

Comprehension of scientific texts in English as a foreign language: the role of cohesion

A compreensão de textos científicos em Inglês como língua estrangeira: o papel da coesão

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ABSTRACT: The reading of scientific texts is a challenge for students of all academic fields and levels. Whether it is a textbook in elementary education or a scientific paper in higher education, students are faced with a type of text which requires the reader's ability to generate inferences and the ability to fill informational gaps (BEST et al., 2005). This notion is in line with empirical evidence obtained by previous studies (e.g. OZURU et al., 2009). All of these works, however, were performed with native English speakers. In this sense, adopting the model of reading comprehension proposed by Kintsch (1998), we aimed to investigate if the results obtained by the previous studies, carried out with native speakers of English are also valid in a context of English as a foreign language. In addition, we pursue a methodological question, investigating whether the evaluation of reading comprehension through objective and subjective questions leads to convergent or divergent results. To investigate these questions, we analyze subjects' answers to an objective questionnaire and in the production of a written summary. The results show that high-cohesion texts generate better results and point to possible research avenues.

KEYWORDS: Reading Comprehension. Cohesion. Scientific Texts. English as a Foreign Language.

RESUMO: A leitura de textos científicos constitui um desafio para estudantes de todas as áreas e níveis acadêmicos. Seja um livro didático no ensino básico ou um artigo científico no ensino superior, os alunos se deparam com um tipo de texto caracterizado por demandar do leitor a capacidade de gerar inferências e a habilidade de preencher lacunas informacionais (BEST *et al.*, 2005). Essa noção está em consonância com evidências empíricas obtidas por estudos anteriores (e.g. OZURU *et al.*, 2009). Todos esses trabalhos, entretanto, foram realizados com falantes nativos de língua inglesa. Nesse sentido, adotando como perspectiva o modelo de compreensão proposto por Kintsch (1998), temos como objetivo principal deste trabalho investigar se os resultados obtidos pelos estudos anteriores, realizados com falantes nativos de língua inglesa, também são válidos em um contexto de Inglês como língua estrangeira. Além disso, propomos uma questão de natureza metodológica, investigando se a avaliação da compreensão por meio de

questões objetivas e subjetivas leva a resultados convergentes ou divergentes. Para investigar essas questões, analisamos o desempenho de sujeitos nas respostas a um questionário objetivo e na produção de um resumo escrito. Os resultados revelam que textos com alta coesão resultam em maior compreensão textual, sinalizando possíveis áreas de investigação futura.

PALAVRAS-CHAVE: Compreensão. Coesão textual. Textos científicos. Inglês como língua estrangeira.

Introduction

Reading and comprehending scientific texts is challenging for students in all academic levels. From a science textbook in elementary school to scientific articles in tertiary education, students encounter a type of text that is notably more demanding in the sense that it often requires a reader who can generate inferences and fill information gaps (BEST; McNAMARA; OZURU; ROWE, 2005). Previous research has found strong evidence suggesting that the comprehension of a text is linked to individual characteristics of the reader, such as prior knowledge about the subject, and text features, such as text cohesion (DEMPSEY; McNAMARA; OZURU, 2009).

Text cohesion is, in its own merit, a text feature that seems to hold a strong correlation with comprehension. Preceding research has observed, for example, that a high-cohesion text may be beneficial for a reader with little previous knowledge about the text subject. The same study that yielded this conclusion (OZURU, 2009) also reported interesting results regarding reading skill: readers with considerable levels of topic-relevant knowledge could only benefit from high-cohesion texts if they had solid reading skill (see BEST et al., 2005, for a thorough discussion on the role of text cohesion in comprehension).

All of the studies cited thus far, however, were conducted in the USA with native English speakers. If similar results were to be obtained with English as a Foreign Language (EFL) students, one could make a stronger argument for the generalization of discussions such as the one proposed by Best et al. (2005).

Two research questions guided this study. First, how do EFL students comprehend scientific texts with different cohesion levels? Second, would results obtained through multiple-choice questionnaires differ from results obtained through text summaries?

Taking into consideration the previous research conducted with native English speakers, the level of cohesion of a text is expected to influence the level of

comprehension achieved by EFL students. As to the second question, one of methodological nature, both multiple-choice questionnaires and text summaries are expected to generate different types of data that agree in essence.

The core goals of this study are, therefore, (I) to assess and compare subjects' comprehension of scientific texts with different levels of cohesion and, (II) to analyze possible differences in results obtained through multiple-choice comprehension tests and results obtained through the evaluation of text summaries.

1 Reading Comprehension in a Foreign Language

Reading comprehension, understood as “the ability to obtain meaning from written text for some purpose” (VELLUTINO, 2003 *apud* BEST, 2005, p. 66) is a complex subject that has been approached from many perspectives. The theoretical framework that underlies previous research used as reference for this study is the one developed by Walter Kintsch (1998), the construction integration (CI) model. According to this framework, in order to achieve deep comprehension, the reader must be able to connect and interpret different parts of a text. In addition, no text is able to provide all the information necessary for its full comprehension, so it is the role of the reader to generate inferences to account for these information gaps (BEST, 2005).

The generation of inferences is closely related to the reader's level of prior knowledge about the subject of the text, which could explain the difficulty experienced by students when faced with a science text. Because the topics discussed by textbooks and articles are often unfamiliar to these readers, it becomes rather challenging for them to generate the necessary inferences, which would not be an issue if it were not for the fact that scientific texts are often low in cohesion (BEST, p. 68). Drawing on the notion that comprehension is linked to both individual differences and text features (OZURU, p.228), Best et al. (2005) argue that teaching reading strategies and assessing the level of cohesion in scientific texts could be beneficial for comprehension and, in a wider sense, to the education process as a whole.

The concept of individual differences, already mentioned in this paper, is one worth clarifying. Ozuru et al. (2009) investigated to what extent readers with different levels of reading skill and prior knowledge comprehended texts with varying degrees

of cohesion. Their results, besides supporting the hypothesis that cohesion is connected to the level of comprehension of a text, showed that readers with solid topic-relevant knowledge, as opposed to those with little previous knowledge, could only benefit from a high-cohesion text if they had high reading skill as well.

2 Methods

Based on the previous research reviewed, in this exploratory pre-experiment (NUNAN, 1992) that combines elements from both qualitative and quantitative research, we attempted to investigate the role of cohesion in reading comprehension with EFL students.

Two groups of *Inglês sem Fronteiras* (IsF) students, a total of 11 people (4 women, mean age 27.45 – SD 5.50), participated in the study. All participants were leveled by the TOEFL (Test of English as a Foreign Language) as B1 English users.

Two scientific texts were selected from the British Council Learn English website, both appropriate for B1 level English students. One of the texts discussed *twins*, and the other discussed *large aquatic animals*. Each text was then manipulated by the researcher to generate a low and a high-cohesion version, therefore, a total of four texts was read by all subjects (see Appendix A for an example of a text in a low and in a high cohesion form).

Each participant was asked to read two different texts, one in high-cohesion form and another in low-cohesion form. After each text, subjects answered six multiple-choice questions and wrote a short summary about the material they had just read. The questions, just as in Ozuru et al. (2009), were prepared according to Kintsch's (1998) Construction Integration Model and were divided into three categories, with two questions each: (I) Text-based questions, which could be answered with information explicitly stated in the text; (II) Local-bridging questions, which could be answered by linking information stated within a five-clause range; (III) Global-bridging questions, which could be answered by making connections between information located in different parts of the text (see appendix B). Since data collection took place during regular class hours, participants were reminded that the study was not a course evaluation and instructed not to discuss their answers with colleagues.

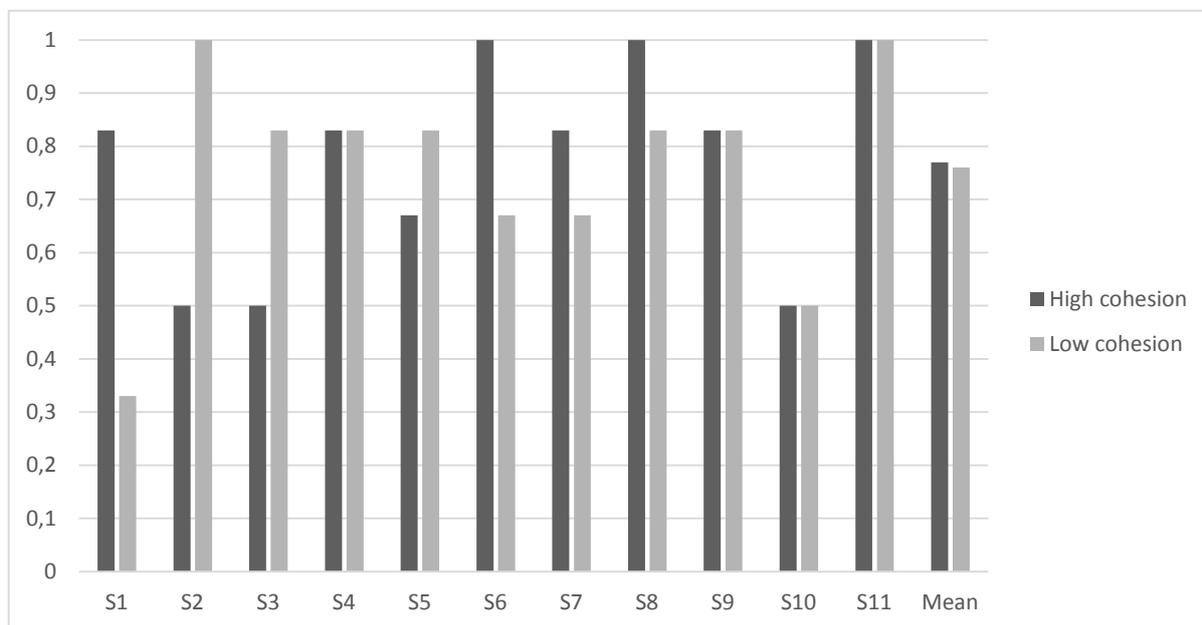
Each multiple-choice item had four possible alternatives, from which only one was an adequate answer. In a preliminary analysis, the number of correct answers upon reading a text in each condition was compared and overall mean scores for both conditions were calculated. As for the summaries, scores were calculated taking into consideration the number of elements participants were able to include based on a pre-selected model (see appendix C). All preliminary data analyses were performed on Microsoft Excel.

3 Results and Discussion

This section reports subjects' answers to an objective multiple-choice questionnaire and in the production of a written summary after reading high and low-cohesion texts in their second language.

Graph 1 displays performance by subject on the multiple-choice questions, comparing the results obtained with a text in each condition (high or low cohesion).

Graph 1: Performance per subject – multiple-choice questions

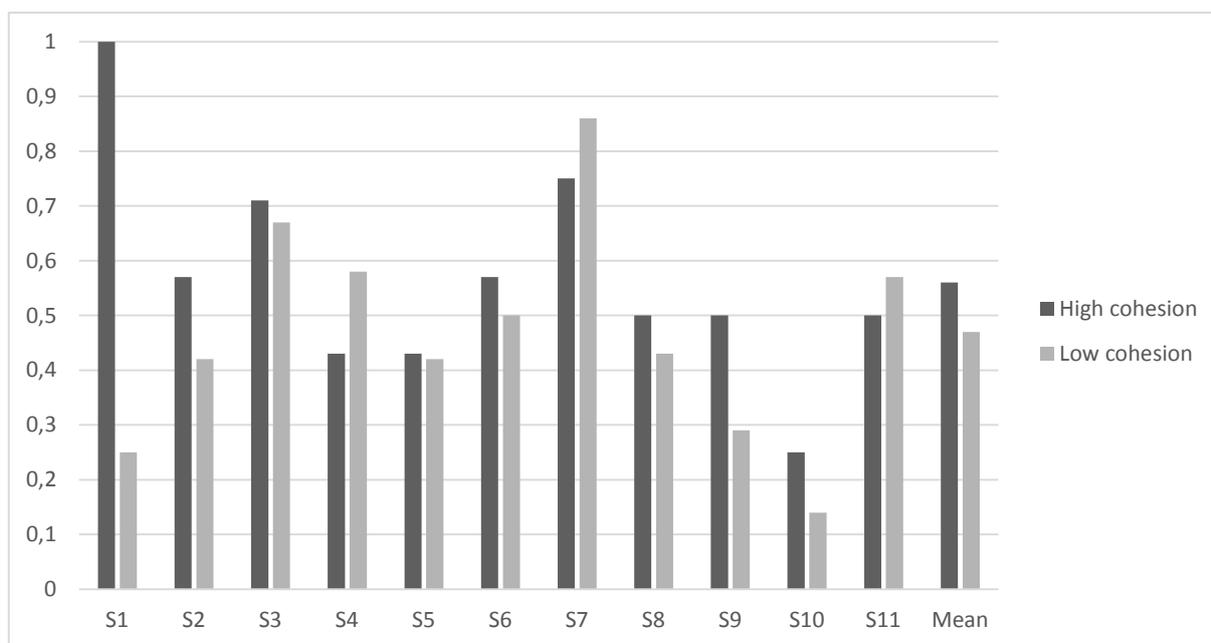


Results yielded by the multiple-choice questions did not show significant differences in the two conditions – text in high or low cohesion form. It is necessary to point out that results were very scattered, and due to the limited amount of subjects, there is no way to determine a significant pattern. See, for example, discrepancies

between subjects 2, 3 and 6. However, as it is shown through the mean score, high-cohesion texts still yielded better results than the low-cohesion versions.

Graph 2 shows performance by subject on the text summary, comparing the results just like in graph 1.

Graph 2: Performance per subject – text summary



Participants had a significant better performance in the production of the summary when they read a high-cohesion text. Results were not as scattered as in the multiple-choice questions. Most subjects had significantly better scores upon reading a high-cohesion text, which is reflected in the mean scores.

These preliminary data, therefore, seem to support the hypotheses presented in section 1.1 – high-cohesion texts did generate better results. Even if it is so, it is fundamental to remember that the small number of participants in this preliminary study makes it impossible to run significant statistical analysis.

Conclusion

The objective of the present study was to investigate how do EFL students comprehend scientific texts with different cohesion levels and to verify whether results obtained through multiple-choice questions differ from results obtained

through text summaries. To investigate these questions, we analyzed subjects' answers to an objective questionnaire and in the production of a written summary.

Results show that high-cohesion texts yielded better results than their low-cohesion counterparts, and that such difference was more visible in the case of text summary responses than in the case of multiple question responses. However, the small number of participants in our study and the lack of statistically significant results do not allow us to generalize our findings to different contexts or populations.

All in all, the reading of scientific texts is a challenge for students of all academic fields and levels, both in L1 and in L2. Taking the results of this study and the literature reviewed, we conclude that cohesion seems to play an important role in reading comprehension. Moreover, different types of reading comprehension questions seem to yield different performance, meaning that they seem to tackle distinct aspects of the skill. Having this in mind, the results in this small scale study point to future research avenues worth investigating in reading comprehension.

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Appendices

Appendix A

Excerpt from the text 'Twins' in low-cohesion form

Twins

What do the singer Alanis Morissette, the supermodel Gisele Bundchen and the ex-Secretary General of the United Nations Kofi Annan all have in common? The answer is, they all have a brother or sister who was born on the same day as them – a twin. And what links actresses Julia Roberts, Geena Davis and Holly Hunter? They all have twin children.

You probably either have some twins in your family or you know/knew some at school – there are more of them about these days. This is because women are having fertility treatment, and are older when they have their first child. Both of these things increase the probabilities of two babies developing from the same egg.

Excerpt from the text 'Twins' in high-cohesion form

Twins

What do the singer Alanis Morissette, the supermodel Gisele Bundchen and the ex-Secretary General of the United Nations Kofi Annan all have in common? The answer is, they all have a brother or sister who was born on the same day as them – a twin. And what links actresses Julia Roberts, Geena Davis and Holly Hunter? They all have twin children.

Why are there so many twins?

You probably either have some twins in your family or you know/knew some twins at school – there are more of them about these days. This is because women are older when they have their first child, and because more women are having fertility treatment. Both of these things increase the probabilities of two babies developing from the same egg.

Appendix B

Example of a text-based question

What is the function of the giant octopus' arms?

- a. The giant octopus uses its arms to lift things.
- b. The giant octopus uses its arms for locomotion.
- c. The giant octopus uses its arms to move rocks.
- d. The giant octopus uses its arms for reproduction.

Example of a local-bridging question

What do the twins mentioned in the text do together?

- a. Everyday activities, such as going to the movies.
- b. Special activities, such as attending parties.
- c. Common activities, such as shopping.
- d. Physical activities, such as swimming.

Example of a global-bridging question

What happened more often in the twins' answers: agreeing or disagreeing?

- a. They agreed on all answers.
- b. Agreeing was more frequent than disagreeing.
- c. Agreeing and disagreeing were equally frequent.
- d. Disagreeing was more frequent than agreeing.

Appendix C

Model summary – text 'Twins'

Many celebrities have twins, and most people know twin siblings or have twins in their families. This is because twins are actually more common nowadays, since women are waiting longer to have children and having fertility treatment. Twins are important for many reasons, but they are particularly important for science because they share the same genes, which makes it easier to study the influence of the environment on us. According to the information collected with the twins mentioned in the text, similar siblings can behave alike in some situations and very differently in others.