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Vocabulary Size, Growth, and Use

Paul Nation

The relationship between vocabulary size, skill in use of the language and content knowledge changes as learners' vocabulary develops. Initially, learners' skill in using the language is heavily dependent on the number of words they know, with around 3,000 word families being a crucial threshold. Then content knowledge becomes dependent on skill in language use, in particular on the degree of fluency with which the learner can access wanted vocabulary. Once learners have developed skill in use it becomes possible for vocabulary growth to occur as learners work in new areas of knowledge. It is important for teachers to be aware of where their learners are so that there can be an appropriate focus in their classes. The teacher and the learners have different roles to play in ensuring that vocabulary knowledge continues to develop.

1 Vocabulary and Related Factors

A large number of different types of studies have shown the strong statistical relationship between vocabulary size and language use. The causal relationships, however, are not so clear. Anderson and Freebody (1981) distinguish three views that are reflected in research.

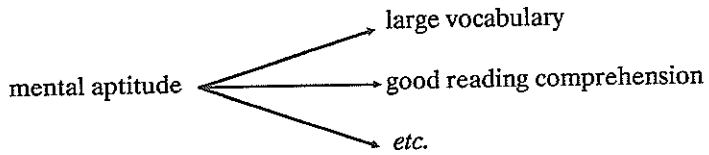
The instrumentalist view sees vocabulary knowledge as being a major prerequisite and causative factor in comprehension. Good vocabulary knowledge enables good comprehension. Nagy (1991, personal communication) sees a need to be cautious about adopting this viewpoint in that it can lead to a "reductionist" view of reading, *i.e.*, if you know the vocabulary then that is about all you

need to be able to read. Diagrammatically, the instrumentalist view can be represented as in (1).

(1) vocabulary knowledge ⟶ reading comprehension

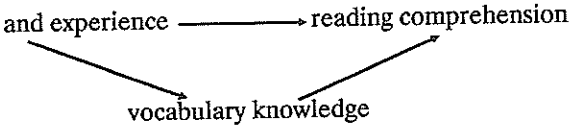
The aptitude view sees vocabulary knowledge as one of many outcomes of having a good brain. Good reading comprehension is also one of these outcomes. Other outcomes might include skill at non-verbal puzzles and the ability to understand oral explanations. Diagrammatically the aptitude view can be represented as in (2).

(2)



The knowledge view sees vocabulary as an indicator of good world knowledge. This world knowledge enables reading comprehension because the reader must bring as much information to the text as the reader expects to get from it. It is difficult to read about astrophysics if you know nothing about it. Diagrammatically, the knowledge view can be represented as in (3).

(3)

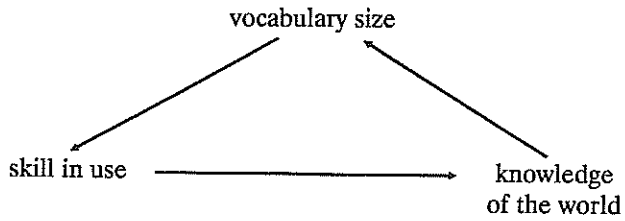


Anderson and Freebody (1981) point out that no serious scholar holds any of these positions to the exclusion of the others and it is the theme of this paper that different relationships exist at different stages of vocabulary growth and skill development.

Mezynski (1983) suggests a fourth view. The access view of the relationship between vocabulary knowledge and language use, like the instrumental view, sees vocabulary as having a causal relationship with comprehension provided that the vocabulary can be easily accessed. Access can be improved through practice. This access can involve several factors including fluency of lexical access, speed of coping with affixed forms, and speed of word recognition (see Grainger, this volume).

The factors involved in these four views include mental aptitude, vocabulary size, skill in language use (*e.g.*, reading comprehension), and knowledge of the world. Because this paper focuses on the teacher and learner's role in vocabulary development, mental aptitude will not be considered although it is clearly an important factor. Diagram (4) shows that the four views described above do not cover all the possible relationships between the factors.

(4)



The nature of the relationship between the three factors changes according to the strength of the three factors involved, with the focus at both the level of short term and long term goals going from vocabulary size to skill in use to gaining subject matter knowledge. Recent theory and research on both first and second language learning provides support for this view and provides details about this changing relationship, which allows us to suggest a vocabulary development programme for second language learners.

2 Changing Relationships

Let us look briefly at first language learning for an example of a changing relationship. Chall (1987) suggests that, with regard to reading, for several years reading comprehension (skill in use in Diagram (4)) has little effect on vocabulary size while children learn the mechanics of reading. Once their reading is proficient, around the ages of 10 to 12, vocabulary growth accelerates. This happens because previously children were learning to recognise known vocabulary. Proficient readers however can use reading to learn new vocabulary (vocabulary size in Diagram (4)).

In terms of Diagram (4), initially first language learners' skill in use depends on the size of their recognition vocabulary. Once the recognition vocabulary is large enough, the direction of the relationship changes. Because the learner's recognition vocabulary becomes large enough to allow skilful language use (reading), then vocabulary size can be affected by skill in use with the now proficient readers learning new vocabulary from context.

These changing relationships have direct implications for teaching. The focus of teaching initially needs to be on increasing the size of the learners' recognition vocabulary. Skilful teachers use a variety of approaches to this including recognition of whole words, phonics, prediction from the message, and repetitive activities such as shared book reading and repeated reading. When the learners have a large enough recognition vocabulary, the emphasis then moves more strongly to guessing from context and the previous teaching procedures will be inappropriate.

This example from first language development illustrates the theme of this paper, namely that as the relationship between vocabulary size, skill in language use, and knowledge changes, the focus of teaching must also change. In order to show the changing relationship of the three factors it is necessary to simplify the relationships and ignore the other factors that play a part. The justification for this simplification is that teaching needs clear directions and it is necessary to isolate the important factors that teaching can affect.

Let us now look at the development of second language learners' vocabulary in relation to the three factors and see the implications for a vocabulary programme for a second language learner going on to academic study. This paper will focus on reading for adults with an English for academic purposes focus. The general principles however also apply to the development of listening, speaking, and writing.

In each of the four following subsections, we will look at a different part of the diagram in Diagram (4) moving anticlockwise, starting with vocabulary size and skill in use, then moving to skill in use and knowledge of the world, and knowledge of the world and vocabulary size.

2.1 Skill in Language Use Depends on Vocabulary Size

Research by Laufer (1989, 1992) shows the importance of having a vocabulary large enough to provide coverage of 95% of the words in a text. Let us look briefly at the ideas of frequency, coverage, and vocabulary size before examining Laufer's findings.

If a learner had a vocabulary of only one English word and that was *the*, the most frequent word in English, that learner's one word vocabulary would provide coverage of 7% of the items in a written text. This is because the word *the* is repeated so many times. If we counted what proportion of the words on a page was *the*, we would find that it accounted for roughly seven out of every one hundred words. A learner could not do much with this one word vocabulary, but the example illustrates an important principle – if you carefully choose what words

to learn, you can get a good coverage of the words on a page. For example, if you chose the most frequent 1,000 words of English, which includes words like *put, end, difficult, come,* and *material,* you would cover about 75% of the words on a page. If, however, you chose to learn 1,000 of the least frequent words of English, like *denticle, blunger,* and *sacrament,* you might be lucky to cover .03% of the words on a page. That is, you might meet only one occurrence of one word that you knew. Clearly, the return for learning the most frequent words in the language is great. Table 1 lists typical coverage figures for different vocabulary sizes, assuming that words are learned in order of frequency. The figures are based on Carroll, Davies and Richman (1971) and underestimate coverage because each different form is counted as a different word.

Table 1 shows that to get around 95% coverage of a written academic text, it is necessary to have a vocabulary size of over 5,000 word forms, which translates to about 3,000 word families if inflections and closely related derivatives

Table 1. Percentage coverage of text for increasing vocabulary sizes

Number of words	Coverage
1	7%
10	25%
100	50%
1,000	75%
2,000	81%
5,000	89%
43,831	99%
86,741	100%

are included in a word family (Bauer and Nation, in preparation).

Laufer (1989, 1992) found that learners whose vocabulary size gave them more than 95% coverage of the words in a text were able to reach an adequate level of comprehension. Those whose vocabulary was not large enough to reach 95% coverage did not reach an adequate level of comprehension. Laufer's subjects were young adults who were already able to read in their first language, thus they did not lack basic reading skills. However, without an adequate second language vocabulary they were unable to put their reading skills into practice. In terms of Diagram (4), in the early stages of foreign language learning, skill in use depends on vocabulary size.

Laufer (forthcoming) also looked to see what the effect of academic ability (knowledge of the world) was on reading comprehension. She found that if vo-

cabulary size was smaller than 3,000 words (3,000 words provides 95% coverage), academic ability did not compensate for it to help comprehension. This finding underlines the critical importance of developing an adequate high frequency vocabulary.

In order to be successful in academic studies, it is necessary to be familiar not only with the high frequency words of English but also with the general academic vocabulary that is common to many academic disciplines. A list of such vocabulary can be found in Xue and Nation (1984) and includes items such as *assume*, *constant*, and *individual*. This list of around 800 headwords combines four independent studies and provides a substantial 8% coverage of the words in academic texts. The list assumes knowledge of the most frequent 2,000 words of English and contains words that occur frequently over a wide range of academic areas such as philosophy, history, law, biology, and accountancy.

The importance of such vocabulary can be seen when vocabulary size is related to the ratio of unknown to known words. With a vocabulary of 2,000 words, a reader will meet 1 unknown word in approximately every 8 known words. With a vocabulary of 2,000 words plus the 800 of the academic word list, a reader will meet 1 unknown word in approximately every 20 known words (95% coverage).

A study by Liu Na and Nation (1985) supports the necessity of learners having a 95% coverage of a text. Liu Na and Nation looked at second language learners guessing or inferring vocabulary from context under two conditions, one where the learners had a 90% coverage of the text and one where learners had a 95% coverage of the text. The study showed that 95% coverage resulted in more successful guessing.

These findings have clear implications for a vocabulary teaching programme. It is critically important that learners become familiar with the most frequent 2,000 to 3,000 words of English as quickly as possible. This can be done in a variety of ways including direct teaching and learning, and learning through extensive graded reading (Nation 1990). If this high frequency vocabulary is not learned, then it is not possible to achieve skill in language use. It is also not possible to compensate adequately for a lack of this vocabulary by relying on knowledge of the world.

2.2 *Knowledge of the World Depends on Skill in Language Use*

In order to learn subject matter from texts, it is not sufficient to know a suitable amount of vocabulary. Among other things, it is necessary to have fluent access to that vocabulary. This fluency of access is an aspect of skill in language use. It is sometimes used to explain why in some experimental studies preteaching of unknown vocabulary has no significant effect on increasing the amount of information that is gained from a text (Mezynski 1983). It is argued that although the pretaught vocabulary is known, it cannot be accessed quickly enough when it is needed.

Fluency of access is related to the number of associations that a word has, to the strength of association, and to the integration of the word within a well-organised system. Put another way, ready access can come from having many paths to an item. It can come from having a well-beaten path to follow, and it can come from being familiar with a well-mapped area.

These two types of access can be developed in a variety of ways, through substantial language use and through learning activities such as collocation exercises, concept building activities, and association chains. Recent research on interactive activities (Hall 1991) indicates that having the opportunity to use a new word in a personally created context results in better learning than repeating a context provided by someone else. Hall looked at the learning of mathematics vocabulary when learners used split information activities. In such activities the information is split between the learners so that each learner has information that the other needs to complete the activity. This means it is essential for each learner to contribute (Nation 1977). The split information activities were like the ones shown in Figure 1. Learner A cannot see B's items and B cannot see A's items.

Some items like the ones shown in panels (I) and (II) gave learners the opportunity to use the new vocabulary in sentences that were modelled for them and others like the one in panel (III) provided the opportunity for learners to construct their own sentences using the new vocabulary (*perimeter* and *diagonal*).

The construction of new sentences resulted in superior vocabulary learning. Presumably this generative use of the new vocabulary resulted in richer and stronger associations. If, as many of the studies in this volume suggest (see, for example, De Groot), first language and second language vocabulary are stored together, the structure of relationships of the first language vocabulary may be a means of providing fluency of access to the second language vocabulary.

2.3 *Vocabulary Growth is Affected by Knowledge of the World*

As a learner gains control over the academic vocabulary that is common to many different disciplines, there is a need to deal with the specialized technical vocabulary that is peculiar to a particular field of study. The size of the technical vocabulary differs from one discipline to another, but a survey of technical dic-

(I)

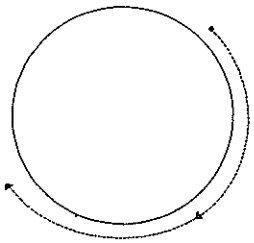
Learner A	Learner B
a) A stone b) A paper dart c) A feather	He watched it drop in a vertical line.
drops in a _____ line	It was a _____

(II)

Learner A	Learner B
How many lines in your and B's paper are vertical?	How many lines in your and A's paper are vertical?

(III)

Learner A	Learner B
Which is quicker, your way or B's?	Which is quicker, your way or A's?



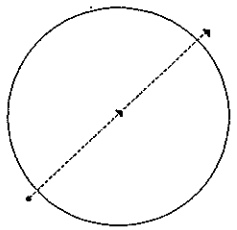


Figure 1. Examples of split information activities

tionaries indicates that for most disciplines it does not exceed two thousand words.

It is possible to describe technical vocabulary from a statistical viewpoint (Becka 1972). Technical vocabulary consists of words that are proportionally much more frequent in a specialized area than they are in the language as a whole. For example, in the Carroll *et al.* count *subtract* and its related forms has a high frequency of occurrence in the field of mathematics. It rarely occurs in other fields like social studies or music.

If we take this statistical view of technical words, then novels and newspapers have their own technical vocabulary. In a novel, and to a large extent newspapers, the technical vocabulary is the names of the people, places and organisations involved in the events described. In most cases it is not expected that readers have knowledge of these words before they read. Reading is a way of finding out about these words. The more knowledge that the reader has of the events, the more meaningful the technical vocabulary becomes. One of my students from China was following a post-graduate course on the religious poetry of Andrew Marvell. During her reading she came across the words *liturgy* and *sacrament*. She looked them up in a dictionary but because of her lack of knowledge of Christian practice was unable to make sense of the definitions. The point is that technical vocabulary usually cannot be learned before dealing with a field of study. It must develop as knowledge of the field develops. Learning the meaning of terms like *phoneme*, *morph*, and *competence* is a significant part of learning the knowledge of that field.

It is interesting to note that in several experimental studies of reading, background knowledge of a text is measured by testing knowledge of the technical vocabulary of the text. It is important to stress the direction of this relationship however. Teaching the technical vocabulary would not provide a good understanding of the field and would be a fruitless undertaking. Knowledge of the vocabulary is a result of mastery of the knowledge of the field.

Research on follow-up stories in newspapers (Hwang and Nation 1989) indicates that staying within a limited field of knowledge provides favourable conditions for vocabulary learning, both in repetition of vocabulary and in a decreased density of unknown words in texts. Hwang and Nation (1989) compared the occurrence of low frequency words in running stories (*i.e.*, stories that appeared on successive days on the same event) and unrelated stories. It was found that running stories provided more repetitions of low frequency words and therefore reduced the vocabulary load to a greater extent, and provided better conditions for the acquisition of words outside the 2,000 most frequent words. This occurred because the related content in the running stories resulted in the reoccurrence of topic related words. This finding suggests that it is prefer-

able from the point of view of vocabulary learning that learners read several related texts or a long text than that they read several unrelated texts as is the case in most text books for second language learners.

2.4 *Broad Vocabulary Growth Depends on Vocabulary Strategies that are Independent of Subject Matter Knowledge*

Haastrup (1990) has suggested that inferring the meaning of unknown words from context can be done in two ways. One way is to take a 'top down' approach relying on background knowledge of the subject matter to infer the meaning. Because this approach is message focused rather than language focused, successful inference might not result in vocabulary learning even though the reading activity is helped. Another way is to take a 'bottom up' approach where the inference makes considerable use of linguistic cues such as part of speech, relationship with words in the immediate linguistic context, and conjunction relationships. Clarke and Nation (1980) describe such a strategy in detail. Because the unknown word is to some extent decontextualized and focused on as a linguistic object, there may be some disruption of the reading process, but considerable opportunity for vocabulary learning.

It is possible to experience these two ways by reading two different kinds of texts. Indeed, the choice of which type of inference is used, 'top down' or 'bottom up', is not a result of a decision on the part of the reader but a result of the relationship between the text and the knowledge the reader brings to it. To experience 'top down' inferring look at a text in a language you do not know or do not know well but which deals with a subject that you are very familiar with. It is possible to make a lot of sense out of such a text and to correctly identify the meanings of many of the words. The resultant vocabulary learning may be however minimal. To experience 'bottom up' inferring, read a text on an unfamiliar topic where most but not all of the vocabulary in the text is known to you. At this stage of vocabulary development, it is useful to read widely in unfamiliar areas.

There are statistical reasons as well why it is necessary to read over a wide range of subject areas to broaden vocabulary knowledge. For pedagogical purposes the vocabulary of a language can be classified into four groups. We have already looked at three of these. The first group is the high frequency words. In English these are generally considered to consist of around 2,000 word families and to provide coverage of over 80 per cent of most written text. The second group is the general academic vocabulary consisting of around 800 word families (Xue and Nation 1984) and covering about 8% of academic text and about 6% of newspapers. The third group is the technical or specialized vocabulary,

usually about 2,000 words for a particular subject area and covering 4-5% of academic text. Webster's 3rd International Dictionary, the largest non-historical dictionary contains approximately 128,000 word families (Goulden, Nation and Read 1990). Even after we subtract the high frequency words, the academic words, and the technical words for one subject area from this total there still remains over 123,000 low frequency words. It is this large number of words which accounts for a very small proportion of text coverage which is the source of a broad vocabulary. The more sensible estimates indicate that adult native speakers of English with a tertiary education have a vocabulary size of around 20,000 word families. Most of this is made up of low frequency words. These words are learned through diverse and wide-ranging contact with the language. What are technical words for one person may be low frequency items for another, although not all low frequency words are technical words in some area.

We have now looked at the relationships between vocabulary size, skill in use, and knowledge of the world. In the next two sections we will look at the roles of the teacher and learner in vocabulary growth.

3 The Teacher's Role in Vocabulary Growth

Interest in vocabulary size, both for first and second language learners, has been partly motivated by the need to evaluate the feasibility of direct vocabulary teaching. If a native speaker typically has a small vocabulary, say thousands of words rather than ten or hundreds of thousands of words, then direct teaching of vocabulary may have some impact. If, however, a native speaker's vocabulary is typically large then direct teaching will have a negligible effect.

Recent estimates of young adult university graduates (Goulden, Nation and Read 1990; D'Anna, Zechmeister and Hall 1991) indicate that native speakers have a smaller vocabulary size than earlier estimates have shown (Seashore and Eckerson 1940; Diller 1978). Seashore and Eckerson's study, for example, estimated that, on the average, college students knew over 58,000 basic words and over 155,000 basic and derived words. The Goulden *et al.* and D'Anna *et al.* studies suggest basic word vocabularies of less than 20,000 words.

The reasons for the wide divergence between recent and earlier estimates can be shown to be primarily a result of faulty research methodology. The faults have come from a failure to realistically and systematically define what is included in a word family, and from sampling procedures that resulted in high frequency words being over-represented. Because high frequency words are more likely to be known than low frequency words, this caused enormous overestimations of vocabulary size. Thorndike (1924) had been aware of these problems

and had suggested solutions, but his paper had been published in a collection that was not readily accessible and thus remained unknown to generations of researchers in this area who committed the errors that he warned against. Lorge and Chall (1963) and Nation (forthcoming) review the situation.

The smaller estimates of vocabulary size have supported interest in direct vocabulary teaching to native speakers. Unfortunately, this interest has not been accompanied by an awareness of the significance of word frequency. As we saw earlier in this paper, it is possible to group vocabulary using frequency and range for the purpose of deciding what vocabulary to focus on at a particular stage of a learner's development and how to focus on it. This decision making is by far the most important aspect of the teacher's role in vocabulary growth.

Native speakers of English begin school with a vocabulary approaching five thousand word families. As we have seen, direct teaching of word recognition for reading is an essential part of vocabulary growth. Further direct teaching of unknown vocabulary cannot just be considered in relation to the possible size of the whole vocabulary but must be evaluated with regard to the usefulness and frequency of the vocabulary that will be taught.

For some learners, the vocabulary most deserving the attention of direct teaching will be the vocabulary of academic study (Corson 1985). This may be general academic vocabulary (Xue and Nation 1984) or specialized technical vocabulary relevant to a particular discipline. If the target of direct vocabulary teaching is not clearly specified in such a way, the effect of direct teaching will be minimal because there will be a very small increase in coverage for such learning, and the learning will not be reinforced by encounters with the vocabulary in normal language use. The most important role of the teacher in vocabulary growth is to ensure that the teacher's and learner's effort is being directed towards the vocabulary and type of learning that provides the best return for the effort.

Because many second language learners begin courses not knowing the high frequency vocabulary of the language, there is greater scope for direct teaching. Direct teaching involves explicitly presenting vocabulary through explanation and exercises that focus on the word as a linguistic item. Such exercises could include showing learners the range of collocations a word takes, analysing the word into base and affixes, explaining and practising spelling rules, and showing the shared meaning that underlies a range of uses of a word.The most useful rule of thumb is that the effort of direct teaching is justified by the return in increased coverage for the first 2,000 words of English (West 1953) and the academic vocabulary. Beyond that, the teacher's effort is best directed towards training learners in strategies that they can use to develop their own vocabulary. These strategies should include guessing from context, the use of word parts as

mnemonic devices, and the use of deep processing techniques such as the keyword technique (which is described later in this chapter) and vocabulary cards (Royer 1973).

A final role for the teacher is to encourage learners in activities that result in indirect vocabulary learning. The most significant of these for vocabulary size are sustained listening and reading. Research by Elley and Mangubhai (1981) with second language learners showed that sustained reading activities during normal class time resulted in the equivalent of 15 months' increase in a range of language proficiency measures over a period of 9 months compared with learners who followed teacher-led drill lessons.

Although Elley and Mangubhai did not include a direct measure of vocabulary size, other included measures such as word recognition and reading comprehension indicate that the sustained reading programme resulted in vocabulary growth.

We have now seen four roles for a teacher in both first and second language vocabulary growth. The first and most important role is the informed direction of teaching effort. The other three roles are particular applications of this, namely direct teaching of high frequency vocabulary, training in vocabulary learning strategies, and the encouragement of activities that lead to indirect vocabulary learning. Table 2 summarises the stages in a vocabulary development programme for second language learners.

We will now look at the role of the learner while reviewing the research on self-directed vocabulary learning strategies.

4 The Learner and Vocabulary Growth

Strategies recommended for enhancing vocabulary growth are the same for first and second language learners. By far the most important of these is inferring the meaning of unknown and partly known words from context clues. Although logically this must be the way in which learners' vocabularies grow, research has experienced difficulty in substantiating this (Schatz and Baldwin 1986). This difficulty arises because vocabulary learning from context is most often incremental for any particular word (Nagy, Herman and Anderson 1985). That is, one encounter with a word does not result in the word being learned, but it results in some learning that can be added to at the next meeting with that word. Nagy, Herman and Anderson (1985) measured this learning by using multiple choice items that used distractors that differed substantially in meaning from the correct answer. This allowed learners to choose the correct answer if they had gained even a small amount of knowledge from a meeting in context.

Table 2. A vocabulary programme for second language learners going on to academic study

Research findings	Vocabulary programme	Techniques
Vocabulary size		
(1) It is necessary to have a 95% vocabulary coverage of written texts to get adequate comprehension and to be able to guess from context (Laufer 1989; Nation 1990).	Get to the 2,000 - 3,000 level as fast as possible.	Direct teaching Graded reading Direct learning
(2) Academic ability does not make up for a lack of the high frequency vocabulary (Laufer, in preparation).		
(3) Grouping related forms into word families reduces the vocabulary learning task considerably (Bauer and Nation, in preparation).		
(4) The academic vocabulary of English is an essential requirement for success in academic studies (Corson 1985; Cummins 1981).	After the high frequency vocabulary is known, focus on academic vocabulary.	Word building
Skill in use		
(5) It is necessary to have fluent access to known vocabulary in order to gain benefit from knowing it (Mezynski 1983).	Provide substantial sustained opportunities for use of all this vocabulary knowledge.	Repeated reading
Field of knowledge		
(6) Reading related texts reduces the vocabulary load and provides more favourable conditions for vocabulary learning (Hwang and Nation 1989).	This should involve reading and listening to related material in appropriate areas of specialization.	Guessing from context
(7) Each genre has its own specialized vocabulary. This vocabulary knowledge develops with knowledge of the subject (Hwang and Nation 1989).		Making use of definitions in context
Vocabulary growth		
(8) Bottom-up guessing from context results in more vocabulary learning than top-down guessing (Haastrup 1990).	Read in unfamiliar areas.	Reporting back to others

Learning from context is not restricted to reading. Research by Elley (1989) shows that listening to stories can result in vocabulary learning, especially if the person telling the story provides some explanation of the words. What are needed are longitudinal studies that track the development of particular vocabulary items to see how knowledge of them grows and to see what factors influence their growth.

Frequency data suggest that knowledge of the low frequency words of a language must grow very slowly and must require substantial amounts of reading or listening to language that contains more low frequency words than colloquial language does. The evidence for this comes from frequency counts such as Carroll, Davies and Richman (1963) which show that over 40% of the words in their count of 5,000,000 running words occurred only once. Five million running words corresponds to about eighty books each 200 pages long with about three hundred words per page. One meeting with a low frequency word would result in little sustained learning.

Research on spoken vocabulary (Schonell, Meddleton and Shaw 1956) shows that high frequency words account for a much greater proportion of the words used than in written language. This suggests that informal spoken language does not provide much opportunity for growth in knowledge of low frequency words.

To best use inferring from context as a means of vocabulary expansion a learner would need to develop proficiency in the skill of inferring and would need to do substantial amounts of reading and listening to formal language.

Direct vocabulary learning, particularly of words removed from context, has not been favoured by teachers. In spite of this, however, foreign language learners make use of lists and cards with translations, and vocabulary expansion texts such as those in the Barrons series sell well. There is support for such learning from a large body of experimental research carried out over the last 80 years (Nation 1982).

Much of this research was not conducted to study vocabulary learning but was done to verify some general principle of learning using vocabulary learning as a convenient means. However, the results of these numerous studies agree in showing that large numbers of foreign word-first language translation word pairs (*e.g., cheval - horse*) can be learned in a short time. The weakness of these studies is that they do not provide data on the carry over of such learning to normal use of the vocabulary in listening, speaking, reading and writing.

Such word pair learning should provide a useful basis for normal language use if there is opportunity for learners to meet the items they have learned in a range of contexts. That is, learning a foreign word–first language translation

word pair should be regarded as just a first step, but a major step, in making that item part of a working vocabulary.

Let us now quickly review the research on the efficiency of word pair learning. Studies by Thorndike (1908), Anderson and Jordan (1928), Webb (1962), Lado, Baldwin and Lobo (1967) and Crothers and Suppes (1967) found that there was a wide range of learning speeds among learners in terms of how many word pairs could be learned per hour with the slowest about nine words per hour and the fastest higher than 34 words per hour. Long-term retention measures showed that much of the learning was not lost a month later, and the fastest learners were not the fastest forgetters.

Crothers and Suppes (1967) showed that learning small groups of words (about 18 words) was most effective if the words were difficult. Words are difficult if they are the first words the learner has met in that language, if they are not similar to words in the learner's first language, if they are difficult to pronounce, if they are learned for recall and not just recognition, if they are not nouns, and if near synonyms, opposites and free associates are learned together. Higa (1965) has a very useful discussion of the concept of 'difficulty' as it relates to vocabulary learning. When the words to be learned are not difficult then it is much more efficient to learn large groups of words (over 100) and very few repetitions will be needed to be able to learn them receptively. It would be expected that the way words are learned would relate to the way that they are stored. Either storage options would affect learning, or particular kinds of learning would result in particular kinds of storage. Several papers in this volume (Kirsner, Lalor and Hird; De Groot; Kroll) look at storage but the implications for learning are not yet clear.

How should the words be learned? Several experiments indicate that it is good to use small cards that can easily be carried in packs of 50 or so, with the word to be learned written on one side and its translation on the other. On the very first meeting, however, it is best if the word and its translation are seen simultaneously (Lado, Baldwin and Lobo 1967; Forlano and Hoffman 1937). This ensures that initially only correct associations are made with the foreign word form. Several of my learners report making an incorrect guess on the first time through a pack of vocabulary cards and then finding it difficult subsequently to make the correct association. On the second and subsequent meetings with the words, cards are very effective. Seeing only the foreign word form and having to recall the translation results in better learning than simultaneous presentation where the effort to recall is not required (Royer 1973). The cards also allow the learner to change the sequence of the items to be learned, by shuffling them or dividing them into subgroups according to difficulty. Research by Atkinson (1972) showed that learner-controlled sequencing resulted in far superior learning to random sequencing.

Having items on cards which can be easily carried in one's pocket and used whenever there is a spare moment means that learning at spaced intervals is helped. Research comparing spaced and massed learning (Pimsleur 1967; Bloom and Shuell 1981) shows a clear efficiency advantage for spaced learning.

Looking at the foreign word and having to recall its translation is a way of adding 'depth' to mental processing. The levels of processing hypothesis (Craik and Lockhart 1972; Craik and Tulving 1975) postulates that it is the mental operations performed on the data to be learned that determines how well it will be retained. The keyword mnemonic technique is a thoroughly researched way of adding depth to vocabulary learning. Research on the technique has been carried out with a variety of languages, including native speakers of English learning English (Pressley, Levin and McDaniel 1987). The technique involves thinking of a first language word that sounds like the foreign word or like the beginning of the foreign word. For example, to learn the Indonesian word *bintang*, the English speaker learner might think of *bin*. Then the learner has to imagine the meaning of *bintang* ('star') interacting with the meaning of the keyword *bin*. This image might be a star in a rubbish bin, or a bin with stars drawn all over it. The power of this technique lies in the keyword involving both a form and meaning connection between the foreign language word form and its meaning. Using word parts, for example *com-* and *pos-* to help learn *composition*, is a parallel technique as it utilizes form and meaning correspondences. Typically learners need practice with making keywords for about a dozen times before they become comfortable with the technique. The sixty or more research studies on the keyword technique show it to be at least 25% superior, in terms of amount learned or time taken to learn, to other rote learning techniques (Pressley, Levin and Delaney 1982).

5 The Process of Vocabulary Growth

This paper has looked at the changing relationships between vocabulary size, skill in language use, and knowledge of the world. It has traced a development for second language learners beginning with an emphasis on vocabulary size as an essential prerequisite to the development of skill in language use. As skill in language use develops, this skill enables a growth in knowledge of the world through the skilful use of language. For this knowledge to increase and broaden there must also be accompanying vocabulary growth. As learners' knowledge of particular areas grows, the opportunity for knowledge related vo-

cabulary growth increases. The development of a broad vocabulary, however, requires that learners must go beyond areas of specialization to refine vocabulary learning strategies that are independent of background subject matter knowledge.

This process of vocabulary growth can stop at any point if the required conditions for a change in focus do not occur. For example, if learners do not develop a sufficiently large vocabulary then skill in language use and the knowledge that comes from that skill will not develop. If learners have a sufficiently large vocabulary but they are not given the opportunity to put this vocabulary to use and develop skill in using it, their growth in knowledge and further vocabulary growth will not be achieved. The skill of a teacher and course designer lies in knowing where the focus of growth must be at the various stages of development. Should the focus be on vocabulary growth, skill growth, or the growth of knowledge? This paper has attempted to answer this question by using available research to show that there is a pattern of development and that there are appropriate pedagogical responses to this pattern.

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