

EST VOCABULARY INSTRUCTION **Instrução de Vocabulário Especializado**

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Abstract

This study aims at contributing to the investigation on the instruction of EST (English for Science and Technology) vocabulary, in terms of receptive use of the language. It evaluates the effectiveness of two teaching approaches to the acquisition of vocabulary. The first approach consisted of teaching vocabulary through the use of dictionaries, where the words were merely translated into the learners' L1 or defined in the target language thus promoting superficial level of word processing. The second approach employed activities promoting deep level of word processing. Data were analysed quantitatively. Results indicated that the two approaches seem to have some equipotentiality, as far as EST vocabulary is concerned.

Key-words: *EST; vocabulary instruction; receptive knowledge; lexical processing.*

Resumo

Este estudo tem por objetivo contribuir para a investigação sobre ensino de vocabulário especializado na aquisição de conhecimento receptivo. Ele avalia a eficácia de duas abordagens de ensino para a aquisição de vocabulário. A primeira abordagem consistiu no ensino de vocabulário através do uso de dicionários; as palavras foram meramente traduzidas ou definidas, promovendo, assim, um processamento superficial da palavra ensinada. A segunda abordagem empregou atividades em que se promove o processamento profundo da palavra ensinada. Os dados foram analisados quantitativamente. Os resultados indicaram que as duas abordagens apresentam alguma equipotencialidade, no que diz respeito à aquisição de vocabulário especializado.

Palavras-chave: *Inglês instrumental; instrução de vocabulário; conhecimento receptivo; processamento lexical.*

1. Introduction

Over the past two decades, the teaching of vocabulary has gained greater importance in the investigation of second language learning. Recent studies have benefited from the development of corpora of spoken and written language and the creation of sophisticated computer-based access tools for such corpora (Dudley-Evans, 2001). As a consequence of this development, vocabulary no longer languishes as the neglected area of applied linguistics. Yet many questions remain unanswered, especially where English for Science and Technology (EST) is concerned. We believe that one factor preventing further research on the instruction of specialised vocabulary lies in the fact that, for many researchers (such as Dudley-Evans & St. John, 1998; Nation, 2001; Read, 2000; Strevens, 1973; Trimble, 1985), it is not the job of the English teacher – not trained in science and technology – to teach specialised vocabulary. As a consequence, EST courses place a major role to the achievement of reading skills to the detriment of explicit instruction of this kind of vocabulary.

Usually, specialised vocabulary is approached through the use of dictionaries, where unknown words are merely either translated into the students' first language (L1) or defined in the target language. In other words, whereas for general service vocabulary – which comprises words of high frequency in most uses of the language – there seems to be a variety of teaching approaches, for specialised vocabulary one approach seems to dominate: translation and definition.

As far as the use of translation for vocabulary instruction is concerned, researchers point out that it encourages the idea of exact equivalence between L1 and L2 as well as L1 thinking (Nation, 2001). Another disadvantage of this approach is that when the meaning is quickly given and the learner has no reason to continue processing it, there will not be deeper encoding and, consequently, it is unlikely that such vocabulary will be learnt (Schmitt & McCarthy, 1997). Similar to the use of translation for vocabulary instruction, the use of definition is also criticised. For Nagy & Herman (1987), methods providing only definitional information about unknown vocabulary do not produce a

significant effect on comprehension. In sum, the use of translation and definition may promote only superficial levels of lexical processing.

In contrast, Beck & McKeown (1991:806) point out that “[vocabulary] instruction that requires the learner to actively generate information improves retention because it helps to build semantic network connections between new and prior information.” Activities such as semantic mapping, word cards, and the use of visual aids are suggested by some scholars (among them Beck & McKeown, 1991; Just & Carpenter, 1987; Nation, 2001; Sökmen, 1997; Trimble, 1985) in order to promote deep lexical encoding.

In view of the above, we aimed at investigating the effects of two teaching approaches on the acquisition of specialised vocabulary. The first approach, called approach A, consisted of teaching vocabulary through the use of dictionaries, where the words were either translated into the learners’ L1 or defined in the L2, thus promoting only superficial level of lexical processing. The second one, called approach B, employed activities such as the cited above that, as suggested, might promote deep level of lexical processing.

We aimed at pursuing the following questions:

Do approaches A and B promote the acquisition of specialised vocabulary for receptive use¹?

Is there any difference, in terms of learning outcomes, between the two approaches?

This paper is organized in six sections. In the first section, we introduce the context of the investigation, state the problem, present the objective of the study and the research questions we aim at pursuing, and outline the structure of the paper. In section two, we present the theoretical background to the study. In section three, we describe the method applied in order to carry out this investigation. Section four

¹ This study focused on vocabulary knowledge for receptive use based on information drawn from the needs analysis questionnaire administered to the participants. This term is further discussed in section 2.

brings the results found. In section five we discuss these results, and, finally, section six points out our final remarks and conclusion.

2. Review of literature

The theoretical background to the present study includes the aspects involved in lexical knowledge, the factors influencing the learnability of vocabulary, the classification of specialised vocabulary, and the definition of deep and superficial levels of lexical processing. In this section, previous research on the instruction of specialised vocabulary is also presented.

2.1. Receptive and productive vocabulary knowledge

When discussing the various aspects of lexical knowledge, researchers make a distinction between receptive and productive knowledge. For Nation (2001), receptive knowledge involves the recognition of the form of the lexical unit² when one participates in listening and reading events, and the retrieval of its meaning. On the other hand, productive vocabulary knowledge involves the need to express meaning when one participates in speaking and writing activities. At this moment, not only does the individual retrieve the meaning of the lexical unit but also produces it in an appropriate spoken or written form.

Faerch, Haastrup & Phillipson (1984, cited in Schmitt & McCarthy, 1997) suggest that vocabulary knowledge should be seen as a continuum between receptive and productive knowledge. The authors state that receptive knowledge is the “ability to make sense of a word” while productive knowledge is the “ability to activate the word automatically for productive purposes” (p. 142).

As can be seen above, scholars have some distinct views on the concept of receptive and productive lexical knowledge. Thus, it becomes necessary to delimit the meaning of these terms in the present study.

² In this study the term *lexical unit* will be employed as proposed by Cruse (1986).

Here the term *receptive knowledge* refers to the recognition of the spoken lexical unit in listening events, the recognition of its written form in reading events, and the knowledge of its meaning in the particular context in which it is presented. The term *productive knowledge* refers to the ability to express the meaning of a lexical unit in speaking and writing events.

2.2. Learnability of vocabulary

In order to select the lexical units for teaching, one factor – namely: learnability – becomes relevant. There has been some research examining the features inherent in a lexical unit itself which might affect the ease or difficulty with which it is learned (Ellis & Beaton, 1993); Laufer, 1997; Rodgers, 1969 cited in Read, 2000). Laufer (1997), for instance, presents seven factors affecting vocabulary learning. According to the author they are 1) pronounceability – where the learner's L1 phonological system may be responsible for the learner's difficulty in vocabulary learning; 2) orthography – where the degree of sound-script correspondence in a lexical unit is a facilitating/inducing factor; 3) length – where longer lexical units are in general more difficult to learn because there is more to learn and remember; 4) morphology – where derivation and inflection play a role in learning new vocabulary, that is, features such as irregularity of plural (multiplicity of plural forms in a language makes vocabulary more difficult to learn) and combination of morphemes (for instance, the learner has to learn that *preview* is correct but *antepreview* is not) may interfere in the process of vocabulary learning; 5) synformy – where lexical units sounding or looking alike may confuse learners; 6) grammar – where some grammatical categories are more difficult to learn than others (for instance, nouns being easier to learn than adverbs); 7) semantic features – where factors such as abstractness (concrete nouns being easier to learn than abstract nouns), register restriction (vocabulary used in a large number of contexts being easier to learn), idiomaticity (the verb *to decide* being easier to learn than the idiomatic expression *to make up one's mind*), and multiplicity of meanings (learners face difficulties discriminating among the different senses of the same form and of using each sense correctly) affect vocabulary learning.

2.3. Classification of the specialised vocabulary

Researchers classify specialised vocabulary into distinct categories (Becka, 1972; Dudley-Evans & St. John, 1998; Huizhong, 1986; Jordan, 1997; Nation, 2001; Read, 2000; Trimble, 1985). Dudley-Evans and St. John (1998) categorise it into 1) technical vocabulary, and 2) semi-technical and core business vocabulary. The authors explain that technical vocabulary is composed of general service words that have specific meanings in certain disciplines (as in computer science: bug). The second category is composed of general service words that have higher frequency in a specific field (e.g. academic: factor, method, function).

For Trimble (1985), specialised vocabulary is divided into technical vocabulary, sub-technical vocabulary and compound nouns. According to the author, technical vocabulary comprises words with a particular sense dictated by the subject matter. Sub-technical vocabulary comprises high frequency words that occur across various disciplines and those that occur with special meaning in specific fields. Finally, compound nouns are lexical units composed of two or more words that together form a single meaning (e.g. automated nozzle brick grinder). This last class may vary from simple to very complex compound nouns. Trimble explains that this last category is considered difficult to understand even to native speakers.

Drawing on the above contributions, the term specialised vocabulary is applied in the present study as vocabulary composed of lexical units with specific meanings in a particular field – whether they are highly frequent or not – (as in textile: apron) and lexical units that have higher frequency in a particular field (e.g. textile: spinning).

2.4. Previous research on the instruction of specialised vocabulary

Stahl & Clark (1987) tested the effects of class discussion on the acquisition of specialised vocabulary and observed that it was relevant for learning. Results showed 68 to 80% of recall in the immediate test

and 28 to 71% of recall in the post-test. Along the same lines, Memory (1990) investigated whether specialised vocabulary was best taught before, during or after reading activities in order to optimise learning. The study revealed no significant difference among the three situations.

After reviewing the relevant literature on the acquisition of specialised vocabulary, we verified that the vast majority of researchers in this area investigate processes of acquisition by native speakers (Memory, 1990; Stahl & Clark, 1987; Hegarty & Just, 1993; Flowerdew, 1992) or foreign students attending scientific and technical classes already in the target language (Nation, 2001; Trimble, 1985; Dudley-Evans & St. John, 1998). There are few studies focusing on non-native learners of EST attending scientific and technical courses in their L1. Among them we can point out Souza's (1994) study.

Souza investigated lexical inference from technical texts. Participants in her study were 51 learners of Electronics attending technical classes in their L1. The study investigated the effect of previous knowledge of the content and of the contextual cues on lexical inference. Learners were instructed to read specialised texts and infer the meaning of 14 lexical units providing their translation. Results indicated that contextual cues are of little help for learners with low proficiency in the L2. She reports that low L2 proficiency prevents learners from capturing contextual cues in the text, that is, learners are not aware of them. She also reveals that, where EST is concerned, there must be a minimum limit of vocabulary knowledge for the reader to benefit from the context.

As can be seen from the report above, there is some research concerned with the instruction of specialised vocabulary. One essential difference among these studies, which makes each one a single and important contribution to this subject matter, concerns the learning setting. Taking this factor into account, the present study aimed at investigating the acquisition of specialised vocabulary by non-native learners of EST attending technical courses in their L1, thus contributing to the investigation on this particular niche.

3. Method

3.1. Participants

Participants of the study included seven teachers of EST and ten learners attending the last semester of the textile course in a technical high school.

3.2. Instruments

3.2.1. Needs analysis

The purpose of the needs analysis questionnaire was to determine the characteristics of the learners participating in this study. The questionnaire contained questions related to learners' contact with the specialised vocabulary, to the intended use of this vocabulary in their professional lives, and to the specific type of activity they perform in the textile company they work for.

3.2.2. Teachers' questionnaire

Three previous assumptions of the present study were that (1) EST courses in Brazil focus on receptive use of the language; (2) a considerable number of EST learners are not proficient in the target language; and (3) for the most part, the teaching of specialised vocabulary is carried out through the use of translation and definition. In order to verify these assumptions, we applied a questionnaire to the teachers for them to describe how they approach the teaching of vocabulary. These assumptions were ratified in the questionnaire.

3.2.3. Prior lexical knowledge test

Prior to the experimental classes, learners received a list of 96 lexical units which they were asked to translate. On the basis of the results of this list, 16 lexical units – unknown to all participants – were selected as target items – 8 for each teaching approach. These lexical

units were: creel, desizing, fabric, foam, knitting, knitwear, knot, loom, package, raw material, spindle, steaming, stitch, wax, weaving, and wool.

3.2.4. The proficiency test

The purpose of the proficiency test was to identify differences in language proficiency since these differences, alone, could account for learning. It comprised a listening passage followed by grammar questions and a reading comprehension task.

3.2.5. The immediate test

The immediate test comprised a listening and a written test and was applied in order to check the percentage of lexical units learnt immediately after the administration of the two approaches. On the one hand, tests were designed to assess receptive vocabulary knowledge. On the other, in order to avoid guessing in multiple-choice questions and to encourage more precise answers, tests were designed in the form of matching columns (see appendix 1 and 2). In column A, there were the target lexical units in the L2, and in column B there were their correspondent translations (for approach A) or their correspondent pictures (for approach B).

3.2.6. The post-test

The purpose of the post-test was to verify the percentage of lexical units that learners could recall after a period of time. This test was applied fifty-seven and thirty-six days after approaches A and B were administered, respectively. In fact, they were the same vocabulary tests previously administered in both teaching approaches.

3.3. Procedure

The objective of this study was to investigate the effects of two teaching approaches on the acquisition of specialised vocabulary for

receptive use. In order to do so, two classes were administered using 16 of the lexical units that were unfamiliar to learners. The first class was based on approach A, and the second was based on approach B. Each class was followed by an immediate test.

3.3.1. Approach A

The procedure to this class was the following:

1. Learners were told that they would receive 4 texts related to the textile field in which 8 lexical units would be taught – 2 in each text. They were informed that they should try to infer the meaning of the target lexical units through contextual cues and visual support. Learners were also told that they would take a test after the treatment.
2. Text 1 was handed in. Previous to reading the text, they were asked to observe the picture that accompanied the text and report what they thought the text would be about. Learners could easily identify text subject.
3. Learners were instructed to read the text and to do an exercise in which they should provide the translation of the two target lexical units.
4. Exercises were corrected in class so that learners could have a standard translation for each lexical unit. Texts and exercises were collected after completion.
5. The following three texts received the same treatment described in 1-4 above.
6. Previous to the listening test, learners listened to the 8 target lexical units taught in order to get familiar with the pronunciation of the native speaker who recorded the text. Learners were told that the listening test would consist of a spoken text in which one or more of the target lexical units would appear. They should listen to the spoken text (twice) and check lexical units heard in column A. After the second time they should find the translation in column B for the target lexical units heard.

7. Listening tests were collected.
8. Written tests were handed in and learners were instructed to relate column “A” – containing sentences in which the target lexical units were inserted – to column “B” – containing their translation.

3.3.2. Approach B

The procedure for this class was the following:

1. Learners were told that they would receive 4 texts related to the textile field in which 8 lexical units would be taught – 2 in each text. They were informed that they should try to infer the meaning of the lexical units through contextual cues and visual support. In this approach, learners were advised to infer the meaning of the lexical units without verbalising their translation. Learners were also told that they would take a test after the treatment.
2. Text 1 was handed in. Previous to reading the text, they were asked to observe the picture that accompanied the text and report what they thought the text would be about. Learners could easily identify text subject.
3. After learners read the first text, the first picture – related to the first lexical unit - was shown on a transparency. Each picture was accompanied by a written definition. This written definition in L2 was read and the picture was used to explain the meaning of the lexical unit in the learners’ L1 since learners were not supposed to understand the written definition. Learners were asked to confirm if they had understood the meaning of the target lexical unit presented.
4. The same procedure described in 3 above was repeated for the second target lexical unit.
5. Text 1 was collected. The following three texts received the same treatment described in 2-4.
6. Learners were provided with a word-card exercise. Half of the class received a card with a sentence in the target

language. The sentence was not complete, that is, the place where the target lexical unit should appear was blank. The other half of the class received a card with one target lexical unit each. Learners were then instructed to get up from their places and find the learner who had the corresponding card that completed the one s/he had. After encountering their complement, learners were instructed to stay together until all sentences were matched. Learners were asked to read the sentences they formed. These complete sentences were shown on a transparency so that all learners could see the sentences formed. Learners managed to match all cards correctly.

7. Learners were provided with a semantic mapping exercise. After completing this task, the exercise was corrected. A complete word map was shown on a transparency so that learners could check their answers.
8. In order to review the 8 target lexical units learned, the sentences formed by learners with the cards were shown on a transparency.
9. All material used in approach B was collected and the listening test was handed in.
10. Previous to the listening test, learners listened to the 8 target lexical units taught in order to familiarise themselves with the pronunciation of the native speaker who recorded the text. Learners were told that the listening test would consist of a spoken text in which one or more of the target lexical units would appear. They should listen to the spoken text (twice) and check lexical units heard in column A. After the second time they should find in column B the correspondent picture for the target lexical units heard.
11. Listening tests were collected.
12. Written tests were handed in. Learners were instructed to match column "A" – containing the pictures representing the meaning of the target lexical units taught – to column

“B” – containing sentences in which the target lexical units were inserted.

13. In order to prevent learners from accessing the target lexical units after the treatment, all material used in approach B was collected.

3.3.3. The post-test

The post-test was applied, without prior notice, fifty-seven days after administering approach A and thirty-six days after approach B. The post-test was a repetition of the written tests for approaches A and B. The listening test was not included at this stage.

3.3.4. Data analysis

Data were analysed quantitatively. The calculation for the final results in the tests was obtained as following:

$X / (Y \times Z)$, where:

X = Total number of target lexical units correctly recalled

Y = Number of learners

Z = Total of target lexical units to be recalled

4. Results

Figure 1 shows the results of the study. As can be seen, more lexical units were recalled in teaching approach B than in A in both the immediate test (A= 89% and B= 92%) and in the post-test (A= 78% and B= 81%). Based on these results we observe that the two approaches seem to have some equipotentiality, as far as the acquisition of specialised vocabulary is concerned. In other words, although there is a slight trend towards approach B, the variation in the graph is very gentle, with no really sharp breaks between both approaches.

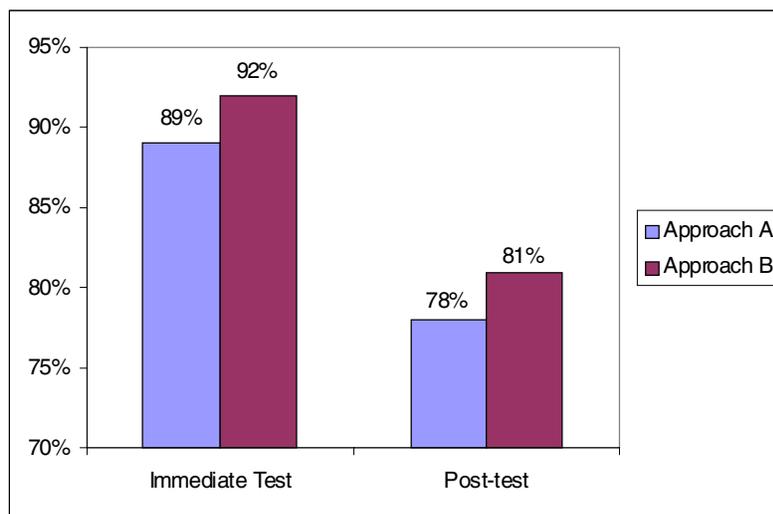


Figure 1: Percentage of lexical units recalled in the immediate test and post-test

According to Ellis (1995: 415), “a few exposures (research suggests 6 or 7 where written input is concerned) may be enough for the basic meaning of a word to be acquired, but many more may be needed before ‘depth’ of word knowledge is achieved”. The frequency with which each target lexical unit appeared in the material employed in both teaching approaches ranged from 50 (lexical unit *weaving*) to 8 (lexical units *wax* and *creel*). One question, which might reasonably be asked in considering the importance of frequency for vocabulary acquisition, is whether lexical units that appeared more frequently in the material – namely, *weaving* (50), *fabric* (26) and *stitch* (24) – presented higher percentages of recall. Table 1 displays the percentage of recall of each lexical unit in the immediate test and in the post-test. As can be seen, the lexical units *weaving*, *fabric* and *stitch* – which were the most frequent lexical units found in the texts – were not the most recalled ones both in the immediate test and in the post-test. This question on frequency will be further discussed in section 5.

EST lexical unit	Immediate test		Post test	Difference
	Approach A	Approach B		
Creel	100%		70%	- 30%
Desizing	90%		100%	+ 10%
Knitting	70%		70%	0%
Package	100%		90%	- 10%
Steaming	80%		80%	0%
Stitch	90%		60%	- 30%
Wax	100%		80%	- 20%
Weaving	80%		70%	- 10%
Fabric		100%	60%	- 40%
Foam		100%	100%	0%
Knitwear		90%	60%	- 30%
Knot		100%	90%	- 10%
Loom		80%	70%	- 10%
Raw material		100%	90%	- 10%
Spindle		100%	100%	0%
Wool		80%	70%	- 10%

Table 1: Percentage of recall of each lexical unit in the immediate test and post-test

5. Discussion

Compared to results obtained in previous studies on vocabulary acquisition (such as Bogaards, 2001; Ellis, 1995; Pressley et al., 1982), the percentages of lexical units recalled in the present one can be considered high for both teaching approaches (between 78 and 92%), thus indicating that 1) both approaches are effective for the acquisition of specialised vocabulary for receptive use, and 2) approach B plays no more of a role in vocabulary acquisition than approach A (the difference of recall between the two teaching approaches was maximum 3 percentage points).

Looking closely at the details of this study, some points can be further discussed. The main aim of the study was to compare vocabulary instruction in which superficial level of lexical processing was employed – approach A – to one in which deep level of lexical processing was employed – approach B. Results reveal that the claim that once learners

have found out the meaning of a word they no longer have reasons to attend to it, and it will be forgotten (Carter, 2001; Grauberg, 1997; Schmitt & McCarthy, 1997) does not receive support in the present study. That is, the lexical units taught through approach A – in which the target lexical units were merely translated into learners' L1 – were as well recalled as the ones taught through approach B – in which the activities employed are said to promote deep level of lexical processing.

Approach A was assumed to represent a teaching approach in which only superficial level of lexical processing is promoted. However, one can speculate that two factors might have contributed to the high percentage of recall in this approach. The first factor has to do with the procedures for the listening test. As described in 3.3.1 and 3.3.2, learners listened to a dictation of the target lexical units previous to this test. Drawing on Grauberg (1997), this procedure may be said to have promoted deep level of encoding. According to Grauberg (1997: 17), “auditory discrimination of words becomes important because they aid remembering”. In other words, by listening to the dictation of the target lexical units, learners might have built an auditory memory of the lexical units which, in turn, helped them recall.

The second factor that might have contributed to the high percentage of recall in approach A concerns the instructions that learners received. That is, learners were told, in the beginning of the treatment, that they would take a test after learning the lexical units. As claimed by Hulstijn (2001), even for implicit vocabulary learning, once learners know that they will be tested on their knowledge, there will be intentional learning and, therefore, acquisition may be promoted.

Concerning the teaching approach B, one factor that might have affected the acquisition of the target vocabulary is closely related to the visual resources employed. There is a considerable body of research advocating that visual support aids vocabulary acquisition, especially when such vocabulary is composed of concrete nouns (Glenberg & Langston, 1992; Locke, 1975 cited in Carter & McCarthy, 1988; Trimble, 1985). According to Hegarty & Just (1993), when people read a text they construct 1) a text-based representation, and 2) a mental model of the referent. The authors explain that the construction of a mental model is facilitated when text is accompanied by visual resource.

In the same line, Ellis & Beaton (1993), in a comparison between three learning strategies for L2 vocabulary acquisition – namely: repetition, keyword, and learners' own strategy – found out that, where the keyword method is concerned, imageability of the word concept is a strong determinant of learnability of foreign vocabulary.

Based on these investigations, one can hypothesize that in a method of vocabulary instruction where visual resources are employed – such as approach B – vocabulary acquisition would be facilitated. However, Grauberg (1997: 17) calls our attention to the fact that “not all words can be represented pictorially, and in any case learners often differ in their interpretation of what they see”. By the same token, Glenberg & Langston (1992) point out that pictures that encourage the noticing of inappropriate relations may reduce comprehension and retention. In other words, the quality of the relationship between a lexical unit and its pictorial representation plays a role in vocabulary acquisition.

One clear example from the present study that supports Grauberg's, and Glenberg & Langston's assumption is that, in approach B, some pictures may have misled the learners. For instance, in the listening test a learner recognized the target lexical unit from the spoken text but he checked the picture of wool instead of the picture of raw material (the right target lexical unit). However, wool is also raw material for the textile industry. That is to say that the quality of visual material employed in the study may have influenced the learners' score in both the listening and the written tests of approach B.

It should be noted that the confusion between lexical units and pictures is different from the confusion among lexical units, i.e. the lexical units *spindle* and *foam* were the only two lexical units recalled by all learners both in the immediate test and in the post-test. This result might be due to the fact that the pictures representing these lexical units could not be confused (see appendix 3). On the other hand, the pictures representing the lexical units *wool* and *loom* did not have any relation. However, learners confused these lexical units because they are morphologically similar.

Choosing the method of data collection for this study involved some degree of trade-off in relation to other aspects of the study.

Therefore, we decided to disregard the problem that the similarity between these two lexical units would possibly cause in regard to the authenticity of texts. Another factor that contributed to the inclusion of these two lexical units in the same approach was that they did not fit into any category of synform words described by Laufer (1997) (see 2.2 for the definition of synformy). Laufer classifies synformy into ten categories but the lexical units *wool* and *loom* do not fit into any of these categories.

According to Laufer (2003, personal communication), her classification of synforms includes only words differing in one – and not in two, as in *wool* and *loom* – consonant. However, she said she would be reluctant to regard our results with these two lexical units as a new category of synforms. She explained that we would first need many similar examples before assuming that there is a new category of synforms and later we would need to verify the existence of the category by testing a large sample. Laufer also called our attention to the fact that lexical units such as *wool* and *loom* – which are identical to each other in their vowels but different in their consonants – would include a huge number of possibilities (such as *bat* and *lap*, and *wool* and *shoot*). She concluded by saying that there might be additional synform categories, but that the differences between words should be small, should follow a reasonable principle, and should include many examples of the same type.

Based on Laufer's (1997) explanation, we disregarded the lexical units *wool* and *loom* as being synforms and included them in the same teaching approach. However, we later discovered that even non-synform words with morphological similarity may promote confusion when taught at once. This effect may have worked as an impediment to the acquisition of these two lexical units by some learners.

Results reveal that in the post-test there was a decrease in recall (up to 30%). Nation (1990) explains that up to 80% of words learned may be forgotten in the first 24 or 48 hours. He lists three reasons why words are forgotten: 1) new items are not revised soon enough; 2) new items are not revised thoroughly enough; and 3) old items are not revised often enough. In the same vein, Saragi, Nation & Meister (1978) state

that when no active effort is made to learn words, most learners have to encounter them on average 10 times before retrieving their meaning and that “even more interaction with a word is required before it can be recalled at will” (p. 19). In line with these views, it seems to be reasonable to conclude that the percentage of recall remained high for both teaching approaches, especially for approach A, which had been administered two months before the post-test.

Results of the present study do not bring support to Ellis’ (1995) findings regarding the number of texts in which each word occurs as the most important factor related to the acquisition of lexical meaning. Since texts were authentic, it was not possible to control for the number of encounters learners would have with each lexical unit, i.e. the lexical units *weaving*, *knitting* and *fabric* appeared more commonly in the texts presented than others. Although there is evidence suggesting that frequency is a significant factor influencing vocabulary acquisition from written input (Ellis, 1995; Nation, 1990), surprisingly, these higher frequency lexical units were not the most recalled ones either in the immediate test or in the post-test. Actually, the lexical unit *weaving* was one of the least recalled ones in Approach A. Moreover, although the lexical units *stitch* and *fabric* had been recalled 90% and 100% respectively in the immediate test, their recall decreased 30 percentage points in the post-test. These lexical units were among the least recalled ones in the post-test.

For almost the totality of lexical units there was a decrease in recall in the post-test. However, for *desizing* an increase was observed, that is, in the immediate test it was recalled by 90% of learners, while in the post-test 100% of learners recalled it. This lexical unit appeared 10 times in the whole material used in the study. This result indicates that frequency of encounter with new vocabulary may not be in itself a predictor of vocabulary acquisition.

In a study on strategies employed in vocabulary learning, Gu & Johnson (1996) found out that visual repetition of new vocabulary (e.g., repeating a new word to oneself by writing it again and again) was the strongest negative predictor of both vocabulary size and general proficiency. It might be the case that frequency must be allied to interval

of encounter. For Tumolo (1999), interval of encountering the vocabulary learned plays an important role in vocabulary acquisition. The author suggests a balanced interval of repetition of words for them to enter into long-term memory³. Based on these studies, one can reasonably conclude that the lexical units most frequently used in the teaching approaches A and B were not the most recalled ones because they were repeated in a too short interval – that is, in the same text – or in a too long interval – that is, in three-weeks' time.

6. Final remarks

6.1. Limitations of the study

In his investigation, Bogaards (2001) observed that on the post-test learners had a significant decrease in recall of word meaning (from 83,6% to 30,7% for multiword lexical units and from 73,6% to 18,6% for single-word lexical units). In our study, the high percentage of recall in the post-test may be due to a “test-retest” effect, i.e. learners may have memorized the sequence of answers. Therefore, the post-test should have been modified in order to mitigate any possible test-taking effect. Moreover, the treatments applied were not counterbalanced. That is, approach A was first applied to the whole group of learners and then approach B. It would be advisable to have one part of the group taking first approach A and then approach B. The other part of the group would do the other way round. It would avoid one approach influencing results of the subsequent one.

Concerning the employment of the lexical units *wool* and *loom* in the same approach, we would recommend avoiding it. Although these lexical units do not form a new category of synforms, our study suggests that words that sound or look alike may confuse learners and, consequently, may be more difficult to learn.

This study applies to concrete nouns. As Nation & Kyongho (1995:37) point out, “different kinds of vocabulary require different

³ For an extensive explanation of this term see Fortkamp (2000).

teaching and learning responses because different kinds of vocabulary provide different benefits for the cost of teaching and learning.” Therefore, results of this study should not be extrapolated to other classes of words.

Finally, the use of vague or ambiguous visual resources should be avoided to prevent any misleading inference of lexical meaning. In the present study, this factor alone might have been the biggest obstacle for learners to acquire the lexical units taught through approach B.

In spite of the limitations of the present study I hope that the suggestive findings have shown that the myth surrounding the use of translation for vocabulary instruction should be given less legitimacy. In other words, as far as specialised vocabulary is concerned, translation has shown to be an effective tool for instruction.

6.2. Further investigation

As evidenced in the present investigation, the vast majority of research on EST focuses either on native speakers or on foreign students attending scientific and technical classes already in the target language. There are only few studies focusing on non-native learners of EST attending scientific and technical courses in their L1. One suggestion for future research would be to investigate whether there is any quantitative and qualitative difference in terms of knowledge of specialised vocabulary for the three groups of students described above. To sum up, future research would be wise to verify whether the context under which students learn EST affects the acquisition of this type of vocabulary.

6.3. Pedagogical implications

This study has clear pedagogical implications. First, it may allow EST teachers to reflect upon common myths surrounding vocabulary acquisition, notably the use of translation for the instruction of specialised vocabulary. Furthermore, it draws our attention to the fact

that the type of learners we deal with in Brazil bear some particularities – such as low target language proficiency and limited opportunities of natural exposure to the target language – and that where specialised vocabulary is concerned, there is still much scope for contributions since, as evidenced in this study, this particular niche receives only a modest attention.

If there is one point in particular that should be retained from this study, it is that EST teachers may in fact resort to translation in order to teach vocabulary. As claimed by Hulstijn (2001), if translation is followed by a task in which the vocabulary is used meaningfully, then there is no reason why it should be avoided. In other words, Hulstijn (2001) maintains that what is critical to retention is actually the richness with which the material is encoded. That is, if this vocabulary is rehearsed and followed up by a task in which it is used meaningfully, then there is no reason why learning from dictionaries should be condemned.

6.4. Conclusion

In Brazil, the main aim of EST courses is to enable learners to achieve reading ability (Scott, 1981). However, Tumolo (1999: 34) points out that in our context in Brazil, where opportunities of natural exposure to and use of the target language are rare, readers may not encounter the same word, especially infrequent words, in due time, or with due frequency, to guarantee the commitment of the new information to long-term memory. The role of the teacher designing pedagogical procedures to deal with the new vocabulary is, therefore, essential.

To conclude, results indicate that vocabulary instruction promoting deep level of processing does promote vocabulary acquisition. On the other hand, there seems to be no impediment to using translation as a tool to the instruction of specialised vocabulary for the group of learners we investigated. This result may be due to the fact that during initial phases of L2 learning, individuals appear to associate L2 vocabulary with their L1 (Chen & Leung, 1989 cited in Kroll, Michael, Tokowicz & Dufour, 2002; Kroll & Curley, 1988). According to these authors, as fluency in L2 increases, there is a corresponding increase in

the degree to which meaning can be accessed directly for L2 words. This was evidenced in the present investigation when one of the learners uttered “matéria-prima” when the lexical unit raw material was being taught although they were instructed not to verbalise any translation.

As a final word, I draw on Beck & McKeown (1991: 805), who posit that “all instructional methods produce better word learning than no instruction”. It is also worth noting that, as in so many other areas of instruction, teachers reflecting upon their pedagogical procedures and adapting to the learners’ reality make all the difference.

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References

- BECK, I. & McKEOWN, M. 1991 Conditions of vocabulary acquisition. IN: R. BARR, M.L. KAMIL, P. MOSENTHAL & P.D. PEARSON (eds.) *Handbook of reading research*. Longman.
- BECKA, J.V. 1972 The lexical composition of specialized texts and its quantitative aspect. *Prague studies in mathematical linguistics*, **4**: 47-64.
- BOGAARDS, P. 2001 Lexical units and the learning of foreign language vocabulary. *Studies in Second Language Acquisition*, **23**: 321-343.
- CARTER, R. 2001 Vocabulary. IN: R. CARTER & D. NUNAN (eds.) *The Cambridge guide to teaching English to speakers of other languages*. Cambridge University Press.
- CARTER, R. & MCCARTHY, M. 1988 *Vocabulary and language teaching*. Longman.

- CHEN, H.D. & LEUNG, Y.S. 1989 Patterns of lexical processing in a nonnative language. *Journal of Experimental Psychology: Learning, Memory and Cognition*, **15**: 316-325.
- CRUSE, D.A. 1986 *Lexical semantics*. Cambridge University Press.
- DUDLEY-EVANS, T. 2001 English for specific purposes. IN: R. CARTER & D. NUNAN (eds.) *The Cambridge guide to teaching English to speakers of other languages*. Cambridge University Press.
- _____ & ST. JOHN, M.J. 1998 *Developments in English for specific purposes: a multi-disciplinary approach*. Cambridge University Press.
- ELLIS, R. 1995 Modified oral input and the acquisition of word meanings. *Applied Linguistics*, **16**: 09-411.
- ELLIS, N.C. & BEATON, A. 1993 Psycholinguistic determinants of foreign language vocabulary learning. *Language Learning*, **43**: 559-617.
- FAERCH, C.; HAASTRUP, K. & PHILLIPSON, R. 1984 *Learner language and language learning*. Gyldendals Sprogbiotek.
- FORTKAMP, M.B.M. 2000 *Working memory capacity and L2 speech production: an exploratory study*. Unpublished doctoral dissertation, Universidade Federal de Santa Catarina, Brazil.
- FLOWERDEW, J. 1992 Definitions in science lectures. *Applied Linguistics*, **13**: 202-221.
- GLENBERG, A.M. & LANGSTON, W.E. 1992 Comprehension of illustrated text: pictures help to build mental models. *Journal of Memory and Language*, **31**: 129-151.
- GRAUBERG, W. 1997 *The elements of foreign language teaching*. Multilingual Matters Ltd.
- GU, Y. & JOHNSON, R.K. 1996 Vocabulary learning strategies and language learning outcomes. *Language Learning*, **46**: 643-679.
- HEGARTY, M. & JUST, M.A. 1993 Constructing mental models of machines from text and diagrams. *Journal of Memory and Language*, **32**: 717-742.
- HUIZHONG, Y. 1986 A new technique for identifying scientific/technical terms and describing science texts. *Literary and Linguistics Computing*, **1**: 93-103.
- HULSTIJN, J.H. 2001 Intentional and incidental language vocabulary learning: a reappraisal of elaboration, rehearsal and automaticity. IN: P. ROBINSON (ed.). *Cognition and second language instruction*. Cambridge University Press.

- JORDAN, R.R. 1997 *English for academic purposes: a guide and resource book for teachers*. Cambridge University Press.
- JUST, M.A. & CARPENTER, P.A. 1987 *The psychology of reading and language comprehension*. Allyn and Bacon.
- KROLL, J.F. & CURLEY, J. 1988 Lexical memory in novice bilinguals: the role of concepts in retrieving second language words. IN: M. GRUNEBERG, P. MORRIS & R. SYKES (eds.) *Practical aspects of memory*. John Wiley.
- _____; MICHAEL, E.; TOKOWICZ, N. & DUFOUR, R. 2002 The development of lexical fluency in a second language. *Second Language Research*, **18**, 2: 137-171.
- LAUFER, B. 1997 What's in a word that makes it hard or easy: some intralexical factors that affect the learning of words. IN N. SCHMITT & M. MCCARTHY (eds.) *Vocabulary: description, acquisition and pedagogy*. Cambridge University Press.
- LOCKE, J. 1975 *An essay concerning human understanding*. Oxford University Press.
- MEMORY, D.M. 1990 Teaching technical vocabulary: before, during, or after reading assignment? *Journal of Reading Behavior*, **22**: 39-53.
- NAGY, W.E. & HERMAN, P.A. 1987 Breadth and depth of vocabulary knowledge: implications for acquisition and instruction. IN: M.G. MCKEOWN & M.E. CURTIS (eds.) *The nature of vocabulary acquisition*. Lawrence Erlbaum Associates.
- NATION, I.S.P. 1990 *Teaching and learning vocabulary*. Newbury House/Harper Row.
- _____. 2001 *Learning vocabulary in another language*. Cambridge University Press.
- _____. & KYONGHO, H. 1995 Where would general service vocabulary stop and special purposes vocabulary begin? *System*, **23**: 35-41.
- PRESSLEY, M., LEVIN, J.R. & MILLER, G.E. 1982 The keyword method compared to alternative vocabulary learning strategies. *Contemporary Educational Psychology*, **7**: 50-60.
- READ, J. 2000 *Assessing vocabulary*. Cambridge University Press.
- RODGERS, J.S. 1969 On measuring vocabulary difficulty: an analysis of item variables in learning Russian-English vocabulary pairs. *IRAL*, **7**: 327-343.
- SARAGI, T., NATION, I.S.P. & MEISTER, G.F. 1978 Vocabulary learning and reading. *System*, **10**: 72-78.

- SCHMITT, N. & MCCARTHY, M. 1997 *Vocabulary: description, acquisition and pedagogy*. Cambridge University Press.
- SCOTT, M. 1981 Reading comprehension in English for academic purposes. *the ESPecialist*, **3**: 41-51.
- SÖKMEN, A.J. 1997 Current trends in teaching second language vocabulary. IN: N. SCHMITT & M. MCCARTHY (eds.) *Vocabulary: description, acquisition and pedagogy*. Cambridge University Press.
- SOUZA, M.H.G.M. 1994 A inferência lexical no texto técnico em inglês. *Alfa*, **38**: 191-210.
- STAHL, S.A. & CLARK, C.H. 1987 The effects of participatory expectations in classroom discussion on the learning of science vocabulary. *American Educational Research Journal*, **24**: 541-545.
- STREVEVS, P. 1973 Technical, technological, and scientific English. *ELT Journal*, **27**: 223-234.
- TRIMBLE, L. 1985 *English for science and technology: a discourse approach*. Cambridge University Press.
- TUMOLO, C.H.S. 1999 *Vocabulary instruction: the text as a source in the classroom*. Unpublished Master thesis, Universidade Federal de Santa Catarina, Brazil.

APPENDIX 1

Este teste de vocabulário faz parte de um projeto de pesquisa do curso de Mestrado da Universidade Federal de Santa Catarina – UFSC. Tal projeto, cujo título é “Investigando a eficácia de duas abordagens de ensino para vocabulário especializado: um estudo exploratório” (Investigation the effectiveness of two approaches to EST vocabulary: an exploratory study), tem o objetivo de investigar os efeitos de duas abordagens de ensino de vocabulário sobre a aquisição de vocabulário técnico. Este teste de vocabulário visa verificar a aquisição do vocabulário ensinado com base na abordagem de ensino “A”. Agradeço, antecipadamente, a sua participação, que em muito contribuirá para este estudo. As informações pessoais aqui contidas, bem como o nome desta instituição de ensino, permanecerão em absoluto sigilo e não serão reveladas na apresentação dos resultados do projeto.

TESTE DE AUDIÇÃO

Nome: _____

Data: _____

Ouçã a informação sobre a NANTONG YONGXING – uma empresa chinesa de máquinas têxteis – e assinale na coluna “A” as palavras que você ouvir. Para cada palavra assinalada na coluna “A”, escolha na coluna “B” a sua tradução usando o número correspondente.

Exemplo:

COLUNA “A”	COLUNA “B”
Palavra assinalada: 1. (X) Spinning	Tradução da palavra assinalada: (1) Fiação

COLUNA “A”	COLUNA “B”
Palavra assinalada:	Tradução da palavra assinalada:
1. () Weaving	() Vaporização
2. () Creel	() Desengomagem
3. () Package	() Malharia
4. () Wax	() Gaiola
5. () Stitch	() Embalagem
6. () Knitting	() Parafina
7. () Desizing	() Tecelagem
8. () Steaming	() Ponto

TESTE ESCRITO

Nome: _____

Data: _____

Observe as frases da coluna "A". Para cada palavra sublinhada, encontre a sua tradução na coluna "B" usando o número correspondente:

Exemplo:

COLUNA "A"	COLUNA "B"
Frase:	Tradução da palavra sublinhada:
1. The process of <u>SPINNING</u> is part of the textile industry.	(1) Fiação

COLUNA "A"	COLUNA "B"
Frases:	Tradução das palavras sublinhadas:
1. <u>Weaving</u> is one of the most ancient forms of human creativity.	() Vaporização
2. The company has 15 years of experience for manufacturing preparatory machinery like warping machine, <u>creel</u> and finishing machine.	() Embalagens
3. The AUTOCONER 338 Schlafhorst has improved the application of <u>wax</u> .	() Tecelagem
4. SHIMA SEIKI produces machines for the textile process of <u>knitting</u> .	() Desengomagem
5. Stitch density control, a new stepping motor finely adjusts the density of the <u>stitch</u> to help the glove conform to the various parts of the hands.	() Gaiola
6. SUPERBA is a leader in the worldwide market of the yarn continuous heat treatment such as <u>steaming</u> and shrinking.	() Malharia
7. BIOFINASE AC-200 can desize TMKP sized goods alone and aids in the <u>desizing</u> of other sized goods when used in conjunction with a nonionic detergent or amylase.	() Ponto
8. The AUTOCONER 338 Schlafhorst provides more uniform density of <u>packages</u>	() Parafina

APPENDIX 2



Universidade Federal de Santa Catarina
 Centro de Comunicação e Expressão
 Curso de Pós-Graduação em Letras/Inglês e Literatura Correspondente

Este teste de vocabulário faz parte de um projeto de pesquisa do curso de Mestrado da Universidade Federal de Santa Catarina – UFSC. Tal projeto, cujo título é “Investigando a eficácia de duas abordagens de ensino para vocabulário especializado: um estudo exploratório” (Investigation the effectiveness of two approaches to EST vocabulary: an exploratory study), tem o objetivo de investigar os efeitos de duas abordagens de ensino de vocabulário sobre a aquisição de vocabulário técnico. Este teste de vocabulário visa verificar a aquisição do vocabulário ensinado com base na abordagem de ensino “B”. Agradeço, antecipadamente, a sua participação, que em muito contribuirá para este estudo. As informações pessoais aqui contidas, bem como o nome desta instituição de ensino, permanecerão em absoluto sigilo e não serão reveladas na apresentação dos resultados do projeto.

TESTE DE AUDIÇÃO

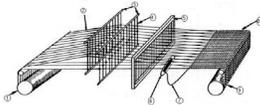
Nome: _____

Data: _____

Ouçã a informação sobre a história da tecelagem e assinale na coluna “A” as palavras que você ouvir. Para cada palavra assinalada na coluna “A”, escolha na coluna “B” a sua figura usando o número correspondente.

Exemplo:

COLUNA “A”	COLUNA “B”
Palavra assinalada:	Figura:
1. (X) Spinning	
	(1)

COLUNA "A"	COLUNA "B"
Palavra assinalada:	Figura:
1. () Fabric	() 
2. () Loom	() 
3. () Knitwear	() 
4. () Raw material	() 
5. () Knot	() 
6. () Wool	() 
7. () Spindles	() 
8. () Foam	() 

TESTE ESCRITO

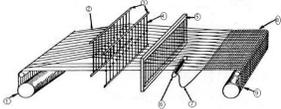
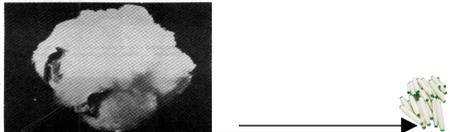
Nome: _____

Data: _____

Abaixo estão duas colunas. A coluna "A" contém figuras e a coluna "B" contém frases com uma palavra ou expressão em destaque. Numere a coluna "B" relacionando a figura da coluna "A" que melhor represente a palavra em destaque na frase da coluna "B":

Exemplo:

Coluna A	Coluna B
<p>1. </p>	<p>(1) The process of SPINNING is part of the textile industry</p>

Coluna A	Coluna B
<p>1. </p>	<p>() Brittany's finishing line the FABRIC goes to the tenter frame with only 20-25% moisture content.</p>
<p>2. </p>	<p>() Designs of Celtic KNOT may be knitted in pure wool.</p>
<p>3. </p>	<p>() Rieter spinning machine model COM4 is provided with up to 1008 SPINDLES.</p>

Coluna A	Coluna B
4. 	<input type="checkbox"/> In Brittany's finishing line chemicals are applied to the fabric as a FOAM.
5. 	<input type="checkbox"/> Fabric is produced in the LOOM.
6. 	<input type="checkbox"/> At Ortak visitor Centre there is an exposition of KNITWEAR.
7. 	<input type="checkbox"/> Fiber is the RAW MATERIAL of the spinning process because it will be transformed into yarn.
8. 	<input type="checkbox"/> Spanish influence on Navajo weaving includes the substitution of cotton for WOOL.

APPENDIX 3

1. Raw material:



COTTON

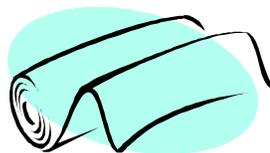


YARN

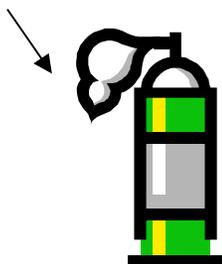
2. Spindle:



3. Fabric:



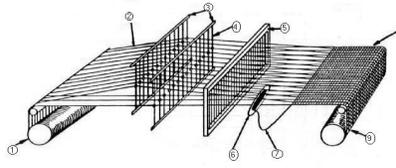
4. Foam:



5. Wool:



6. Loom:



7. Knitwear:



8. Knot:



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