Reading in a Foreign Language April 2010, Volume 22, No. 1
ISSN 1539-0578 pp. 117–138

The quality and frequency of encounters with vocabulary in an English for Academic Purposes programme

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Abstract

This longitudinal case study tracks an adult second-language (L2) learner's quality and quantity of encounters with 20 vocabulary items in an English for Academic Purposes course over 3 months. The learner completed pretest and posttest vocabulary knowledge interviews, submitted course materials and notes for analysis, and was observed during class lessons. The results show that frequency of encounters contributes more to vocabulary learning than contextual richness does. In addition, the case study data illustrate the highly incremental nature of L2 vocabulary acquisition in a naturalistic context.

Keywords: longitudinal, case study, vocabulary frequency, vocabulary depth, contextual richness, generative processing

A common concern among teachers and learners in intensive English for Academic Purposes (EAP) programmes is the extent to which previously learnt, known and new vocabulary items encountered in text are available for subsequent use in the immediate and longer term. Learners who are faced with reading and understanding academic texts are often frustrated by their inability to retrieve words or their meanings on demand.

Given the incremental nature of vocabulary acquisition, longitudinal studies that track learners' encounters with words in particular contexts can provide insights into precisely how learners approach vocabulary learning, both within and beyond language classes. They can also reveal the types of vocabulary encounters that are likely to contribute to long-term retrieval of word form and meaning and to productive use

This case study illustrates the role of three contributing factors to vocabulary learning: quality of input, quality of output, and frequency of occurrences with target vocabulary items. While there are studies that investigate one or two of these factors, to my knowledge, there are no studies that investigate all three, drawing on both quantitative and qualitative data.

Following Paul Nation's tenet of adopting a rigorous approach to research design (see Nation & Webb, in press), this naturalistic classroom research, consisting of a single case study,

triangulates quantitative and qualitative data at different points to better understand how frequency, contextual richness, and generative use enhance vocabulary learning. It also reflects his interest in gaining insights from more fine-grained single cases to complement larger-scale experimental studies. Moreover, it draws on an area of scholarship within which Paul Nation has contributed enormously: the necessary conditions for vocabulary acquisition.

Quality of Input

Contextual richness can contribute to vocabulary acquisition, but, on its own, does not appear to be a sufficient condition for later recall of word forms and meanings. Studies promoting the use of rich, clear contexts for vocabulary acquisition (e.g., Schouten-van Parreren, 1989) are tempered with studies claiming that there may be greater benefits for reading comprehension than vocabulary learning (e.g., Mondria & Wit-de Boer, 1991; Parry, 1991). In a study comparing the quality (richness of context) and quantity of vocabulary encounters in input, Zahar, Cobb, and Spada (2001) found no consistent pattern showing that rich, directive contexts led to greater vocabulary growth. On the contrary, they found highly variable contexts to be favourable. They suggest it is likely that variability enhances vocabulary learning because it exposes learners to a wide range of natural contexts in which words can occur. Opaque, unclear contexts might trigger learners to notice the word, piquing learners' curiosity and paving the way for close selective attention to the word in clear contexts met in the future. Similarly, Haastrup (1989, pp. 319–320) has pointed out that puzzling over problems with word meanings in context involves greater cognitive engagement, which helps subsequent recall both in highly variable and in rich, clear contexts. It is of interest to investigate whether or not target words that are learned better in an EAP programme have been embedded in clear contexts with relevant clues to the word meanings.

Quality of Output

Studies from cognitive psychology on depth of processing and memory (Craik & Lockhart, 1972) have shown that long-term retention is influenced by the level at which information is processed. Processing begins at shallow sensory levels, such as how a word is pronounced, and progresses to deeper levels, such as analyzing the meaning of words and relating this to stored knowledge in memory, thus leaving a more permanent memory trace.

Taking this theory further, Craik and Tulving (1975) maintained that elaborative processing enhanced long-term retrieval by strengthening the memory trace. In other words, actively generating new information by connecting new and known information enriches semantic networks. The critical point is that these richer connections set up much more distinct and "discriminable" memory traces than those items that are not elaborated (Baddeley, 1990, p. 170). These, in turn, enhance later recognition and recall (Baddeley, 1998).

Based on this framework, a number of studies investigating depth of cognitive processing and second language (L2) vocabulary acquisition have found that semantic elaboration indeed enhances later recall. Joe (1998) compared two groups of learners who completed a read and

retell task. One group had access to the text during the retelling whereas the other did not. Using a generative knowledge scale, measuring different levels of semantic elaboration, she found that those who made the greatest vocabulary learning gains in a posttest were those who retrieved and used the target words in novel ways from the original text.

Barcroft (2004) conducted an experiment comparing a group of learners who wrote sentences using new word forms with a group of learners who only viewed the words. He argued that semantic elaboration has a facilitative effect for partially known but not completely new words, mnemonic techniques aside. He further argued that recognition tasks where word forms are provided can facilitate acquisition, but semantic elaboration tasks drawing on learners' own knowledge do not.

Cognisant of the fact that the quality of learning, or depth of processing, is but one factor affecting vocabulary learning, Laufer and Hulstijn (2001) proposed an *involvement load hypothesis*, combining three factors: need (motivation), search (use of references), and evaluation (appropriate use of a word in context). Hulstijn and Laufer (2001) applied their construct to two groups of advanced university students in Israel and the Netherlands who were studying English as a foreign language (EFL). They compared the involvement load and the amount of incidental vocabulary learning from three different task conditions: (a) reading comprehension with the aid of marginal glosses, (b) reading comprehension and gap-fill exercises, and (c) writing a letter to an editor integrating the target words. As proposed, they found that the amount of vocabulary learning was determined by cognitive engagement with particular tasks. These studies point to the facilitative effect of deep-level semantic processing.

Frequency of Occurrence

Although explicit, elaborative learning at the semantic level is crucial for the maintenance of vocabulary knowledge, implicit (subconscious) knowledge and explicit attention to word form also contribute to long-term retention. Baddeley (1990, pp. 160 & 172) maintained that rote rehearsal alone is not as effective as deeper elaborate rehearsal for storing and processing knowledge, but substantial quantities of rote rehearsal may activate existing lexical items, thereby facilitating subsequent word recognition. Many studies on acquiring vocabulary incidentally and incrementally through reading refer to this explanation to account for vocabulary gains from frequent exposures to words (e.g., Beck, Perfetti, & McKeown, 1982; Brown, 1993; Krashen, 1989; Nagy, Herman, & Anderson, 1985; Rott, 1999). N. Ellis (1995) suggested that repeated exposure to the regularities of words' surface phonological and orthographical features in spoken and written input helps learners to recognise and produce those forms subsequently.

In an experimental study investigating the contribution of phonological repetition in long-term memory, Ellis and Sinclair (1996) argued that rehearsing aloud sequences of phonemes in a foreign or second language helps to establish regular language patterns that are abstracted and stored for later reference. Subsequent exposures to these familiar words and word sequences serve to consolidate their long-term representation both receptively and productively. Conversely, the greater the exposure to possible word sequences, and increased long-term storage of these,

the greater the likelihood of those words being accessed automatically. In turn, the greater capacity for freed-up attentional resources in short-term memory allows for more complex language processing (see R. Ellis, 2002).

These studies suggest that conscious effort to learn the semantic and conceptual aspects of words, using deep and elaborative processes, is needed to prevent attrition, and repetitive exposure to the form of words is required to establish words' surface features. How frequently should learners encounter words, though?

Experimental research indicates that distributed practice of words over a number of days is preferable to massed practice, or exposure to words in fewer periods but in rapid succession (Baddeley, 1990, p. 173; Dempster, 1987; Laufer & Osimo, 1991; Mondria & Mondria-de Vries, 1994). Research tracking long-term retention of words from repeated readings of simplified novels in case studies (Horst, 2005; Horst & Meara, 1999) or intact classes (e.g., Cho & Krashen, 1994; Taguchi, Takayasu-Maass, & Gorsuch, 2004) has shown how repeated exposure to words within these reading books enhances vocabulary acquisition. However, because these studies have been conducted under controlled conditions with the manipulation of discrete independent variables, it is difficult to know to what extent they apply to naturalistic conditions where learners hear or see words in multiple data sources over time.

Taking quality of input or output and frequency together, these studies indicate that all three aspects contribute to long-term vocabulary acquisition. However, the role of frequency appears to be most important. Receptive and productive knowledge of a word involves attention to its forms, meanings, and uses in a range of contexts (Nation, 2001, p. 27). Without exposure, it would not be possible to develop these different dimensions of vocabulary knowledge.

Experimental research on implicit learning (N. Ellis, 1995) has suggested that repeated exposure to words' formal features in input is crucial if words are to be established in learners' lexicons. Furthermore, in a study of incidental reading that compared frequency and contextual richness, Zahar et al. (2001) came to the conclusion that vocabulary acquisition was a function of frequency. Laufer and Hulstijn (2001) also suggested that frequency be considered alongside depth of processing when investigating vocabulary growth. What is of interest in this study is whether the overriding importance of frequency is corroborated in research where learners are tracked during their regular course of study, without any instructional intervention. The main question and secondary questions investigated in this case study are listed below.

> 1. The main question: Are words that are encountered frequently learned better, irrespective of the richness of context and the type of cognitive processing?
>
> 2. The secondary questions: (a) How many encounters with target words are needed to shift them from one state of vocabulary knowledge to another? (b) Are words embedded in rich, clear contexts learned better? (c) Is evidence of greater depth of processing associated with greater vocabulary development?

Method

This case study of a single learner is derived from a larger study investigating the quality and frequency of four L2 learners' encounters with vocabulary as they studied in an academic English preparation course over 3 months. It draws on both quantitative and qualitative data to illustrate actual target vocabulary encounters in the normal course of instruction. The study focuses on three aspects: (a) how often words were encountered, (b) the depth of cognitive processing evident in tasks involving output, and (c) the richness of written and aural contexts in which words were embedded.

In any intensive programme, it is impossible to track all data sources and use of target words because of the unacceptably high level of intrusion. A more realistic approach involved targeting vocabulary use at the beginning, middle, and final weeks of the course. To capture the distribution of target items over the course, this study examined the total number of days that learners encountered the words, as well as actual encounters with the words on particular dates.

To assess learners' quality of cognitive engagement with and opportunities to encounter new vocabulary, four data gathering procedures were employed throughout the course: (a) collection of written texts from learners and teachers, (b) non-participant classroom observations, (c) semi-structured interviews about vocabulary learning practices, and (d) structured pretest and posttest interviews.

The design of the study involved non-participant observations of learner interactions on 1 day each week throughout the course. There were also daily observations of the full class programme for 1 week at the start (Week 2), middle (Week 6) and end (Week 10) of the course. A key purpose was to record particular sources of target vocabulary use in the classroom. Vocabulary knowledge interviews to test target words were conducted in Weeks 2, 3, 6, 7, and 12. Learners submitted class-related and independent language learning materials at twice-weekly intervals.

Throughout the programme learners received a total of 25 hours of content-based, integrated-skill instruction from two teachers each week. Three key components of the course included (a) studying 40 words for personalized weekly vocabulary tests, (b) using theme booklets as a basis for all integrated-skill work in class, and (c) completing an oral and written news log about one issue throughout the course.

Participant

The participant in this case study, Zeki, was a married, 23-year-old student from Turkey who had lived in New Zealand for 14 months. He had completed two-thirds of an economics degree in Turkey but had not studied English previously. During the main study, he was enrolled in his second 14-week EAP course at a New Zealand university and was aiming to embark on undergraduate courses in economics, politics, and history.

Zeki placed into the highest-level class. A diagnostic measure of receptive vocabulary knowledge, the Vocabulary Levels Test (Nation, 1990), indicated that he knew about two-thirds

of the second thousand most frequent words of English and about half of the third thousand and University Word List items.

Target Words

To investigate different encounters Zeki had with vocabulary in the long term, attempts were made to choose words that received different amounts of processing as a result of different task demands and task purposes.

Zeki was tested on a total of 74 words. Thirty words were chosen from study themes, which the teacher planned to cover in class, and 44 words were chosen from Zeki's own in-class or out-of-class language use or learning materials. Of the 30 words selected from the class themes, 15 words were tested in Week 2 and the other 15 in Week 6. The 15 theme words were either (a) met incidentally in reading and listening or (b) considered central for comprehending key concepts and worth studying because of their high frequency and wide application to a variety of contexts. The class teacher and a student from a previous course were asked to read the themes and compile a list of 10 words considered to be central, probably unknown, and worthwhile for future purposes. The researcher, teacher, and student compared lists and agreed on which words to include. Another five words were selected in case Zeki already knew the precise meanings of words presented previously, and could use them accurately and appropriately in a sentence.

Zeki's 44 individualised target words were tested in two sets: one set of 22 words in Week 3 and another set of 22 in Week 7. Each set was divided into the following six categories: (a) 5 words from individualised vocabulary lists, (b) 5 words from Zeki's own class study notes, (c) 3 words from Zeki's writing, (d) 3 words from Zeki's speaking in class, (e) 3 words from Zeki's listening in or out of class, and (f) 3 words from Zeki's independent reading.

Time constraints meant that only a small number of words could be administered in the posttest in Week 12 of the course. Words that were either known well prior to the course or that did not arise in class tasks were discarded. In the end, a total of 20 partially known or unknown words were included (see the Results and Discussion section). The words fell into three main categories: (a) 3 words used as part of a task sequence with guided teacher input such as dictoglosses or tasks involving reading comprehension and discussion; (b) 4 words used in tasks receiving less teacher intervention and requiring learners to take more responsibility such as essay writing, direct study for vocabulary tests or news logs; and (c) 13 words encountered incidentally in reading or listening.

Procedure and Measures

A semi-structured interview format provided Zeki with opportunities to demonstrate knowledge and use of the 20 target words met during the course. Drawing on the importance of using multiple sensitive vocabulary measures (Joe, 1995; Nagy, Herman, & Anderson, 1985; Nation, 2001, p. 361), five measures were developed. Three measures elicited different aspects of word knowledge or use: (a) knowledge of a word's form and meaning, (b) knowledge of a word's associates, and (c) the ability to generate a sentence accurately and appropriately using the target word. A fourth measure assessed how precisely a meaning of a word could be inferred from

contextual clues or how precisely a word's meaning could be linked to existing word knowledge by using target words in novel ways.

Scripted prompts were used to probe for more elaborate word meanings or illustrative sentences when these were not forthcoming. The interview proceeded along the following lines. Zeki was told that the focus of the interview was on testing his knowledge of vocabulary. He was then asked to define the target word provided ("What does this word mean?") and to use the word in a sentence (i.e., "Can you use that word in a sentence?"). The first time he completed the tests, he practised the procedure on two known words.

At the end of the productive test, Zeki completed the fifth measure: a word recognition task. This was developed to tap partial knowledge of word meanings and associations that he was unable to express during the interview phase.[1]

Vocabulary knowledge scale. The three vocabulary knowledge and use measures were adapted from the Vocabulary Knowledge Scale (VKS), developed by Wesche and Paribakht (1996). The VKS is a single progressive rating scale designed to identify five incremental stages of vocabulary knowledge. One problem of the VKS is that each step of the uni-dimensional scale lacks precision and detail. To overcome this problem, multiple scoring scales to measure different dimensions of declarative word knowledge and use were devised.

Table 1 shows the first measure, which assessed knowledge of form and meaning. It takes the first four descriptors from Read's (1994) adapted VKS scoring scale to measure word knowledge and recognition of word form.

Table 1. *Knowledge of form and meaning*

Score	Interpretation
0	The word is not familiar
1	The word is familiar but the meaning is not known
2	One meaning of the word is partly known
3	One meaning of the word is known
4	A second meaning of the word is partly known
5	A second meaning of the word is known

The second measure assessed learners' ability to produce word associates for target items in phrases. This is shown in Table 2.

Table 2. *Ability to produce word associates*

Score	Interpretation
0	No evidence of ability to use the target item in context
1	Attempts to use associates that are not plausible
2	Can use plausible associates for one meaning within one context
3	Can use plausible associates for one meaning in more than one context
4	Can use plausible associates for a second word meaning

The third measure assessed the ability to produce a well-formed, plausible sentence. Like the word associates scale, grammatical accuracy and plausibility were rated along five points. The scoring is presented in Table 3.

Table 3. *Ability to use words in context*

Score	Interpretation
0	No evidence of ability to use the target item in context
1	Partial evidence of ability to use the target item in context
2	Can use the target item in a plausible sentence with reasonable accuracy
3	Can use the target item in a plausible sentence with a high level of accuracy
4	Can use a different word form in a plausible sentence with reasonable accuracy

Scoring

Scoring procedures were adapted from a written version of the VKS used by Scarcella and Zimmerman (1998) with tertiary level learners of English as a second language in an academic writing programme. Four modifications were made. First, because an oral interview format was used, where learners were probed when answers needed clarification, the principle of giving full credit for unclear responses was less applicable; when an ambiguous sentence was presented, credit was apportioned according to the response. Full credit was not automatic. Second, while Scarcella and Zimmerman rated spelling in their writing samples, spelling was not tested in the oral interview. Third, partial credit was awarded when learners clearly demonstrated general understanding of the word but supplied implausible sentences because of confusion with similarly related words. Fourth, when learners supplied more than one illustrative sentence, with one being highly plausible and accurate, and a second being implausible or plausible but less accurate, then, credit was given for the most plausible and accurate. Five principles were applied:

1. Give credit when grammatical errors do not relate to the target word (e.g., “The 18 years old guy *offended* the girl who was walking . . . .”).

2. Give a score of 0 for errors indicating that learners do not have any knowledge of the meaning of the word (e.g., “I *distress* the man who disturb me,” where *distress* was defined as “dislike.”).

3. Give a score of 1 for errors indicating that learners have partial knowledge of the word meaning but have confused its use with a closely related word (e.g., “Go away or expel. I’m not sure exactly. I can say he was *dispelled* by his boss.”).

4. Give credit to words that are changed to a different part of speech and are used correctly at Levels 1, 2, and 3 (e.g., “The school *deter* the children from doing wrong thing.” [Target word is *deterrent*.] Word associates = 2, Use in context = 2).

5. Give credit for incomplete sentences as long as the learner indicates they know how to use the word.

Measuring contextual richness and generation. Finally, a fourth measure was designed to assess both the level of generative processing[2] evident in learner output and the extent to which word meanings were explicitly stated or could be inferred from oral and written contexts. Since this paper focuses on the quality compared with the quantity of encounters, it was important to see whether words that were learned better were in fact embedded in richer written or oral contexts or if they were more likely to have been learned better because of frequent encounters across the course. It was also important to compare the level of generative processing with the frequency of encounters.

The *level of generativeness scale* (Joe, 1995) was employed to measure the level of generative processing evident in learner production. This scale made incremental distinctions between words used productively without any modification from the original source up to words used creatively in form and meaning from the original.

Categories devised by Beck, McKeown, and McCaslin (1983) were used as the basis for measuring the level of contextual support for unknown items in oral and written contexts. They focused on the type of contextual support available in a text from which a reader could infer an unknown word meaning.

As shown in Table 4, a single rating scale was used to combine both the levels of contextual richness and learner-generated output. In the scale, levels of "use" refer to productive output or level of generative use, and levels of "context" refer to the richness of the listening or reading input surrounding the lexical items.

Table 4. *Levels of contextual richness and generativeness*

Score	Level	Interpretation
1	Verbatim use	No generation: no demonstrated effort to integrate meaning. Learners repeat the text word for word.
	Verbatim context	Repeated exposure to the same word forms, collocations or sentences through reading or listening (i.e., no new contextual information added).
2	Nonspecific use	Low generation: very little effort to integrate meaning. Learners make structural changes to the target form. Very little elaboration.
	Nonspecific context	The context does not direct learners to understand a precise or general word meaning (e.g., "What is trigger?")
3	General use	Reasonable generation: reasonable effort to integrate meaning. Reasonable elaboration on a word's general properties and associations.
	General context	The context provides clues about the semantic field or general category but not sufficiently to define precise properties of the word.
4	Specific use	High generation: considerable effort to integrate meaning. Extensive elaboration on a word's specific properties and associations.
	Specific context	The context directs learners to a specific meaning that can easily be inferred.

Note. Adapted from Joe (1995, p. 151) and Beck et al. (1983).

Before applying this scale, all target word forms and their word family members were identified in class materials, copies of Zeki's reading materials and his learning materials. Each instance was then coded by the researcher.

Results and Discussion

The variables investigated are the number of days target words were encountered on the course, the richness of input surrounding the target words in authentic contexts, and the level of generative use in learner output. For transparency, the actual tokens of target words in listening, speaking, reading, and writing are presented in Tables 6, 10, and 13.

Analysis is divided into three parts: (a) target words encountered solely through input, (b) target words used without any evidence of change from the original context (verbatim use), and (c) target words used with structural or semantic modifications.

Target Words Encountered Solely Through Input

Table 5 presents the results of Zeki's vocabulary tests for five of the 20 target items met through listening or reading, that is, Zeki did not attempt to produce any of these items during the course. It shows he was unable to produce word associates or to use the words in context in either the pretests or the posttests. At best, he was able to provide a partial word meaning for one item in the posttest.

Table 5. *Test scores for words encountered solely through input*

Target item	Meaning		Associates		Use in context	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
disparity	0	0	0	0	0	0
sacred	0	1	0	0	0	0
launder	1	2	0	0	0	0
compromise	1	1	0	0	0	0
indifferent	1	1	0	0	0	0

Note. Scores for meaning, from 0–5; associates, from 0–4; use in context, from 0–4.

Table 6 shows the level of contextual richness encountered in the input and the actual distribution of word tokens. Given the extremely limited number of meetings with words in listening or reading on the course, the results are probably not surprising. Minimal encounters through input alone did little to shift Zeki's awareness of word knowledge or use beyond the original state for most words.

Table 6. *Level of contextual richness and distribution of words encountered solely through input*

Target item	Verbatim use	Non-specific	General	Specific
disparity	-	-	2 × reading	-
sacred	-	1 × reading	1 × list	-
launder	-	-	1 × list	-
compromise	-	1 × reading	-	1 × list
indifferent	-	-	-	1 × list

Note. List = listening.

However, exposure to one or two tokens of the target item in reading or listening did result in an increase in incremental vocabulary knowledge for two words. As Table 5 shows, knowledge of the word form *sacred* increased between the pretest and posttest. In addition, knowledge of the meaning of *launder* shifted from being unknown to partly known.

Table 7 shows the total number of days words were met on the course and the total number of tokens, that is, the times the word actually occurred. Unsurprisingly, encountering only one or two tokens over a total of 3 or 4 days over a course was insufficient to move words from an unknown state to the ability to articulate a precise word meaning and the ability to use words in context.

Table 7. *Total number of days and word tokens*

Target item	Total number of days[a]	Total number of tokens[a]
disparity	4	4
sacred	3	4
launder	3	3
compromise	4	4
indifferent	3	3

Note. [a]Including cases where the target item was seen once during pretests and posttests.

Input and Verbatim Use

Table 8 shows the vocabulary test scores for the nine target items that Zeki reproduced in his writing or speaking, using exactly the same form as that in the original context. Four of these items remained unknown throughout the course. Five were recognized in form only, and just one word's general semantic properties were known.

Table 8. *Test scores for words encountered through input and used verbatim*

Target item	Meaning		Associates		Use in context	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
deceased	0	0	0	0	0	0
dissuade	0	0	0	0	0	0
intact	0	0	0	0	0	0
thorough	0	0	0	0	0	0
intend	1	1	0	0	0	0
undermine	1	1	0	0	0	0
rapport	0	1	0	0	0	0
empathy	0	1	0	0	0	0
dissolve	1	2	0	0	0	0

Note. Scores for meaning, from 0–5; associates, from 0–4; use in context, from 0–4.

Table 9 shows that most words occurred on only 1 or 2 days of the course, although half of them occurred with greater frequency. Encountering items on at least 4 days and at least six times over the course enabled Zeki to recognise the word forms *intend*, *undermine*, *rapport*, and *empathy* in the posttest, but this number of exposures was not sufficient to produce greater knowledge of word meaning.

Table 9. *Total number of days and word tokens*

Target item	Total number of days[a]	Total number of tokens[a]
deceased	3	10
dissuade	3	6
intact	3	4
thorough	4	7
intend	8	9
undermine	5	6
rapport	4	8
empathy	4	11
dissolve	4	5

Note. [a]Including cases where the target item was seen once during pretests and posttests.

Table 10 shows Zeki's actual encounters with words that he used in speaking or writing without any modification from the original context. Let us examine in more detail how he used these words.

Table 10. *Level of contextual richness, generativeness, and distribution of words used verbatim*

Target item	Verbatim use	Non-specific	General	Specific
deceased	1 × writ 1 × collocation writ 1 × spk 1 × collocation spk	3 × reading		1x list
dissuade	1 × mng writ	1 × list		2 × list
intact	1 × collocation writ	1 × reading		
thorough	2 × mng writ	3 × reading		
intend	1 × writ	6 × reading		
undermine	1 × collocation writ		3 × reading	
rapport	1 × mng writ 1 × writ		2 × reading 1 × list	1 × list
empathy	1 × writ 1 × writ	2 × reading	3 × reading	2 × reading
dissolve	1 × mng writ		1 × reading	1 × list

Note. List = listening, spk = speaking, writ = writing; mng = meaning.

The pretest and posttest scores remained the same for three items that Zeki studied directly for a weekly vocabulary test and met in contexts that provided no clues about the words' general or precise meanings. Zeki encountered *intact* and *thorough* up to three times over 1 or 2 days while reading or studying vocabulary, but he failed to recognize the word forms in the posttest 2 months later. In addition, Zeki was familiar with the word form *intend* but was unable to provide a general meaning in the posttest after encountering the word seven times over 6 days.

Two items, *rapport* and *empathy*, are worthy of comment because they were embedded in rich written contexts and were studied directly for vocabulary tests. Including these words in his vocabulary study shows that Zeki noticed a gap in his lexical knowledge and wanted to further

his vocabulary knowledge, yet he was unable to provide a plausible associate, sentence or a general meaning for these words. At best, he recalled having seen the words previously.

As the excerpt below shows, Zeki noticed the word *rapport* in text and asked his teacher about its meaning. However, over-elaboration may have prevented Zeki from getting a clear sense of the meaning of *rapport*. That is, wordy explanations may not assist with clarifying word meaning (Chaudron, 1982). The turn ends with the teacher, and Zeki does not attempt to clarify, extend, or elaborate on the word meaning at all.

> Zeki: is it close to telepathy
>
> T1: yes and no some people would say yes but other people would say no. um it can come from just understanding someone very well. because you know them very well OK. for example my husband I. like last night we were at the supermarket and we said the same thing at the same time. it's not because we're telepathic it's just because we know each other very well OK. and that's a kind of rapport. um but you can also meet someone and right away you have a rapport with them so some people would say that's telepathic [21/3 Class]

Unlike *rapport*, *empathy* was richly elaborated on within written text. It was also recorded for vocabulary study, translated four times in writing, and used in the simple, non-defining sentence, "She has empathy." *Empathy* was salient because it was central for text comprehension. It occurred seven times and was clearly defined in a "directive" context (Beck et al., 1983). Despite the very rich context in which the word was embedded, Zeki could not provide a word meaning. For both these items, an incremental shift in vocabulary knowledge was limited to greater awareness of word form. This gradual vocabulary growth is not to be dismissed. These examples illustrate how demanding vocabulary learning is. Multiple opportunities were needed, ranging from incidental exposures to rich word meanings, direct vocabulary study, frequent occurrences with the word in a single text, or noticing and comparing a new word with one that was known.

Another point to consider is that the elusiveness of *rapport* and *empathy* may relate to inherent difficulties underlying the semantic properties of the words themselves. Because of the higher conceptual burden, Zeki may have needed further meetings with these words over the course to consolidate semantic and formal features of the words. A similar case could be made for the item *intend*. Although it was encountered on 8 different days across the course, it too proved to be elusive.

Input and Modified Output

Table 11 shows the vocabulary scores for words that were modified structurally or semantically. Six target words were elaborated on in writing or speaking. As is predicted in a depth of processing framework, the two words displaying the highest level of semantic elaboration were those that Zeki could define most precisely in the long term.

What is striking about all the words that were changed from the original context, whether slightly or much more substantially, is evidence of the ability to use the words in context. Four of the six words that scored 0 for evidence of use in the pretest increased to the point where plausible associates were provided, and an attempt was made to use the word in delayed tests.

Table 11. *Test scores for modified words*

Target item	Meaning		Associates		Use in context	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
intensive	1	1	0	2	0	1
determine	1	2	0	2	0	2
advocate	1	3	0	2	0	1
chronology	3	3	1	2	1	2
eligible	2	2	2	2	2	3
weak	1	3	0	4	0	2

Note. Scores for meaning, from 0–5; associates, from 0–4; use in context, from 0–4.

Table 12 shows the overall frequency with which Zeki met items used in a different way from the original. What is striking is that words used in a novel way were met much more frequently. They were distributed across the course over at least 8 days and occurred at least 12 times.

Table 12. *Total number of days and word tokens*

Target item	Total number of days[a]	Total number of tokens[a]
intensive	9	23
determine	11	19
advocate	10	18
chronology	8	19
eligible	10	19
weak	9	12

Note. [a]Including cases where the target item was seen once during pretests and posttests.

Of all the target items, the one with the highest number of tokens was *intensive*, half of which were recycled within one task. In a class debate about immigrant children and teenagers being required to take an intensive English language course before entering regular schools, Zeki used the phrase “intensive English language course” twice and listened to classmates using it 11 times.

While the score for word form familiarity remained the same at both the pretest and posttest, the word associates score increased to the point where Zeki could automatically produce a plausible associate within one context in the posttest. The ability to produce a memorised phrase but not to supply a general or precise word meaning is in line with findings from research on formulaic phrases or multiword units, which show that learners can produce chunks of language to aid fluency (Pawley & Syder, 1983) without necessarily having analysed each part (McNeill, 1996).

Table 13 shows the levels of contextual richness and generativeness for modified words. Three important features can be noted: (a) a high frequency of distributed occurrences with items across the course, (b) opportunities for frequent meetings with items in newspaper articles related to a topic of Zeki’s choosing (*What are the arguments for and against compulsory superannuation in New Zealand?*), and (c) the variability of contexts from which word meanings could be inferred. There was also evidence of direct vocabulary study and translations for all words except *eligible*.

Table 13. *Level of contextual richness, generativeness and distribution of word tokens* (modified words)

Target item	Verbatim use	Non-specific	General	Specific
intensive	1 × writ 1 × spk	5 × reading 1 × writ 6 × list 1 × spk	5 × list 1 × spk	1x list
determine	4 × writ	2 × reading	8 × reading 1 × writ	2 × reading
advocate	1 × mng writ 2 × collocations writ 6 × writ		4 × reading 1 × writ (errors)	1 × reading 1 × writ (errors)
chronology	1 × list 5 × spk	1 × reading 1 × list 2 × spk	1 × list 1 × mng spk	2 × reading 2 × spk 1 × mng spk
eligible	1 × mng & collocation writ	6 × reading	5 × reading 3 × spk	2 × reading
weak	1 × collocation writ 2 × writ	4 × reading 1 × collocation writ	2 × reading	

Note. List = listening, spk = speaking, writ = writing; mng = meaning.

The distribution of tokens for writing and speaking shows there is more general and specific generative use for the items *advocate*, *chronology* and *eligible,* which happen to have better vocabulary test scores than *intensive* and *determine*.

While there is no record of Zeki using *weak* with high levels of generative processing in speaking or writing, he was observed reviewing *weakness* on his word card ring after having read a passage from a book about the impact of economic reforms in New Zealand. It would appear that he noticed a lexical gap or wanted to quickly confirm the word meaning. The metacognitive act of noticing the word, possibly evaluating its lexical status, guessing, and confirming the word meaning suggests deep level processing may have occurred.

An important point to note with the items *determine*, *advocate*, *chronology*, and *eligible* is that they were recycled within and across different texts focusing on specialist topics of Zeki's choosing, that is, economics, history, politics, and law. He not only had multiple opportunities to see target words in contexts of interest, he also used these words in novel ways. Below are examples of sentences he generated for vocabulary study and vocabulary tests.

> I thought because I read very quickly I thought he said if taxes er wouldn't rise in the future ah do you the age of elibility eligibility rise to 17 in the future I thought but it was wrong was wrong understanding [9/4 Interview]

> Minister of finance has been advocated all of his colleagues and the PM in the House of Representatives [20/3 Vocab study]

> He's advocated by a large group of lawyer (L1) [2/4 Vocab cards]

His productive use of *advocate*, generated independently in the examples above, is validated by his performance in the posttest, as shown in the extract below. Zeki often read his wife's law essays, so he was exposed to legal terms. This may account for the narrower definition given for *advocate* "to defend a client" rather than the wider sense, "to speak publicly in support of something."

> Zeki: advocate. defend something. defend mm. like lawyer advocate. a lawyer advocates mm. [switches to the next target item]
>
> Researcher: so that's a new one. if we go back to advocate you said before. that you defend something and like a lawyer would defend something. can you give me a sentence using the word advocate. or advocate
>
> Zeki: isn't advocate a name of the lawyer. an advocator. what can I say advocate. it doesn't mean it is an idea and you support it. if you defend or advocate something ah. it is like a. business or to educate your company's. company's pattern or. method yeah advocate advocate it's the same advocate [18/6 Interv]

We can see that Zeki evaluates how well the example fits with an ideal sentence illustrating the precise meaning intended. This does not quite hit the mark, but in terms of depth of processing theory, what is important is the cognitive effort involved in comparing, evaluating, and integrating old and new knowledge, that is, the transformation and generation of new knowledge. A key point is that cognitive processing is primary; accuracy relating to the learning product is secondary. This example is characteristic of his cognitive effort and approach to vocabulary perceived as relevant to his central interests.

As alluded to previously, words that had been modified in some way were sourced mainly from self-selected tasks: (a) words selected for direct vocabulary study, (b) words encountered while reading news articles on a class project of his own choosing, and (c) reading books, essays or internet articles related to his interests. This finding positively supports the view that learner input into decision-making processes enhances vocabulary acquisition.

It reinforces the importance of greater need, search, and evaluation (Laufer & Hulstijn, 2001) to acquire new words. An element of autonomy in the selection of words and topics studied in sustained tasks can lead to higher levels of motivation because of greater learner interest and ownership of the task. Active engagement in the process of reading and choosing relevant extracts or lexical items for projects or personalised vocabulary programmes also required evaluation of the usefulness of the items, for example, when deciding on whether a word is worth studying for receptive or productive purposes. Each instance of encountering a word served to promote retrieval of word form, at a minimum, and potentially to notice how words were used in context.

As we have seen in this section, exposures to words accrued and contributed to Zeki's ability to generate novel sentences. Let us now turn to the extent of the cumulative encounters that Zeki had with target words over the course.

Frequency of Encounters

Table 14 summarises the average number of days that target words were encountered over the course and the average number of tokens according to Zeki's comprehensive word knowledge and ability to use the items in context.

Table 14. *Pretest and posttest status of target words*

	Mean number of days	Mean number of tokens	Number of words
•Unknown form, meaning, and use	3	6	5
•Familiar word forms only with no evidence of plausible word use	5	5.5	4
•Minimal increase in word form familiarity only	4	7.5	3
•Increase in word meaning with little or no evidence of use	3.5	4	2
•Unstable meaning or use	0	0	0
•Increased evidence of plausible use	9.5	18	6

By classifying Zeki's 20 target words according to various states of vocabulary knowledge between pretests and posttests, then averaging the days' encounters associated with each state, we can identify key trends related to states of knowledge and frequency. Table 14 clearly reveals that frequent distributed meetings (9.5 days) with words averaging 18 tokens across the course were necessary for Zeki to use target words in plausible sentences.

While words reported as unknown in all aspects of vocabulary knowledge were encountered on an average of 3 days across the course, with an average of six tokens, words used plausibly in illustrative sentences occurred three times as often. Zeki needed repeated exposures and opportunities to produce the words in order to generate meaningful and grammatically accurate sentences. As previous researchers (e.g., Sternberg, 1987, p. 92; Zahar et al., 2001) have stated, learning is more likely to occur when unknown words are met frequently across variable contexts.

That is not to say however that fewer occurrences with words over the course were unproductive. Encounters with words over 4 days of the course with as few as four instances resulted in incomplete vocabulary growth, evident in the partial ability to recognise word forms, retrieve word meanings, and attempts to use words in sentences. Obviously the number of meetings needed to shift vocabulary knowledge, and the ability to use words productively, is influenced by other factors such as the underlying conceptual difficulty of the words themselves, cognates, opportunities for use, and the learner's own purpose.

Bearing in mind that Zeki began the course with a receptive knowledge of about two-thirds of the second thousand words and over a third of the University Word List, it is likely that greater numbers of exposures to words were required over the course because of greater gaps in his lexicon. If he had started off with a greater breadth of vocabulary knowledge, he would have had richer associations within his existing vocabulary networks, thereby lessening the learning burden.

Quality of Input

Other researchers (e.g., Beck et al., 1983; Zahar et al., 2001) investigating the effect of contextual richness on vocabulary acquisition have found acquisition to be a function of frequency, not contextual richness based on incidental exposure to reading alone. Table 15 shows a comparison of mean scores for contextual richness and level of generative output. We can see there is little difference between words associated with high, medium or low vocabulary test scores and the ability to infer the precise meaning of words from reading and listening texts (see Appendix A, B, and C for detailed analyses). This is in line with previous findings.

Table 15. *Mean for the richness of contexts and level of generative output*

	Mean context (range 0–4)	Mean generativeness
Highest scoring words	2.54	1.97
Medium scoring words	2.87	1.55
Lowest scoring words	2.83	0.57

Table 15 also shows that the higher vocabulary scores are associated with greater levels of generative use. As we saw with words that were modified and learned best, there was a tendency for words learned better to have been used with reasonable or high levels of generation. However, this was coupled with frequent encounters with words across the course.

Conclusion

What is noticeable about the words that were unknown in all aspects or were reported to be familiar in both the pretest and posttest are fewer opportunities for input and less evidence of noticing.

Although Zeki's test results show the greatest effect for richly elaborated words and for frequent distributed meetings with related texts, it would be wrong to dismiss the contributions that tasks such as verbatim copying and intensive, massed encounters had on incremental vocabulary development. The results do reveal that vocabulary is cumulative with a shift from no knowledge to perceived word form familiarity. We saw how noticing a word, having opportunities for focused practice and encountering words over 4–6 days over a distributed period moved Zeki's vocabulary development incrementally, even though it was below his optimum threshold of 18 tokens over 9 or more days.

To sum up, the majority of words that Zeki retained well long-term were met extensively across the course and involved greater levels of processing. Embedding words in rich, instructive contexts on its own did not contribute to better opportunities for vocabulary learning. It needed to be coupled with noticing and frequent meetings over a distributed period to improve vocabulary development. We have seen that vocabulary acquisition is indeed an incremental process, requiring multiple encounters with new or partially known words in a wide range of tasks.

Notes

1. Refer to Joe (2006) for a detailed description of the word recognition measure.

2. This study applied Stahl and Fairbanks' (1986, p. 75) definition of *depth of processing*: "decisions that require more mental effort, or require greater amount of available cognitive resources." The depth of generative processing was operationalised by evidence of learners comparing, evaluating, and integrating new words with known words in tasks and by the extent of semantic elaborations observed in output (refer to Table 4 for descriptors used to measure different levels).

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Appendix A

Descriptive Statistics for Best Acquired Target Words
(Ratings and means for richness of contextual input and level of generative output)

Most acquired words 7+	Test score	Tokens in	Tokens out	Context rating	Mean context	Generative rating (gen)	Mean gen
chronology	33 12 12	6	11	1, 2, 2, 3, 4, 4	2.6	1, 1, 1, 1, 1, 2, 2, 3, 4, 4, 4	2.18
eligible	22 22 23	13	4	2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4	2.69	1, 3, 3, 3	2.50
weak	13 04 02	6	4	2, 2, 2, 2, 3, 3	2.33	1, 1, 1, 2	1.25
Mean		8.3	6.3		2.54		1.97

Appendix B

Descriptive Statistics for Partly Acquired Target Words
(Ratings and means for richness of contextual input and level of generative output)

Total test score 4–6	Test score	Tokens in	Tokens out	Context rating	Mean context	Generative rating (gen)	Mean gen
determine	12 02 02	12	5	2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4	3	1, 1, 1, 1, 3	1.4
advocate	13 02 01	5	11	3, 3, 3, 3, 4	3.2	1, 1, 1, 1, 1, 1, 1, 1, 1, 3, 4	1.45
intensive	11 02 01	17	5	2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4	2.41	1, 1, 2, 2, 3	1.8
Mean		11.3	7		2.87		1.55

Appendix C

Descriptive Statistics for Least Acquired Target Words

Descriptive statistics for target words acquired the least: Ratings and means for richness of contextual input and level of generative output.

Total test score 0–2	Test score	Tokens in	Tokens out	Context rating	Mean context	Generative rating (gen)	Mean gen
rapport	01 00 00	4	2	3, 3, 3, 4	3.25	1, 1	1
dissolve	12 00 00	2	1	3, 4	3.5	1	1
indifferent	11 00 00	1	0	4	4	0	0
empathy	01 00 00	7	2	2, 2, 3, 3, 3, 4, 4	3	1, 1	1
undermine	11 00 00	3	1	3, 3, 3	3	1	1
compromise	11 00 00	2	0	4, 2	3	0	0
launder	12 00 00	1	0	3	3	0	0
deceased	00 00 00	4	4	2, 2, 2, 4	2.5	1, 1, 1, 1	1
dissuade	00 00 00	3	1	4, 4, 3	4	1	1
intact	00 00 00	1	1	1	1	1	1
thorough	00 00 00	3	2	2, 2, 2	2	1, 1	1
sacred	01 00 00	2	0	2, 3	2.5	0	0
intend	11 00 00	6	0	2, 2, 2, 2, 2, 2	2	0	0
disparity	00 00 00	2	0	3, 3	3	0	0
Mean		2.92	1		2.83		.57

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