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# Towards text simplification for poor readers with intellectual disability: When do connectives enhance text cohesion?

Inmaculada Fajardo *, Gema Tavares, Vicenta Ávila, Antonio Ferrer

*ERI Lectura, Department of Developmental and Educational Psychology, University of Valencia, Avda. Blasco Ibáñez, 21, 46010 Valencia, Spain*

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ABSTRACT

Cohesive elements of texts such as connectives (e.g., *but*, *in contrast*) are expected to facilitate inferential comprehension in poor readers. Two experiments tested this prediction in poor readers with intellectual disability (ID) by: (a) comparing literal and inferential text comprehension of texts with and without connectives and/or high frequency content words (Experiment 1) and (b) exploring the effects of type and familiarity of connectives on two-clause text comprehension by means of a cloze task (Experiment 2). Neither the addition of high frequency content words nor connectives in general produced inferential comprehension improvements. However, although readers with ID were less likely to select the target connective in the cloze task than chronologically age-matched readers (mean age = 21 years) in general, their performance was affected by the type of connective and its familiarity. Familiarity had a facilitative effect for additive and contrastive connectives, but interfered in the case of temporal and causal connectives. The average performance of a reading level-matched control group (typically developing children) was similar to the group of readers with ID although the pattern of interaction between familiarity and type of connectives varied between groups. The implications of these findings for the adaptation of texts in special education contexts are discussed.



## 1. Introduction

It is well established that individuals with intellectual disability (ID) present reading difficulties at both decoding and comprehension levels (see Conners, 2003 for a review). Despite intervention efforts in special education settings to improve literacy in students with ID, several studies have recently indicated that the average level of reading and comprehension abilities of students with ID (aged 16–22) is equivalent to that observed in primary students in the age range of 6–10 years (Fajardo, Ávila, Tavares, & Ferrer, 2010; Moni & Jobling, 2001; Morgan & Moni, 2008). This reading literacy problem is dramatically constraining their academic success, access to information (e.g., news), job opportunities (e.g., access to job offers) and even their entertainment options (use of digital social networks, forums, etc.).

In academic settings, the instructional intervention approach, aimed at directly improving reading abilities (e.g., Alberto, Waugh, & Fredrick, 2010; Allor, Mathes, Champlin, & Cheatham, 2009; Cohen et al., 2006; Gersten, Fuchs, Williams, & Baker, 2001; Joseph & Eveleigh, 2011; Van der Bijl, Alant, & Lloyd, 2006), has been used alone or in combination with the text simplification approach. The second approach is characterised by the modification of the text in order to make it more legible for a target reader group. Both approaches seem to be essential for making reading activities not only profitable but enjoyable for readers with special needs (Mastropieri & Scruggs, 1992).

* Corresponding author. Tel.: +34 963983093; fax: +34 963864671.
*E-mail address:* INFABRA@UV.ES (I. Fajardo).

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Therefore, the deliberate simplification of texts is a common practice for teachers dealing with adolescents and adults with intellectual disabilities (Morgan & Moni, 2008). The interest in this type of approach is represented by official educational programs like the one framing the study presented here. The program, called "LecturaFácil" (funded by the Spanish Ministry of Industry in 2009), "Easy-Reading" in English, is aimed at promoting newspaper reading in students with ID. As part of the program, news articles within the range of interests of students with ID are selected on a daily basis, simplified and uploaded on a website especially designed for this aim, which has been operating since 2009 (http://www.noticiasfacil.es). The general aim of the first experiment of the study reported here was to measure the utility of the program by comparing different ways of simplifying the news articles to improve their readability (how easy a text can be read and understood).

Text simplification is not a straightforward issue. In order to simplify, adapt, create or simply select texts that match students' reading level, several factors can be considered, such as interest and relevance for the learner, use of illustrations, orthotypography issues or linguistic features of the texts (Morgan & Moni, 2008; Tronbake, 1997). The purpose of the present study was to bring the latter ones, that is, text linguistic features, into focus by identifying, which and how they might influence text comprehension for students with ID.

From a linguistic point of view, Crossley, Louwerse, McCarthy, and McNamara (2007) suggest two approaches to evaluate text readability: (a) the use of shallow-based readability measures and (b) the use of textual cohesion measures (also called deep readability measures). Following the framework of Kintsch's construction-integration model (1988), each approach would be related to different levels of reading comprehension. On the one hand, shallow-based readability measures, for example, word length (number of characters or syllables), sentence length (number of words) and word frequency (number of appearances of a word in a corpus of texts) would mainly affect the literal comprehension of texts, that is, comprehension of the strict meaning of single propositions. On the other hand, textual cohesion features (presence or density of connectives-linking devices such as *but*, *and* or *for that reason* and co-references – anaphors such as pronouns or repeated names in a text) would affect the inferential level, that is, the integration between text segments or between text and prior knowledge.

In the following sections, the literature about the influence of word frequency and presence of connectives (a shallow-based and a cohesion linguistic feature respectively) on reading comprehension performance of students with and without ID is briefly reviewed. Afterwards, the research goals and hypotheses of Experiment 1 are stated.

## 2. The effect of word frequency on reading comprehension

Traditional shallow-based readability measures assume that the shorter the word and sentence length (measured by means of standard formulas such as the Flesch Index by Flesch, 1948) and the higher the word frequency [e.g., using word frequency databases such as CELEX by Baayen, Piepenbrock, and Gulikers (1995) for English or Alameda and Cuetos (1995) for Spanish], the lower the text difficulty and the higher the readers' comprehension. However, empirical evidence does not provide clear support for this assumption, especially with regard to word frequency. While some studies have found a facilitative effect of word frequency on reading comprehension (Doctorow, Wittrock, & Marks, 1974; Ozuru, Rowe, O'Reilly, & McNamara, 2008), others studies have shown no effect for readers with a regular level of reading skills (Freebody & Anderson, 1983; Ryder & Hughes, 1985).

When it comes to students with ID, who tend to present a small receptive vocabulary (amount of words a person recognises and understands when read or heard), which is strongly correlated with their reading comprehension performance (Nash & Heath, 2011), we would expect that texts with high word frequency would certainly enhance literal comprehension. For instance, in the sentence "Anne and Tom spent an agreeable afternoon", the substitution of the term "agreeable" with the term "lovely" would theoretically make the sentence easier to understand for a person with an equivalent vocabulary age of 6 years since "lovely" is a more frequent word than "agreeable".

To our knowledge, there are only two previous studies that have addressed this issue in students with ID showing, as in the case of regular readers, contradictory findings. On the one hand, Karreman, der Geest, and Buursink (2007) adapted several digital texts (texts included on a website) by modifying different linguistic elements (e.g., word and sentence length, frequency and abstractness of words) and asked groups of students with ID to answer comprehension questions after reading both versions (between-subject manipulation). The results showed that both literal and inferential comprehension were higher in the adapted version than in the non-adapted version of the same digital texts. However, as word frequency was manipulated at the same time as other linguistic features (word length, sentence length, etc.) in the adapted texts, it is unclear whether word frequency actually contributed to the comprehension and, if so, to what extent.

On the other hand, in a previous study conducted by the authors of this manuscript within the program "LecturaFácil" (Fajardo et al., 2010) students with mild ID were asked to read a set of 48 journalistic texts (during a period of 16 weeks) and answer literal and inferential questions about them afterwards. In this case, participants did not read adapted and non-adapted versions of the same texts like in Karreman et al.'s (2007) study. It was assumed instead that the 48 texts varied in the target linguistic variables (e.g., word frequency, word and sentence length, etc.), which were measured and correlated with students' comprehension scores. Contrary to the word frequency facilitation assumption, there was no significant positive correlation between word frequency and comprehension (at either the literal or inferential level). Using the dictionary of frequencies of the Spanish linguistic units (Alameda & Cuetos, 1995), a database of two million words, some studies have considered a minimum frequency of occurrence of 20 per two-million as the high frequency boundary for regular readers (e.g., Álvarez et al., 2001). Therefore, in Fajardo et al.'s study (2010), presumably there was a ceiling effect of