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(Re)Examining the benefits of pre-reading instruction for vocabulary learning

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Introduction

Exposure to novel words in reading is an important source of second language (L2) vocabulary growth (e.g., Pellicer-Sánchez & Schmitt, 2010; Webb, 2007). Successful vocabulary learning from reading depends on the degree of involvement while processing new words (Laufer & Hulstijn, 2001). However, learners do not always notice unknown words in the input (Laufer, 2005). Thus, vocabulary researchers have explored different techniques to increase the salience of unknown vocabulary in written input, making the new words more likely to be noticed. Explicit vocabulary instruction prior to reading is one such techniques. Pre-reading instruction has been claimed to increase the salience and cognitive processing of target vocabulary (Paribakht & Wesche, 1993, 1996). Although pre-reading vocabulary instruction is a common activity in the language classroom, very few studies have examined its benefit on vocabulary learning and its effect on learners' attention to the taught items during subsequent reading.

A recent study by Pellicer-Sánchez, Conklin, and Vilkaitė-Lozdienė (2020) used a combination of vocabulary tests and recordings of eye movements to examine the effect of pre-reading instruction on learners' attention to the target vocabulary during reading and their vocabulary learning. If pre-reading instruction increases salience (Paribakht & Wesche, 1993, 1996), learners should pay

more attention to taught words than to other novel words that have not been taught. It is also possible that pre-reading instruction may discourage guessing strategies (Nation & Coady, 1988), which might lead to learners paying less attention to the taught items than the unfamiliar/un-taught words. However, the study by Pellicer-Sánchez et al. (2020) failed to support any of these assumptions, showing that at the initial encounter both taught and un-taught items were processed in a similar way. The findings of the study revealed that, while pre-reading instruction had an advantage over reading-only in terms of the acquisition of form and meaning of novel lexical items, it did *not* lead to increased attention when novel items were first encountered in the text. The authors concluded that learning the items in pre-reading activities did not lead to differences in the amount of attention paid to taught and un-taught novel words during their first encounter in reading. This finding goes against the hypothesis that pre-reading instruction increases the salience and cognitive processing of pre-taught items and questions the effectiveness of pre-reading instruction as an attention-drawing device. Crucially, as the authors acknowledge, frequency of exposure was a confounding variable in the study: novel words in the pre-reading instruction condition had been encountered twice before the reading, thus their first encounter in the text was their third overall occurrence while un-taught words occurred for the first time in the text. The difference in number of occurrences could impact looking patterns (i.e., reading times) and has important theoretical implications that warrant further examination. The study by Pellicer-Sánchez et al. (2020) showed that, in the pre-reading instruction condition, exposures to target words in reading further contributed to the learning that accrued from the initial explicit instruction. The extra exposures in reading could contribute not only to the consolidation of this initial knowledge but also to the acquisition of other components of vocabulary knowledge. Importantly, increased attention to taught items during reading has the potential to further enhance this incremental development. Thus, it is crucial to understand the effects that pre-reading instruction has on the attention to pre-taught items during reading. The present study examines the role of pre-reading

instruction on learners' initial attention to pre-taught items in reading while controlling for frequency of exposure, providing a clearer picture of the benefits of pre-reading instruction on vocabulary learning.

Background

Direct teaching of vocabulary is a common pre-reading activity used to introduce learners to unknown words that might be needed to comprehend a text (Grabe & Stoller, 2011). Vocabulary instruction before reading is thought to raise learners' awareness of items, leading to increased noticing when reading, thereby supporting vocabulary learning from reading (Nation, 2001). Empirical evidence has been provided to support the positive effect of pre-reading vocabulary instruction on reading comprehension (e.g., Webb, 2009), but very few studies have examined its benefits for L2 vocabulary learning.

The few available studies have provided evidence for the benefits of pre-reading instruction for vocabulary learning with young (Biemiller & Boote, 2006) and adult (File & Adams, 2010) learners. Biemiller and Boote (2006) compared vocabulary learning in two conditions: reading-only (with target words only encountered in the text), and explicit instruction (with target words encountered in the text and explained by the teachers before or during the reading). Results of meaning recall post-tests showed an advantage of explicit instruction over reading-only. File and Adams (2010) examined vocabulary learning in three conditions: reading-only, pre-reading instruction, and instruction during reading. Results of the study provided evidence for the advantage of explicit instruction over reading-only, but there was no difference between instruction before or during the reading.

Notably, these previous investigations assessed performance on vocabulary tests and did not explore how pre-reading instruction affected the processing of the taught words during reading.

Eye tracking has recently been used to examine learners' attention to novel vocabulary during reading (e.g., Elgort et al., 2018; Godfroid et al., 2018; Pellicer-Sánchez, 2016). In the context of learning from viewing, Montero Perez (2019) used eye-tracking to investigate the effect of pre-viewing instruction on learners' processing of taught and un-taught words during captioned viewing. The results of the study showed that pre-viewing instruction did not lead to differences in number of fixations and time spent on the target words in the captions. Differences between the processing of taught and un-taught target items were only found in skipping rate, which led the author to conclude that the effect of pre-viewing instruction was more pronounced in the vocabulary post-tests than in the eye-movement measures. To the authors' knowledge, only one study has used eye-tracking to examine learners' attention to target vocabulary with and without instruction in the context of reading. Pellicer-Sánchez et al. (2020) examined learners' eye movements to a set of target items repeated several times in a text in three conditions: pre-reading instruction (direct instruction + reading), reading-only, and reading baseline (same text with known, control items). Analysis of the eye-movement data showed that attention to the target items in both pre-reading instruction and reading-only conditions decreased in a similar way with further occurrences in the text. Importantly, results showed that the amount of attention that learners paid to the target items at the first encounter was the same regardless of whether they had been taught them before the reading or not. The findings from Montero Perez (2019) and Pellicer-Sánchez et al. (2020) are surprising as they go against claims that pre-reading instruction increases the salience and noticing of target items. They also fail to support the assumption that the processing of taught items should be similar to that of familiar words, as learners initially paid more attention to taught items than to control/known words. Notably, the analysis in Pellicer-Sánchez et al. (2020) looked at how target items were processed when they were first encountered in the reading text. For the reading-only condition, this was indeed the first time that the learners were exposed to the items. For the pre-reading instruction condition, this was the third time that

learners were exposed to the items (having seen them already in two pre-reading activities). To gain a clearer understanding of the effect of pre-reading instruction on online processing, it is important to examine processing in both conditions when number of exposures are matched. The present study addresses this issue by re-examining the effect of pre-reading instruction on the allocation of attention to taught vocabulary during the first encounter in reading while controlling for frequency of exposure. This analysis provides a more comprehensive understanding of the benefits of pre-reading instruction on vocabulary learning.

The Study

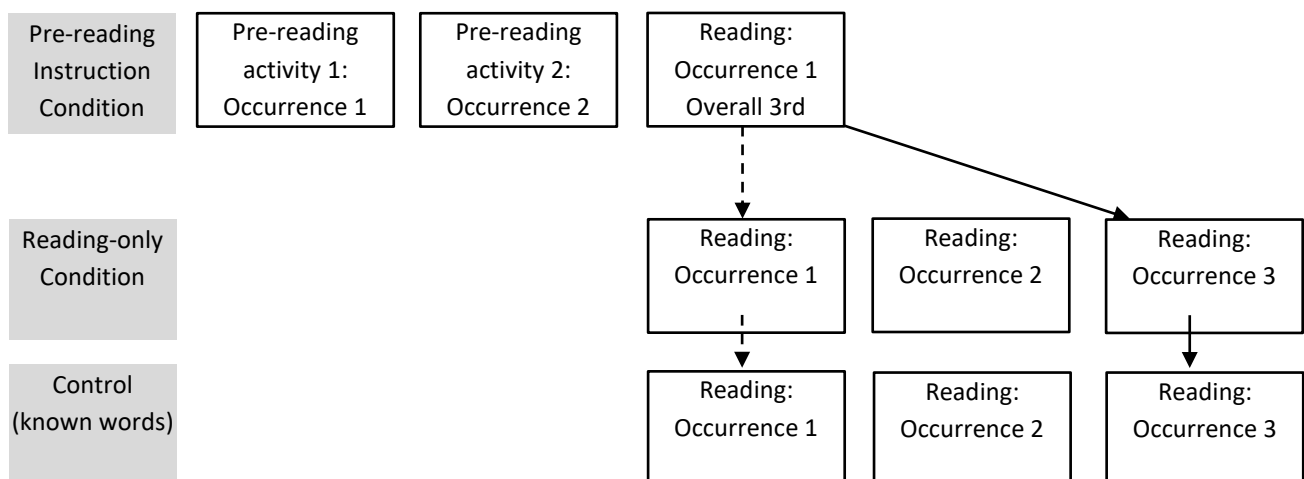
The current study (re-)examines the data from Pellicer-Sánchez et al. (2020) to explore the impact of pre-reading instruction on the allocation of attention to novel items in reading when the overall number of occurrences are accounted for, addressing the following research question:

- Does pre-reading instruction (i.e., intentional learning) have an effect on the processing of pre-taught vocabulary when initially encountered in reading?

The data set from Pellicer-Sánchez et al. (2020) includes recordings of eye movements while participants read a story that contained six target words repeated eight times in three different conditions (i.e., pre-reading instruction (followed by reading), reading-only, and reading-baseline). As explained above, the focus of the current investigation is the effect of pre-reading instruction on the processing of items when initially encountered in reading, as this is the finding that warranted further examination. As depicted in Figure 1, to ‘control’ for the additional occurrences of the (novel) words in the pre-reading instruction (i.e., two occurrences in the initial explicit activities), the first occurrence in reading in the pre-reading instruction condition (overall the third occurrence of the target items) is compared to the third occurrence of novel words in the text in the reading-only condition and the third occurrence of known words in the text in the control condition. It is important to note that, while this approach controls for the number of exposures

(i.e., third exposure in all cases), the type of exposure provided in the two initial exposures in both conditions were indeed different. If, as expected, the two exposures in the initial activities in the pre-reading instruction condition are more effective than the two exposures in reading in drawing learners' attention to the target items, this will be reflected in longer reading times on the target items in the pre-reading instruction than in the reading-only condition.

Figure 1. Depiction of what is being compared across the conditions with dotted (analysis from Pellicer-Sánchez, et al., 2020) and solid arrows (new analysis) indicating comparisons.



Methods

Participants

The data set included data from ninety-two L1 English speakers and 88 L2 English speakers (from various L1 backgrounds). Their vocabulary size was measured by the V_Yes-No v1.01 (Meara & Miralpeix, 2015): L1 speakers $M = 8,682.04$ words, $SD = 740.28$; L2 speakers $M = 6,924.40$ words, $SD = 1,153.30$. (For a complete description of participants and methods see Pellicer-Sánchez et al., 2020).

Materials

The reading text used in Pellicer-Sánchez et al. (2020) was a story which contained six target pseudowords repeated eight times for the pre-reading instruction and reading-only conditions and a matched story with real words in the control condition. Knowledge of the 4,000 most frequent words in English provided a lexical coverage of 98% in the text with the pseudowords and 99% in the control condition. The story was presented over 25 screens on a computer monitor, with no more than two pseudowords on a screen. The text was black on a white background in point-18, Courier New font with double spacing (as advised by Conklin, Pellicer-Sánchez, & Carrol, 2018). The target pseudowords/control words never occurred at the end or beginning of a sentence or at a line break. Twelve true-false statements checked participants' general comprehension of the story. The six pseudowords used by Pellicer-Sánchez et al. (2020) were controlled for neighbourhood size, number of body neighbours, and number of phonological neighbours (min=1, max=5). The pseudowords replaced high frequency words in the story, which occurred in the control condition. The real nouns and the pseudowords were of the same length (in characters and syllables).

Participants in the pre-reading instruction condition completed two activities before the reading: memorising words and their definitions from a list and a matching activity.

Procedure

Participants in Pellicer-Sánchez et al. (2020) were randomly allocated to one of the conditions. In the pre-reading instruction condition, participants took part in the vocabulary learning activities. All participants did the vocabulary size test and the L2 speakers completed a language background questionnaire. Then participants read the story on a computer screen while their eye movements were recorded with a desktop-mounted, EyeLink 1000 Plus eye-tracker (SR Research, Canada) at 1000 Hz with an accuracy of 0.25-0.5° and a precision of < 0.01°. Recording was monocular (right eye) in the head-stabilised mode. An initial 9-point calibration was conducted before a practice

story and again before the experimental task. A drift correction was performed before each screen with additional calibrations carried out as necessary. Finally, participants did the vocabulary learning tests: *form recognition, meaning recall, and meaning recognition*. (These are not considered in the current study, so are not described further.)

Analysis

For the purposes of the current analysis, the data were analysed using *R* version 3.4.4 (R Core Team, 2013). Linear mixed effects models were fit to take into account by item (target word) and by subject variation in the same model using the *lme4* package (Bates, Maechler, Bolker, & Walker, 2014). *P*-values were estimated using the *lmerTest* package (Kuznetsova, Brockhoff, & Bojesen Christensen, 2015). Total reading time and vocabulary scores were log-transformed to make sure that all of the predictor variables were on the same scale. The model included the experimental condition (pre-reading instruction, reading-only or control), participant group (L1 or L2), and vocabulary scores of the participants. Length of the target words was also added as a covariate. We tested an interaction between condition and group, but it was dropped from the final model as it was non-significant and did not improve model fit¹.

Results

We compared total reading times during: a) the first occurrence in reading in all three conditions (as analysed and reported in Pellicer-Sánchez, et al., 2020), which for the pre-reading instruction group was in fact the third encounter with the words while it was the first for the reading-only group (dotted lines in Figure 1); and b) the third (matched) occurrence (solid lines in Figure 1). The means and standard errors of both language groups in all three conditions are summarized in Figure 2.

Figure 2. Total reading times in the pre-reading instruction (PRI), reading-only (RO) and control (C) conditions

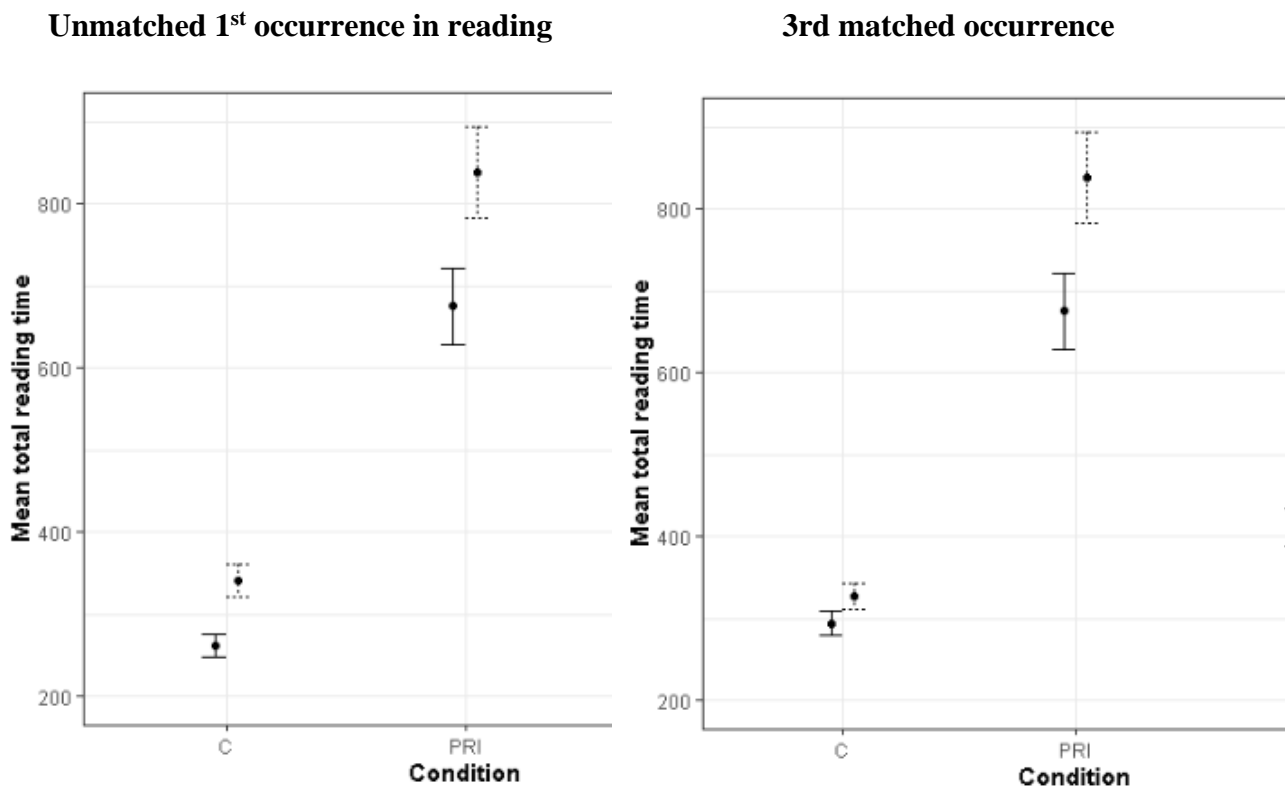


Figure 2 shows that during the first occurrence in reading (left panel), total reading times in the pre-reading instruction and reading-only were very similar. When we analysed the third (matched) encounter (right panel), that takes into account the fact that participants in pre-reading instruction had already encountered the target words during the instruction stage, the difference between pre-reading instruction and reading-only was much more pronounced. Total reading times in the pre-reading instruction condition were longer than in reading-only for both L1 and L2 speakers. We analysed these differences statistically. Table 1 summarizes mixed effects model predicting total reading time during the third occurrence. The same analysis for the first occurrence in reading (same as analysed in Pellicer-Sánchez et al., 2020) is presented alongside for comparison.

Table 1. Total reading times during the third (matched) occurrence and first occurrence in reading

Log-transformed total reading time								
<i>Predictors</i>	Third (matched) occurrence				First occurrence in reading			
	<i>Estimates</i>	<i>SE</i>	<i>CI</i>	<i>p</i>	<i>Estimates</i>	<i>SE</i>	<i>CI</i>	<i>p</i>
(Intercept)	15.258	1.989	11.360 – 19.155	.000***	16.551	2.070	12.494 – 20.609	.000***
Condition [C]	-0.420	0.081	-0.578 – -0.263	.000***	-0.686	0.083	-0.849 – -0.524	.000***
Condition [PRI]	0.365	0.078	0.213 – 0.518	.000***	0.142	0.080	-0.015 – 0.299	.077
Group [L2]	0.035	0.078	-0.119 – 0.188	.658	-0.018	0.081	-0.176 – 0.140	.826
Vocabulary score	-1.086	0.220	-1.517 – -0.655	.000***	-1.211	0.227	-1.657 – -0.766	.001***
Length	0.088	0.025	0.040 – 0.136	.024*	0.103	0.051	0.003 – 0.203	.044*
Random Effects								
Residuals		0.279			0.273			
Participant (intercept)		0.074			0.084			
Word (intercept)		0.004			0.027			
Marginal R^2 / Conditional R^2		.293 / .448			.329 / .523			

Note: *** $p < .001$, ** $p < .01$, * $p < .05$.

As Table 1 shows, the models for the first or the third occurrence are very similar: the same predictors are significant; their estimates have the same signs and similar strengths. The only difference lies in the effect of the pre-reading instruction condition. For the first occurrence in reading, as reported in Pellicer-Sánchez et al. (2020), there was no significant difference between pre-reading instruction and reading-only conditions. However, when we took into account initial encounters at the instruction stage and looked at the third overall occurrence across conditions,

there was a significant difference between pre-reading instruction and reading-only conditions, with target words in pre-reading instruction receiving more attention.

Discussion and Conclusions

The aim of the present study was to examine the effect of pre-reading instruction on learners' initial attention to taught lexical items while controlling for frequency of occurrence. Specifically, it aimed to further examine the recent finding that pre-reading instruction does *not* lead to differences in amount of attention allocated to taught items when first encountered in the text (Pellicer-Sánchez, et al., 2020). The current analysis focused on the first encounter of the taught items in the text in the pre-reading instruction and compared it to the matched exposure in the reading-only and control conditions. By controlling frequency of exposure, and therefore implementing a different approach to data analysis, a new finding emerged. The results of the study showed that, when frequency of occurrence is controlled for and matched occurrences are compared, there is a clear effect of pre-reading instruction on the amount of attention paid to taught items when they are initially encountered in the text. This analysis demonstrates that pre-reading instruction does lead to increased attention, when compared to reading-only.

The results from this study extend previous findings, showing that pre-reading instruction has a positive effect not only on learners' reading comprehension (e.g., Webb, 2009) and vocabulary learning (e.g., Biemeller & Boote, 2006; File & Adams, 2010), but also on the cognitive processing of the taught items, leading to increased attention. This finding provides empirical evidence for the claim that pre-reading instruction increases the salience and cognitive processing of target vocabulary (Paribahkt & Wesche, 1993, 1996). Importantly, it provides support for the use of pre-reading instruction as an attention-drawing device. The study by Pellicer-Sánchez, et al. (2020) compared vocabulary gains in the pre-reading instruction (followed by reading) with those of reading-only and instruction-only and showed that the extra exposures in reading in the pre-

reading instruction further contributed to vocabulary gains, beyond what was learned from the initial activities. Thus, this study suggests that the benefits of pre-reading instruction on vocabulary gains reported in previous studies could indeed be attributed to increased initial attention, further supporting the role of attention and engagement in vocabulary learning.

These results have important methodological implications. The study of eye movements in Pellicer-Sánchez, et al., (2020) did not show differences in amount of attention to target vocabulary between pre-reading instruction and reading-only conditions. This led the authors to conclude that the effect of pre-reading instruction might not be reflected in the amount of attention but in the manner in which lexical items were processed. A similar conclusion was drawn by Montero Perez (2019) in the context of pre-viewing instruction. She explained that the similar amounts of attention paid to taught and un-taught lexical items might reflect different underlying processes, i.e., rehearsal or retrieval for taught items and lack of familiarity for un-taught items. The findings of the present study suggest that, when the confounding effect of frequency of exposure is controlled for, the effect of pre-reading instruction is evident in the amount of attention and cognitive effort. Thus, we do not have to hypothesise differences in processing; they are evident when the number of occurrences is controlled for. These findings suggest that eye movements can indeed capture the increased initial noticing that pre-reading instruction leads to. The present analysis focused on the initial encounter. Future studies might want to examine the processing of subsequent matched encounters.

It is important to note that in the present study, the initial exposures in the pre-reading instruction condition were considered to be two, since there were two pre-reading activities. However, it is possible that learners looked a word more than once in an activity. Thus, it is likely that, while for most participants the first encounter in reading in this condition was the overall third exposure, for some participants it might have been greater. While this is possible, it is a

likely limitation of most vocabulary learning studies. Researchers can manipulate the number of exposures in the conditions we create but it is difficult to control for the number of times that learners themselves decide to engage with the items. It is also important to note that the analysis of matched encounters in the present study involved comparing the processing of items that appeared in different textual environments. While the story was carefully designed to control for contextual informativeness, processing patterns could have been affected by contextual features.

To conclude, results from the present study demonstrate that pre-reading instruction leads to increased initial attention to target vocabulary, supporting the role of attention and engagement in vocabulary learning and contributing to our understanding of the effects of pre-reading instruction as an attention-drawing technique.

Notes

¹ The same analyses were conducted with other eye-movement measures. The same pattern of results was found with first fixation duration, fixation count, and total reading time. Gaze duration did not show a significant difference between pre-reading instruction and reading-only. Total reading time was selected for the present study as it includes first fixation, gaze durations, and any subsequent re-reading and therefore, better reflected overall attention to the target items at the initial encounter in reading.

Authors Bio

Ana Pellicer-Sánchez is Associate Professor of Applied Linguistics and TESOL at the UCL Institute of Education. Her research centres around the teaching and learning of vocabulary in a second or foreign language, with a particular focus on the use of eye-tracking to explore the cognitive processes involved in vocabulary learning.

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