ACQUISITION OF L$_2$ VOCABULARY FOR EFFECTIVE READING: TESTING TEACHERS' CLASSROOM PRACTICE

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Abstract

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Four practical approaches taken by teachers in their attempts to help students acquire the minimum sight vocabulary necessary for reading English for Science and Technology (EST) texts are described. Over a period of 12 weeks, subjects (native Spanish speakers at university level) were divided into 4 intact groups and worked under different conditions. Initial measurement showed that the groups were not significantly different and that all subjects featured low levels of vocabulary knowledge. Comparison of means obtained in a final test revealed that all groups improved their vocabulary significantly, and that the different approaches seemed to have helped to different degrees. The approach that produced the most improvement was that which trained subjects in the use of a specific vocabulary-memorizing technique. Due to the use of intact, numerically varying groups, results should be viewed with caution. However, they are consistent with previous research findings showing that Hispanic students with strategy training improved their vocabulary (O'Malley and Chamot, 1990). In addition, our results also conform to research showing that students, especially those at lower levels of proficiency, are accustomed to and favor the use of mechanical strategies for learning vocabulary (Schmitt, 1997; Riazi and Alvari, 2004).

Keywords: English (second language); English for Special (or specific, academic) Purposes; English for Science and Technology; Reading Instruction; Vocabulary Development (learning); Sight Vocabulary; Word Lists; Individualized Instruction; Foreign Countries.

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Introduction

In universities and institutes of higher learning in Latin America much emphasis is placed on the reading comprehension component of English language courses, especially in the area of English for Specific Purposes (ESP) and English as a Foreign Language (EFL). On the basis of empirical research analyzing the relationship between vocabulary size and reading in a second language (Laufer and Sim, 1985a, 1985b; Liu and Nation, 1985; Koda, 1989; Laufer, 1992a, 1992b; Coady, Magoto, Hubbard, Graney and Mokhtari, 1993; Haynes and Baker, 1993; Quian, 1999; Nassaji, 2003; Tozcu and Coady, 2004), experts in the areas of reading comprehension and vocabulary have claimed that vocabulary knowledge is instrumental in reading comprehension and essential for the application of certain reading strategies, such as inferring meaning

from context (Nation and Coady, 1988; Nation, 1990, 2001; Laufer, 1997; Alderson, 2000; Tozcu and Coady, 2004).

The purpose of the First Year English Program at Universidad Simón Bolívar (USB) in Caracas, Venezuela is to enable native Spanish-speaking freshmen students pursuing engineering and science majors to understand scientific and technological texts written in English. The acquisition of reading comprehension skills is vital as these will be required by students once they begin to take courses in their majors in their second year. The program is made up of three 48-hour courses, depending on the English proficiency level of students who are required to take a placement test in the first term.

The first course taken by all students at the beginner level emphasizes the development of reading skills and strategies. Course materials include a selection of short texts on varied topics from the science section of newspapers and magazines, as well as from the Internet and a course handbook. This handbook contains information on different aspects of the reading process with exercises, a list of vocabulary learning strategies and an English-Spanish glossary with a selection of words taken from West's (1953) General Service List of English Words (GSL). Also included is non-cognate academic vocabulary from Coxhead's (2000) Academic Word List (AWL).

Although all students entering the program take a placement test, there is no specific assessment of their lexical knowledge. Based on years of experience in the program, some of the instructors feel that students do not possess the necessary lexical level to profit significantly from the courses offered. They share the belief that providing an overview of vocabulary learning strategies and a vocabulary glossary in the first course is not enough. Over several terms, instructors discussed their specific beliefs about the best way to help students learn vocabulary. Three different approaches were suggested: (a) dividing and structuring the glossary into sub-lists to be tested independently on a regular basis; (b) training students in the use of a specific vocabulary-memorizing technique, and (c) providing different types of vocabulary exercises during the course. The instructors believe that their pedagogical practice should be tested in order to find the most effective way for students to learn L_2 vocabulary within the university context and the definition of action research proposed by Carr and Kemmis (1986), seemed appropriate to put the different approaches to the test in the classroom. Two research questions were raised:

1. What is the level of vocabulary knowledge of students entering the beginners' course of the First Year English Program at USB?
2. Which of the three different approaches to vocabulary learning mentioned above would best contribute to students' acquisition of the high-frequency words contained in the course glossary?

Learner's Vocabulary Knowledge and Reading in EFL

The reduced number of studies specifically investigating the relationship between vocabulary knowledge and reading comprehension in English as a Foreign Language (EFL) have consistently found a strong connection between the two (Laufer and Sim, 1985a; Laufer, 1992a, 1992b; Hu and Nation, 2000). They have concluded that the most significant obstacle for readers of EFL is neither the lack of adequate reading strategies nor of grammatical knowledge, but rather the lack of sufficient vocabulary (Llinares, 1990; Haynes and Baker, 1993).

The threshold hypothesis in reading comprehension postulates that there exists a minimum level of vocabulary readers in an L_2 must reach in order to be able to attain some level of comprehension (Clarke, 1980; Laufer and Sim, 1985a, 1985b; Laufer,

1992a, 1992b, 1997; Nation, 1990, 2001). The nature of the threshold can be analyzed from two points of view: one that deals with the number and characteristics of the words that constitute it, and another that studies the kinds of knowledge necessary for comprehension. With respect to the former view, Laufer concludes that the threshold consists of around 3,000 word families (approximately 5,000 lexical items). This provides the 95% text coverage necessary for minimum acceptable comprehension (55%). Based on analysis of the coverage of text provided by words in different frequency bands, Nation states:

> To reach 95% coverage of academic text, a vocabulary size of around 4,000 word families would be needed, consisting of 2,000 high-frequency general service words, about 570 general academic words (the *Academic Word List*) and 1,000 or more technical words, proper nouns and low-frequency words (2001, p. 147).

Coady (1997) also refers to the vicious cycle in which limited lexical knowledge discourages reading and, simultaneously, a lack of reading restricts vocabulary growth, as the beginners' paradox. Other researchers have stated that compared to English as a Second Language (ESL) learners, EFL learners often lack an adequate amount of oral or written input and they may need to "go out of their way" to create for themselves opportunities to learn new English words (Kojic-Sabo and Lightbown, 1999). Therefore, the need to provide EFL beginner readers with a way to acquire as much lexis as possible in a short period of time is a key element to the development of their reading comprehension skills.

Researchers refer to the word forms and common meanings that have to be recognized automatically by the reader, regardless of the context, for a minimum of comprehension to be achieved as "sight vocabulary". There have been very few empirical studies on how to approach students' acquisition of this sight vocabulary in the context of ESL and EFL courses. However, three previous studies appear particularly relevant to this paper: Coady et al. 1993, Pino-Silva 1993, and Tozcu and Coady 2004.

Coady et. al. (1993) and Tozcu and Coady (2004) had groups of ESL students in university academic preparation programs working independently for eight weeks with computer programs which presented lists of words in the 2,000 frequency range. Pre- and post-tests of vocabulary knowledge and reading comprehension were administered. Subjects selected a word and a definition. Then an example sentence was displayed and space was provided to add a synonym, translation or other personal mnemonic. For the subjects of Coady et al., practice multiple choice tests (select the correct word for a definition given) were made available and subjects were completely independent in the way they went about the "lessons" and tests. Tozcu and Coady's subjects, instead of practice quizzes, utilized extra features in the computer "lessons" which allowed subjects to select one of three things: the correct word of a given definition, the word necessary to complete a sentence, or the correct definition for a given word. In both studies, experimental subjects improved significantly more than control subjects both in vocabulary and reading comprehension. Coady et al.'s control subjects had no extra activity apart from regular classes; Tozcu and Coady's had three extra weekly hours of reading and reading comprehension exercises.

Pino-Silva (1993) worked with native Spanish-speaking freshmen using vocabulary lists as complementary and autonomous activities for the learning of English vocabulary, while class time was mostly dedicated to reading strategies. He

claims that his students improved both their vocabulary and reading comprehension, and had a positive attitude towards the activity.

The Study

After being classified as beginners via the placement test taken by all freshmen, 437 students enrolled in the first course of the EST reading program. A total of 129 subjects were divided into four intact groups: three experimental and one control. All groups worked under the course guidelines described below, which correspond to the 'regular' (REG) teaching conditions for the course. Forty-nine students received no additional treatment (control group). The remaining 80 students participating in the study also worked under the regular conditions, but received additional treatment described below as 'plus conditions' (three experimental groups). All four groups met four hours a week and worked to a strict 12-week timetable.

Regular Course Conditions (REG)

Course guidelines were the same for all students. The reading program at USB is based on the Interactive Model, which combines both the bottom-up and the top-down processes alternatively or simultaneously incorporating the reader's background knowledge, language proficiency level, motivation and use of strategies among other factors, to the new information in the text (St. Louis, 2001). The model was chosen since reading ability has been operationalized as a syllabus-based construct where reading is seen as "a complex behavior which involves conscious and unconscious use of various strategies including problem-solving strategies, to build a model of the meaning which the writer is assumed to have intended" (Johnston, as cited in Mikulecky, 1989, p. 2). As a result, the required materials used in the program were a reading strategies handbook entitled *Focus on Reading* (St. Louis and Pereira, 2005a) and a set of reading materials made up of short texts taken from scientific magazines and the science and technology columns of newspapers entitled *Reading Selections* (St. Louis and Pereira, 2005b). In-house materials were used as most commercial materials are geared for students that come from different linguistic and cultural backgrounds, while students in this program are all native Spanish speakers. This situation provides a pedagogical competitive advantage which allows material developers to design reading-comprehension exercises to address their particular needs, i.e. taking advantage of L_1-L_2 shared lexical knowledge, as in the case of cognates. Besides, students in the program belong to similar fields of studies, i.e. engineering and basic sciences.

The handbook covered the reading strategies taught in the program such as those used for predicting, activating prior knowledge, scanning and skimming, finding the main idea and details, and detecting inferences. Regarding rhetorical patterns found in technical and scientific texts throughout the handbook, students were instructed in the identification of definition and description, classification, and comparison and contrast. With regard to vocabulary development, students were exposed to instruction on dictionary use, word analysis and word formation, cognate and false cognate identification, compound nouns, signal words which indicate the use of the rhetorical functions studied, and different strategies for guessing meaning from context.

The handbook also included, as an appendix, a 940-word glossary. The words in the glossary belong to a vocabulary list compiled by Cobas (2003) and made up of words taken from the GSL and the AWL. From the original lists, Cobas eliminated all function words, auxiliary verbs, adjective-derived adverbs, Spanish cognates, and words which are rarely found in EST texts. The English words, listed alphabetically,

were translated into Spanish with the most common meaning given. This list was then processed by the *Web Vocabprofile*[1] (Cobb, 2006) to separate the words into sub-lists: 409 words were found to belong to the 1-1,000 word category, 326 to the 1,001-2,000 category, and 205 to the AWL.

Plus Conditions

The three experimental groups were assigned 20% of the total evaluation of the course to vocabulary. These groups were divided into three categories according to the learning approach used by students to acquire new words from the list. The intensive vocabulary testing (IVT) and the memory enhancement condition (MEM) did not invest class time on practicing activities related to the acquisition of new lexis while the personalized online exercises (POE) groups was allowed the choice to dedicate class time to do personalized computer exercises based on each student's individual list of unknown vocabulary during their lab period.

Intensive Vocabulary Testing (IVT)

This group was made up of 37 students who worked under the perception that word learning could be more manageable through the division of the word list into several smaller sub-lists with constant motivation to study for weekly class quizzes. Ten short vocabulary quizzes were given regularly throughout the term and students were given a list of 50 words with their corresponding meaning in Spanish seven days before each quiz.

Memory Enhancement Condition (MEM)

This group was made up of 32 students who were trained to learn the new vocabulary through the use of a memory-enhancing technique. Students were instructed in the operation of a low-tech device for the accelerated memorization of receptive L_2 vocabulary known as "Leitner's Hand Computer" (Mondria and Mondria-DeVries, 1994; see appendix).

The first week of the term, students were instructed on the use of the hand computer and were asked to thoroughly examine the glossary to determine the words they did not know. A personalized sub-list of unknown words was drawn up and used to make their individual word cards. From week two on, students fed the hand computer with word cards, learning them by heart until the end of the term. Four vocabulary quizzes were given throughout the term.

Personalized Online Exercises (POE)

Eleven students were subjected to cognitive manipulation of linguistic input through personalized online exercises. The first week of the term, students were asked to go through the glossary at the end of their handbook and make five personalized sub-lists with the words they did not know but would like to learn during the term. Students were then given six weeks to make and hand in their lists and learn the words on them, after which six weekly individualized vocabulary quizzes were given.

Several different types of in-class vocabulary exercises were used. They included matching the English word to its image, the English word to its Spanish equivalent, choosing the correct definition for the word, selecting the most appropriate word to complete an English sentence and writing the Spanish equivalent of the word. The different types of exercises required different levels of processing of the word and

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[1] The *Web Vocabprofile* is a free-access computer software available at http://www.lextutor.ca/vp/ originally developed by Paul Nation, Victoria University of Wellington, New Zealand, and Bathia Laufer, University of Haifa, Israel; AWL & sub-lists by Averyl Coxhead, Victoria University of Wellington; and its web version was adapted and maintained by Tom Cobb, Université du Québec à Montréal, Canada.

it was hoped that this would lead to longer retention after its initial learning by the student. This group of students was taking part in a "blended" course with two of the four contact hours in a traditional classroom and the other two using computers in a lab.

The Instrument

Subjects' knowledge of vocabulary was tested through a pre- and post-test. The instrument used was adapted from the Vocabulary Knowledge Test (VKT, Cobas 2003), which had been developed to measure subjects' sight knowledge of the words contained in the glossary. Versions of this test (100- and 60-item versions) have been applied to different samples of student populations entering the first English course at USB. Internally consistent reliability of the test was calculated for each group by using the Kuder-Richardson 21 (K-R 21) formula. Values of K-R 21= 0.88 and K-R21= 0.875 were obtained, respectively.

In the process of validating a test to measure vocabulary knowledge, Laufer, Elder, Hill, and Congdon (2004) argue that if samples of words are taken randomly from different word frequency levels, they would represent the entire vocabulary of test-takers at these levels. They found that 30 items could be considered to represent each level of 1,000 words. Therefore, it was decided that a version of Cobas' (2003) VKT containing 50 items (VKT50) would be appropriate since the glossary contains 940 words. Of the 50 English words tested, 35 belong to the GSL (20 to the 1-1,000 word category and 15 to the 1,001-2,000 category). The remaining 15 words belong to the AWL.

The 50 items in the VKT50 were presented on two pages. Twenty-five English words and 40 meanings in Spanish were presented on each page: English words were listed in random order of frequency in the left-hand column, and their meanings in Spanish, along with 15 distracters, were presented in alphabetical order in a column on the right, preceded by numbers. The distracters used were words in Spanish that also appear in the glossary. Students were asked to match the English words to their corresponding Spanish equivalent. Each right match between the word in English and its correct meaning in Spanish was worth one point and there was no correcting penalty for guessing answers in either test. This instrument was used as diagnostic and post-test to measure the potential gains in vocabulary knowledge of the sample under study (K-R 21 = 0.836 and 0.933, respectively).

Procedure

On the second week of the term, all students participating in the study took the VKT50 as a diagnostic test. All tests were rated by an independent evaluator who was not an instructor in the program at that time. This was done so that teachers would concentrate on the planned tasks and avoid a possible "teach to the test" effect. From weeks 2 to 12, each group of students worked as already described (REG, IVT, MEM, and POE). At the end of the course, in week 12, all groups took the VKT50 as a post-test. Tests were rated once more by the same independent evaluator who also applied statistical tools to analyze the results. Diagnostic and final test scores were both compared within and among groups. A 'gain' score was also calculated for each student by subtracting the diagnostic test score from that of the post-test. Gain scores were also compared within and among the different groups. In view of the differences in group size, the Levene test of homogeneity of variance was applied before any further comparison of means was analyzed.

Results and Discussion

Diagnostic Test

Since the results of the diagnostic test would indicate the vocabulary knowledge of students entering the first course, these scores were not expected to be high. Results, presented in Table 1, in fact show that vocabulary knowledge varied greatly within what could be considered a *low* level of knowledge, especially if we consider that 20 items corresponded to the first 1,000 word level.

Table 1

Descriptive Statistics of Diagnostic Test, Post-test and Gain (N = 129)

	Minimum	Maximum	*M*	*SD*
Diagnostic Test	1	23	9.50	5.509
Post Test	5	50	26.08	12.316
Gain	1	45	16.58	11.761

Further analysis of the results, presented in Table 2, shows that there was not a significant difference between the means obtained from the diagnostic test in the groups that would be working under the different conditions.

Table 2

Analysis of Variance for Diagnostic Means of Groups under Different Conditions (ANOVA Diagnostic)

	SS	*df*	*F*	*MS*	Significance
Between Groups	215.647	3	2.449	71.882	.067
Within Groups	3668.601	125		29.349	
Total	3884.248	128			

Post-test

Since the same instrument was used as both diagnostic and post-test, some minor improvement in student performance was expected. The difference between the means (9.50 in the diagnostic test and 26.08 in the post-test) shows that students did in fact improve their scores. While some students' improvement could be explained by a repeated application of the measuring, most students showed gains that were too large to be attributed to this effect. See Table 1.

Paired *t*-tests were calculated for each group of students. Results indicate that each group obtained significantly (sig. = .000) higher means in the second application

of the test. This is interpreted as an indication that all groups learned vocabulary during the term.

In addition, when a value of gain was calculated for each student by subtracting the diagnostic-test score from that of the post-test score, all values obtained were positive numbers. As seen in Table 1, the mean of gain for the group as a whole was 16.58.

To better understand the relationship (if any) between improvements in vocabulary knowledge and the different conditions under which students worked during the term, the post-test results and gain indexes were subjected to further statistical analyses. The comparison of mean values for the different conditions as seen in Tables 3 and 4 indicate that there was a significant difference between the results obtained by the different groups in the post-test and in the gain indexes.

Table 3
Analysis of Variance for Post-test Means of Groups under Different Conditions (ANOVA Post Test)

	SS	*Df*	*F*	*MS*	Significance
Between Groups	8923.450	3	35.438	2974.483	.000
Within Groups	10491.775	125		83.934	
Total	19415.225	128			

Table 4
Analysis of Variance for Gain Means of Groups under Different Conditions (ANOVA Gain)

	SS	*df*	*F*	*MS*	Significance
Between Groups	8348.913	3	37.180	2782971	.000
Within Groups	9356.482	125		74.852	
Total	17705.395	128			

In a more detailed analysis of the four different specific conditions, Table 5 shows these conditions organized according to the means of post test and gain obtained, from highest to lowest: MEM, POE, IVT, and REG. Due solely to the fact that students working in the plus conditions were all subjected to frequent vocabulary tests, receiving extra motivation and more practice, it was expected that each of these groups would improve significantly more than the group in the regular condition. Statistical comparison of each of the *Plus* groups with the *Regular* group shows this to be true for both the post test and gain index (sig. = 0.000).

Table 5
Means for Groups under Different Conditions (Organized from Highest to Lowest in Post test & Gain)

Condition	*N*	*DIAGNOSTIC*	*POST TEST*	*GAIN*
MEM	32	9.34	36.69	27.34
POE	11	6.55	27.09	20.55
IVT	37	11.19	29.73	18.54
REG	49	8.98	16.16	7.18

Conclusions

This study was undertaken by a group of instructors concerned about their students' poor vocabulary knowledge and with a desire to test their pedagogical beliefs so as to adjust their classroom practice for the benefit of their students. The results of this study show that students entering the first course of the EST reading program at Universidad Simón Bolívar in Caracas, Venezuela have a level of vocabulary knowledge far from what researchers have described as necessary to read science and technology texts. In many cases the scores are so low that it would be unrealistic to expect these subjects to successfully apply certain vocabulary strategies such as guessing meaning from context or using a monolingual L_2 dictionary, strategies taught in the first reading course.

It seems that the regular course conditions (providing an L_2-L_1 glossary, making students aware of the importance of learning vocabulary and presenting vocabulary-learning strategies) can significantly improve students' vocabulary knowledge. Instructors have included three types of additional activities hopefully conducive to further improvement of students' vocabulary: (a) dividing and structuring the glossary into sub-lists to be tested independently; (b) training students in the use of specific vocabulary-memorizing techniques; and, (c) providing different types of vocabulary exercises.

Apparently, the option of training students in the application of a low-tech device for the accelerated memorization of receptive L_2 vocabulary enables them to achieve the greatest improvement in their vocabulary knowledge in the short term. This result confirms prior findings by Cobas (2003). Training in the use of this technique requires little effort on the part of the instructor, consumes very little class time and provides the student with a tool that can be later applied for further vocabulary improvement. All of these factors make it the best additional practice for these students who need to increase their vocabulary in a short period of time.

Other extra activities that also produce improvement in students' vocabulary knowledge include having them work on different types of vocabulary exercises which require students to process the new word at different cognitive levels once the word has been initially learned through L_1 to L_2 translation. Finally, focusing students' attention on certain words discussed in the class as well as the extrinsic motivation to do well on tests also appear to play a role in vocabulary acquisition. While both of these options might imply the investment of instructors' time in the elaboration of either the exercises

or the lists, as well as the use of class time that could otherwise be used for reading and the practice of reading strategies being taught which are the main objectives of the course, the gains to be achieved can be seen to outweigh any perceived disadvantages.

       Due to the use of intact, numerically varying groups in this study, results have to be viewed with caution. However, they are consistent with previous research findings indicating that Hispanic students with strategy training improved their vocabulary (O'Malley and Chamot, 1990) and that students, especially those at lower levels of proficiency, are accustomed to and indeed favor the use of mechanical strategies to learn vocabulary (O'Malley and Chamot, 1990; Schmitt, 1997; Riazi and Alvari, 2004).

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<u>Appendix</u>

Information on Leitner's Hand Computer

This device, described by Mondria and Mondria–DeVries (1994), in its simplest form consists of a shoe box with a series of internal compartments at pre-established intervals (1, 2, 5, 8 and 14 cm, of width) in which students place a collection of word cards. Each card has, on one side, the word to be learned in English and, on the other, its most frequent equivalent in Spanish. The first group of cards is placed in the first compartment and the student goes through it. The cards containing words that the student knows are moved to the next compartment and the others remain in compartment one. Each time the student has five cards left in the first compartment, more cards must be added. By repeating this procedure, at a certain point all of the compartments are also going to be filled with word cards. Students then proceed following these basic steps: (a) go through a compartment when it has been completely filled with cards, (b) what is known moves forward, (c) what is not known returns to the first compartment, and (d) compartment one is replenished every time there are only four or five cards left. By the time a word reaches the fifth and last compartment, it can be considered "learnt" (i.e., as having entered the long-term memory) and is taken out of the box.

This hand computer has the added advantage over simple word card use in that it is based on a progressively larger repetition interval rooted in two learning psychological principles: distributed and retrieval practices (Mondria and Mondria-DeVries, 1994). It also takes into account the principle of autonomous and personalized learning, as students can work at their own pace.