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Tracking the Incremental Acquisition of Second Language Vocabulary: A Longitudinal Study

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Previous vocabulary research has focused on the size of lexicons and the number of words learned through various activities. To date, this type of research has generated little understanding of how individual words are acquired. To explore this issue, I tracked the acquisition of 11 words over the course of a year for 3 adult learners with advanced proficiency in English. I measured 4 kinds of word knowledge: spelling, associations, grammatical information, and meaning. The participants had little problem with spelling, but rarely knew all of a target word's meaning senses or derivational word forms. Knowledge of the meaning senses of the target words improved about 2.5 times more than it was forgotten, and some of the word knowledge types appear to be interrelated. However, the study did not show evidence of a developmental hierarchy for word knowledge types.

The mechanics of vocabulary acquisition is one of the more intriguing puzzles in second language acquisition (SLA).

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Unfortunately, researchers still can say little with confidence. As Paul Nation has noted:

> There isn't an overall theory of how vocabulary is acquired. Our knowledge has mainly been built up from fragmentary studies, and at the moment we have only the broadest idea of how acquisition might occur. We certainly have no knowledge of the acquisition stages that particular words might move through. (Schmitt, 1995b, p. 5)

This lack of knowledge stems not from lack of effort; as Meara (1987, 1992) and many others have pointed out, there is now a virtual explosion of vocabulary studies. One reason this increased research has not yet translated into an adequate understanding of vocabulary acquisition is because nearly all of it has focused on the size and growth of lexicons, on how many words are gained (or forgotten) over time. Among the myriad examples of this research perspective are studies that have attempted to quantify the number of words average native speakers (NSs) know (D'Anna, Zechmeister, & Hall, 1991; Goulden, Nation, & Read, 1990), the number of words non-native speakers need to know (Hazenberg & Hulstijn, 1996; Laufer, 1992), the numbers of words learned from incidental exposure while reading (Huckin, Haynes, & Coady, 1993; Nagy, Herman, & Anderson, 1985), and the number of words which can be learned by using various exercises, techniques, and strategies (Avila & Sadoski, 1996; Cohen & Aphek, 1980).

This line of research, though obviously important, does not explain how individual words are acquired diachronically. Logic suggests that this requires research which focuses on the individual words themselves, rather than on the overall growth of lexicons. Such research needs to incorporate a number of key features. First, the studies have to chart vocabulary development within individual persons, because learners probably know somewhat different vocabulary even if they are members of rather homogeneous groups; this makes generalizations about the development of any individual word problematic in a group study. Second, the studies need be longitudinal in nature: This stems from the commonsense fact that describing acquisition or loss within an

individual person requires at least two separate measurements. Third, because words are learned incrementally, and not in a dichotomous "not acquired/acquired" manner (Meara, 1984; Sharwood Smith, 1984), acquisition studies need measurement procedures that can capture degrees of lexical knowledge. Fourth, full mastery of a word requires more than just a knowledge of its meaning and form (Nation, 1990, pp. 30–33; Richards, 1976).

Nevertheless, most previous studies have accepted recognition or production of a single meaning sense as evidence that a word is "known," even though this type of response demonstrates only partial knowledge at best. A truly adequate test of acquisition would have to capture a much wider range of lexical knowledge. For example, many teachers assume that grammatical aspects like word class and derivational morphology are easily learned, but research has shown that one cannot assume that learners have mastered these elements. Alderson, Clapham, and Steel (1997) found that their participants often did not have clear metalinguistic knowledge about which word class different words belonged to. Similarly, Schmitt and Meara (1997) found that their Japanese intermediate students typically had trouble changing root word forms into their derivatives. These two grammatical aspects are obvious topics for investigation.

Studies that inform about individual word acquisition have been either very specific or are thin on the ground. Psychology journals are filled with studies that have measured the acquisition of various features of individual words (often in laboratory conditions), such as intuitions of frequency (Hintzman, Block, & Summers, 1973), a word's orthographical form (Thomas & Dieter, 1987), and word associations (McNeill, 1963). Other studies have similarly focused on single elements of lexical knowledge, such as meaning (Carey, 1978). The problem lies in the fact that these specifically focused studies tell us little about what else is happening in the acquisition process at the same time. Surely acquisition of at least some word knowledge components occurs concurrently; so researchers need to investigate them together at the same time in order to establish their interrelationships. Studies that have

done this are rare. Two of the few that have tackled concurrent tracks of acquisition were by Nagy, Diakidoy, and Anderson (1993; meaning and derivative suffixes) and Schmitt and Meara (1997; word association and suffixes, along with vocabulary size).

To study the incremental acquisition of individual words, one must be able to measure the degree or depth of knowledge for each of those words. There are two main approaches for doing this: a developmental approach and a dimension approach (Read, 1997). The developmental approach uses scales to describe the stages of acquisition of a word. Many of these describe 4 levels of knowledge, including scales by Dale (1965, p. 898), Drum and Konopak (1987, pp. 79–80), and Schmitt and Meara (1997). One scale that has received some attention lately is the Vocabulary Knowledge Scale (Paribakht & Wesche, 1993), which has 5 levels:

Stage 1: The word is not familiar at all.

Stage 2: The word is familiar but the meaning is not known.

Stage 3: A correct synonym or translation is given.

Stage 4: The word is used with semantic appropriateness in a sentence.

Stage 5: The word is used with semantic appropriateness and grammatical accuracy in a sentence.

Perhaps the main advantage of using scales is that they promote an incremental notion of vocabulary acquisition, rather than the dichotomous not acquired/acquired view. But they pose serious problems as well. Scales attempt to measure stages of knowledge in vocabulary acquisition, but defining the stage boundaries may be problematic if acquisition is in fact a continuum. Scales also tend to suffer from uneven intervals between the stages. In addition, there is at present no principled way of determining the number of stages necessary to accurately describe the acquisition process. Finally, it is difficult to give balanced attention to both receptive and productive knowledge within a scale; the

beginning levels of a scale usually focus on receptive knowledge and the more advanced levels on production.

The dimension approach, on the other hand, describes the level of mastery of the various component types of word knowledge. This approach has its roots in a seminal paper by Richards (1976) which set out a number of competencies necessary for mastery of a word. Later scholars have taken up the idea, suggesting their own lists of word knowledge types (Alexander, 1982; Blum-Kulka, 1981; Laufer, 1997). Perhaps the most complete and balanced description of word knowledge to date is that proposed by Nation (1990, pp. 30–33). It consists of 8 word knowledge categories, each of which has receptive and productive aspects:

1. The spoken form of a word;
2. The written form of the word;
3. The grammatical behavior of the word;
4. The collocational behavior of the word;
5. The frequency of the word;
6. The stylistic register constraints of the word;
7. The conceptual meaning of the word;
8. The associations the word has with other related words.

Both the weakness and the strength of such a word knowledge list lie in its comprehensiveness. It is hard to imagine how addressing each of these word knowledge types for each individual target word could be practical in any normal classroom teaching or testing situation. Even though the pedagogical applications of such a list may be limited, Schmitt (1995a) suggested that it could still be useful to classroom teachers as a conceptual framework with which to evaluate various vocabulary tests and vocabulary learning activities. By viewing the tests and activities through such a framework, teachers can come to a clearer understanding of which word knowledge types the tests and activities are and are not addressing.

It is in a research context that the dimension approach may prove to be of more value. True, measuring knowledge of several of the above dimensions would be time-consuming and would severely limit the number of words that could be studied. However, such research could produce a very rich description of vocabulary knowledge, making it well worth the effort. Schmitt and Meara (1997) noted that the present word knowledge lists are purely descriptive and have no explanatory power. However, they also suggest that such descriptive summaries can be used as frameworks for explanatory research. If research based on a word knowledge framework could lead to a better understanding of how each lexical dimension is acquired, researchers would surely be closer to piecing together the overall lexical acquisition process, something that remains a major gap in the field. This knowledge may later make it possible to isolate a few key dimensions of lexical knowledge, which may be limited enough to have pedagogical practicality. Meara (1996a) suggested that the size and organization of the lexicon might be two of these dimensions.

The dimension approach has several advantages beyond its comprehensiveness. One is the simplifying effect of breaking complex behavior (vocabulary acquisition) into its more manageable components for analysis. Also, analyzing the components separately allows the possibility of discerning their relationships. A number of these relationships have long been obvious (e.g., between frequency of occurrence and formality of register; between word class and derivational suffixes); Schmitt and Meara (1997) recently demonstrated some of these interrelationships correlationally. An intriguing possibility is that some of these relationships are hierarchal; that is, learned in some type of developmental order. Developmental sequencing has been posited in other areas of language, syntactic structures (e.g., Pienemann & Johnston, 1987) and morphemes (e.g., Larsen-Freeman, 1975), so it would not be surprising if the principle obtained in the area of lexical acquisition as well.

In fact, it seems counterintuitive that word knowledge is not at least partially hierarchal. It is unlikely that the initial exposure

to a word yields much more than some partial impression of its written or phonological form and one of its meaning senses, possibly in an idiomatic usage. After more exposures (or some explicit study), a learner would gradually learn the other kinds of word knowledge, with perhaps collocational and stylistic knowledge being the last. Indeed, it doesn't seem reasonable that a learner would have a rich associative and collocational network built up without a knowledge of the word's form, for instance. Bahns and Eldaw (1993) found some evidence for this intuition; their participants' collocational knowledge lagged behind general vocabulary knowledge. Research designs based on a word knowledge framework would allow investigation into whether some kinds of word knowledge are acquired before others.

Finally, such word knowledge research may lead to a better understanding of the movement of vocabulary from receptive to productive mastery. This movement is still something of a mystery; researchers are not even sure whether receptive and productive knowledge forms a continuum, as Melka (1997) argued, or whether it is subject to a threshold effect, as Meara (1996b) has suggested. Part of the problem is the typical assumption that the whole word is either receptively or both receptively and productively known. The actual situation is probably that, for any individual word, each of the different types of word knowledge is known to different receptive and productive degrees. For example, a word's spelling might be productively known, some of its meaning senses receptively known, and its register constraints totally unknown. Thus, research into the underlying receptive/productive word knowledge states should prove informative about learners' overall ability to use words in a receptive versus productive manner.

For all of these reasons, I believe that the dimension approach and the word knowledge framework should be investigated as an avenue of research. This article reports on an exploratory study that incorporated the elements discussed above in a longitudinal study of vocabulary acquisition. It attempted to describe the acquisition of individual words by measuring the development of 4 types of word knowledge: written form, associations, grammatical

behavior, and meaning. Ideally, the study would have measured each of the 8 word knowledge types, but this was not practical due to time constraints.

Method

Participants

The 4 participants were international students just beginning a course of postgraduate study at a British university. They came from different countries and were studying in different departments. They had never previously resided in a country where English was the first language, except for their respective university presessional courses. The students voluntarily agreed to participate; I paid them a token fee of £10 (UK) per session. Details about the students appear in Table 1. Longitudinal studies are prone to participant attrition; unfortunately, this one was no exception. Kor dropped out of her program before the second session, so there are no longitudinal results for her.

Table 1

Longitudinal Study Participants

Pseudonym	'Lith'	'Kor'	'Tai'	'Ind'
Native Country	Lithuania	Korea	Taiwan	India
L1	Lithuanian	Korean	Chinese	Tamil
Months[a]	2	8	3	5
Age	30	24	30	27
Sex	Male	Female	Male	Male
Course of Study	Politics	Neural Science	Insurance	Life Science
TOEFL[b]	560	530	537	547

[a]Length of time spent in English-speaking countries at time of first test
[b]Score as submitted as part of admission requirements

Target Words

Because this study investigated the target words in some detail, I could include only very few, making the selection criteria even more important than usual. First, I needed a high likelihood that the participants would be exposed to the words during their course of study. Because the participants belonged to different departments in a British university, I considered general academic vocabulary most suitable. Therefore, I took the majority of the target words from the University Word List (UWL: Xue & Nation, 1984; reprinted in Nation, 1990, pp. 265–239), a list of academic words occurring frequently across various academic disciplines. Second, I chose only polysemous UWL words that had 3 or more meaning senses, because this would allow examination of the participants' growing awareness of the different senses. Third, because the participants might at least partly know all of these words (being advanced enough to enter British postgraduate programs), I required a few lower-frequency, relatively unknown words in order to allow insights into the beginning stages of lexical acquisition. I selected 3 words from the 4,000 to 5,000 word level of the Brown word list (Francis & Kucera, 1982) with the same criterion of having at least 3 major meaning senses. To confirm that the eventual target words were likely to fall at various points on the acquisition continuum for the participants, I piloted 18 candidate words on 12 international students, who were similar to the eventual participants, to check their familiarity. I reduced the candidate list to 11 target words, which later piloting indicated was the maximum that could be addressed in a session approximately 2 hours long. They included 2 relatively unknown words (*brood, spur*), 4 relatively well-known words (*abandon, dedicate, illuminate, suspend*), and 5 words in between (*circulate, convert, launch, plot, trace*).

Word Knowledge Types and Measurement

I focused on knowledge of spelling, associations, grammatical information, and meaning. I also measured collocation, but the results indicated that the experimental measurement procedure needed further development (see Schmitt, in press a). I eliminated the other word knowledge types because (a) the target words had no obvious register marking, (b) the words were given to the participants orally, thus eliminating the possibility of a productive measure of phonological form, and (c) a previous study had highlighted the difficulty of measuring intuitions of frequency (see Schmitt & Dunham, 1997).

On the assumption that the various word knowledge types are learned incrementally, the measurement procedures had to be as sensitive as possible to increments in the different word knowledge aspects, ranging from no knowledge at all to full NS-like mastery. The test of written form (spelling) consisted of a 4-point rating system. Zero (0) on the scale indicated that the participant demonstrated no knowledge of a word's spelling. One (1) signified that the participant could give the initial letters of the target word, but omitted some later letters, added unnecessary letters, or transposed letters. Two (2) indicated that the word was phonologically correct, but perhaps some vowels or consonants were replaced by similar-sounding but erroneous items (*brood—*brud; illuminate—*elluminate*). Three (3) indicated fully correct spelling. This scale almost certainly suffers from the scale-specific problems discussed above, but I considered it adequate to indicate a progression in the mastery of written form. In an assessment of how NSs might perform on this measure, 3 NS pilot respondents (see below) scored 100% correct spelling of the target words.

The association measurement procedure asked participants to give 3 responses for each target word stimulus. These responses I compared to an NS norming list. I scored each of the participants' responses according to how many of the norming NSs also gave that response. The 3 scores were totalled and matched against a 4-category profile of NS behavior. In Category 0, none of the 3

responses matched any of those on the norming list, in which case, no NS-like association behavior was demonstrated. In Category 1, some responses matched infrequent ones on the norming list, indicating a minimal amount of NS-like association knowledge. In Category 2, the responses were similar to those typical of the NS norming group, indicating NS-like associations. Last, in Category 3, the responses were similar to those in the top half of the NS norming group, indicating a NS-like rating in which even more confidence can be put (see Schmitt, in press b, for more detail). Eighty-two percent of the association responses from the 3 NS respondents belonged in Categories 2 or 3, while 12% fell into Category 1 and 6% into Category 0.

I obtained the norming word class and derivational forms from 3 dictionaries: the *Longman Dictionary of English Language and Culture* (1992), the *Oxford Advanced Learner's Dictionary* (1995), and *Webster's Ninth New Collegiate Dictionary* (1987). The participants got 1 point for knowing the word class of the target word, and 1 point for knowing how to transform it into each of the 3 other word classes. If a form for a word class does not exist, participants got credit for being able to state that fact. When 2 or more forms were possible for any word class, only 1 was required for credit. For example, participants were awarded 1 point for knowing that *illuminate* is a verb, and 1 point each for knowing *illumination* is the noun form, *illuminated* or *illuminating* (only 1 required) is the adjective form, and that no common adverb form exists. During the development of this section, I noted that the norming data from the dictionaries sometimes conflicted with the NS pilot participants' answers, particularly for adverbials, with the dictionaries occasionally listing forms that the NSs found strange. In these cases, I consulted the British National Corpus to check those forms' frequency of occurrence. If it was very low, I still accepted it as a possible form for that word class, but I also considered acceptable an answer that no form existed. For example, the very rare adverb form of *circulate, circularly*, is so uncommon that I also accepted the answer "No form exists." Thus, the possible scores ranged from 0 (knowledge for no word class) up to

4 (knowledge for all four word classes). The NS pilot participants knew all 4 word classes for 70% of the target words and 3 word classes for the remaining 30%.

Because this study attempted to describe vocabulary acquisition up to the level of full mastery, it was important to measure knowledge of all of the major meaning senses of the target words. (Knowing only a single meaning sense for a polysemous word must be considered only partial knowledge.) I consulted the 3 dictionaries to determine the major meaning senses. For cases in which they disagreed, I made decisions based on the responses from both the NS and NNS pilot participants and on corpus data. Whereas I only measured the other word knowledge types productively, it was both feasible and desirable to measure both receptive and productive knowledge of word meaning, because a major part of the incremental acquisition of word meaning probably involves the move from receptive to productive mastery of different meaning senses. In addition, meaning has traditionally been the type of word knowledge given most weight in vocabulary testing; it was relatively easy to tap into the participants' receptive knowledge.

I asked the participants to explain all of the meaning senses they knew for each target word. After the participant could not think of any additional senses, I gave prompt words designed to elicit additional senses that the participant might know but could not recall. The prompts were designed to trigger the related sense if the participant knew it, but not to give it away if it were unknown. For example, for the target word *spur*, the prompt word *horse* was designed to suggest the meaning, "metal device worn on the heel of a boot used to guide or encourage a horse." If the participant could not describe the meaning sense after the prompt, I scored that meaning sense as "unknown."

With no real guidance in the literature about how to relate productive and receptive meaning knowledge to each other and score them, I devised the following scoring system. Because the whole study was an exploratory look into a new area, I felt that a simple, transparent system would be best. Therefore, I assumed unprompted explanations of meaning sense demonstrated

productive knowledge and awarded them 2 points. I considered prompted explanations to be related to receptive knowledge and gave them 1 point. Unknown meaning senses received 0 points.

Because the target words had differing numbers of meaning senses, a convenient way of comparing the different words was to calculate a meaning proportion by taking the participant's total point score for each word and dividing that by the number of possible points (= number of meaning senses × 2 points each). Thus, a meaning proportion of .50 could indicate knowing all meaning senses receptively, half productively, or some combination of the two.

Of course, even NSs do not necessarily know every meaning sense for all of the target words, but the 3 NS pilot participants demonstrated an understanding of most of the 61 meaning senses: Participant A, productive knowledge 56%, receptive knowledge 20%, unknown 24%, meaning proportion .66; Participant B, 69%, 21%, 10%, .80; Participant C, 61%, 21%, 18%, .71.

Once the entire measurement battery was assembled, I piloted it on the 3 NSs mentioned above, resulting in some fine-tuning of the meaning prompts. Next, I tested 3 international postgraduate students (1 Japanese, 1 Brazilian, and 1 Taiwanese) from the same cohort as the eventual study participants. Their results indicated that the measurement battery would be suitable for the main study.

Interview Procedure

The first session (T1) was at the beginning of November 1995, with subsequent sessions at approximately half-year intervals. The only exception was Tai's T3, which was administered 3 months after his T2 because he left his university early due to financial reasons.

The format was a one-on-one interview, with me working down the interview instrument (see Appendix) in lockstep order. The sessions were generally held in my or the students' office; I tape-recorded them for future reference. After a brief exchange of

pleasantries to set the student at ease, I either explained or reminded the student about the format of the session. (In the T1, we went through the entire battery for the example word *secure*.) Next, I checked to see whether the student was comfortable with the metalinguistic notions and terms *noun*, *verb*, *adjective*, and *adverb*. If so, the interview proceeded. Occasionally some instruction was required before this point. The students had lists of words that belong uniquely to a single word class for reference. These steps insured that lack of metalinguistic knowledge was not a factor in the grammar task.

At this point, the session proper began. The first type of word knowledge measured was written form. I asked "How do you spell _____?" The student had pencil and paper available throughout the interview, and was allowed to either spell the word out orally or write it out. In practice, the students normally did both simultaneously. If they misspelled the word, I gave the correct spelling at that point so that they would have it in front of them for the rest of the questions on that word. I next elicited associations by using the following instruction, "Please give the first 3 words you think of when you hear the word _____." The next lexical aspect elicited was grammatical knowledge, initiated by the prompt "What word class (part-of-speech) is _____?" Depending on the answer, I went on to ask "Is there a (noun, verb, adjective, adverb) form? If so, what is it?" for the remaining 3 word class forms. I then asked the students to explain any meaning senses they knew for the target word, reminding them to use any means necessary to convey understanding of the meaning senses (give definitions, give examples, use the word in sentences, draw sketches or diagrams, use gestures, etc.). After I determined which meaning senses the student knew productively, I gave the prompts, one-by-one, including the word class of that meaning sense, to elicit any receptive knowledge of meaning. In the T2 and T3 sessions, after the tests for each word, I went back and explained the different meaning senses to the student, both to keep the students' interest up during the rather long interview sessions and to make sure that they

received at least some input from which they could learn about the words. After this was finished, I went on to the next word.

Results

The results for all 4 students are summarized in Tables 2 through 5. The study's design allowed statements about how the 4 kinds of word knowledge developed over time, but not why this knowledge developed, or what facilitated or inhibited development. Lith and Ind both confirmed that they did not study the words between test sessions, and so the only time they explicitly focused on the words was in the T2 and T3 sessions. Thus they must have gained any additional exposure in a naturally-occurring context. On the other hand, Tai reported explicitly looking up the words in a dictionary and studying them to a minimal extent.

Discussion

Meaning Knowledge

In only one case was a meaning proportion of 1.00 attained in a single session, signifying that *all* of the meaning senses of that target word were known productively. Thus, in all but this one case, the students had only partial meaning knowledge. In addition, the average meaning proportion was generally less than .50, indicating that the "partial" knowledge was nowhere near full productive mastery. In only 5 cases—all from one student, Lith—were all meaning senses known to some degree (indicated by "Unknown" = 0). The limited state of meaning knowledge these tables paint is surprising; one might have assumed that advanced students like these would know the majority of the target words fairly well. The upshot is that advanced NNSs may have mastery over only a rather limited number of the possible meaning senses of a word, even if they are proficient enough to study in British universities.

Table 2

Longitudinal Study Results for Lith

	Spelling			Association			Grammar			Meaning											
Session	1	2	3	1	2	3	1	2	3	1				2				3			
										P	R	U	MP	P	R	U	MP	P	R	U	MP
Abandon	3	3	3	2	3	2	2	2	3	1	1	4	.25	1	3	2	.42	3	1	2	.58
Brood	2	2	3	0	0	2	2	2	2	0	0	6	.00	0	0	6	.00	1	0	5	.17
Circulate	3	3	3	1	1	2	2	2	3	1	2	1	.50	1	3	0	.63	1	1	2	.38
Convert	3	3	3	1	1	2	2	3	2	1	2	1	.50	3	0	1	.75	3	0	1	.75
Dedicate	3	3	3	2	2	2	3	2	2	1	3	0	.63	3	1	0	.88	2	1	1	.63
Illuminate	2	2	2	3	3	3	3	2	3	2	1	1	.63	2	1	1	.63	4	0	0	1.0
Launch	2	3	3	0	3	3	3	2	4	2	1	5	.31	2	4	2	.50	5	3	0	.81
Plot	3	3	3	0	1	2	3	2	3	0	1	5	.08	0	2	4	.17	3	0	3	.50
Spur	2	2	3	1	1	0	2	2	4	0	0	7	.00	0	0	7	.00	0	0	7	.00
Suspend	3	3	3	2	2	3	2	2	3	2	0	3	.40	4	0	1	.80	4	0	1	.80
Trace	3	3	3	0	2	2	3	2	3	1	3	3	.36	4	1	2	.64	4	0	3	.57
Mean	2.64	2.73	2.91	1.09	1.73	2.09	2.45	2.09	2.91	1.00	1.27	3.27	.33	1.82	1.36	2.36	.49	2.73	0.55	2.27	.56

Note. P=productive knowledge, R=receptive knowledge, U=unknown, MP=meaning proportion.

Table 3

Longitudinal Study Results for Ind

	Spelling			Association			Grammar			Meaning											
Session	1	2	3	1	2	3	1	2	3	1				2				3			
										P	R	U	MP	P	R	U	MP	P	R	U	MP
Abandon	3	3	3	1	0	0	2	2	2	1	1	4	.25	1	2	3	.33	1	0	5	.17
Brood	2	2	2	0	0	0	1	1	0	0	0	6	.00	0	0	6	.00	0	0	6	.00
Circulate	3	3	3	1	3	3	2	2	2	2	1	1	.63	2	0	2	.50	1	2	1	.50
Convert	3	3	3	1	1	3	4	3	3	2	0	2	.50	2	0	2	.50	2	0	2	.50
Dedicate	3	3	3	2	2	2	2	2	2	1	1	2	.38	2	1	1	.63	3	0	1	.75
Illuminate	3	3	3	3	3	3	3	3	1	2	1	1	.63	2	0	2	.50	2	0	2	.50
Launch	2	2	2	3	2	3	2	3	1	3	0	5	.38	2	2	4	.38	3	2	3	.50
Plot	3	3	3	2	2	1	2	3	2	2	2	2	.50	3	0	3	.50	2	0	4	.33
Spur	3	2	2	2	2	3	1	2	1	0	0	7	.00	0	0	7	.00	0	0	7	.00
Suspend	3	3	3	1	1	0	3	2	3	2	0	3	.40	2	1	2	.50	2	0	3	.40
Trace	3	3	3	2	1	1	1	3	1	1	1	5	.21	2	1	4	.36	2	1	4	.36
Mean	2.82	2.73	2.73	1.64	1.55	1.73	2.09	2.36	1.64	1.45	0.64	3.45	.35	1.64	0.64	3.27	.38	1.64	0.45	3.45	.36

Note. P=productive knowledge, R=receptive knowledge, U=unknown, MP=meaning proportion.

Table 4

Longitudinal Study Results for Tai

	Spelling			Association			Grammar			Meaning											
Session	1	2	3	1	2	3	1	2	3	1				2				3			
										P	R	U	MP	P	R	U	MP	P	R	U	MP
Abandon	3	3	3	1	1	1	2	1	4	1	1	4	.25	1	2	3	.33	1	1	4	.25
Brood	2	2	3	0	0	2	2	2	3	0	0	6	.00	0	1	5	.08	1	1	4	.25
Circulate	3	3	3	2	3	2	2	2	4	1	0	3	.25	1	0	3	.25	1	1	2	.38
Convert	3	3	3	1	2	3	2	3	3	1	1	2	.38	1	1	2	.38	2	0	2	.50
Dedicate	3	3	3	2	0	2	2	2	3	1	0	3	.25	2	1	1	.63	1	1	2	.38
Illuminate	3	3	3	1	3	3	2	3	3	2	0	2	.50	2	0	2	.50	3	0	1	.75
Launch	2	3	3	0	3	3	3	2	4	0	1	7	.06	2	2	4	.38	3	1	4	.44
Plot	3	3	3	1	3	3	2	2	3	0	2	4	.17	2	2	2	.50	2	1	3	.42
Spur	0	3	3	0	2	0	2	4	4	0	0	7	.00	1	1	5	.21	4	0	3	.57
Suspend	3	3	3	2	3	3	1	2	2	2	1	2	.50	2	2	1	.60	2	1	2	.50
Trace	3	3	3	2	2	2	0	3	4	2	1	4	.36	2	2	3	.43	2	2	3	.43
Mean	2.55	2.91	3.00	1.09	2.00	2.18	1.82	2.36	3.36	0.91	0.64	4.00	.25	1.45	1.27	2.82	.39	2.00	0.82	2.73	.44

Note. P=productive knowledge, R=receptive knowledge, U=unknown, MP=meaning proportion.

Table 5

T1 Results for Kor

	Spelling	Association	Grammar	Meaning			
				P	R	U	MP
Abandon	3	1	3	0	5	1	.42
Brood	2	2	3	0	1	5	.08
Circulate	3	2	2	1	0	3	.25
Convert	3	2	3	0	3	1	.38
Dedicate	3	1	4	1	0	3	.25
Illuminate	3	0	2	1	0	3	.25
Launch	3	2	3	1	2	5	.25
Plot	1	0	1	0	1	5	.08
Spur	3	2	3	1	2	4	.29
Suspend	3	0	2	0	2	3	.20
Trace	3	1	2	2	2	3	.43
Mean	2.73	1.18	2.55	0.64	1.64	3.27	.26

Note. P=productive knowledge, R=receptive knowledge, U=unknown, MP=meaning proportion.

Longitudinally, 2 of the students, Lith and Tai, progressed steadily in their meaning knowledge, while Ind remained relatively static. There is no obvious reason for this; Ind seemed to take the sessions seriously and certainly had better language proficiency than Tai.

Examining the changes in the state of the students' meaning knowledge (Table 6), one first notices that the vast majority of meaning senses stayed at the same state of knowledge (72%, 263/366). This suggests knowledge of meaning sense has a certain amount of inertia and does not change easily. This is probably to be expected, as acquiring a large number of meaning senses quickly and easily might be too auspicious to hope for, at least in L2 learning. On the other hand, this stability means there is not a large amount of forgetting either. In the 103 cases where

Table 6

Changes in State of Knowledge for the Different Meaning Senses of a Word

	Lith	Ind	Tai	Total[a]
R↗P	14	3	10	27
U↗R	8	9	11	28
U↗P	8	2	9	19
Total ↗	30	14	30	74
P↘R	2	0	5	7
R↘U	4	8	4	16
P↘U	1	3	2	6
Total ↘	7	11	11	29
P→P	28	31	19	78
R→R	11	3	7	21
U→U	46	63	55	164
Total →	85	97	81	263

Note. P=Productive Knowledge of Meaning Sense, R=Receptive Knowledge of Meaning Sense, U=Unknown Meaning Sense, ↗=Improves to, ↘=Deteriorates to, →=Remains in Same State.

[a]N=122 per student (61 meaning senses × 2 intervals, T1-T2 and T2-T3), N=366 total (122 × 3 students)

meaning knowledge did change, it improved 2.5 times more than it deteriorated. In fact, forgetting occurred in only about 8% of the cases; there was improvement in 20%. Each of the students gained more than they lost in terms of number of progressions and regressions.

It is informative to check where the regression and progression occurred. It was uncommon for meaning senses in a productive state to slip down to either receptive or unknown states (as defined here). Forgetting was more likely a shift from a receptive to an unknown state; Tai alone lost more productive knowledge than receptive knowledge. However, the overall level of forgetting was still quite low. These results suggest that once a meaning sense is known productively, it is not very likely to be forgotten, at least not over a 6-month period.

In the 3 students' total of 74 cases of progression, meaning knowledge moved from receptive to productive and from unknown to receptive a similar number of times. As might be expected, there were fewer cases of meaning knowledge making the presumably larger move from unknown to productive, although the existence of such cases suggests that a productive level of knowledge can be attained within 6 months with only natural exposure as input. We know this because there were unknown to productive improvements from T1 (students were not told the meaning senses of the words in this session) to T2.

Table 7 compares the degree of meaning knowledge with association and grammar knowledge, again illustrating the partial nature of the students' meaning knowledge. There were only 3 instances of a meaning proportion higher than .8; the majority of instances fell in the .2 to .6 range. In general, association and grammar knowledge seem to increase in line with meaning knowledge. A meaning proportion level of .4 to .6 appears to match the NS-like association threshold of 2. The data also suggest that students can possess other kinds of word knowledge even when they can demonstrate no meaning knowledge. In this situation, the participants usually demonstrated knowledge of 2 word classes, which resulted in a mean grammar score of 1.69; in only

Table 7

Meaning Scores vs. Association and Grammar Scores

	Meaning Proportion					
	.00	.00–.20	.20–.40	.40–.60	.60–.80	.80–1.0
Association Score (Max. 3)	.69	.73	1.51	2.09	2.13	2.67
Mean Grammar Score (Max. 4)	1.69	2.09	2.49	2.56	2.31	3.00
Number	13	11	35	32	16	3

one instance was there a grammar score of zero. They also produced some NS-like associations, but further analysis showed these were tied to a memorized idiom and so are suspect (see below).

Knowledge of Written Form (Spelling)

One of the more noticeable things in Tables 2 through 5 is that the participants did not seem to have much trouble spelling the target words. Although these words do not seem particularly tricky, there are still cases where they cannot be spelled directly from the phonological rendering; for example, the *schwa* in the final syllable of *abandon* could be virtually any vowel. If the students demonstrated any meaning knowledge of the words at all, they were almost always able to spell them too. In the 13 cases where they could not demonstrate any meaning knowledge, they could still produce a phonologically correct spelling 10 times and a completely correct spelling twice; only once did the student have no idea. These students had apparently reached a level of proficiency where they were able to use sound-symbol correspondences to produce at least phonologically correct spellings of unknown words.

There were exceptions, however. For example, by T3, Lith knew all of the meaning senses for the word *illuminate* productively (the only full meaning marks in the study) and also scored high on the other word knowledge measures. Still, Lith persisted in spelling *illuminate* with an "e": T1, "elluminate"; T2, "eluminate"; T3, "eluminate." Having a good understanding of other types of word knowledge does not necessarily mean that one will know how to spell a word correctly.

In most cases, the students improved their spelling scores over the course of time. Only twice was there any backsliding (Ind, launch and spur). One might hence infer that once the spelling of a word is mastered it is not usually forgotten. However, the students had probably been spelling the vast majority of these words correctly for quite some time. Therefore, I probably do not have enough data about words that have been recently learned and consolidated (e.g., *brood* and *spur* for Tai, or *plot* for Lith) to make strong claims about words just over the threshold of spelling control.

Association Knowledge

The associations given by both Ind and Tai became more NS-like over time; Lith remained at about the same level. This is difficult to explain; from my experience, Lith had a similar ESL proficiency to Ind, and noticeably better than Tai. Of the 33 association cases (3 students × 11 words), 23 showed stability or progress, while 10 indicated some backsliding. However, if we count the times that a student backslid from NS-like knowledge (2 or 3) down to not NS-like (0 or 1), then the total number of cases is only 4. Three of the remaining 6 instances of backsliding dropped from 3 to 2, meaning these performances were all NS-like, but with slightly less typical associates. In the other 3, the students had dropped from a level of producing only minimally NS-like associates (1), usually idiosyncratic, to not producing any norm-list matches at all (0). In general, students' association knowledge progressed in an ever-improving direction; and where there were

downward fluctuations, they were seldom across the NS-like threshold.

Schmitt and Meara (1997) found that their participants, having judged a word as unknown, could not produce NS-like associations that were on a norming list. The present study required demonstrations of knowledge rather than self-evaluation, but its results appear to suggest that learners can produce NS-like associations with no corresponding meaning knowledge. However, the associations themselves make the reasons for this clearer.

(1)	Ind	T1 - moment	suddenly	[no answer]
(2)	Ind	T2 - moment	events	suddenly
(3)	Ind	T3 - moment	horse	[no answer]
(4)	Lith	T1 - spin	movement	beginning
(5)	Lith	T2 - water	around	quick

Ind's NS-like association scores were mainly achieved on the basis of knowing the idiom *spur of the moment*. Because *moment* was on the norming list at a high enough value to put a student over the NS-like threshold by itself, Ind produced 3 NS-like scores by knowing only one fixed phrase. Even more interesting, at T3 Ind could produce the primary association *horse* even though having no idea of the meaning of *spur*. Ind was either a lucky guesser or, more likely, had some small sense of at least one lexical field with which the word *spur* connected. If so, this might be one of the earliest indications that Ind's acquisition of *spur* had begun. Lith gave *movement* and *quick* very rare NS-like associations (1 and 2 responses respectively). Taken together, they suggest that Lith had some idea of "movement" in connection with *spur*. Again, this may hint at the very start of acquisition, or, considering that Lith gave no NS-like associations at T3, might have been a fluke. Combining these results with those in Schmitt and Meara (1997) leads to the revised conclusion that learners are very unlikely to be able to give NS-like associations unless they know at least one

meaning sense of a word—unless that word is part of a known phrase.

Table 8 illustrates how association knowledge relates to grammar and meaning knowledge. Unsurprisingly, as mean association scores increased, so did average meaning scores. With only 4 participants, I thought it inappropriate to use statistical procedures to verify this; however, the trend in the table seems clear enough. The acquisition of grammatical knowledge, on the other hand, did not seem strongly related to the development of more NS-like associations. Schmitt and Meara (1997) suggested that different kinds of word knowledge are interrelated; however, the data in the present study suggest that the strength of the relationship may vary between different word knowledge types, some perhaps being unrelated. It seems meaning knowledge has closer links with association and grammar knowledge than the latter two do with each other.

Grammar Knowledge

One reason for the lack of parallel progression between association and grammatical knowledge is that the students' grammatical knowledge seemed already somewhat advanced when their association knowledge was still at the point where they

Table 8

Association Scores vs. Grammar and Meaning Scores

	Association Category			
	0	1	2	3
Mean Grammar Score (Max. 4)	2.19	2.36	2.42	2.42
Average Meaning Proportion	.17	.37	.41	.52
Number	21	25	38	26

could give no NS-like associations. They seemed to have a relatively strong sense of the grammatical aspects of words, even when not knowing them according to meaning (Table 7). In most cases, the students could readily give the word's class and at least one derivative form.

Grammatical acquisition longitudinally was erratic for Lith and Ind; only Tai's mean scores consistently improved. Only Tai reported explicitly looking up the target words in a dictionary and studying them, which might have helped; grammar information like that required in the grammar task is available in the typical dictionary. Association information is not given in dictionaries, but Tai's improved association scores could be attributed to better mastery of the words' meaning gained from explicit study. Perhaps these results illustrate the value of explicit study in addition to implicit learning; however, to test this empirically would require a redesigned, future study.

Table 9 compares the longitudinal grammar scores to those of the other types of knowledge tested. Both types of knowledge increase more or less steadily through Grammar Categories 0 to 3 but then drop unexpectedly at Category 4. I could only deduce that the students had moved from Category 3 to Category 4 by stating there was no form for a certain word class, because that

Table 9

Grammar Scores vs. Association and Meaning Scores

	Grammar Category				
	0	1	2	3	4
Mean Association Score (Max. 3)	1.00	1.55	1.54	1.86	1.50
Average Meaning Proportion	.18	.23	.38	.45	.38
Number	2	11	52	35	10

would have been somewhat easier than actually having to give the form if it existed. However, that turned out not to be the case; most of the students reached Category 4 by supplying a word class form.

Schmitt and Meara (1997) reported that their beginning/intermediate Japanese EFL students did not have very good mastery of the different derivative forms of a word. The present study has found the same situation even with advanced NNSs who are capable of pursuing postgraduate studies in an English-speaking university. In only 10 cases out of the 110 possibilities did the participants know all 4 word classes (9%); in almost 60% of the cases they knew 2 or fewer. Even when they knew words rather well, their average number of word class forms was usually 3 at best (Tables 2–5). This definite gap in these advanced learners' morphological knowledge calls into question the assumption that a learner who knows one member of a word family can easily learn the others.

Breaking the results down into the individual word classes shows that the students knew some better than others (Table 10). However, the target words were nouns and verbs, and so these word classes could be answered through recognition alone; adjective and adverb word forms had to be produced. Still, the figures show such a disparity that it seems nouns and verbs were the best mastered word classes; adjectives and adverbs appear to be learned at a later stage, and still represented knowledge gaps even for these advanced students. This suggests that adjective and adverb forms are not so readily learned from general exposure (perhaps due to their lower frequency of occurrence) and hence might be good candidates for explicit instruction.

Checking for the Developmental Sequencing of Word Knowledge

In my introduction, I raised the possibility of a developmental hierarchy of types of word knowledge. If this were the case, acquisition of the four word knowledge types should fall into an implicational scale. I explored the possibility of such a scale by means of the Guttman procedure (see Hatch & Lazaraton, 1991,

Table 10

Number of Words Known in Each Word Class

	Noun		Verb		Adjective		Adverb	
	n	%	*n*	%	*n*	%	*n*	%
Lith[a]	30	91	33	100	11	33	8	24
Ind[a]	21	64	28	85	6	18	13	39
Tai[a]	30	91	31	94	10	30	11	33
Kor[b]	10	91	10	91	7	64	1	9
Total[c]	91	83	102	93	34	31	33	30

[a]Total *N*=33
[b]Total *N*=11
[c]Total *N*=110

for details and formulas). This required making decisions about when each type of word knowledge could be considered "acquired" and operationalizing these decisions in a series of cut-points. As Anderson (1978) showed with morpheme studies, the placement of the cut-point can seriously affect the scaling results. The criterion of 80% accuracy typically used in grammatical studies did little good in this study. However, I could fortunately still generally make principled decisions. The association criterion I had already experimentally determined as being Category 2 (Schmitt, in press b). Judging from the data here, the strength of the students' performance on the written form task suggests that fully correct spelling is the logical criterion; the vast majority of spelling performances were at that level.

As for grammar knowledge, the students seemed to know a target word's word class plus one derivative form (2 word classes) even if they had little or no idea what the word meant. On the other hand, they rarely knew all 4 word class forms. Hence, knowledge of 3 word class forms seems the most reasonable criterion. Criteria for meaning were not so easily resolved. Because there seems to be no principled way to set the meaning proportion criterion, I explored three proportions: .25, .38, and .50. No combination of parameters led to an indication that implicational

scaling was present. There were simply too many "errors" for the scaling to be valid. Therefore, at this early point I found no evidence of a developmental hierarchy for word knowledge types.

Limitations

The intensive and detailed one-to-one interview employed in this study should have produced as valid a measurement of the various word knowledge types as is now possible. However, there are some possible weaknesses in the procedure. First, even with repeated probing, I sometimes found it difficult to determine the students' knowledge of the subtle differentiation between similar meaning senses without actually giving away those differences (e.g., *abandon* = "leave" or "desert and not return" vs. "leave because of danger"). Future studies of this type should probably use only clearly distinguishable meaning senses. Second, I was the only rater; this inevitably involved a certain amount of subjectivity in scoring. Third, this study has given some indication of the manner in which 4 types of word knowledge were acquired concurrently. It was not designed to isolate the factors affecting this acquisition; that remains for future studies.

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References

Alderson, J.C., Clapham, C.M., & Steel, D. (1997). Metalinguistic knowledge, language aptitude, and language proficiency. *Language Teaching Research, 1*, 93–121.

Alexander, R. (1982). What's in a four-letter word? Word meaning in English and second language learning. *Die Neueren Sprachen, 81*, 219–224.

Anderson, R. (1978). An implicational model for second language research. *Language Learning, 28*, 221–282.

Avila, E., & Sadoski, M. (1996). Exploring new applications of the keyword method to acquire English vocabulary. *Language Learning, 46*, 379–395.

Bahns, J., & Eldaw, M. (1993). Should we teach EFL students collocations? *System, 21*, 101–114.

Blum-Kulka, S. (1981). Learning to use words: Acquiring semantic competence in a second language. In M. Nahir (Ed.), *Hebrew teaching and applied linguistics* (pp. 229–243). Washington, DC: University Press of America.

Carey, S. (1978). The child as word learner. In M. Halle, J. Bresnan, & G. A. Miller (Eds.), *Linguistic theory and psychological reality* (pp. 264–293). Cambridge, MA: MIT Press.

Cohen, A. D., & Aphek, E. (1980). Retention of second-language vocabulary over time: Investigating the role of mnemonic association. *System, 8,* 221–235.

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. *Elementary English, 42*, 895–901, 948.

D'Anna, C.A., Zechmeister, E.B., & Hall, J.W. (1991). Toward a meaningful definition of vocabulary size. *Journal of Reading Behavior, 23*, 109–122.

Drum, P., & Konopak, B.C. (1987). Learning word meanings from written context. In M.G. McKeown & M.E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 73–87). Hillsdale, NJ: Lawrence Erlbaum.

Francis, W. N., & Kucera, H. (1982). *Frequency analysis of English usage*. Boston: Houghton Mifflin.

Goulden, R., Nation, P., & Read, J. (1990). How large can a receptive vocabulary be? *Applied Linguistics, 11*, 341–363.

Hatch, E., & Lazaraton, A. (1991). *The Research manual*. New York: Newbury House.

Hazenberg, S., & Hulstijn, J.H. (1996). Defining a minimal receptive second-language vocabulary for non-native university students: An empirical investigation. *Applied Linguistics, 17*, 145–163.

Hintzman, D.L., Block, R.A., & Summers, J.J. (1973). Modality tags and memory for repetitions: Locus of the spacing effect. *Journal of Verbal Learning and Verbal Behavior, 12,* 229–238.

Huckin, T., Haynes, M., & Coady, J. (1993). *Second language reading and vocabulary learning*. Norwood, NJ: Ablex.

Larsen-Freeman, D. (1975). The acquisition of grammatical morphemes by adult ESL students. *TESOL Quarterly, 9,* 409–430.

Laufer, B. (1992). Reading in a foreign language: How does L2 lexical knowledge interact with the reader's general academic ability? *Journal of Research in Reading, 15*, 95–103.

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* (pp. 140–155). Cambridge, UK: Cambridge University Press.

Longman dictionary of English language and culture. (1992). Harlow, UK: Longman.

McNeill, D. (1963). The origin of associations within the same grammatical class. *Journal of Verbal Learning and Verbal Behavior, 2,* 250–262.

Meara, P. (1984). The study of lexis in interlanguage. In A. Davies, C. Criper, & A.P.R. Howatt (Eds.), *Interlanguage* (pp. 225–235). Edinburgh, Scotland: Edinburgh University Press.

Meara, P. (1987). *Vocabulary in a second language* (Vol. 2). London: CILT.

Meara, P. (Ed.) (1992). Vocabulary in a second language (Vol. 3) [Special issue]. *Reading in a Foreign Language, 9*.

Meara, P. (1996a). The dimensions of lexical competence. In G. Brown, K. Malmkjaer, & J. Williams (Eds.), *Competence and performance in language learning* (pp. 35–53). Cambridge, UK: Cambridge University Press.

Meara, P. (1996b). *The vocabulary knowledge framework* [On-line]. Available Internet: http://www.swansea.ac.uk/cals/vlib.html

Melka, F. (1997). Receptive vs. productive aspects of vocabulary. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 84–102). Cambridge, UK: Cambridge University Press.

Nagy, W.E., Diakidoy, I.N., & Anderson, R.C. (1993). The acquisition of morphology: Learning the contribution of suffixes to the meanings of derivatives. *Journal of Reading Behavior, 25*, 155–170.

Nagy, W.E., Herman, P.A., & Anderson, R.C. (1985). Learning words from context. *Reading Research Quarterly, 20*, 233–253.

Nation, I.S.P. (1990). *Teaching and learning vocabulary*. New York: Newbury House.

Oxford advanced learner's dictionary. (1995). Oxford, UK: Oxford University Press.

Paribakht, T.S., & Wesche, M.B. (1993). The relationship between reading comprehension and second language development in a comprehension-based ESL program. *TESL Canada Journal, 11*, 9–29.

Pienemann, M., & Johnston, M. (1987). Factors influencing the development of language proficiency. In D. Nunan (Ed.), *Applying second language acquisition research* (pp. 45–141). Adelaide, Australia: National Curriculum Resource Center, Adult Migrant Education Program.

Read, J. (1997). Vocabulary and testing. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 303–320). Cambridge, UK: Cambridge University Press.

Richards, J.C. (1976). The role of vocabulary teaching. *TESOL Quarterly, 10,* 77–89.

Schmitt, N. (1995a). A fresh approach to vocabulary using a word knowledge framework. *RELC Journal, 26*, 86–94.

Schmitt, N. (1995b). The word on words: An interview with Paul Nation. *The Language Teacher, 19*, 5–7.

Schmitt, N. (in press a). Measuring collocational knowledge: Key issues and an experimental assessment procedure. *ITL Review of Applied Linguistics.*

Schmitt, N. (in press b). Quantifying word association responses: What is nativelike? *System.*

Schmitt, N., & Dunham, B. (1997). *Native and nonnative intuitions of word frequency*. Manuscript submitted for publication.

Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word associations and verbal suffixes. *Studies in Second Language Acquisition, 19*, 17–36.

Sharwood Smith, M. (1984). Discussion of P. Meara's "The study of lexis in interlanguage." In A. Davies, C. Criper, & A.P.R. Howatt (Eds.), *Interlanguage* (pp. 236–240). Edinburgh, Scotland: Edinburgh University Press.

Thomas, M.H., & Dieter, J.N. (1987). The positive effects of writing practice on integration of foreign words in memory. *Journal of Educational Psychology, 79*, 249–253.

Webster's ninth new collegiate dictionary. (1987). Springfield, MA: Merriam-Webster.

Xue, G., & Nation, I.S.P. (1984). A university word list. *Language Learning and Communication, 3*, 215–229.

Appendix

The following word class forms were accepted in this study. In addition, the various meaning senses are illustrated here, along with their receptive prompts, including word class, in parentheses.

Abandon

(Noun)	(Verb)	(Adjective)	(Adverb)
abandon/ abandonment	abandon	abandoned	[no form]

1. (abandon a baby - verb) leave or desert and not return
2. (abandon a ship - verb) leave because of danger
3. (abandon a project - verb) give up before finishing
4. (abandon a political leader - verb) withdraw help or support from somebody

5. (abandon yourself to despair - verb) allow oneself to be completely controlled by something

6. (gay abandon - noun) state where feelings and actions are uncontrolled or uninhibited

Brood

broodiness/ brood	brood	broody/ brooding	broodily/ broodingly

1. (problem - v) spend time anxiously thinking about something

2. (clouds - v) to hang closely; menacing, threatening

3. (ducks - n) a family of young creatures, esp. birds

4. (situation in a household - n) the children of one family

5. (horse - adj) animal used for breeding

6. (hen - v) sit on eggs in order to hatch them

Circulate

circulation	circulate	circular/ circulatory	[no form]/ circularly

1. (liquid - v) to move around in a closed system

2. (information - v) disseminate or spread widely

3. (air - v) to move about freely

4. (party - v) move from one person to the next

Convert

converter/ convert/ conversion	convert	converted convertible	[no form]

1. (sofa - v) change [be able to be changed] from one form or use into another
2. (religion - v) change one's beliefs
3. (religion - n) person who has changed beliefs
4. (football - v) gain extra points after scoring a goal or touchdown

Dedicate

dedication	dedicate	dedicated	[no form]/ dedicatedly

1. (cause - v) devote oneself to a good cause
2. (publication - v) address one's publication to someone
3. (church - v) devote something to a sacred purpose
4. (money - v) to set aside something for a particular reason

Illuminate

illumination	illuminate	illuminated/ illuminating	[no form]

1. (candle - v) to give light or cast light on something
2. (festival - v) to decorate a street or building for a special occasion
3. (difficult idea - v) cause to understand, make clear
4. (manuscript - v) decorate a book with gold paint and colors

Launch

launch/ launcher	launch	[no form]/ (newly) launched	[no form]

1. (attack - v) put something or somebody into action, begin
2. (merchandise - v) make a new product publicly available
3. (navy - v) put a new ship into the water
4. (missile - v) put something in motion or on its course
5. (oneself into something - v) begin enthusiastically something important or something that will take a long time
6. (out into something [career] - v) to do something new or more exciting or profitable
7. (yacht - n) a large motor boat
8. (baseball - v) to throw long, high, or very hard

Plot

plot	plot	plotted	[no form]

1. (spy - v) to make a secret plan to do something
2. (spy - n) the secret plan
3. (graph - v) to connect a series of points into a curve
4. (navigation - v) to mark something on a map
5. (real estate - n) a small piece of land marked for a special purpose
6. (novel - n) outline of events in a play or novel

Spur

spur	spur	[no form]/ spurred	[no form]

1. (horse - n) metal attachment on the heel of a boot
2. (horse - v) to use these spurs
3. (sports coach - v) to urge or encourage forcefully

4. (complaints - n) event or influence that encourages action

5. (mountains - n) length of high ground coming out of mountains

6. (trains - n) track or road that goes away from the main line

7. (rooster - n) back part of a bird's foot

Suspend

suspension/ suspender(s)	suspend	suspended	[no form]

1. (gravity - v) to hang something from above

2. (rail services - v) to temporarily stop or prevent from being in effect

3. (prison sentence - v) not enforce, delay, or happen at a later time

4. (policeman - v) prevent someone from holding usual position [because of misbehavior]

5. (dust - passive verb) hold still in liquid or air

Trace

trace/ tracing	trace	traceable/ tracing/ traced	[no form]

1. (detective - v) find something or someone by following their course

2. (clue - n) mark or sign of the presence or someone or something

3. (family tree - v) going back in time to find the origins or proof of something

4. (book about the monarchy - v) follow the course, development, or history of something

5. (picture - v) to copy something by drawing its lines on transparent paper

6. (poison - n) very small amount of something

7. (horse - n) part of the harness which pulls a cart