounts of nitrosamines; the other 47 showed no nitrosamines. In tests by the FDA, nitrosamines were found in one out of 60 hams tested. *Additionally, the* [The] FDA found that the process of cooking bacon resulted in the formulation of nitrosamines in the bacon.

The levels of nitrosamines found in these samplings were much lower than the levels that would have to be present to cause cancer in experimental animals. *However, extensive* [Extensive] studies are being conducted to determine how nitrates and nitrites can be used to preserve meats and yet pose no problem for human consumption.

The Tradeoff

Further, research [Research] being conducted by the meat industry in cooperation with FDA is aimed at determining the lowest levels of nitrite and/or nitrate needed in foods to prevent the growth of organisms which cause poisoning, and to determine whether nitrosamines are formed when these low levels are used in processed foods.

Consumers do have some protection though. After studies revealed that nitrites were being used in some products only to fix color, the FDA initiated formal action to ban such unnecessary use. This action, when final, will stop the use of sodium nitrate in smoked cured sable-fish, and shad; sodium nitrite in smoked tunafish products; and potassium nitrate in cod roe. *Also, the* [The] Federal Food, Drug and Cosmetic Act requires food products which use nitrates and nitrites to show this information on the label.

Note: original text that was adjusted for discourse marker addition appears in brackets.

¹ Fraser (1999:938) says that DMs have one common property: they impose a relationship between some aspects of the discourse segment that are a part of (S2), and some aspect of a prior discourse segment (S1). In other words, they function like a two-place relation, one argument lying in the segment they introduce, the other lying in the prior discourse.

² Sperber and Wilson (1986/1995) have developed a theory, the Relevance Theory, based on Grice. This is a pragmatic model that attempts to explain how speakers interpret utterances. It is based on a hypothesis of a cognitive nature about how human beings process linguistic information. This hypothesis suggests that the mind's central processor is highly effective in handling the information because it is specifically oriented towards the search for relevance.

The Principle of Relevance entitles the addressee to assume that an utterance comes with a guarantee of its own optimal relevance. An interpretation is considered to be consistent with the presumption of optimal relevance if the speaker could rationally have intended to be optimally relevant to the hearer on that interpretation. Having accessed an interpretation consistent with the presumption of optimal relevance, the hearer takes that to be the intended interpretation.

³ Context includes not only the information about the immediate physical environment (physical context), or about previous utterances (linguistic context or co-text), but also a set of assumptions stored in memory and deductively accessible, which participate in the interpretation of an utterance as well. These assumptions are made up of information of all kinds: beliefs, cultural knowledge, sociolinguistic competence, daily experience, encyclopaedic knowledge of the world, etc.

⁴ DMs are characterised as aids or instructions for interpretation – specifically, the facilitation of inferences- and, therefore, they are considered elements with procedural meaning. Blakemore proposes that DMs do not have a representational meaning the way lexical expressions like *boy* and *hypothesis* do, but have only a procedural meaning, which consists of instructions about how to manipulate the conceptual representation of the utterance (cf. Blakemore, 1987, 1992). Words with conceptual meaning contribute to the content of assertions and are analysed as encoding elements of conceptual representations. Words with procedural meaning, on the other hand, encode information about how these representations are to be used in inference, they tell you how to 'take' these representations. In Blakemore's view, DMs do not contribute to the proposition expressed by an utterance or to any other conceptual representation the utterance may communicate; rather they point the hearer to the context in which he is expected to process the utterance and the conclusions he should be drawing from it.

⁵ This is the test the Department of English uses for testing the level of English of the students who enter some English courses at the University of Oviedo.

⁶ With respect to gender, students show that females are superior in verbal skills, while males are superior in spatial skills, and these findings relate to brain functioning (Burstein, Bank, and Jarvik 1980; Kimura 1992). In general, females are slightly more feeling oriented, while males are slightly more thinking oriented (Myers and McCaulley 1985). In several studies (e.g., Kahle and Lakes 1983), females enjoyed cooperative and social learning, while males preferred individual, independent learning. Most studies (e.g., Green and Oxford 1995; Oxford and Nyikos 1989; Saleh 1997) found that females use language learning strategies more frequently than males. Age is also significant. Singleton and Lengyel (1995) attacked the critical period hypothesis, which suggests that learning a language at an early age is sufficient or necessary to attain nativelike proficiency and that there is an age beyond which learning another language is not fully possible. Although younger learners do have some advantages (fluency and pronunciation), older learners have other advantages (syntax and morphology) (Scarcella and Oxford 1992). However, many adults and children can become proficient in the target language under the right conditions, perhaps by following different routes.

⁷ This session took place on the first day of class of the 2006-2007 academic year.

⁸ This session took place on the second day of class of the 2006-2007 academic year.

⁹ We carried out the Kolgomorov-Smirnov test. We found out that the contrast distribution for all the variables utilized was normal. This was used to subsequently choose the most adequate statistical instruments.

¹⁰ This is a test for the statistical analysis of one variable with respect to another. It is a method for the comparison of groups of data and detection of significant differences among them. It is based on the representativeness of the data chosen within the total data of a whole sample. By means of chi-square we can know if there exists a big difference between the observed and expected frequencies.

¹¹ This test will allow us to determine if the independent samples were extracted from the same population or from different populations that possess the same distribution.

¹² This is a test that explains relationships among variables.