

Reading fluency and reading comprehension in Spanish secondary students

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Abstract

Background: Studies of the relationship between reading fluency and reading comprehension have traditionally focused on primary schools and narrative texts. However, reading fluency continues to develop during secondary school, when the texts used most are expository texts. **Method:** The aim of our study was to investigate reading fluency and reading comprehension in secondary-school students, comparing two texts (i.e. narrative and expository) containing various types of sentences (i.e. declarative, adversative and enumerative sentences). **Results:** We found differences in reading fluency between narrative and expository texts, the expository text being read with a more marked prosody (pauses and melodic contour) suggesting that readers rely on this for their understanding. In addition, we also found a relationship between reading fluency and reading comprehension, with a greater relationship of prosodic variables with the expository text than with the narrative one. **Conclusions:** Our results confirm that reading fluency continues to develop during secondary school. The expository text, due to its increased difficulty, seemingly needs to lean on and exaggerate the prosody more when reading in order to understand it.

Keywords: Reading fluency, reading comprehension, reading prosody.

Resumen

Fluidez lectora y comprensión en estudiantes españoles de secundaria. **Antecedentes:** tradicionalmente, los estudios sobre fluidez lectora y comprensión se centraban en primaria y usaban textos narrativos. Sin embargo, la fluidez lectora continúa desarrollándose en Educación Secundaria, en la que los textos más usados son expositivos. **Método:** el objetivo de nuestro estudio era investigar la fluidez y la comprensión lectoras en estudiantes de Secundaria, comparando dos textos (narrativo y expositivo) con distintos tipos de oraciones (declarativa, adversativa y enumerativa). **Resultados:** encontramos diferencias en fluidez lectora entre textos, con una prosodia más marcada (pausas y contorno melódico) en el texto expositivo, sugiriendo que los lectores confían en ella para su comprensión. Además, encontramos una mayor relación de variables prosódicas con el texto expositivo que con el narrativo. **Conclusiones:** nuestros resultados confirman que la fluidez lectora continúa desarrollándose en Secundaria. Parece que el texto expositivo, debido a su mayor dificultad, requiere un mayor apoyo y exageración de la prosodia al leerlos para poder comprenderlos.

Palabras clave: fluidez lectora, comprensión lectora, prosodia en lectura.

Reading fluency is a crucial skill for children if they are to achieve satisfactory academic performance. Several studies have related it with other reading skills such as reading comprehension (Klauda & Guthrie, 2008; Paige, 2011; Rasinski & Padak, 2005; Rasinski et al., 2005). However, it is not enough to only have good reading fluency to achieve reading comprehension; subject variables (e.g. level of vocabulary, syntactic awareness, etc.) and text variables (e.g. text difficulty, text genre, syntax, etc.) also affect reading comprehension. Reading fluency implies appropriate speed, accuracy and expressiveness in reading (National Reading Panel, 2000). The rate of improvement in reading accuracy varies according to the transparency of the orthographic system involved (Seymour, Aro, & Erskine, 2003). Spanish children (i.e.

transparent language) reach a high level of reading accuracy in the first year of reading learning, unlike English children (i.e. opaque language), but need more time to reach a proper reading speed (Castejón, González-Pumariega, & Cuetos, 2015; Suárez-Coalla & Cuetos, 2012).

Reading prosody develops along with other reading skills as reading experience increases (Álvarez-Cañizo, Suárez-Coalla, & Cuetos 2015, 2018; Miller & Schwanenflugel, 2006, 2008). Comparing Spanish children from the third and sixth grades of primary school, Álvarez-Cañizo and colleagues (2015) showed that the more experienced readers had a better reading prosody in terms of pausing and pitch contour at the end of declarative and interrogative sentences. Similar results were found when children from third and fifth grade were compared with an adult sample (Álvarez-Cañizo et al., 2018): the fifth-graders had a more adult-like prosody than that of third-graders, who differed from adults in terms of inappropriate pauses and the final pitch of declarative, interrogative and exclamatory sentences. One might expect that Spanish children, due to their very early reading accuracy (Seymour et al., 2003) would achieve an adult-like prosody

earlier than would children who use opaque languages. However, the results are similar to those found in studies of children with opaque orthographies. For example, Miller and Schwanenflugel (2008) conducted a longitudinal study of English-speaking children in first and second grade and found that the number of pauses decreased and the pitch contour tended to be more adult-like as grade increased. Furthermore, in third-graders Miller and Schwanenflugel (2006) found that those with good reading skills in terms of accuracy and speed had a final, flat melodic contour and made fewer and shorter pauses when reading.

There are no studies on the development of prosody during secondary school. However, some authors have focused on the relationship between reading prosody and reading comprehension in various populations including secondary-school students. Some talk of prosody as a bridge between reading fluency and reading comprehension, as good readers rely on prosody to understand texts (Basaran, 2013; Kokaarslan, 2019; Koriat, Kreiner, & Greenberg, 2002; Pikulski & Chard, 2005). Reading prosody and reading comprehension are related in primary-school children (e.g. Kuhn et al., 2006; Veenendaal, Groen, & Verhoeven, 2014). Children with good reading comprehension have a more adult-like melodic contour in declarative and interrogative sentences and make fewer and shorter pauses compared with children with poor reading comprehension (Álvarez-Cañizo et al., 2015; Benjamin & Schwanenflugel, 2010; Miller & Schwanenflugel, 2006).

The development of reading fluency and reading comprehension begins at an early age, which is why it has been studied more in primary-school children. However, both reading fluency and reading comprehension continue to develop at middle- and secondary-school levels (Paige, 2011; Rasinski & Padak, 2005; Rasinski et al., 2005). According to a report by the National Reading Panel (2000), literacy instruction in high school includes fluency and comprehension skill-building and practice. Secondary students are typically asked to read more often and understand more deeply. To achieve this level of fluency they must exhibit more proficiency in prosody, because an increase in prosody leads to an increase in reading rate which ultimately leads to an increase in comprehension (Rasinski, 2004).

Some studies focusing on the relationship between reading prosody and reading comprehension in secondary-school students have found that even in high school these variables are related (e.g. Paige, Rasinski, & Magpuri-Lavell, 2012; Rasinski, Reutzel, Chard & Linan-Thompson, 2011). Paige, Rasinski, Magpuri-Lavell & Smith (2014) found that silent reading comprehension by English ninth-graders was correlated with prosodic reading measured by the Multidimensional Fluency Scale (Zutell & Rasinski, 1991). Similar results were found by Breen, Kaswer, Van Dyke, Krivokapić and Landi (2016) with English students aged 14 to 19 years. They found that students with good comprehension made more pitch variations according to the syntactic structure of the sentences. Moreover, their results showed that good comprehenders also signalled boundaries with longer durations, thus demonstrating better phrasing skill along with their better ability to assign linguistic constituent structure. In the same vein, Paige and colleagues (2012) argued that fluent English readers from the ninth grade could construct the meaning of a text while reading; further, when reading inappropriate pausing, and therefore inappropriate phrasing, they would become confused by words being grouped in meaningless ways, thereby emphasising the relationship between reading prosody, syntactic awareness and reading comprehension.

Hence, pauses and pitch variations can be considered the main prosodic features influencing reading comprehension.

With regard to pauses, some studies have argued that the satisfactory collocation of pauses when reading (i.e. correct phrasing) is essential for reading comprehension, since it works as a predictor of text structure (Paige et al., 2017; Veenendaal et al., 2014). These findings support the Implicit Prosody Hypothesis (Fodor, 2002), according to which when readers are confronted with ambiguous text they project different prosodic contours onto it, using a trial and error strategy to choose the one that seems the most natural. Evidence from a variety of studies shows that readers are sensitive to prosodic cues in reading in ways that are similar to listening (e.g. Hirose, 2003; Kraljic & Brennan, 2005; Snedeker & Trueswell, 2003).

Regarding the role of pitch variations in reading comprehension, such variations show that readers have identified the lexical and morphosyntactic features of a text (Ravid & Mashraki, 2007), and thus the structure of texts is more accessible to fluent readers (Schrauben, 2010). This is also related to syntactic awareness as it allows readers to identify the type of sentence sooner, which is necessary for reading comprehension (Hagtvet, 2003; Leikin & Bouskila, 2004; Mokhtari & Thompson, 2006). Koriat et al. (2002) showed that children were more sensitive to syntactic structure than to semantic content. It seems that prosody is applied in an online modality during reading, before and independently of semantics. On the other hand, readers with poor reading comprehension seem to have a particular difficulty assigning or even recognising the constituent linguistic structure (Breen et al., 2016).

One of the factors that can influence reading comprehension is the type of text. Text genre has been identified as a factor that affects text difficulty, with narrative text considered to be less difficult than expository prose. The former draws on everyday experiences and uses more familiar words and connectives demarcating causal relations (Best, Floyd, & McNamara, 2008; García & Cain, 2014; McNamara, Graesser, & Louwerse, 2012). Text genre influences reading comprehension (Cervetti, Bravo, Hiebert, Pearson, & Jaynes, 2009; Eason, Goldberg, Young, Geist, & Cutting, 2012), in a similar way to reading speed (Barth, Tolar, Fletcher, & Francis, 2014; Graesser, Hoffman, & Clark, 1980; Paige, Magpuri-Lavell, Rasinski, & Rupley, 2015), as readers take longer to read an expository text than a narrative one. As regards expressiveness, Schwanenflugel, Brock, Tanaka, Westmoreland and Mon (2016) found that adults used reading prosody differently for narrative and expository texts. In the case of expository texts, they used sentence boundaries to make stronger demarcations between sentences and paragraphs; narrative texts, on the other hand, had a bigger final pitch declination.

To our knowledge, most of the studies on reading fluency and reading comprehension are focused on children, while little is known about the development of reading fluency and reading comprehension in secondary-school students. One might suppose that the latter would have a higher prosodic level—with more adult-like intonation and correct phrasing— than that of young children, as prosody develops in parallel with other reading skills that would allow them to better understand texts. For that reason, the aim of our study was to investigate the way adolescents develop reading fluency and its relationship with reading comprehension. In addition, the majority of studies on prosody or reading comprehension have used narrative texts, but expository texts are the type most frequently used with secondary-school students (academic texts).

Likewise, it has been observed that text genre also affects reading speed, a component of reading fluency. Thus, our study included two types of texts in order to see whether there are differences between them when it comes to understanding or prosodic reading. From this, we can determine the specific objectives of our study: 1) to investigate the way secondary school students develop their reading fluency in terms of speed, accuracy, and prosody; 2) to see how different types of sentences influence reading fluency; 3) to determine the relationship of the three components of reading fluency with reading comprehension; 4) to know how the type of test influences comprehension and reading fluency. We selected students from the first and second grades of secondary education (between 12 and 14 years old) and asked them to read aloud two different texts in order to assess their understanding of them. We analysed the main prosodic features (i.e. pauses, pitch and duration) and their comprehension of the two types of texts, expecting to find differences between grades and texts.

Method

Participants

Forty-three students participated in this study, twenty-one (6 girls and 15 boys) from the first grade of high school ($M_{age}=12.79$, $SD=0.25$) and twenty-two (12 girls and 10 boys) from the second ($M_{age}=13.73$, $SD=0.37$). All were from a private school and had Spanish as their first language. The school has one section in each secondary education grade. None of them had developmental, behavioural, cognitive, or reading problems and they were all from the same geographical area to avoid geographical differences in prosody. In addition, none of them had repeated grade, and all participants had a similar academic level. None of the participants was removed from the initial sample.

Instruments

We created two texts of about the same length from existing texts in secondary schoolbooks: a narrative text entitled “El simio científico” [“The scientific ape”] (457 words) and an expository text, “La atmósfera” [“The atmosphere”] (455 words). We modified the original texts in order to include one declarative, one adversative, and one enumerative sentence with the same syntactic structure being maintained in both the original and the modified sentence. See Table 1 for the three target sentences in both texts. We also prepared five comprehension questions (for making inference) for each text.

Using the INFLESZ programme, we tested the readability of the texts with various parameters in order to ensure that they were appropriate for secondary-school students:

- Narrative text: Flesh-Szigriszt score (Szigriszt-Pazos, 1993)=71.99 and Flesh Fernández-Huerta score (Fernández-Huerta, 1959)=76.14, corresponding to a simple text.
- Expository text: Flesh-Szigriszt score=65.84 and Flesh Fernández-Huerta score=70.18, also corresponding to a simple text.

Procedure

Firstly, students were asked collectively to complete some of the subtests of the PROLEC-SE-R (Cuetos, Arribas, & Ramos, 2016) so that we would have measures of their semantic (i.e. lexical selection and semantic categorization subtests) and syntactic levels (i.e. grammatical structures and grammatical judgments subtest).

The task involved reading the text aloud and answering comprehension questions. The text was presented on paper in 12-point, Times New Roman font. Children read individually in a quiet room in their school. Readings were recorded using an H4n voice recorder and an Ht2-P Audix headset dynamic microphone, and processed offline using Praat software (Boersma & Weenink, 2018). We then analysed certain prosodic parameters in the target sentences cited above. We automated the Praat analysis process using a combination of published scripts (Atria, 2014; Elvira García, & Roseano, 2014) and specially written scripts.

The research design was approved by the Ethics Committee for Research of the Principality of Asturias, Spain. The study was designed in accordance with the Declaration of Helsinki and the Spanish Law of Personal Data Protection (15/1999 and 3/2018) principles, and written informed parental consent was received for all participants authorising the students to take part in the experiment.

Data analysis

The data obtained from Praat were statistically analysed using R (R Core Team, 2019). The parameters analysed were those commonly used in research in this field:

- Errors: the number of errors in the target sentences. We considered when reading was not exactly the same as the written text as an error, even if there was rectification. It allows us to measure the accuracy, a part of reading fluency.
- Pauses: a measure of reading prosody; the number and mean percentage of pauses in the target sentences. We used the percentage of pauses because this gives more information on how long a reader takes on pauses, and therefore, we also see how much time these pauses take from the total reading time.

Table 1
Target sentences

Sentence	Narrative	Expository
Declarative	“Un clan de simios antropoides vivía en los árboles” [“A clan of anthropoid apes lived in the trees”]	«La masa de aire atmosférico cuida de los hombres» [«The atmospheric air mass protects men»]
Adversative	“Un simio acuna a un bebé, pero no consigue que el niño duerma” [“An ape cradles a baby, but does not get the child to sleep”]	‘El traje protege al astronauta, pero no consigue que los peligros desaparezcan’ [‘The spacesuit protects the astronaut, but does not eliminate the dangers’]
Enumerative	“Los simios eran altos, fuertes, ágiles” [“The apes were tall, strong, agile”]	“El espacio es malo, hostil, dañino” [“Space is bad, hostile, harmful”]

- Appropriate pauses: pauses made when encountering a grammatical mark, such as a comma.
- Inappropriate pauses: pauses made in the absence of a grammatical mark indicating a break, which could be between words or within words.
- Duration:
 - Text (s): duration of the reading of the whole texts, narrative and expository. It is a measure of reading speed, a part of reading fluency.
 - Sentence (s): duration of a target sentence. It is also a measure of reading speed.
 - Vowels (s): duration of the middle and last vowels in three sentences. We selected sentences with the same final vowel in both texts (i.e. a, e and o). This is a measure of reading prosody.
- Pitch variables: they are measures of reading prosody.
 - Initial rise (St): the difference in pitch between the first trough and the first peak in the pitch contour of the sentence, in declarative and adversative sentences only.
 - Final rise (St): the difference in pitch between the last peak and the end of the sentence, in declarative and adversative sentences only.
 - Range of F0 (St): the difference in pitch (maximum–minimum) in the words of the enumeration in enumerative sentences.

Results

Errors

We counted the number of errors made in the target sentences and performed an ANOVA. Secondary-school students of first grade made more errors ($M=0.64, SD=1.08$) than did second-graders ($M=0.45, SD=0.77$). Furthermore, there were more mistakes in the narrative text ($M_1=0.66, SD=0.89; M_2=0.66, SD=0.99$) than in the expository text ($M_1=0.08, M_2=0.07$). See Table 2.

Pauses

We only considered those pauses longer than 100 ms. We classified pauses in the target sentences into two categories: appropriate pauses (determined by a punctuation mark) and inappropriate pauses (between or within words). We obtained two

Table 2
Mean number of errors in target sentences, by grade

Text	Sentence	1 st grade M(SD)	2 nd grade M(SD)
Expository	Declarative	0.286(0.643)	0.409(0.730)
	Adversative	0.809(1.504)	0.409(0.666)
	Enumerative	0.333(0.658)	0.318(0.568)
Narrative	Declarative	1.143(1.014)	1(1.113)
	Adversative	0.905(1.338)	0.273(0.703)
	Enumerative	0.333(0.796)	0.273(0.456)

measures for pauses, number and percentage, and conducted an ANOVA using number or percentage of pauses as the dependent variable, and type of text (expository and narrative), type of sentence (declarative, adversative and enumerative), grade (first and second grades of secondary-school) and type of pause (appropriate and inappropriate) as independent variables.

First, we conducted an ANOVA to analyse the number of pauses and found a text effect ($F(1,245)=7.01; p=.008; \eta^2=.20$), with more pauses in the expository ($M=1.29, SD=0.09$) than in the narrative ($M=1.16, SD=0.45$) text. The results also showed a significant interaction between text and sentence ($F(2,245)=8.88, p<.001; \eta^2=.50$): differences between the texts were apparent for the enumerative sentences, with more pauses in the expository ($M=1.63, SD=0.48$) than in the narrative ($M=1.19, SD=0.39$) text.

With regard to the mean percentage of pauses, we found a significant interaction between sentence and text ($F(2,227)=13.36, p<.001; \eta^2=.70$): in the declarative sentences the percentage of pauses was significantly smaller in the expository text ($M=6.78, SD=2.74$) than in narrative text ($M=11.97, SD=5.4$); the opposite was the case for the enumerative sentences, with the percentage of pauses being greater in the expository text ($M=11.71, SD=7.99$) than in the narrative text ($M=7.35, SD=5.4$).

For the followed analysis explained, group comparisons of other prosodic parameters were performed using a mixed-effects modelling design. The fixed effects were prosodic parameters (duration and pitch variables) and the random effects were the participants (Baayen, 2008; Baayen, Davidson, & Bates, 2008). We used the Tukey adjustment in the post hoc analyses of the main effects and interactions.

Total duration

Analysis of text duration showed a significant main effect of Grade ($F(1,41)=5.33, p=.026; \eta^2=.75$) with students in the first grade taking longer than second-graders to read the text. In addition, a Type of text effect was also found to be significant ($F(1,41)=127.89, p<.001; \eta^2=.90$), whereby the narrative text was read faster than the expository text was read (Tables 3 and 4).

As regards sentence duration, our analysis suggested a significant main effect of Grade ($F(1,41)=6.425, p=.015; \eta^2=.77$): younger readers took longer than students from second grade to read every sentence. Moreover, a significant interaction between type of text and type of sentence was found ($F(2,205)=35.791, p<.001; \eta^2=.91$), with readers taking more time over declarative sentences in the narrative than in the expository text (Tables 3 and 4).

Table 3
Mean and SE of prosodic variables by grade

	1 st grade M(SE)	2 nd grade M(SE)
Total duration-text (s)	191(4.63)	176(4.52)
Total duration-target sentences (s)	3.49(0.11)	3.09(0.11)
First pitch declination-adversative sentences (St)	1.771(0.387)	0.793(0.378)
Final pitch declination-declarative sentences (St)	-3.06(0.324)	-1.04(0.316)
Final pith declination-adversative sentences (St)	-4.103(0.313)	-0.807(0.305)
Pitch range in words-enumerative sentences-expository text (St)	8.26(0.976)	5.47(0.974)
Vowel duration (s)	0.107(0.006)	0.098(0.006)

Table 4
Mean and SE of prosodic variables by type of text

	Expository M(SE)	Narrative M(SE)
Total duration-text (s)	194(3.36)	173(3.36)
Total duration-declarative sentence (s)	2.73(0.116)	3.48(0.116)
First peak-declarative sentence (St)	3.43(0.306)	1.57(0.306)
Pitch range in words-enumerative sentences (St)	7.05(0.860)	5.87(0.866)
Pitch range in words-enumerative sentences-1 st grade (s)	8.62(0.976)	5.36(0.985)
Difference in vowel duration (s)	0.042(0.004)	0.059(0.004)

Pitch measures

First, we analysed the initial pitch rise in declarative sentences. We found a Type of text significant effect ($F(1,42)=21.25, p<.001; \eta^2=.90$), with pitch variation at the beginning of the declarative sentences larger in the expository than in the narrative text ($Estimate=1.87, SE=0.41, p<.001$) (Table 4).

Secondly, the pitch fall before the comma in adversative sentences was analysed. Although the main effect of grade was not significant, it approached significance ($F(1,82)=3.27, p=.07; \eta^2=.62$); there was a bigger pitch declination among first-graders than among second-graders ($Estimate=0.98, SE=0.54$) (Table 3).

Thirdly, we analysed the final pitch declination in declarative and adversative sentences. For the declarative sentences, we found a significant main effect only of Grade ($F(1,82)=19.86, p<.001; \eta^2=.91$), with first-graders making a larger pitch fall than that made by second-graders ($Estimate=2.02, SE=0.45$). In relation to adversative sentences, a main effect of Grade was found to be significant ($F(1,42)=56.85, p<.001; \eta^2=.96$), with high-school

first-graders making a larger final pitch declination than second-graders ($Estimate=3.3, SE=0.44$) (Table 3).

Finally, the pitch range of the words enumerated in the enumerative sentences was analysed. We found a main effect of Type of text ($F(1,202)=4.96, p=.027; \eta^2=.62$), with the pitch range being larger in the expository text ($Estimate=1.18, SE=0.53$). We also found a significant interaction between grade and type of text ($F(1,202)=15.65, p<.001; \eta^2=.85$), with the type of text effect only appearing in first-graders ($Estimate=3.26, SE=0.74$); and we found a grade effect with the expository text only, that being a larger pitch range among first-graders ($Estimate=3.16, SE=0.92, p=.005$). See Tables 3 and 4.

We also performed regression analysis on the semantics and syntactic scores of the PROLEC-SE-R and the pitch measures. We found that syntactic scores correlated negatively with the final pitch declination of the declarative ($r=-.609, p<.001$) and adversative sentences ($r=-.674, p<.001$). See Figure 1 and 2 for pitch contours.

Vowel duration

Analysis of the duration of vowels showed a significant main effect of Grade ($F(1,41)=5.04, p=.030; \eta^2=.37$), with first-graders taking longer than second-graders on all vowels ($Estimate=0.009, SE=0.004$). A main effect of Position was also observed ($F(1,463)=405.4, p<.001; \eta^2=.95$), with the final vowel being significantly longer than the middle vowels ($Estimate=0.05, SE=0.008$). Finally, the results showed a significant interaction between type of text and position ($F(1,463)=11.06, p<.001; \eta^2=.38$), the final vowel being longer in the narrative than in the expository text ($Estimate=0.009, SE=0.003, p=.04$) (Table 3).

We also analysed the difference between the final and middle vowels. The type of text effect was found to be significant

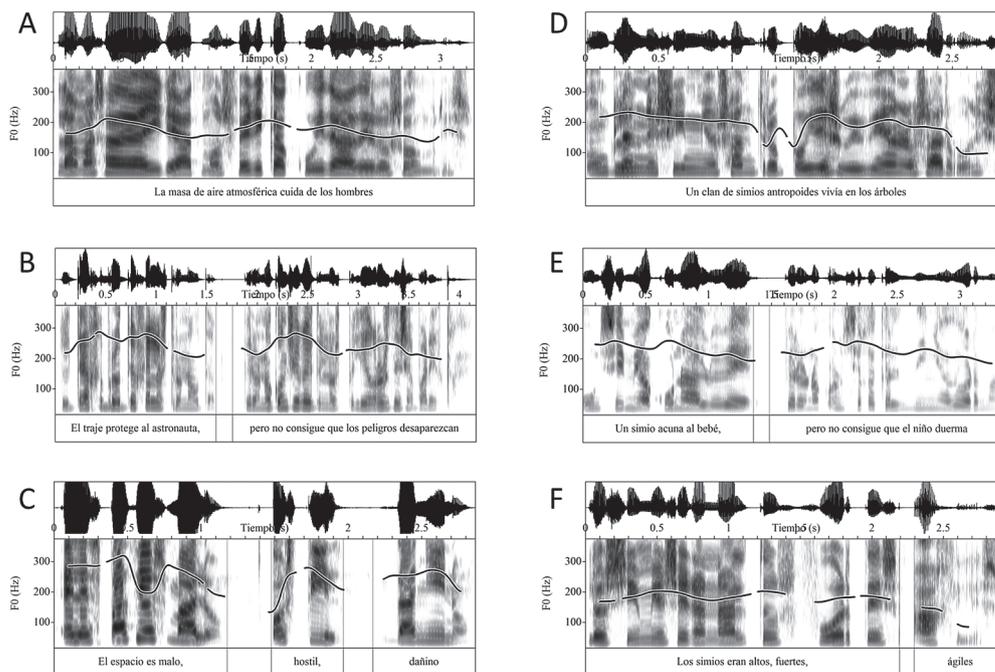


Figure 1. Examples of melodic contour in declarative, adversative and enumerative sentences in narrative (A,B,C) and expository text (D,E,F) in first-graders

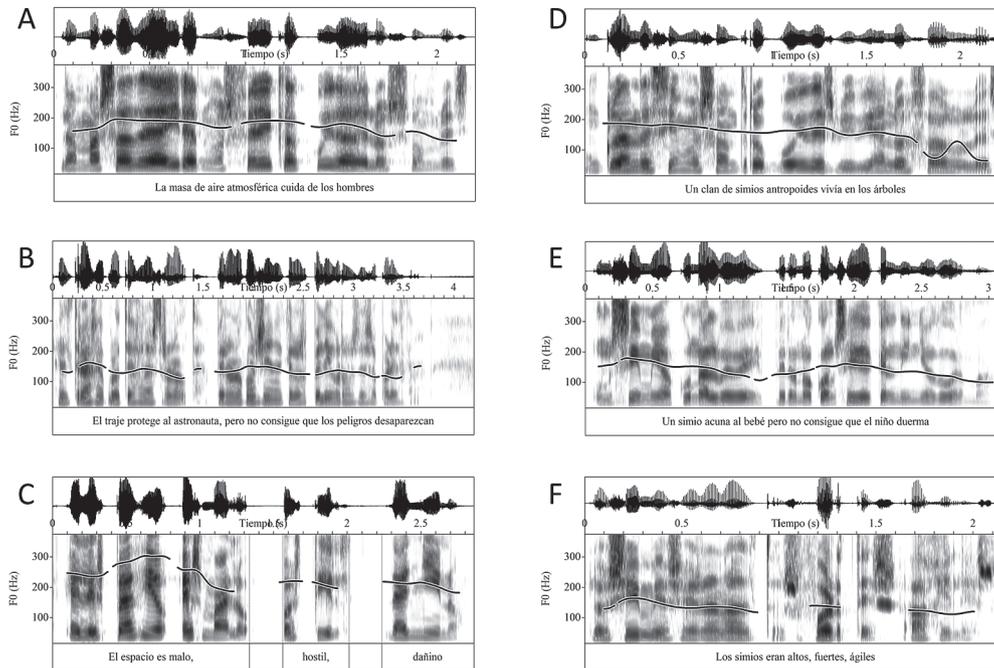


Figure 2. Examples of melodic contour in declarative, adversative and enumerative sentences in narrative (A,B,C) and expository text (D,E,F) in second-graders

($F(1,213)=14.97, p<.001; \eta^2=.80$), the final lengthening being longer in the narrative than in the expository text ($Estimate=0.017, SE=0.004$) (Table 4).

Reading comprehension

A T Student analyses showed significant differences between comprehension scores for both texts in first, ($t(20)=5.27, p<.001; \eta^2=.42$) and second ($t(21)=2.48, p=.022; \eta^2=.13$) grade, with students better able to understand the narrative than the expository text (Table 5).

We also analysed the relationship between the reading comprehension scores for both texts with the prosodic measures and results of the PROLEC-SE-R, in an attempt to determine which variables better predicted reading comprehension in the two grades. To do this aim we performed a regression analysis and correlation analysis.

First, with regard to the expository text, first-graders’ reading comprehension was related to total mistakes in the target sentences of the expository text ($r=-.409, p=.033$), the percentage of appropriate pauses (commas) in enumerative sentences in the expository text ($r=.441, p=.023$) and the final lengthening of vowels in the expository text ($r=.378, p=.045$). In the second grade, the best predictors of reading comprehension were the total

duration of expository text ($r=-.389, p=.037$), the final lengthening of vowels in the expository text ($r=.438, p=.021$) and the syntax scores from the PROLEC-SE-R ($r=.453, p=.017$).

Secondly, with reference to the narrative text, first-grade reading comprehension could be explained by the semantics score on the PROLEC-SE-R ($r=.451, p=.020$). No significant correlations were found for the second grade.

Discussion

The aim of our study was to investigate the development of reading fluency in secondary-school students and its relationship with reading comprehension. We also wanted to examine possible differences in reading fluency and comprehension relating to the text genre, as the latter is known to influence reading speed (Barth et al., 2015; Graesser et al., 1980; Paige et al., 2015) and reading comprehension (Cervetti et al., 2009; Eason et al., 2012). To achieve this objective, we asked students in the first and second grades of high-school to perform a reading task and then answer some comprehension questions. We included two types of text, narrative and expository, each including a declarative, adversative and enumerative sentence matched in length and syntactic structure.

Our results showed that reading fluency continues to develop during secondary school. Several studies have found that reading prosody changes along with other reading skills during primary school (e.g. Álvarez-Cañizo et al., 2015; Kuhn et al., 2006; Veenendaal et al., 2014). However, we found differences between high-school grades in total duration of reading texts and sentences, with first-graders taking longer to read both texts and all types of sentences. This result tells us that reading speed continues to develop beyond primary school, as other authors have found (Castejón et al., 2016; Suárez-Coalla & Cuetos, 2012), as do prosodic measures such as final pitch declination in declarative and

Comprehension score	1 st grade M(SD)	2 nd grade M(SD)
Narrative	5.48(2.6)	5.46(3.19)
Expository	2.57(2.29)	3.23(2.5)

adversative sentences. It has also been observed that in primary-school students the main differences between grades are to be found at the end of the sentences (Álvarez-Cañizo et al., 2018), as with adults with dyslexia (Suárez-Coalla, Álvarez-Cañizo, & Cuetos, 2016). The main explanation for this difference is the possible difficulty of anticipating the end of sentences making it difficult to adapt the intonation. Regression analysis showed that syntactic scores on the PROLEC-SE-R correlated negatively with final pitch declination in declarative and adversative sentences. Hence, students with higher syntactic scores (or better syntactic awareness) made a not-so pronounced final declination in pitch, knowing when the sentence might end and gradually lowering their tone; students with lower syntactic ability performed a more abrupt descent in pitch.

One of our aims in the present study was to compare two types of texts. On a daily basis, students are exposed to a great number of expository texts (literature studies aside). Our results showed differences in reading fluency for the two types of texts. First, text genre appears to affect reading speed, as the narrative text was read faster than the expository text was independently of grade, as has been found in previous studies (Barth et al., 2015; Graesser et al., 1980; Paige et al., 2015). However, the narrative text elicited more mistakes than the expository text did. This could be due to certain words included in the narrative text (e.g. anthropoid), which might be difficult to read because of their syllabic structure or word frequency. We also found that students made more pauses when reading the expository text. Moreover, this difference between texts was found in the enumerative sentences, as readers made more pauses between the commas of the enumeration. Similarly, the percentage of pauses in the enumerative sentences was higher for the expository text than for the narrative text. As regards intonation, students made a larger initial pitch rise in the declarative sentences and demonstrated a bigger pitch range in the enumerated words in the enumerative sentences. Moreover, in the case of the enumerative sentences, the differences between the texts were only found among the first-graders. These results indicate that the children had a more exaggerated prosody in the case of the expository text, with more and longer pauses and larger pitch variations. According to Benjamin and Schwanenflugel (2010), readers need to make a more marked prosody when reading complex texts in order to better understand them. Other authors have found differences between text genres, with expository texts generally found to be high in syntactic complexity, longer sentences and complex vocabulary, and relatively low in coherence (Barth et al., 2014; Best et al., 2008). These differences are mainly due to the different functions of the texts. On the one hand, expository texts seek to inform the reader of ideas or concepts that they do not have; on the other, narrative texts try to entertain the reader based on knowledge that they already have (Brewer & Lichtenstein, 1982).

Another of the main objectives of this research was to study the relationship between reading fluency and reading comprehension. This relationship exists in primary-school children (e.g. Álvarez-Cañizo et al., 2015; Miller & Schwanenflugel, 2006; Veenendaal et al., 2014) and also in English secondary-school children (Breen et al., 2016; Paige et al., 2012, 2014; Rasinski et al., 2011). In our sample of Spanish secondary-school children, we found that readers understood the narrative text easier than they did the expository text. This was to be expected, since previous studies of the influence of text genre on reading comprehension have also

found that narrative texts are easier to understand (Eason et al., 2012; Cervetti et al., 2009).

Our results also showed several relationships between reading comprehension and reading fluency depending on the grade of the children and the type of text. In the first place, first-graders' comprehension of the expository text was related to the number of errors they made; that is, comprehension was directly related to reading accuracy. This was not the case, however, for the second-graders, possibly also because the number of errors committed was significantly lower than that made in the lower grade. However, among second-graders there was a relationship between reading comprehension and total duration of the text; that is, comprehension depended on speed of reading. As for prosody, we saw how first-graders comprehension was related to the percentage of pauses between commas in the enumerative sentences, whereby readers who made a greater number of pauses had a better understanding of the text. In addition, with both grades we found a relationship with the lengthening of the final vowel and reading comprehension. On the basis of these results we might deduce that when understanding an expository text, there are more variables relating to reading fluency that influence comprehension in the first grade than in the second. This happens because this type of text is more difficult to comprehend (Barth et al., 2014; Best et al., 2008; García & Cain, 2014; McNamara et al., 2012), and because first-graders' reading level is lower than that of second-graders they have to rely more on the prosody to understand what they are reading (Benjamin & Schwanenflugel, 2010; Schwanenflugel et al., 2016). As regards relations found in the narrative texts, our results showed a relationship only between reading comprehension and first-graders' semantics scores on the PROLEC-SE-R. It seems clear that, as observed by other authors, prosodic reading and reading comprehension are related (Benjamin & Schwanenflugel, 2010; Lopes et al., 2015; Miller & Schwanenflugel, 2006, 2008; Schwanenflugel et al., 2006), but our results also confirm that reading prosody is one of the most important variables relating to reading comprehension (Kocaarslan, 2019).

To summarize, our study confirms that reading fluency continues to develop during secondary school. We also verified differences in reading fluency between narrative and expository texts: the expository text was read with a more marked prosody, suggesting that readers rely on prosody for their understanding. Finally, we also confirmed the relationship between reading fluency and reading comprehension, with a greater relationship with prosodic variables in the case of expository texts. This is also due to the difficulty of the text and the need to observe the prosody more when reading it in order to understand it. These findings have significant implications for education, highlighting as they do the importance of continuing to teach reading after primary education is completed. Many teachers consider secondary-school students to have reached an adult reading level; however, we have seen that this is not the case.

Secondary school students need to continue their training in reading to achieve competent levels of accuracy, speed, and prosody in reading fluency. Furthermore, we highlight the importance of prosody in reading to facilitate the comprehension of texts. It was thought that good accuracy and adequate speed already guaranteed the comprehension of texts; however, as researched by O'Connor (2018), reading at a faster rate does not give a reading comprehension advantage for students with reading disabilities. It is also just as important to train students in reading all types of

texts. Primary schools usually focus children on reading narrative texts, and as observed in this research, secondary school students have difficulties in reading and understanding expository texts. It would be interesting to study in the future the relationship between reading fluency and reading comprehension across different secondary school grade levels in order to learn more about their

development in reading fluency as well as determining other subject variables, if any, that may affect comprehension.

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References

- Álvarez-Cañizo, M., Suárez-Coalla, P., & Cuetos, F. (2015). The role of reading fluency in children's text comprehension. *Frontiers in Psychology*, 6, 1810. <https://doi.org/10.3389/fpsyg.2015.01810>
- Álvarez-Cañizo, M., Suárez-Coalla, P., & Cuetos, F. (2018). Reading prosody development in Spanish children. *Reading and Writing*, 31(1), 35-52. <https://doi.org/10.1007/s11145-017-9768-7>
- Atria, J.J. (2014). Generate pitch object using utterance-specific thresholds: Using Hirst and Delooze's s two-pass method [Praat script]. Retrieved from https://github.com/jjatria/plugin_jjatoools.
- Baayen, R.H. (2008). *Analyzing linguistic data: A practical introduction to statistics*. Cambridge (United Kingdom): Cambridge University Press.
- Baayen, R.H., Davidson, D.J., & Bates, D.M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, 59, 390-412. <https://doi.org/10.1016/j.jml.2007.12.005>
- Barth, A.E., Tolar, T.D., Fletcher, J.M., & Francis, D. (2014). The effects of student and text characteristics on the oral reading fluency of middle-grade students. *Journal of Educational Psychology*, 106(1), 162. <http://dx.doi.org/10.1037/a0033826>
- Basaran, M. (2013). Reading fluency as an indicator of reading comprehension. *Educational Sciences: Theory and Practice*, 13(4), 2287-2290.
- Benjamin, R.G., & Schwanenflugel, P.J. (2010). Text complexity and oral reading prosody in young readers. *Reading Research Quarterly*, 45(4), 388-404. <https://doi.org/10.1598/RRQ.45.4.2>
- Best, R.M., Floyd, R.G., & McNamara, D.S. (2008). Differential competencies contributing to children's comprehension of narrative and expository texts. *Reading Psychology*, 29(2), 137-164. <https://doi.org/10.1080/02702710801963951>
- Boersma, P., & Weenink, D. (2018). *Praat: Doing phonetics by computer* (Version 6.0. 43) [Computer software]. Amsterdam: Institute of Phonetic Sciences.
- Breen, M., Kaswer, L., Van Dyke, J.A., Krivokapić, J., & Landi, N. (2016). Imitated prosodic fluency predicts reading comprehension ability in good and poor high school readers. *Frontiers in Psychology*, 7, 1026. <https://doi.org/10.3389/fpsyg.2016.01026>
- Brewer, W.F., & Lichtenstein, E.H. (1982). Stories are to entertain: A structural-affect theory of stories. *Journal of Pragmatics*, 6(5-6), 473-486. [https://doi.org/10.1016/0378-2166\(82\)90021-2](https://doi.org/10.1016/0378-2166(82)90021-2)
- Castejón, L., González-Pumariega, S., & Cuetos, F. (2015). Development of word reading fluency along primary education: A six-year follow-up. *Infancia y Aprendizaje*, 38(4), 842-871. <https://doi.org/10.1080/02103702.2015.1076266>
- Cervetti, G.N., Bravo, M.A., Hiebert, E.H., Pearson, P.D., & Jaynes, C.A. (2009). Text genre and science content: Ease of reading, comprehension, and reader preference. *Reading Psychology*, 30(6), 487-511. <https://doi.org/10.1080/02702710902733550>
- Cuetos, F., Arribas, D., & Ramos, J.L. (2016). *PROLEC-SE-R: batería de evaluación de los procesos lectores en Secundaria y Bachillerato revisada* [Prolec-R: Battery for the reading process assessment, reviewed]. Madrid: TEA Ediciones.
- Eason, S.H., Goldberg, L.F., Young, K.M., Geist, M.C., & Cutting, L.E. (2012). Reader-text interactions: How differential text and question types influence cognitive skills needed for reading comprehension. *Journal of Educational Psychology*, 104(3), 515. <https://doi.org/10.1037/a0027182>
- Elvira García, W., & Roseano, P. (2014). *Create pictures with tiers v.4.1*. [Praat script]. Retrieved from <http://stel.uv.edu/labfon/en/praat-scripts>.
- Fernández Huerta, J. (1959). Medidas sencillas de lecturabilidad [Simple measures of readability]. *Consigna*, 214, 29-32.
- Fodor, J.D. (2002, April). *Psycholinguistics cannot escape prosody*. Paper presented at Speech Prosody 2002, Aix-en-Provence, France. Retrieved from https://www.researchgate.net/profile/Janet_Fodor/publication/2891257_Psycholinguistics_Cannot_Escape_Prosody/links/09e41507c2300f3cca000000.pdf
- Graesser, A.C., Hoffman, N.L., & Clark, L.F. (1980). Structural components of reading time. *Journal of Verbal Learning and Verbal Behavior*, 19(2), 135-151. [https://doi.org/10.1016/S0022-5371\(80\)90132-2](https://doi.org/10.1016/S0022-5371(80)90132-2)
- Hagtvet, B.E. (2003). Listening comprehension and reading comprehension in poor decoders: Evidence for the importance of syntactic and semantic skills as well as phonological skills. *Reading and Writing*, 16(6), 505-539. <https://doi.org/10.1023/A:1025521722900>
- Hirose, Y. (2003). Recycling prosodic boundaries. *Journal of Psycholinguistic Research*, 32(2), 167-195. <https://doi.org/10.1023/A:1022448308035>
- Klauda, S. L., & Guthrie, J. T. (2008). Relationships of three components of reading fluency to reading comprehension. *Journal of Educational Psychology*, 100(2), 310. <https://dx.doi.org/10.1037/0022-0663.100.2.310>
- Kocaarslan, M. (2019). The effects of reading rate, accuracy and prosody on second grade students. *Acta Psychologica*, 197, 86-93. <https://doi.org/10.1016/j.actpsy.2019.05.005>
- Koriat, A., Kreiner, H., & Greenberg, S.N. (2002). The extraction of structure during reading: Evidence from reading prosody. *Memory & Cognition*, 30(2), 270-280. <https://doi.org/10.3758/BF03195288>
- Kraljic, T., & Brennan, S.E. (2005). Prosodic disambiguation of syntactic structure: For the speaker or for the addressee? *Cognitive Psychology*, 50(2), 194-231. <https://doi.org/10.1016/j.cogpsych.2004.08.002>
- Kuhn, M.R., Schwanenflugel, P.J., Morris, R.D., Morrow, L.M., Woo, D.G., Meisinger, E.B., ... & Stahl, S.A. (2006). Teaching children to become fluent and automatic readers. *Journal of Literacy Research*, 38(4), 357-387. https://doi.org/10.1207/s15548430jlr3804_1
- Leikin, M., & Bouskila, O.A. (2004). Expression of syntactic complexity in sentence comprehension: A comparison between dyslexic and regular readers. *Reading and Writing*, 17(7-8), 801-822. <https://doi.org/10.1007/s11145-004-2661-1>
- McNamara, D.S., Graesser, A.C., & Louwerse, M.M. (2012). Sources of text difficulty: Across genres and grades. In J. Sabatini, E. Albro, & T. O'Reilly (Eds.), *Measuring up: Advances in how we assess reading ability* (pp. 89-116). Lanham, MD: R&L Education.
- Miller, J., & Schwanenflugel, P.J. (2006). Prosody of syntactically complex sentences in the oral reading of young children. *Journal of Educational Psychology*, 98(4), 839. <http://dx.doi.org/10.1037/0022-0663.98.4.839>
- Miller, J., & Schwanenflugel, P.J. (2008). A longitudinal study of the development of reading prosody as a dimension of oral reading fluency in early elementary school children. *Reading Research Quarterly*, 43(4), 336-354. <https://doi.org/10.1598/RRQ.43.4.2>
- Mokhtari, K., & Thompson, H.B. (2006). How problems of reading fluency and comprehension are related to difficulties in syntactic awareness skills among fifth graders. *Literacy Research and Instruction*, 46(1), 73-94. <https://doi.org/10.1080/19388070609558461>
- National Reading Panel (US), National Institute of Child Health, & Human Development (US) (2000). *Report of the National Reading Panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading*

- instruction: Reports of the subgroups. Washington, DC: National Institute of Child Health and Human Development, National Institutes of Health.
- O'Connor, R. E. (2018). Reading fluency and students with reading disabilities: How fast is fast enough to promote reading comprehension? *Journal of Learning Disabilities*, 51(2), 124-136. <https://doi.org/10.1177/0022219417691835>
- Paige, D.D., Rasinski, T., Magpuri-Lavell, T., & Smith, G.S. (2014). Interpreting the relationships among prosody, automaticity, accuracy, and silent reading comprehension in secondary students. *Journal of Literacy Research*, 46(2), 123-156. <https://doi.org/10.1177/1086296X14535170>
- Paige, D., Magpuri-Lavell, T., Rasinski, T., & Rupley, W. (2015). Fluency differences by text genre in proficient and struggling secondary students. *Advances in Literary Study*, 3(04), 102. <https://dx.doi.org/10.4236/als.2015.34016>
- Paige, D.D., Rupley, W.H., Smith, G.S., Rasinski, T.V., Nichols, W., & Magpuri-Lavell, T. (2017). Is prosodic reading a strategy for comprehension? *Journal for Educational Research Online/Journal für Bildungsforschung Online*, 9(2), 245-275.
- Paige, D.D. (2011). Engaging struggling adolescent readers through situational interest: A model proposing the relationships among extrinsic motivation, oral reading proficiency, comprehension, and academic achievement. *Reading Psychology*, 32(5), 395-425. <https://doi.org/10.1080/02702711.2010.495633>
- Paige, D.D., Rasinski, T.V., & Magpuri-Lavell, T. (2012). Is fluent, expressive reading important for high school readers? *Journal of Adolescent & Adult Literacy*, 56(1), 67-76. <https://doi.org/10.1002/JAAL.00103>
- Pikulski, J.J., & Chard, D.J. (2005). Fluency: Bridge between decoding and reading comprehension. *The Reading Teacher*, 58(6), 510-519. <https://doi.org/10.1598/RT.58.6.2>
- R Core Team (2019). R: A language and environment for statistical computing (Version 3.5.3) [Computer software]. Retrieved from <https://www.R-project.org/>.
- Rasinski, T., & Padak, N.D. (2005). Fluency beyond the primary grades: Helping adolescent struggling readers. *Voices from the Middle*, 13(1), 34.
- Rasinski, T.V., Padak, N.D., McKeon, C.A., Wilfong, L.G., Friedauer, J.A., & Heim, P. (2005). Is reading fluency a key for successful high school reading? *Journal of Adolescent & Adult Literacy*, 49(1), 22-27. <https://doi.org/10.1598/JAAL.49.1.3>
- Rasinski, T.V., Reutzel, D.R., Chard, D., & Linan-Thompson, S. (2011). *Reading Fluency*. In M.L. Kamil, P.D. Pearson, E.B. Moje & P. Afflerbach (Eds.), *Handbook of reading research* (pp. 286-319). Mahwah, NJ: Erlbaum.
- Rasinski, T. V. (2004). *Assessing reading fluency*. Honolulu, HI: Pacific Resources for Education and Learning (PREL).
- Ravid, D., & Mashraki, Y. E. (2007). Prosodic reading, reading comprehension and morphological skills in Hebrew-speaking fourth graders. *Journal of Research in Reading*, 30(2), 140-156. <https://doi.org/10.1111/j.1467-9817.2007.00340.x>
- Schrauben, J. E. (2010). Prosody's contribution to fluency: An examination of the theory of automatic information processing. *Reading Psychology*, 31(1), 82-92. <https://doi.org/10.1080/02702710902753996>
- Schwanenflugel, P.J., Brock, M., Tanaka, V., Westmoreland, M., & Mon, S. (2016, July). *Influence of passage genre on reading prosody*. Paper presented at Twenty-Third Annual Meeting Society for the Scientific Study of Reading, Porto, Portugal.
- Schwanenflugel, P.J., Meisinger, E.B., Wisenbaker, J.M., Kuhn, M.R., Strauss, G.P., & Morris, R.D. (2006). Becoming a fluent and automatic reader in the early elementary school years. *Reading Research Quarterly*, 41(4), 496-522. <https://doi.org/10.1598/RRQ.41.4.4>
- Seymour, P.H., Aro, M., & Erskine, J.M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94(2), 143-174. <https://doi.org/10.1348/000712603321661859>
- Snedeker, J., & Trueswell, J. (2003). Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language*, 48(1), 103-130. [https://doi.org/10.1016/S0749-596X\(02\)00519-3](https://doi.org/10.1016/S0749-596X(02)00519-3)
- Suárez-Coalla, P., & Cuetos, F. (2012). Reading strategies in Spanish developmental dyslexics. *Annals of Dyslexia*, 62(2), 71-81. <https://doi.org/10.1007/s11881-011-0064-y>
- Suárez-Coalla, P., Álvarez-Cañizo, M., Martínez, C., García, N., & Cuetos, F. (2016). Reading prosody in Spanish dyslexics. *Annals of Dyslexia*, 66(3), 275-300. <https://doi.org/10.1007/s11881-016-0123-5>
- Szigriszt-Pazos, F. (1993). *Sistemas predictivos de legibilidad del mensaje escrito: fórmula de perspicuidad [Readability predictive systems of the written message: Formula perspicuity]* (Doctoral dissertation). Universidad Complutense de Madrid. Retrieved from <http://biblioteca.ucm.es/tesis/19911996/S/3/S3019601.pdf>
- Veenendaal, N.J., Groen, M.A., & Verhoeven, L. (2014). The role of speech prosody and text reading prosody in children's reading comprehension. *British Journal of Educational Psychology*, 84(4), 521-536. <https://doi.org/10.1111/bjep.12036>
- Zutell, J., & Rasinski, T.V. (1991). Training teachers to attend to their students' oral reading fluency. *Theory into Practice*, 30(3), 211-217. <https://doi.org/10.1080/00405849109543502>