The Impact of the Redundancy Effect on L2 Reading Comprehension Skills: A comparative study

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Abstract

This paper sets out to explore the extent to which the redundancy effect influences the L2 (second language) reading comprehension skills of two groups of learners of different ages and English language proficiency. The participants’ L1 (first language) was Spanish. Some of them were teenagers with low-intermediate L2 proficiency level, and the remaining were adults whose command of English was advanced. Each group was divided into two sets, one being exposed to a single mode of instruction (reading alone), while the other to a dual format (reading and listening). The students exposed to the simple presentation format outperformed the other group in a reading comprehension task, independently of their command of the language. Furthermore, when comparing results obtained in both read-only groups (low intermediate and advanced), the older students with higher L2 proficiency level obtained better results. Pedagogical implications of these findings will be discussed.

Key words: Cognitive load, reading comprehension, instruction, redundancy effect
Introduction

The process of comprehension involves the construction of a mental representation of a text (Kintsch, 1998; Zwaan & Radvansky, 1998). Several simultaneous operations are involved in it; lexical processes are required to access word meanings, memory retrieval is required to elaborate on the text and thus form connections to prior knowledge, and inference processes are crucial when it comes to integrating a sentence with prior ones and background knowledge (Moss, Schunn, Schneider, McNamara & VanLehn, 2011). Comprehension, then, becomes a determining predictor of success in language learning as it involves mental processes of learning, memory and problem solving. These procedures allow learners to build up a knowledge system which can be automatically called on for speaking and understanding.

Cognitive load refers to the entire load which is imposed on working memory during human mental activities (Gao, 2012), and it has been used in the analysis of common instructional procedures (Sweller, 2003, 2004), which may produce the so-called redundancy effect (henceforth, RE). The RE occurs when the same information is presented to learners simultaneously through different modes of instruction generating an extraneous cognitive load which obstructs learning (Chandler & Sweller, 1991; Sweller, 2005; Sweller & Chandler, 1994).

In the second/foreign language-learning classroom, students are often provided with a spoken version of a written text they are supposed to work with. It is overtly suggested among teachers -and even believed so by many students- that this multiple format mode of instruction reinforces learning. However, the effectiveness of this practice is highly questioned by CLT.

This paper aims to explore the extent to which the RE impinges on comprehension skills of two groups of L2 learners whose ages and language proficiency levels differed widely. The first group was made up of teenagers from a private school in Mar del Plata, Argentina with a low-intermediate command of L2. The second group was composed of adult English majors from the Teacher Training Program at Universidad Nacional de Mar del Plata. The first part

of the paper will include the theoretical background regarding CLT and RE. Following this section, the participants will be described and the method employed for the research will be explained. Next, the results will be presented and the findings discussed. Finally, some avenues for further research will be addressed.

Theoretical framework

Over the last decades, there has been a growing interest in the field of reading comprehension in a second/foreign language. In this scenario, comprehension cannot be merely reduced to a process of accessing word meanings and combining them; it is an undeniably more active and complex process as there are a number of interactive variables involved in it. When learners tackle a comprehension task, they must resort to several cognitive procedures to select information from discourse clues, and connect it to their existing knowledge located in long-term memory (Gao, 2012).

It is often the case that many second/foreign language instructors use an explicit dual mode of presenting a text to teach reading comprehension. They believe that presenting information to their students through multiple formats will actually foster reading comprehension. Yet, this actually turns out to be counterproductive for comprehension purposes as it has been demonstrated that simultaneous reading and listening is less effective than reading alone.

Learning structures are defined in terms of an information processing system involving long term memory, which stores all of our knowledge and skills on a more-or-less permanent basis and working memory, which performs the intellectual tasks associated with consciousness. It is the medium through which we are allowed to think both logically and creatively, to solve problems and express ourselves. Working memory is closely related to where and how we direct our attention to think about something, or to process information. (Sweller, 1999, 1994).

Only after being attended to and processed by working memory, information is saved in long term memory. It is important to highlight that the former is extremely restricted in both capacity and duration as it is incapable of dealing with more than eight elements of
information at the same time (Miller, 1956). These restrictions may slow down or even impede learning. If our working memory’s capacity is surpassed while processing a body of information, it is very likely that most of that information may not be recovered when needed.

Learning consists in the capacity of encoding or storing knowledge and skills into long-term memory in a way that they can be easily recovered and later applied on demand. This knowledge base is held in *schemas* and if they are well learnt, they may be recalled and applied with relative ease. Being able to recall schemas may be compared with learning to drive as both processes provide a good example of developing fluency and automaticity. When first learning to drive, novices cannot carry on a conversation while driving. As the driver gains confidence and experience, navigating the car and chatting simultaneously becomes easier. Similarly, novice readers whose ability to decode words is not yet fluent cannot devote attention to the task of understanding what they are reading until they have gained fluency and experience in the task (LaBerge & Samuels, 1974). Therefore, it can be argued that as learners become more proficient in the foreign language, they develop strategies to handle difficulties they might come across when tackling comprehension tasks.

Cognitive load can be understood as the burden that a task imposes on an individual’s working memory (Gao, 2012). Cognitive load may be classified into two different types: *intrinsic* and *extrinsic*. Chandler and Sweller (1991) first defined intrinsic cognitive load as the inherent difficulty of learning material. It is important to highlight that it cannot be altered by any instructional means other than changing the task or the levels of knowledge held by learners (Sweller, 1994). On the other hand, extrinsic cognitive load is defined as an unproductive burden imposed on the cognitive system which results from learners’ investing cognitive resources in activities which are irrelevant to learning. Unlike intrinsic cognitive load, the extraneous one typically results from an inappropriate mode of instruction and can therefore be altered and even reduced if a more effective instructional procedure is employed (Gao, 2012).
CLT has raised awareness regarding the drawbacks of many instructional procedures currently utilized in EFL classrooms (Sweller, 2003, 2004). One of these procedures is the redundancy effect, which occurs when the same information is presented to learners in different forms. Presenting information to learners using a dual-format forces them to synchronize psychologically the multiple forms and inflicts an extraneous cognitive load on them that hinders learning (Chandler & Sweller, 1991; Sweller, 2005; Sweller & Chandler, 1994).

When it comes to exploring pedagogical purposes in the second/foreign language field, it must be borne in mind that the quality of instructional design affects reading comprehension and even language acquisition. Many studies based on CLT suggest that multiple forms of presenting information hinder comprehension.

In a study, carried out with a group of 30 students preparing to take the TOEFL (Test of English as a Foreign Language) exam at a private middle school in Mar del Plata, Argentina, Machado & Luchini (2013) showed that there were significant differences in gain scores in a reading comprehension task across the two presentation modes of instruction. Examination of text comprehension scores indicated that learners exposed to the reading alone mode (group A) obtained better results than those in group B, exposed to the redundant mode of instruction (read and listen). That is, the students who only read the text were able to retrieve more main ideas than the other group which read and listen to the same material at the same time. In a similar study conducted with EFL trainees at a Teacher Training Program at a university in Mar del Plata, Argentina (Tuero, Luchini & Gómez Laich, 2012), similar results were obtained. In this investigation, two groups of university students were exposed to two different reading treatments: read alone and read and listen, and the group exposed to the reading alone treatment outperformed the other one.

In a similar vein, Luchini & Ferreiro (2014) did another study in which they analyzed the impact of the RE on the L2 reading comprehension skills of a group of learners, taking a low-intermediate course in English in a local middle school in Mar del Plata, Argentina. The
students, divided into two groups, were exposed to a single mode of instruction and with a multiple format presentation, respectively. Data were collated using a text that was cautiously chosen to meet the students’ age and L2 proficiency level. After completing the reading task, both groups completed a questionnaire, and five students from each group were interviewed individually. Qualitative and quantitative data were cross-checked. Findings revealed that the non-redundant group scored better results than the other group.

In another two experimental studies, and using the CLT as the theoretical framework, Luchini (2015) and Luchini, Ferreiro & Gonzalez (2016) also analyzed the extent to which the RE influences the L2 reading comprehension skills of two groups of young learners in private schools in Mar del Plata, Argentina. In both experiments, the participants were divided into two groups: A & B, and each completed the same reading comprehension task independently, but each used a different mode of presentation. Group A was exposed to a single mode of instruction (reading alone), while group B was presented with a dual format (reading + listening). Both groups had the same amount of time on task. Results in both experiments revealed that the non-redundant groups did better than the redundant groups. Once more these findings were consistent with the ones obtained by other similar investigations in similar contexts.

That is, if tenets from cognitive load theory were used when designing instructional materials and working memory’s role and its limitations were taken into account, better results could be obtained. In most ESL and EFL reading comprehension lessons, teachers often present reading comprehension activities in a way that implicitly assumes that spoken and written text should be presented jointly. The belief underlying this teaching practice is that the more integrative the presentation modes are, the more beneficial for learning they will be.

CLT suggests that instructional design that pushes learners to split their attention between multiple sources of information is ineffective for learning to happen. Furthermore, information should be conflated into one and presented to learners through a single mode that does not impose a heavy extraneous cognitive load and saves learners from performing
unnecessary mental integrations that interfere with learning. Seemingly, reading comprehension skills are polished by learners as their language proficiency increases. Other research projects have also underscored the importance of age in the development of reading comprehension skills and strategies. Results obtained from these studies, in fact, showed that learners’ spans of working memory improved with their age (Gao, 2012).

**Method**

**Context and participants**

The participants in this study were two groups of students learning English as a foreign language of two different age groups and proficiency levels. The group of young learners consisted of twenty-four students aged 13, enrolled in a low-intermediate course at CADS (Colegio Atlántico del Sur), Mar del Plata, Argentina. CADS is a private school where students have English classes twice a week, and receive a total of 4 weekly hours of instruction, starting at kindergarten and finishing in High School. These learners received training to take the PET Cambridge Exam. The group of adults was formed by 35 students aged 20 or more, with an advanced level of English. These students were taking Advanced Communication I and II at the English Teacher Training Course (ETTC) at Universidad Nacional de Mar del Plata (UNMdP). These courses focus on language development and are taught in the last stage of the program. They belong to the area of Linguistic Skills.

To carry out this experiment, researchers worked separately with each group of learners (young learners and adults). Each group of students was randomly arranged in two subgroups (A & B), in order to complete a reading task separately. Group A, which included both young and adult learners, was exposed to a single mode of instruction (reading alone), while Group B was asked to read and listen to the same scripted text simultaneously.

**Research instruments and Procedures**

The instruments used to gather data were two different texts. These texts were used with young learners and adults, accordingly. Level of linguistic challenge as well as length and topic were taken into consideration for the selection of the texts. This was done in an attempt to choose pieces of discourse appropriate for each group. The text chosen for young learners
was “Plastic Ducks Lost at Sea”. It consisted of about 500 words, and was taken from the students’ course book PET Result (Baker, 2010). Because students were preparing for PET in their English class, they were familiar with this type of material. This assured that no extra complexity was being imposed to these learners by the text itself.

In the case of the adults, the text used was an extract from a short story called “Window in the Sea”, by Ralph Nading Hill (1856). This text consisted of 367 words. Although this was a little shorter than the text used with the young learners, it contained more complex vocabulary and grammatical structures.

To evaluate the data that would be obtained from the students, both texts were segmented into linguistic units or clauses, following the usual procedure used to measure prose objectively (Lee & Ballman, 1987). A group of eight judge evaluators classified those linguistic units into main and secondary ideas, following Johnson’s methodology (1981). Discrepancies in the classification of ideas were discussed, and finally agreed upon among the evaluators. Inter-rater reliability was used. In the end, 9 main ideas were identified in each of the texts used.

The days on which the data were collected, researchers introduced themselves to students, and let them know that they should all carefully read a text that would be screened, trying to understand and remember the greatest amount of information as possible. To facilitate the screening of the texts, they were fragmented into different paragraphs, each similar in length. These paragraphs were shown to both young and adult learners respectively on successive power point slides. Each slide was held on display for about 30 seconds. The pacing of the slides was controlled by the researchers. Both young and adults learners were then separated into subgroups A: “Read Only” (RO), and B: “Read and Listen” (RL), respectively. Researchers worked with each subgroup in different rooms.

The RO group was subjected to a single mode presentation of the text. Students just silently read the text from the screen. Participants from the RL group were exposed to a dual format,
as they were presented with the on-screen text (just as group A), along with a synchronized redundant audio narration.

Right after completion of the reading and reading + listening tasks, learners in both groups were asked to write a summary of the text, containing as much information as they could retrieve. The methodology of free recall utilized by Diao and Sweller (2007) was applied, considering that what is understood can be remembered. Students were told not to worry about expressing ideas in the same chronological order in which they had appeared on the screen. Researchers pointed out, too, that grammar and spelling mistakes would not be considered, as the focus of the task was on ideas remembered, and not on how accurately they were expressed. Students were also allowed to write their summaries in L1 or L2, according to their preference to facilitate the expression of their ideas.

**Data Analysis**

The data analyzed were the summaries collected from groups A and B of both young and adult learners. In order to evaluate how many main ideas the students had remembered, researchers carefully examined the students’ productions, identifying and counting how many main ideas out of the ones previously selected they had recalled. The “master rating” (total number of main ideas counting all students within a group) for young learners was 108 and for adult learners was 153. The total number of main ideas recalled in each group was compared to its corresponding master rating.

**Results**

Results were analyzed on two different levels: (i) Differences between RO and RL groups within each age group; and (ii) Differences between intermediate and advanced learners. Considering the first level of analysis (i), there were significant differences in gain scores across the two presentation modes. In the case of young learners, the students exposed to the reading alone treatment identified 51 main ideas out of the total average of 108, while those

presented with the dual mode of instruction spotted 32 main ideas. Table 1 below summarizes the means score for each group and the difference between the means in percentages:

<table>
<thead>
<tr>
<th>LOW-INTERMEDIATE LEARNERS</th>
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<tbody>
<tr>
<td>Group A (Read only)</td>
<td>47.22 %</td>
</tr>
<tr>
<td>Group B (Read and Listen)</td>
<td>29.62 %</td>
</tr>
</tbody>
</table>

*Table 1. Difference between the Means for Low-Intermediate Learners*

As Table 1 shows, students from group A, who were presented the text through a single mode, obtained better results than those in group B, who were subjected to the redundant instruction modality. The difference between the means (17.6%) shows that group A could recall more main ideas than group B. Similar results were obtained with the group of advanced students, though the gap between groups A and B was not as significant as that obtained among the subgroups of young learners. Students exposed to a single-format presentation were able to retrieve 85 main ideas out of 153, whereas learners who read and listened simultaneously recalled 68. The means score for each group, and the variations between the means in percentages are represented in Table 2 below:

<table>
<thead>
<tr>
<th>ADVANCED LEARNERS</th>
<th></th>
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<tbody>
<tr>
<td>Group A (Read only)</td>
<td>55.5 %</td>
</tr>
<tr>
<td>Group B (Read and Listen)</td>
<td>44.45 %</td>
</tr>
</tbody>
</table>

*Table 2. Difference between the Means for Advanced Learners*

The results obtained with advanced students correspond with those gained from the young learners, favoring a single mode presentation. In this instance, the variation between means was of 11.05 %, supporting the use of a single format presentation.
Taking into consideration the second level of analysis, the results obtained from low-intermediate students were compared with those gathered from advanced learners. The findings obtained from this comparison showed that, though with both groups there were better results in recall of main ideas when using a single mode presentation, the redundancy effect instilled by a simultaneous dual format instruction decreased with students who had a higher level of L2 proficiency.

Discussion and conclusion

The results obtained in this study indicate that applying a dual mode presentation increases the redundancy effect in reading comprehension tasks. A double format of presentation hinders the recall of main ideas after reading a text, because this imposes an extraneous cognitive load. A single mode method in the presentation of information is more appropriate, as it increases the number of key ideas to be retrieved.

Even though students of varied ages and, more importantly, different levels of L2 proficiency benefit from single-modality presentation, advanced students do it less. We believe that because they have studied the language for more time, and thus developed more strategies to cope with varied difficulties when reading a text, the RE is not as detrimental for advanced learners as it is for less proficient students.

These findings actually challenge very common practices held by foreign language teachers, and even by some theories of Second Language Acquisition, which promote the use of multiple presentations. What needs to be distinguished here is that presenting information in different modalities is beneficial to attend to different learning styles (kinesthetic, visual, auditory, etc.) and to bring variety into the classroom. However, the assumption being defied here is that of presenting the exact same information in more than one mode simultaneously.

CLT argues that the load directed towards constructing, processing and automating schemas can be manipulated and optimized by means of good instructional design in ways that help learning by directing attention to more relevant learning processes. The findings of the
present research show that this outcome is achieved more effectively by one modality mode than the redundant mode.

**Some pedagogical implications**

First, from a pedagogical and instructional perspective, the results obtained in this study indicate that some habitual practices in the Foreign Language classroom need to be reconsidered and readapted. Teachers should not ask their students to read and listen to the exact same information at the same time when the aim is to teach or develop reading comprehension. Approaching a text in a foreign language is already a very challenging task for students, so instructors should ensure not to be adding any extra difficulty that could impinge on reading comprehension. The intrinsic linguistic difficulties presented by a piece of discourse are out of teachers’ control, but it is through instruction that a difference can be made. In order to facilitate learning, teachers should use instructional methods that will reduce extraneous or unnecessary cognitive load.

An analogous reasoning can be applied when approaching instructions to activities on tasks. Even if the primary goal of a task is not reading comprehension, but, for instance, writing, learners need to process and understand instructions accurately before completing the activity provided. Therefore, if teachers read instructions out loud at the same time that students are reading the instructions, they are impinging on the understanding of those guidelines. The most appropriate practice in this scenario is to let students read instructions on their own, give them time to process and comprehend that information, and only then, the teacher could paraphrase, clarify, or enlarge on the written instruction provided, to clear any possible doubts.

As for material designers, the same should be taken into consideration. It is very common to find reading comprehension tasks in foreign language course books that encourage the simultaneous reading and listening of a text. This could be done as a second step to pursue a different aim, or as a follow-up activity to focus on, for instance, pronunciation. However, if the task that students are required to complete focuses on understanding ideas in the text, instructions should guide students into only reading, to reduce an unnecessary cognitive load.
Limitations of the study

However revealing the results of this study may have been, there are some limitations that need to be taken into consideration. First, the number of participants in this experiment represents a small portion of the student population learning English as a Foreign Language both in the school and at college. To obtain results that are more representative of the student population, and therefore more generalizable, the study could be carried out with more students in the selected institutions, as well as in others.

On a second note, all the data collected for this study have a quantitative nature. Even though this type of data offers compelling results than can be easily organized and processed into percentages to compare performances, the collection of qualitative data would have made the analysis of the results more comprehensive. This could be done by having one-to-one or group interviews with the students or by asking them to write about their feelings or responses to the activity carried out. These two methods of data collection and analysis could then be crosschecked to compare and evaluate any possible correlations or disparities in results. The triangulation technique would further increase the validity of these results.

Avenues for further research

As was stated in the previous section of this paper, it would be interesting to carry out this experiment with a larger student sample to obtain more generalizable results. The collection of qualitative data would as well expand the reach of the study.

A thought-provoking variation that could be applied to this experiment is analyzing, not only students’ recall of main ideas, but of secondary, and distracting ideas as well. This could help researchers evaluate if the RE that occurs when information is presented in a dual format also affects the type of ideas remembered.

Finally, as was hinted at in the “Implications” section above, it could be interesting to conduct a similar experiment focusing on learners’ understanding of instructions, in particular. Again, the triangulation technique and the crosschecking of information coming from both qualitative and quantitative data could be applied to yield more reliable and robust results.

References


