

THE RELATION BETWEEN EXTENSIVE READING AND WORKING MEMORY, PROCESSING SPEED, LEARNING MOTIVATION AND LITERACY SKILLS IN A FOREIGN LANGUAGE

LA RELACIÓN ENTRE LA LECTURA EXTENSIVA Y LA MEMORIA DE TRABAJO, LA VELOCIDAD DE PROCESAMIENTO, LA MOTIVACIÓN HACIA EL APRENDIZAJE Y LAS HABILIDADES LECTO-ESCRITORAS EN LENGUA EXTRANJERA

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ABSTRACT

This article reports on a research project carried out between 2018 and 2019 with eight grade students from two private schools of Medellín, Colombia. The objective of the study was to analyze the relation among an Extensive Reading (ER) program (as proposed by Day and Bamford, 1998) with working memory, processing speed, motivation towards learning and the development of reading and writing skills in English as a Foreign Language (EFL). This project had a pre experimental method with variable control on the age, school level and neuro-cognitive diagnosis of the students who participated in it. Results show an influencing relation between ER and working memory, processing speed and motivation which can explain the cognitive effectiveness of this program. Finally, conclusions regarding the program's strengths given the impact it had on students' cognitive performance and learning motivation, limitations on its implementation and future research possibilities are discussed.

Keywords: Extensive reading, working memory, processing speed, motivation, reading and writing skills, English as a Foreign Language.

RESUMEN

Este artículo informa sobre un proyecto de investigación llevado a cabo entre 2018 y 2019 con estudiantes de octavo grado de dos escuelas privadas de Medellín, Colombia. El objetivo del estudio fue analizar la relación entre un programa de Lectura Extensa (ER) (según lo propuesto por Day y Bamford, 1998) con la memoria de trabajo, la velocidad de procesamiento, la motivación hacia el aprendizaje y el desarrollo de habilidades de lectura y escritura en inglés como Lengua Extranjera (EFL). Este proyecto implementó un método pre-experimental con control de variables sobre la edad, el nivel escolar y el diagnóstico neurocognitivo de los estudiantes que participaron en él. Los resultados muestran una relación influyente entre la lectura extensiva y la memoria de trabajo, la velocidad de procesamiento y la motivación, lo que puede explicar la efectividad cognitiva de este programa. Finalmente, se discuten las conclusiones sobre las fortalezas del programa dado el impacto que tuvo en el rendimiento cognitivo y la motivación hacia el aprendizaje de los estudiantes, las limitaciones en su implementación y las posibilidades de investigación futuras.

Palabras clave: Lectura extensiva, memoria de trabajo, velocidad de procesamiento, motivación, habilidades de lectura y escritura, inglés como lengua extranjera.

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1. INTRODUCTION

Reading, and most especially reading in a foreign language, has been a wide topic of debate among EFL teachers and researchers, having agreed that it is both highly important, but also one of the most challenging skills to develop in these contexts. Given this background, there have been considerable efforts to enhance reading skills in foreign language classrooms, some, as expected, having greater impact than others, but all of them contributing to the development of new alternatives and strategies that may lead to better results.

One of the most successful strategies according to research (Al-Homoud and Schmitt, 2009; Poulshock, 2010; Alzu'bi, 2013; Senoo and Yonemoto, 2014), has been Extensive Reading (henceforth referred to as ER in this paper). This reading method was described in 1998 by Day and Bamford in their book "Extensive Reading in the Second Language Classroom", as a method in which students and teachers negotiate key aspects of their reading process, such as the used materials, the reading pace, their opportunities to change materials and the evaluation process. Since its publishing, the amount of research on this method has grown at a considerable rate.

Shin (2013) goes on to deeper and further analyze the advantages of extensive reading by comparing it to other two reading methodologies that have been implemented in EFL teaching (the grammar- translation method and the com-

prehension-questions approach). He suggests that, given the learner-centered approach to education that has grown since the late 20th century, ER provides better resources for teachers to develop linguistic fluency in their students, rather than the old-fashioned concept of native-like accuracy and accent.

However, research on ER has been mostly limited to linguistic development aspects such as vocabulary growth, reading comprehension and writing performance, narrowing the research potential this alternative strategy to the teaching of reading in a foreign language has. This paper reports on a quantitative research carried out between 2018 and 2019, in which a group of eight grade students was exposed to a year-long extensive reading program, their scores on working memory, processing speed, motivation and performance in reading and writing were measured and compared to those of a control group that was matched according to sex, age, school level, socio-economical strata of the school and general academic performance.

This research intends to provide evidence of the neuro-cognitive, psychological and educational benefits of extensive reading, and to open new research possibilities in which new knowledge can be produced, which is why the following hypotheses were formulated: ER improves the vocabulary, reading comprehension, writing and motivation levels of EFL students; and there is a positive correlation between ER and the neuropsychological variables of working memory and processing speed. This last hypothesis is based on a study by Alptekin and Erçetin (2010) which found that performance in working memory affects reading processes in a foreign language, however, there is no research to support if this relation is bidirectional.

Finally, this paper aims at answering the question of what is the relation between extensive reading and: working memory, processing speed, motivation towards learning and literacy skills in English as a Foreign Language (EFL) learning in 8th grade students from private schools in Medellín, Colombia?

2. THEORETICAL FRAMEWORK

There have been a significant number of projects that connect extensive reading and aspects like vocabulary development, reading fluency and comprehension, motivation and self-regulation processes. This section will mention some of the most relevant studies in the field, which give theoretical support to the present research.

The relationship between extensive reading and vocabulary development has been proven several times, there are accurate instruments that measure not only students' amount of vocabulary, but also its depth. Tests like the VLT (Vocabulary Length Test) and the WAT (Word Association Test), for example, were used by Al-Homoud and Schmitt (2009), proving that extensive reading had a positive effect on 70 Saudi Arabian students' knowledge and use of new words when learn-

ing English as a foreign language, increasing their vocabulary by 33% more than the control group used in the study. Alzu'bi (2013) considered a TOEFL-based vocabulary test for the 41 Jordanian students of his research, results report that their scores significantly improved after being exposed for three semesters to an extensive reading approach.

Iqbal and Komal (2017) also analyzed the incidence of an extensive reading program in vocabulary development by exposing 100 eight graders (ages 12 to 15) from Singapore to a 12-week extensive reading program and measured them with the VKS (Vocabulary Knowledge Scale by Paribakht and Wesche, 1996) before and after the mentioned intervention. They found that there was significant growth in the amount of words students handled, although they also pointed out that improvement could have been higher if the program had been longer.

Reading comprehension and extensive reading have also been analyzed in several research projects, showing meaningful results in favor of this reading methodology. Authors agree that extensive reading provides a wider and more integral understanding of texts, allowing them to comprehend them faster and obtaining more details from them. Iwahori (2008) found that students' reading comprehension is improved by extensive reading, students' scores in this study went from a median of 46 to 52 in the implemented C-test taken by the subjects before and after the seven-week extensive reading program of the project. Poulshock (2010) exposed thirty-four students to a two-semester extensive reading program using not only graded readers but also LAS (Liberal Arts and Sciences) texts, reporting in the used Likert scale that students perceived extensive reading as much more useful for their learning process than the previously implemented methodology they had, this study also used the BNC (British National Corpus) with a range of 2000 to 3000 words with the mentioned students, which also matched the graded readers they studied; results also indicated a significant improvement in vocabulary range, which increase was measured through 5 weekly vocabulary quizzes at the end of the project.

There is also empirical evidence that suggests that extensive reading benefits reading fluency and speed. Authors agree that promoting extensive reading in EFL classrooms can lead students to read more effectively without compromising accuracy. Iwahori (2008) found that students' reading fluency is improved by extensive reading by testing them with a 1-minute reading aloud exercise in which students went from reading 84.18 to 112.82 words per minute making more progress compared to groups that read through an intensive reading approach. Al-Homoud and Alsalloum (2012) found similar results with a group of 127 female EFL learners using the same tool as Iwahori and obtaining results in which these students moved from an average of reading 80 to 170 words per minute.

Now, regarding motivation and extensive reading we find studies like the one of Takase (2007), which assessed the reading motivation of 219 female students

from Japan by using a Likert scale, in which students reported that after the year of the extensive reading intervention, they were more intrinsically motivated to read. These results were reinforced by Chen, Chen, Chen, and Wey (2013) by applying Stokmans's Reading Attitude Scale (1999) with 89 tertiary level EFL students from Taiwan (46 in the experimental group which received a ten-week extensive reading program and 43 in the control group). Results showed an improvement in students' attitude towards reading in components such as: utility, development and enjoyment.

Research also suggests that blending ICT's with extensive reading projects can also be beneficial for students as shown in Milliner and Cote (2015), they worked with 35 university students who were asked to read extensively for a year in their cellphones, tablets or computers during the assigned classes for this. Students reported not only better reading fluency results, but an increased interest in reading through the mentioned devices.

These studies have analyzed mostly the relation between pedagogical variables, leaving behind the neurocognitive component of learning, which is why it is necessary to deepen into this understanding by implementing interdisciplinary studies that support better pedagogical strategies such as this one.

3. RESEARCH OVERVIEW AND QUESTIONS

This research is framed in the field of neuropsychopedagogy, an interdisciplinary field of knowledge which aims at understanding, developing and improving learning processes. This is the reason for its objective, to analyze which teaching methodologies and / or strategies enhance the neurocognitive abilities that lead students to better academic results.

As it was stated before, the research question that guided this study is: what is the relation between extensive reading and the working memory, processing speed, motivation towards learning and literacy skills in English as a Foreign Language (EFL) learning in 8th grade students from private schools in Medellín, Colombia? In order to answer this question, this research developed the objective of establishing the relation between the independent and dependent variables of the study.

4. METHOD

This research was carried out in two private high schools of Medellín, Colombia. Both schools belonged to middle class, and have had similar academic results in national standardized tests for the last 10 years. This was a quantitative, pre-

experimental study in which the researcher controlled the following variables: sex, age, absence of neuropsychological diagnose and no additional instruction or environment for the learning of English as a foreign language; this was done in order to standardize as much as possible the sample of students that participated in the study.

The independent variable of the study was the implemented extensive reading program and the dependent variables that were analyzed were working memory, processing speed, motivation towards learning and the reading and writing performance of the participant students, which were measured (see section 4.2) in order to answer the question of their relationship.

4.1. Participants

The population were eight grade students of private high schools, aged 13 to 15, with no neuropsychological disorder diagnosis and no additional instruction or context in which they could develop higher communication skills in English. Sampling for this study was non-randomized, both schools were chosen by the researcher given her knowledge and experience in the educational background of the institutions. The final sample of students, after applying inclusion and exclusion criteria were 25 students in the control group and 32 in the experimental group.

As it was mentioned earlier, the 57 students who took part in the study, signed (along with their parents given the fact that they were underage), the consent form, additional to this, they answered a survey that collected their demographic data, in order to characterize the sample. In the following table, these demographic data are described.

The collected data show a fairly even distribution in all categories except the socio-economical strata of the students who participated in the study, being the students in the control group in higher strata than the ones in the experimental group, and therefore having higher possibilities to access better basic services and complementary activities than students in the experimental group, however, this fact did not seem to interfere with the results, given that students in the experimental group achieved better scores in some of the variables of the study (see Results below).

4.2. Instruments

This project was conceived from a neuropsychopedagogical perspective (given the researcher's academic formation in the field), because of this, instruments were

chosen in order to analyze data from all three perspectives, selecting tests that have been validated for Latin America and used in other research projects. These instruments and the variables they analyzed are described below:

- Neuropsychological tests: Toulouse-Pieron (2010) and WISC IV (2003) for working memory; WISC IV (2003) and D2 (Brickenkamp, 2002) for processing speed.
- Psychological questionnaire: ACRA support scale for learning motivation. (Román Sánchez & Gallego Rico, 1994)
- Cambridge KET – Key English Test (reading and writing sections) for literacy skills in English.

As shown above, from these tests, all validated for Latin America and with high acceptance in this context, four dependent variables were chosen: working memory, processing speed, learning motivation and performance in reading and writing in English as a foreign language; the independent variable was the extensive reading program to which only the experimental group was exposed. After the intervention of extensive reading was finished, the researcher performed the same tests to both groups with the exception of Toulouse-Pieron which was replaced by the D2 test and the used subtests from WISC IV, which in the pretest were the compulsory subtests and in the posttest were the additional ones.

4.3. Procedure

Before participating in the study, students and parents were informed of the project's procedures and they gave their consent in written form. After all consents were signed and collected, the researcher trained the English teacher of the experimental group in the development of an extensive reading program for 10 hours; once the teacher fully understood the way the program should be carried out, she started the program with her students. This program was developed for an academic year (40 weeks) with a frequency of 2 hours per week and consisted mostly on making agreements between teacher and students regarding the reading material, the pace and the assessment of the reading process. During the first week of the intervention, the researcher performed the pretest to both groups (experimental and control). After the extensive reading program (and the academic year) was done, the researcher performed the posttest to both groups as well.

In order to gather all data from both the experimental and the control groups, the researcher had the support of a group of students from Universidad Católica Luis Amigó who were trained along with her in the application and scoring of all the tests which were administered. Each session lasted 60 minutes.

4.4. Statistical analysis

Once all data was collected, they were organized and filtered in Microsoft Excel before being exported to the Statistical Package for Social Sciences (SPSS), version 24 for Windows. According to the nature of the variables and their scales, the researcher ran distribution analysis that established they did not have a normal distribution; because of this, quantitative data were processed through their medians and interquartile ranges, while qualitative data were processed through frequencies and percentages. Data was also used to run Spearman correlation analysis to establish possible associations and finally both groups (experimental and control) were compared through the U of Mann-Whitney test for non-parametric measurements.

5. RESULTS

According to the performed descriptive analysis, carried out through crossed tables and the statistic of Chi², the experimental and control groups are meaningfully differentiated by their socio-economical strata, in which most of the participants belong to levels 2 and 3 (see Table I).

This chart, even though not directly connected to the results of the study, presents an interesting panorama of the students who participated in the project. Students in the control group belonged mostly to lower social classes than the ones in the experimental one, who could have access to better materials and teachers with more training and greatly influence their students' learning skills, however, students in the control group showed more improvement in their process as shown in Table II.

Table I: Socio-demographic characteristics of the experimental and control group.

Category	Experimental group. N=32		Control group. N=25		<i>p</i>
	%	Chi ²	%	Chi ²	
Sex					
Masculine	46.9%	0.47	44%	0.47	0.829
Feminine	53.1%		56%		
Repeated years					
Yes	84.4%	0.757	92%	0.757	0.384
No	15.6%		8%		

Continuation Table I.

Laterality					
Right	93.8%	3.583	84%	3.583	0.167
Left	3.1%		16%		
Ambidextrous	3.1%		0%		
Strata					
1	3.1%	19.511	0%	19.511	0.002
2	21.9%		16%		
3	71.9%		32%		
4	0%		36%		
5	3.1%		12%		
6	0%		4%		

As it was also mentioned above, the data collection tools that were used in this research can be sub-divided into 3 categories: there were neuropsychological tests, psychological questionnaires and a pedagogical test to measure reading and writing skills in English as a foreign language, the results of these tools are presented in the table below.

Table II: Central tendency measures of pretest and posttest.

Test	Experimental group. N=32		Control group. N=25			<i>p</i>
	Med	IR	Med	IR	UMW	
Pretest						
Toulouse-Pieron	102.00	6	106.00	10	305.500	0.127
WISC IV – WM	98.50	2	101.00	3	179.000	0.000
WISC IV – PS	94.00	5	93.00	6	320.000	0.195
ACRA 4	96.00	5	96.00	2	312.500	0.154
Reading / writing	49.00	10	48.00	9	368.000	0.606
Posttest						
D2	422.00	10	420.00	9	335.500	0.299
WISC IV – WM	99.00	2	101.00	5	245.500	0.012
WISC IV – PS	98.00	6	93.00	4	191.000	0.001
ACRA 4	100.00	5	96.00	4	79.000	0.000
Reading / writing	53.00	11	51.00	11	313.000	0.161

This chart shows meaningful pretest differences in working memory (measured by the WISC IV test) and posttest differences between the groups ($p < 0.05$) in working memory, processing speed (according to the WISC IV results in these two categories), and in learning motivation (tested through the ACRA questionnaire). However, there are no meaningful differences between the experimental and the control group regarding the reading and writing skills tests ($p > 0.05$), these last skills were tested through a mock test of the Cambridge Key Test, which is an international standardized test designed for an A2 level of communicative proficiency according to the Common European Framework of Reference (Council of Europe, 2001), however, differences were close to being statistically meaningful.

6. DISCUSSION

The objective of this study was to establish if there are relations between extensive reading and working memory, processing speed, motivation and literacy skills in EFL. This study showed results for some of the considered hypotheses, which partially answer the proposed research question, these results and their implications are discussed below.

Results from this project can be considered to give a partial answer to the research hypothesis related to neuro-cognitive variables, given the meaningful differences in the scores obtained from the tests that evaluated them. Therefore, it could be affirmed that, for the context of this research, there might be a connection between extensive reading and both working memory and processing speed. These results complement the study by Alptekin and Erçetin (2010), which suggest a connection between performance in working memory and reading processes and suggesting that this relation runs in both directions, which opens the possibility of researching to what extent can alternative approaches to EFL reading can enhance cognitive functions such as working memory or others.

Results also showed meaningful differences in the scores of the ACRA 4 scale which measured motivation towards learning, this study is consistent with those of Takase (2007), Iwahori (2008) and Judge (2011), which indicated that implementing an extensive reading program brings attitudinal and motivation benefits to EFL classrooms, proving another of the hypothesis of this project, which was that extensive reading increases motivation towards learning in EFL students.

On the other hand, it is also important to point out that these results showed no effect on the reading and writing scores of students involved in the project, as it was found in previous studies such as those of Al-Homoud and Schmitt (2009), Alzu'bi (2013) and Senoo and Yonemoto (2014), which found that extensive reading significantly improved reading comprehension, reading fluency and writing processes. The absence of results in this variable may be explained through

factors like differences in educational contexts (most studies cited in the literature are from Asian countries), cultural backgrounds, studying habits or even the exposure time of the programs, given that for this particular project the amount of hours per week to which students were exposed to extensive reading were 2; these differences may benefit from further research exploration or more attention from Latin-American settings.

Another aspect to consider is that this project did not use a tool to measure vocabulary growth in the students who were exposed to the extensive reading program; and although this hypothesis could have been measured through the reading and writing skills test, an individual scale to evaluate students' improvement in vocabulary range and depth could have benefited the outcome of the project, as it did to other studies such as Al-homoud and Alsalloum (2012) and Chen et al. (2013), which used specific measurements from the TOEFL exam and vocabulary range and depth scales to analyze vocabulary growth in the students who were exposed to extensive reading programs.

This study also had limitations such as the narrow size of the sample and the lack of control over some intervening variables such as psycholinguistic factors, phonological, syntactical and semantical processes of students, which make the results of this particular study difficult to extrapolate to other educational contexts. Research projects like this may benefit from a more rigorous study that not only has higher variable control, but also a wider sample of participants.

However, the study showed potential benefits in terms of the attitude development of the students, as some of them manifested in the posttest session, which is why it is the researcher's belief that not only further research would enrich this field of knowledge, but also improve some school processes that deal directly with students' perceptions of reading and the learning of a foreign language such as English.

To sum up, this study opened new potential ideas that could take educational research in new directions; in order to fully understand teaching and learning processes we need to consider several views of education given its multidisciplinary composition. This project also impacted on the educational community that involved extensive reading in their curriculum: the school decided to implement this method as a regular part of their syllabus for all high school because of the positive results they perceived in the population that participated in the study.

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