13 *Vocabulary and reading comprehension*

It is difficult to see how even a conservative estimate of English vocabulary could go much below a million lexemes. More radical accounts, allowing in all of science nomenclature, could easily double that figure. Only a small fraction of these totals, of course, are learned by any one of us. (Crystal, 1995: 119)

Over the past 15 years, there has been an increasing number of important research studies, review chapters, and books on the learning and teaching of vocabulary. A review of many current surveys of L1 and L2 vocabulary reveals a fairly standard set of questions that are posed and then answered. For example, what does it mean to know a word? How many words are there in English? How many words can be learned from the reading context? Should vocabulary be taught directly? How many words can be taught? (Baumann & Kame'enui, 2004; Bogaards & Laufer, 2004; Folse, 2004; Hiebert & Kamil, 2005; Nation, 2001; Schmitt, 2000; Stahl & Nagy, 2006; Wagner, Muse, & Tannenbaum, 2007b). Furthermore, most publications addressing vocabulary learning make strong connections between reading and the learning of written forms of words. There are, of course, good reasons for this connection between vocabulary and reading. This chapter departs somewhat from the format of other chapters in this book – it addresses the questions listed above (and others) in the process highlighting the promising relationship between reading and vocabulary.

The reading–vocabulary relationship

In L1 reading research, many studies demonstrate the strong relationship between vocabulary and reading. Thorndike (1973), in a study of reading in 15 countries (and with over 100,000 students), reported median correlations across countries and age groups of between r =.66 and r =.75 for reading and vocabulary. Stanovich (1986, 2000) has also reported on studies that support this relationship, and in his own research, he has reported strong correlations between vocabulary and reading for third- through seventh-grade L1 students (r =.64 to r =.76). In fact,

Stanovich (1986, 2000) makes a strong argument for a reciprocal causal relation between reading and vocabulary. That is, vocabulary growth leads to improved reading comprehension, and amount of reading leads to vocabulary growth. (See also Beck & McKeown, 1991; Biemiller, 2005; Roth, Speece, & Cooper, 2002; Stahl & Fairbanks, 1986; Wagner, Muse, & Tannenbaum, 2007a.) In Chapter 8, we commented as well on research by Hart and Risley (1995) and Snow et al. (2007) that demonstrates the strong role of early vocabulary learning in later reading achievement, describing the importance of vocabulary learning from the age of one to its impact on reading at the age of 16 (tenth grade).

In a further set of research studies, Carver (2000, 2003) has argued that the relationship between vocabulary knowledge and reading comprehension is so strong that they can produce perfect correlations. When reliable vocabulary tests are converted to grade-level equivalent scores (to give an example, a student with a score of 52 on standardized vocabulary measures could be rescored as reading at fourth-grade level), and when reliable reading comprehension measures are also converted to grade-level equivalent scores, Carver predicts that the correlations between the two measures will be almost perfect. While the argument is almost startling in its assertion, Carver presents extensive evidence from multiple sources of assessment data to support his position. For our purposes, it is fairly safe to claim that a strong and reliable relationship exists between vocabulary and reading comprehension.

In L2 settings, Verhoeven (2000) reported strong relations between vocabulary knowledge and reading abilities in a LISREL multivariate component analysis (a type of Structural Equation Model). Vocabulary was a predictor variable for reading at .63. In a second major study, Droop and Verhoeven (2003) demonstrated a powerful causal effect of vocabulary on the reading comprehension abilities of third- and fourth-grade language-minority children in the Netherlands. Bossers (1992) reported that L2 vocabulary knowledge was the strongest predictor of L2 reading ability in his research among 50 Turkish L2 Dutch learners. Nassaji (2003b) showed that vocabulary knowledge was strongest among component skills associated with L2 reading for 60 university-level ESL learners. Schoonen, Hulstijn, and Bossers (1998) reported that L2 vocabulary knowledge was a very strong predictor of L2 reading ability for eighth-grade Dutch EFL students ($r = .76$).

In research on L2 language assessment, there are many reports of strong relationships between vocabulary and reading comprehension. Pike (1979) reported correlations between vocabulary and reading on TOEFL tests in the order of $r = .88$ to $r = .94$. Laufer (1997) cited several assessment studies with strong correlations between reading and vocabulary knowledge ($r = .50$ to $r = .75$). More recently, Qian (2002) found

correlations from r = .68 to r = .82 between TOEFL reading and three vocabulary measures.

What does it mean to know a word?

A number of recent surveys of vocabulary learning have pointed out that there are many ways to know a word; the simple form–meaning connection does not provide an accurate picture of the types of word knowledge we all learn (Nation, 2001; Richards, 1976; Schmitt, 2000). In the case of the reading–vocabulary connection, when we know a word well, we access at least nine components of word knowledge (cf. Nation, 2001), as listed in Table 13.1.

Table 13.1. *Components of word knowledge*

1. Orthography (spelling)
2. Morphology (word-family relations)
3. Parts of speech
4. Pronunciation
5. Meanings (referential range, variant meanings, homophones)
6. Collocations (what words very commonly go with a word)
7. Meaning associations (topical links, synonyms, antonyms, hyponyms)
8. Specific uses (technical, common)
9. Register (power, politeness, disciplinary domain, formality, slang, dialect form)

When we learn a word, we do not know everything about a word immediately, and in many cases, we continue to add information to our mental lexical entries throughout our lives. First encounters with words may only leave a brief impression of the word form or the part of speech of the word. Much of our word knowledge outlined above develops over time through multiple encounters in multiple contexts. Given the range of types of word knowledge to be learned, it should be evident that word learning must be an incremental process. Moreover, knowing one or two meanings for most words is not nearly the full set of word information that we eventually build. Even when we know a word, we continually update the entry for the word and fill additional pieces of the puzzle. At the same time, each time we access a word, we increase our word-recognition fluency until we achieve automatic access for that word.

This range of word knowledge that we build while reading points out the strength of the argument made by Perfetti (1992, 1999, 2007; Perfetti & Hart, 2001). He has argued consistently that the ability to know words thoroughly may be one of the best indicators of reading-ability levels (an argument presented as the Lexical Quality Hypothesis).

If, in fact, the information listed in Table 13.1 represents the network of information that can be accessed automatically with thorough word learning, it is not difficult to see how such an extensive network would build multiple paths for reading comprehension. From a more practical applied linguistics perspective, Read (2004) has noted that relatively little has been done in L2 contexts to explore relationships among the various components of word knowledge beyond breadth and depth of vocabulary knowledge.

How many words are there in English?

A second question commonly asked over the past two decades is how many words there are in English (without asking here how well each of the words needs to be known). Estimates vary (almost wildly, and depending on the selected unit of analysis). Certainly, if one were to count all the technical and scientific words used in English, and add proper names for the many things we know, one could easily say that there are probably between one and two million words in English (see Crystal, 1988). For this chapter, the immediate answer is that there are likely to be about 110,000 words in common use.

Staying with a more general criterion of unabridged dictionaries and analyses of large academic and educational corpora, estimates of the number of words in general use range between 100,000 and 500,000 words (see Anglin 1993; Miller, 1999; Nagy & Anderson, 1984; Schmitt, 2000; Stahl, 1999; Zeno et al., 1995). An interesting argument has been made for a much smaller total number of (nonspecialist) words, claiming that English has 54,000 word families (Goulden, Nation, & Read, 1990). This argument remains to be validated, and a number of problems remain with the assumptions underlying the claim. The concept of a word family is not entirely clear as a unit of analysis. For example, recent evidence suggests that claims about the complete semantic transparency of word families (base word, inflectional forms, and derived forms) do not hold up well (Anderson, 1996; Cobb, 2009; Gardner, 2007a; Stahl & Nagy, 2006). Many derived words are not readily understandable from knowing the base meaning of a word (Anglin, 1993; Cobb, 2009; Nagy, 1997; Nation, 2001; Schmitt, 2000; Schmitt & Zimmerman, 2002). It is almost impossible to sort out competing claims about word size based on either number of words or number of word families. Without going into extensive detail, there are good reasons to accept that there are many more word meanings to learn than the more restrictive claims of Goulden, Nation, and Read (1990).

Based on the work of Nagy and his colleagues (e.g., Nagy, 2005; Nagy & Anderson, 1984; Nagy & Scott, 2000; Stahl & Nagy, 2006) as well as the American Heritage word-list frequencies compiled by Carroll,

Davies, and Richman (1971), it is reasonable to assume a general vocabulary of well over 100,000 words in active use in English (compound forms, idioms, and common names will increase this total considerably) (see Miller, 1999; Nagy, 1997; Nation, 2001; Schmitt, 2000). Such an argument matches well with the claimed coverage of the *Webster's 3rd International Dictionary*, noted by Nation (2001: 20) as presenting 113,161 base words in general use.

How many words do L1 students know?

The number of words that are used in general academic settings up to university levels appears also to be quite large. Nagy and Anderson (1984) estimated that L1 students encounter approximately 88,000 word families (for Nagy & Anderson, these include base word forms, inflectional forms, and transparent, closely related derivational forms) in texts during the course of primary and secondary schooling in the United States. In the American school setting, good estimates of L1 word knowledge by graduating high-school students appears to be about 40,000 words (recognizing that there will be wide variability among individual students) (Anderson, 1996; Cunningham, 2005; Graves & Watts-Taffe, 2002; Nagy & Anderson, 1984; Stahl, 1999, 2005; White, Graves, & Slater, 1990). This number is a useful benchmark to consider in that it represents the likely upper limit of what could be expected of any L2 student hoping to study in an English L1 university setting (allowing for wide-ranging fluent reading ability). Claims for a much smaller number of word families known by L1 students in the United States have been proposed (D'Anna, Zechmeister, & Hall, 1991; Zechmeister et al., 1995). This estimate appears to be based on a notion of complete transparency of word families which is unlikely (cf. Anderson, 1996; Gardner, 2007a; Schmitt, 2000; Schmitt & Zimmerman, 2002). Nation (2001) suggests that L1 readers know about 20,000 word families. Recognizing that word families are likely to be in a 1:2 relationship with independent word meanings, his estimate matches with 40,000 words as an average for educated L1 adults.

How many words should an L2 learner know?

In order to make sense of competing assertions about the amount of vocabulary that an L2 reader should know, some preliminary information on word frequency and word counts in texts is helpful. In most English texts for nonspecialized nontechnical uses, the most common word is *the*, usually representing 6–7 percent of the words in a text. The 100 most frequent words in the English language represent about

44 percent of the words appearing in the text. The 1,000 most frequent word families (ignoring the word vs. word family distinction) from the General Service List (West, 1953) that appear in a text usually represent about 71 percent of the total words in a text. The 2,000 most frequent word families usually represent about 76 percent of total word coverage in an English text (Nation, 2001, 2004). When one adds the Academic Word List (570 additional word families; Coxhead, 2000) or the BNC 3000 word list (1,000 additional word families; Nation, 2004), coverage of most academic texts reaches 85 percent or 86 percent, respectively. From this outline (see also Table 13.2), one can see that a goal would be to identify the most frequent word families and teach them in order to cover the highest number of words appearing in a text, and this has been a goal of much research and instructional advice on vocabulary teaching. However, the problem for reading comprehension is a bit more complicated than just teaching the 2,000 or 3,000 most frequent word families.

Table 13.2 *Word frequency coverage of academic texts (Nation, 2001, 2004; Schmitt, 2000)*

the	6–7% of total word coverage
top 10 words	22% of coverage
top 50 words	37% of coverage
top 100 words	44% of coverage
top 1,000 words families	71% of coverage
top 2,000 words families	76% of coverage
BNC 3000 word families	86% of coverage

One problem with word-count coverage of texts is that the genre and specific content of texts can have an impact on these generalizations, although the variation created is not huge. For the BNC 3000 (Nation, 2004), word-family coverage of a fiction corpus is about 90 percent while word-family coverage for an academic corpus is about 86 percent. The bigger problem is that the number of words needed to cover a text grows in an exponential way, especially after about 89 percent coverage. That is why about 40,000 words are needed to provide 98–99 percent coverage for most general texts in English. This changing ratio beyond 89 percent word coverage is a problem for vocabulary learning and reading comprehension, as will be described below.

A helpful explanation of vocabulary size needed to read a range of English texts is provided by Nation (2006). He argues that about 4,000 word families (plus proper nouns) (roughly 10,000 independent word meanings) are needed for *reading instructionally* (that is, with instructional support) with approximately 95 percent of words known in a given text. About 9,000 word families, comprising 98 percent of words known in a text, are needed for *fluent reading in English*. Even

without examining closely the concept of word families versus word meanings, this estimate is more realistic than earlier claims of 3,000 word families as sufficient for English L2 reading comprehension (cf. Nation, 2001; Nation & Waring, 1997).

It seems that a minimum of 10,000 words (not counting inflectional suffixation distinctions) gives an L2 reader a reasonable chance at understanding an academic text, though not reading the text fluently (Hazenburg & Hulstijn, 1996; Schmitt, 2000). This minimal level assumes that instruction of some kind will help students learn key thematic vocabulary that relates to the topic of a given text. Also, the earlier estimate of 40,000 words for L1 students graduating from secondary school (Anderson, 1996; Stahl, 2005) matches well with fluent reading requirements, even for L2 readers. In the American Heritage word list (Carroll, Davies, & Richman, 1971), the compilers note that 43,831 words provide 99 percent word coverage of most texts. Nation (2001) argues that 98–99 percent word knowledge of a text is a common expectation for fluent reading. However, it is not reasonable to expect that L2 students read almost any text they encounter in the L2 with fluency, so the real goal is an L2 vocabulary level anywhere above 10,000 words. With more opportunities for fluent reading practice, a greater number of words will become known.

It is important to reflect in a concrete way on the idea that readers should know 95 percent of the words in a text to read it successfully with instructional support. After all, knowing 95 percent of the words on a page seems quite reasonable initially. At this coverage, the rate of unknown words is one to two words for every two lines of continuous text. Students reading a text in which they do not know 15 words on a 300-word page (95 percent coverage) will need some instructional support to comprehend the text well, especially considering that the unknown words may carry most of the new information in the text. So this level of word coverage in a text would make it an instructional text. Students can read and understand the text with help, support, and good strategies. At 99 percent coverage, there will be three unknown words on a 300-word page. This level of word coverage would count as a situation allowing fluent independent reading.

Following this logic, good instructional texts in reading classes need to aim for a level of vocabulary knowledge that provides 95 percent of text coverage for most texts encountered and should not go below 90 percent coverage of words known in a text. (This page contains approximately 510 words. Ninety percent coverage would mean that a reader did not know 51 words in this single page. This would surely count as a frustration-level text.) The logic of word coverage reinforces the more general message that an L2 student will need to develop a very large receptive vocabulary knowledge base to become an independent reader. It is also worth pointing out that the relatively small size of an L2

student's vocabulary does not prevent that student from building word knowledge by reading, though it is harder to learn words from context incidentally when words in the immediate context are also unknown (Nation, 2001; Pulido, 2009).

In some respects, trying to decide the exact number of words an L2 student will need to function in an advanced academic setting is not ever going to be fully successful. There are too many variables that influence student comprehension. Moreover, the means for deciding what counts as an independent word that needs to be learned sometimes can veer into flights of fancy. At the same time, it is clear that academically oriented L2 students will need to learn many words beyond the 2,000 most frequent word families, and the notion that L2 students still need to know the first 2,000 words families in English well retains its force as an important argument for vocabulary instruction (Meara, 1995; Nation, 2001; Schmitt, 2000).

How many words can be learned from the reading context?

One of the strongest implications from the above section on the size of vocabulary needed by students is that a good percentage of word learning needs to occur by extensive exposure to print and learning words from context. Explicit vocabulary instruction will never include 10,000 words. There are actually two major issues that arise in discussions of learning from context. One is the issue of how incidental word learning from extensive exposure to texts leads to large vocabulary gains over time. The second is the issue of students learning specifically to guess words from context. These are potentially independent issues.

Learning words incidentally from context

In L1 settings, researchers have estimated that children learn somewhere between 1,000 and 5,000 words per year (Graves & Watts-Taffe, 2002; Stahl, 1999; White, Graves, & Slater, 1990), with most estimates being in the 2,000–4,000 range. However, the situation for L2 learners, particularly in EFL settings, is not generally comparable. Even assuming that a reading curriculum included an intensive vocabulary-learning component, it is probably not realistic to expect L2 students to learn 2,000 words per year taught directly in class (assuming 50 words per week times 40 weeks) in any circumstance other than an intensive language-learning program (20 or more hours of instruction per week). Word learning in an intensive context would also likely only provide a partial level of word knowledge. And even in a very intensive L2 language experience, it is unlikely that students could learn any number of words close to the 10,000 minimum through direct vocabulary instruction over

the course of a year (though some intensive programs may approximate the estimates for L1 children — 2,000 to 4,000 words to some level of word knowledge). Given this circumstance, the only way a learner will gain the number of words needed to read most academically oriented texts with some level of adequate comprehension is through *additional exposure* to the needed words in the context of reading (Cunningham, 2005).

Learning words from context entails incidental exposure to new words; that is, the goal of the learner is to read and understand, not to notice and try to learn new words. Exposure to new words involves some passing attention as comprehension is constructed, but a new word may not even be noticed in any conscious way. If it is noticed, it may be skipped, or some minimal possible meaning may be assigned to it in order to continue the effort to understand the text. Multiple studies have shown that word learning from context typically involves learning 5–15 percent of the new words read on a first encounter, at least to some extent of word knowledge (Kuhn & Stahl, 1998; Nagy, Herman, & Anderson, 1985; Nation, 2001; Scott, 2005; Stahl & Nagy, 2006; Swanborn & de Glopper, 1999). Rates of new word understanding and retention are higher with instructional support and multiple exposures (Cobb, 2009; Horst, 2009; Stahl & Nagy, 2006).

The argument for learning words from context is persuasively argued by Nation (2001), Schmitt (2000), Stahl (1999), and Stahl and Nagy (2006) in the context of extensive reading. If students read approximately a million words of running text in a year, and if they know 96–98 percent of the words, they will be exposed to 20,000 to 40,000 new words. (One million words equals 10–12 shorter novels, 25 *Newsweek* magazines, or 65 graded readers.) If a student reads 100 wpm for 45 minutes per day, and for 222 days in the year, that student would read just under one million words in a year (Nation, 2001). If students learn one word in ten through context, they will learn somewhere between 2,000 and 4,000 new words through extensive reading in a year. And, as Nation (2001: 238) notes: "Learning rates can be increased considerably by some deliberate attention to vocabulary." Similar analyses are provided by Hiebert and Kamil (2005) and Stahl and Nagy (2006). One consequence of this argument is that students learn vocabulary by reading extensively over an extended period of time.

It is important to stress that learning the vocabulary required to become a good reader does not mean making a choice between direct vocabulary instruction and extensive exposure to words through reading. Both paths to vocabulary learning are needed and they support each other in complementary ways. Direct instruction can target the most frequent words, key topical words, and generally useful academic words. Direct instruction also supports the reading practice that is needed as

learners work to build larger recognition vocabularies. Extensive reading reinforces the more frequent words, adds many more topical words, builds elaborated meaning networks to connect many of the related words, and exposes readers to many less frequent words (see Chapter 15).

Guessing words from context

Learning words from context leads naturally to a discussion of consciously guessing word meanings from context, a far more complex issue (see also Chapter 4). Guessing words from context is a general skill practiced by all readers to varying extents (Beck, McKeown, & Kucan, 2002; Kuhn & Stahl, 1998). When we see a new word, we may notice it and (tacitly) recognize its form and part of speech; we may notice some aspects of the word form – some affixes or word-stem parts that contribute to a guess; we may quickly associate some meaning with the word – a property, a thing, an action – within the topic of the reading passage; we may quickly decide on a meaning that seems to work well enough in the immediate context of trying to understand the text. These decisions are all inferences made about words, or 'guesses at word meaning from context.' In some cases, the guess may be fairly accurate, but in more cases, the guess may not be accurate at all. When a guess is not very accurate, it may not affect overall comprehension, though sometimes the new word may carry important meaning and disrupt comprehension.

In many instances, the guessed meaning of the word will be quickly lost. On further encounters with the word, the process repeats itself, but with more supporting information available on each iteration. Over many encounters in differing contexts, a reasonable meaning (or meanings) of the word takes shape and develops into an ever-wider range of knowledge about the word. It is important to point out that this way to learn new vocabulary is relatively inefficient if replicated as a type of exercise to learn specific words. After all, a 5–15 percent learning rate across one reading of a text is not very efficient and many words are not repeated frequently enough to maintain learning through just a few exposures. But if one recognizes the need for multiple exposures to a word and the very gradual nature of vocabulary acquisition, and if one also recognizes the many other benefits of extensive reading, then the strategic process of guessing words from context takes on tremendous importance over time (see also Nagy, 2005; Nassaji, 2003a).

Guessing words from context (in L1 reading situations) represents a reasonable way to problem-solve one's way quickly through unknown words in a text, a way of doing the best one can with what one has available without seriously disrupting the reading process itself. Direct

instruction in guessing from contexts has been proposed as a good technique for supporting reading comprehension and also enhancing word learning (Fukkink & de Glopper, 1998; Nation, 2001; Schmitt, 2000; Sinatra & Dowd, 1991; Stahl 1999; Stahl & Nagy, 2006; Sternberg & Powell, 1983). However, the arguments to support explicit vocabulary learning by guessing word meanings from context needs to be qualified by the extensive research conducted on this issue over the past 15 years.

First, the context in which new words appear can vary radically. Beck, McKeown, and Kucan (2002) argue that word contexts are generally of four types: (a) misdirective contexts; (b) nondirective contexts; (c) general contexts; and (d) directive contexts. Misdirective contexts lead students to the wrong meaning. Nondirective contexts provide no assistance in directing a student to any particular meaning for a word. General contexts provide a minimal level of support. Only directive contexts provide a strong set of clues for guessing the right meaning for a new word. Following this taxonomy, only one of the four possible contexts proposed by Beck, McKeown, and Kucan (2002) strongly supports guessing from contexts in real texts. In addition, any context, to be at all useful, requires that almost all of the surrounding words are known to the learner. It also seems that most useful clues are in the immediate context of the word – within a few words of the new word – and guessing works better when there are no confusing alternative clues in the immediate context. Moreover, most useful context information requires that the word itself be identified precisely – assuming good decoding skills (Beck, McKeown, & Kucan, 2002; Nassaji, 2003a; Qian, 2004; Schmitt, 2000; see also Coady & Huckin, 1997; Huckin, Haynes, & Coady, 1993).

Second, there is persuasive evidence that guessing words from context does not provide a good way of learning precise meanings of specific words. In several studies, the observation of student guesses shows that they more often than not make poor guesses from the context given. In other cases, the assessment of word learning from context shows that the percentages of word meanings learned reasonably well were quite low. Beck, McKeown, and Kucan (2002) reported on a study in which adults were able to guess one out of 13 words correctly when the words appeared in a very supportive context (a directive context). Gough and Wren (1999) demonstrated that only 14 percent of nondirective context words were guessed correctly. Words in a strongly supportive context were guessed correctly approximately 25 percent to 45 percent of the time. (See also Bensoussan & Laufer, 1984; Carnine, Kame'enui, & Coyle, 1984; McKeown, 1985; McKeown & Beck, 2004; Nassaji, 2003a; Pressley & Woloshyn, 1995; Shatz & Baldwin 1986; Stahl, 1999.) The conclusion to draw from this research is that guessing from context is a strategic way to read through difficult texts, but it is

not a very efficient way to learn new words as part of explicit vocabulary instruction.

Despite these qualifications, guessing words from context represents an important independent word-learning strategy over time (e.g., Huckin & Bloch, 1993; Nassaji, 2003a; Nation, 2001; Sanaoui, 1995). It also represents an important way for learners to cope with difficult texts. To help students develop guessing skills appropriately, students need to practice and analyze guessing from context in texts that they are reading, recognize clues that may be useful (e.g., discourse-marking words, punctuation, word-part information, part of speech, examples, and descriptions), and be encouraged by teachers to become more aware of new words while reading. Fukkink and de Glopper (1998), "in a meta-analysis of 21 studies involving native speakers found that training resulted in better guessing, particularly if learners' attention was directed to clues in the context" (cited in Nation, 2001: 251; cf. Baumann et al., 2002, who point out that there was no vocabulary from context studies found to be sufficiently rigorous to be included in the meta-analysis by the National Reading Panel 2000). A reasonable conclusion to draw from the debate on teaching context clues is the need to raise L2 student awareness of context information that will help them derive a good guess of the meaning of a new word (see Baumann et al., 2005; Huckin & Bloch, 1993; Nation, 2001; Stahl & Nagy, 2006).

Should vocabulary be taught directly?

Learning words from context does not represent the sole, or even the primary, way to support vocabulary learning for better reading comprehension. In fact, most vocabulary researchers argue that effective vocabulary learning is a combination of (a) learning words from context through extensive reading; (b) providing direct instruction of vocabulary words; (c) developing word-learning strategies; (d) building word-recognition fluency; and (e) developing word appreciation (and motivation) on students' parts (Graves, 2000; Nation, 2001; Stahl & Nagy, 2006).

While the number of words learned through explicit instruction may not be very large, they represent key words for comprehension, words that associate with many other words conceptually and thematically, and words that form foundations for less powerful contextual word learning. A number of research studies and research syntheses have identified several specific approaches for direct instruction of vocabulary that provide effective word-learning outcomes (Beck, McKeown, & Kucan, 2002; Blachowicz & Miller, 2000; Graves, 2000; Nation, 2001; Sanaoui, 1995). The techniques and activities outlined in Table 13.3 all provide ways for students to learn vocabulary through direct instruction.

Table 13.3: *Direct instruction that promotes vocabulary learning*

1. Engaging in semantic mapping and word mapping
2. Developing concept-of-definition maps
3. Attending to glosses in texts
4. Learning key words before reading
5. Experiencing multiple exposures to words
    A. Repeating words multiple times
    B. Encountering words in multiple contexts
    C. Manipulating words in multiple activities and for multiple purposes
    D. Encountering words in structured overviews, reading guides, and advance organizers before reading
6. Developing strategies for independent word learning
    A. Using mnemonic strategies (key-word methods) as well as analogies and imagery
    B. Learning word-part, word-root, and word-affix information
    C. Reading ahead, rereading, verbally repeating the word, paraphrasing, substituting synonyms
    D. Using a dictionary
    E. Working with synonym word lists and flash cards
7. Raising awareness of words and motivation for learning
    A. Becoming more aware of words
    B. Choosing individual words to learn
    C. Increasing interest in words and motivation for word learning

The first recommendation for direct instruction has been shown to improve vocabulary learning and retention in various research studies (Blachowicz & Miller, 2000; de Groot & van Hell, 2005). Semantic mapping typically emerges from a reading text and a topic, and allows students to generate a range of associated words that can then be grouped in relation to the information actually presented in the text (see Appendix, this chapter). Word mapping focuses on a key word and has students generating word-family members and associated words in a visual display (see Appendix, this chapter). The second activity, concept-of-definition maps, provides an intensive exploration of the meaning of a key word, focusing on the meaning, meaning associations, examples, and non-examples (see Appendix, this chapter).

The use of glosses for unknown words has proven to be helpful for reading comprehension. Glosses make the reading context easier to understand, and they provide students with simple definitions that they can use as needed. Both Nation (2001) and Schmitt (2000) refer to a number of studies that demonstrate the usefulness of glossing words in texts. They also agree that providing quick simple definitions for words leads to reasonably good learning of words appearing in a text.

A focus on a few key words per text allows students to focus on a small number of important words and not try to learn long lists of words that

are quickly forgotten. Key words should provide learning connections to sets of additional thematic or associated words that appear in a given text, providing students with opportunities to work with many good vocabulary items while only being required to learn a small set of words that are central to the text.

Instructional activities that involve students in repeated exposure to words and opportunities to manipulate words in various contexts will improve vocabulary learning. Both Beck, McKeown, and Kucan (2002) and Nation (2001) review research and suggest a wide variety of vocabulary-learning activities that support effective learning through instruction that provides multiple exposures to new words and gets students to manipulate these words in various ways. Vocabulary activities that involve matching, sorting, classifying, connecting, and example finding can create ways to reintroduce large numbers of words in a variety of contexts and uses. Activities that ask students to use words in new contexts or for new purposes, and then generate additional examples, require students to see words in new contexts and manipulate them in new ways.

Research supports a number of strategies for learning vocabulary. The further benefit of strategy learning is that students can continue learning on their own if they are motivated to do so. Among strategies for word learning are using dictionaries, working with word lists (paired associations and L1–L2 synonyms), using flash cards, learning word-part information, and using mnemonics, analogies, and key-word methods to build associations for word meanings. While reading texts, some word-learning strategies are very simple and seemingly not very imaginative. These include repeating words, rereading sentences, trying simple synonyms or translations, and reading ahead. Nonetheless, these strategies often trigger connections and associations that help vocabulary learning. Many traditional strategies for word learning (e.g., flash cards) are often derided and viewed as ineffective; yet research has shown that, in the right contexts, and used in the right ways, they are effective supports for vocabulary learning. Overall, word-learning strategies of various types are important supports for vocabulary learning (Gardner 2007b; Nation, 2001; Nist & Olejnik, 1995; Schmitt, 2000).

Word-part knowledge, in particular, has been gaining increasing research support as an effective vocabulary-learning resource. Several studies have demonstrated that knowledge of prefixes and suffixes improves students' word learning (Anglin, 1993; Baumann et al., 2005; Graves, 2004; Schmitt & Meara, 1997; Stahl & Nagy, 2006; White, Power, & White, 1989; White, Sowell, & Yanagihara, 1989). While word-part knowledge cannot be conveyed simply and quickly, a steady set of simple exercises over time as well as activities that raise word-part awareness can provide learners with a useful resource for learning words

from context (e.g., Baumann et al., 2005; Nation, 2001; Stahl & Nagy, 2006).

Raising students' awareness of new words that they encounter in texts represents an important learning goal. Almost every current review of vocabulary now stresses the importance of (a) making students aware of the new words they encounter, and (b) motivating students to learn and use the new words. Students need to become collectors of words; that is, they need to attend to new words they encounter, either by listing words that are interesting or difficult, or by noting possible connections between new words and known words, or by trying to use new words in some interesting way. Arguments for the role of word awareness are discussed in Anderson (1999), Beck, McKeown, and Kucan (2002), Graves and Watts-Taffe (2002), Nation (2001), Pressley and Woloshyn (1995), Schmitt (2000), Scott (2005), Scott and Nagy (2004), and Stahl and Nagy (2006).

What words should be taught (and learned)?

An important issue commonly asked is what words to teach (and what words should be learned). Many researchers suggest that the first criterion for word selection should be frequency. Logically, this is a reasonable argument. If everyone agrees that students need many thousands of words, then the more frequent words need to be learned first. It is at this point that one can also see a major difference between L1 and L2 contexts. Beck, McKeown, and Kucan (2002) argue that L1 learners up to the third grade have vocabularies of approximately 8,000–10,000 words so the focus of vocabulary instruction should be on what they call "tier 2" words – words from 8,000 to 15,000 on frequency lists. They argue that, for L1 learners, these "tier 2" words (n = 7,000) represent a range that is necessary for school learning through ninth grade. If 700 words per year could be part of the curriculum, by tenth grade, these additional 7,000 words would be covered.

L2 vocabulary-learning contexts are very different from the L1 vocabulary-learning context described above. Most L2 curricula would be considered very successful if students knew the most frequent 8,000 words, no less taking that figure as a starting point. As noted above, a useful end goal for students hoping to read advanced academic texts or study in an English-medium university is a minimum of 10,000 words (although many other L2 instructional settings do not need to aim so high). In such circumstances, it is quite reasonable that students would need to know the 2,000 most frequent words in the L2 and also the general academic words described in Coxhead (2000) or the BNC 3000 (Nation, 2004). The issue becomes how to make decisions about word coverage beyond this simple goal.

If the 300 most frequent words are essentially the "glue" of the language, being words that have to be learned just to learn the grammar and have enough words for simple sentences to manipulate as L2 learning begins, they are part of any basic English instruction. These words do not have to be covered explicitly as part of separate vocabulary instruction. For example, the words that appear between 41 to 50 in the list of the most frequent words in American English (Fry, Kress, & Fountoukidis, 1993) are as follows: *would, all, she, her, more, been, about, there, when, its*. These words are all function words in English. Words between 91–100 involve two verbs (*call* and *get*), one noun (*water*), and seven function words. Since the first 1,000 words provide 71 percent of coverage of most texts (Nation, 2004), the remaining 700 words need to be included in part of explicit vocabulary instruction. The second 1,000 words may provide about 4.5 percent coverage, but the first 500 of these second 1,000 do most of the work. These second-tier words, from 300 to 1,500, should all be strong candidates for explicit instruction. The third tier should include words from 1,500 to 2,500, including the Academic Word List (Coxhead, 2000). They should be taught whenever the opportunity arises and it is reasonable to do so. Alternatively, Nation's (2004) British National Corpus Word List could provide the third tier for words from 1,500 to 3,000 on this list. This core word list of three tiers, based on word families, would most likely provide L2 learners with about 6,000 important independent words to learn. This, in itself, is a formidable L2 learning task.

Beyond these 6,000 primary candidate words for learning, students need to build up additional words through multiple exposures to topically related reading material (e.g., through extensive reading) as well as instructional discussions on content materials. Reading topically related material offers good opportunities for the recycling of vocabulary, working with associated sets of words, and word collecting (as well as greater engagement with reading and learning). These reading materials will allow for extended vocabulary learning through context, exposure to less common words, and repetitions with more frequent vocabulary. The combination of extensive reading, word-collecting habits, and word-learning strategies will eventually bring the motivated learner to the recognition vocabulary level needed for advanced academic study.

How many words can be taught? (How are words learned?)

Most L1 direct vocabulary instruction in classrooms does not involve more than 300 to 500 words per academic year (Beck, McKeown, & Kucan, 2002; Stahl, 1999; Stahl & Nagy, 2006). However, vocabulary

instruction in L2 contexts, involving widely varying contexts and different types of demands on learning, may make it possible to learn many more words per year in some situations. Even in contexts of FL (and EFL) learning, there is a much greater emphasis on word learning as part of instruction than occurs in L1 learning contexts. Because students are actively trying to raise their basic (and increasingly advanced) L2 proficiency levels, it is reasonable to expect a greater level of vocabulary learning for L2 students. Students who are in ESL settings, or in more intensive instructional situations, will certainly have many opportunities to engage in intensive vocabulary learning through direct instruction and explicit exercises.

Unlike in more common settings of 3–6 hours of foreign-language instruction per week, it is possible to argue that, in fairly intensive instruction (12–20 hours per week) 2,000 words per year (50 words per week × 40 weeks) could be taught directly to L2 learners. More intensive settings for ESL instruction (20–30 hours per week) could include well over 2,000 words per year (assuming that these 2,000 words would be the target of multiple exposures in multiple contexts and be parts of word lists, word sets, semantic mapping, word-part mapping, and other vocabulary exercises). As students move beyond the 2,000 most frequent words, they should develop word-learning strategies and also greater efficiency in word learning because they already know a larger set of words to build upon (the more words a learner knows, the easier it is to make connections to new words and to use textual contexts). For example, the words *mild*, or even *tepid*, are far easier to learn when a learner already has control over *hot*, *cold*, *freezing*, *warm*, and *cool* (Beck, McKeown, & Kucan, 2002). L2 learners have many such sets, based on both L2 words already learned and L1 vocabulary knowledge. Nagy and Scott (2000) highlight another such example. The word *dolphin* is more likely to be learned very quickly when a learner already knows the words for *mammal*, *whale*, and *shark*.

L2 students have an important advantage over L1 learners with respect to vocabulary development. In most cases, L2 students already know the concepts that the words refer to and only need the appropriate label for these concepts in the L2. While conceptual overlap may not be complete between two languages for any given word pairing, the overlap is generally sufficient for the building of an initial entry of the new L2 word in the learner's lexicon. These quick connections as a labeling process have some parallels to a concept known as "fast mapping" in L1 vocabulary development among young children. It seems that certain words are learned very quickly by children with very few exposures. (They are "fast-mapped" into the young learners' lexicon.) Whether because of immediate needs, or because the word fills a perceived gap in words being learned, or because the word simply attracts attention,

fast mapping is possible (though this is probably not done with a large percentage of learned words in the L1). L2 learners have real advantages in that many L2 words represent labels for concepts that are already well-developed, and there is a ready-made space in the L2 lexicon that is waiting to be filled. It is reasonable to suggest that L2 students have their own favorable conditions for some type of fast mapping with some subsets of encountered words.

The argument that words are ready to be learned because they can fill a cognitive space may seem, at first glance, to be an unusual idea. One might ask why the word *dolphin*, from the example above, might fill a cognitive space said to be well-established across L1 knowledge networks as well as a growing L2 network. Theoretically, the idea that *dolphin* is "ready to be learned" gains support from the recent theory of Latent Semantic Analysis (Landauer, 1998; Landauer & Dumais, 1997). As Stanovich (2000) notes:

Landauer's (1998) work . . . has demonstrated how the paradox of vocabulary growth – how children's vocabularies grow at prodigious rates despite the seeming inefficiency of direct instruction in vocabulary – can be explained by the effect of mere exposure. Specifically, when a word is encountered in the context of other known words, it is not just the representation of the unknown word that is sharpened, but that of all related words in the lexicon (which, in the abstract, includes all words in the lexicon). (Stanovich, 2000: 254)

To put the idea simply, the more known words that regularly appear in the semantic neighborhood of the word *dolphin*, the easier it will be to acquire the meaning of the word *dolphin*. When we learn about whales and sharks, we learn also about the sea, about fins, about swimming habits, about predators, and so on. As a result, many concepts associated with certain fish and sea mammals are readily transferable to the new word, *dolphin*, and *dolphin* becomes easy to learn.

Landauer and his colleagues (Landauer & Dumais, 1997) have demonstrated this phenomenon empirically, drawing on conceptualizations from connectionist modeling and large-scale statistical analyses. They wrote a computer program to "learn" many words simply by being exposed to many texts. The performance of the connectionist learning program on a vocabulary test indicated that many words could be learned by the computer from fairly minimal direct exposure if the words were associated with large networks of related words that were given many exposures. This empirical demonstration functions much like the student who knows a lot of related words and many concepts associated with the word to be learned.

L2 students may find themselves in many situations in which a word is "ready" to be learned, both because of growing L2 vocabulary knowledge and because of extensive cognitive / conceptual networks from their

L1 knowledge. In short, L2 students, in a vocabulary-rich environment, and with extensive exposure to new words, can acquire quite a large vocabulary through relatively few exposures if words are ready to be learned and if teachers can estimate likely words to include in instruction. A similar perspective on accelerating vocabulary learning has been developed by both Biemiller (2005) and Hiebert (2005) in L1 contexts. Biemiller (2005) discusses the need to identify and teach words that are already partially known in order to accelerate word learning, arguing that many words are partially known and ready to be learned well. Both Biemiller (2005) and Hiebert (2005) discuss possible ways to determine which words are more likely to be partially known words. These perspectives, while exploratory, could also be useful for L2 vocabulary teaching and learning.

Implications for instruction

Vocabulary learning needs to be developed from a combination of direct vocabulary instruction, vocabulary-learning strategies, extensive reading and word learning from context, heightened student awareness of new words, and motivation to use and collect words. Instruction needs to provide opportunities for practice using words and multiple encounters with words over time. There needs to be a continual effort to recycle words into new lessons. A number of researchers have generated important principles for direct vocabulary instruction (Anderson, 1999; Beck, McKeown, & Kucan, 2002; Nation, 2001; Stahl, 2005; Stahl & Nagy, 2006). Drawing on these ideas, 17 key implications for planning vocabulary instruction emerge:
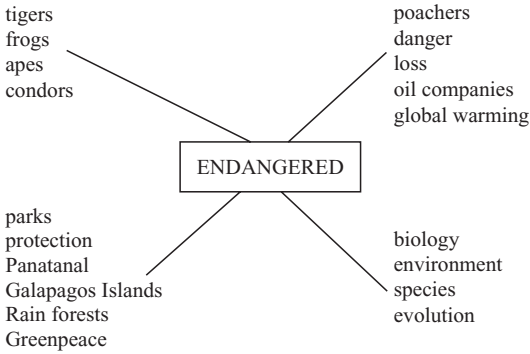
1. Prioritize instruction so that key activities are practiced consistently and systematically over time. (Vocabulary learning is a long-term incremental process.)
2. Provide vocabulary exposures in multiple contexts. Teach different words in different ways (e.g., words for which students know synonyms, words that can be explained well with definitions and examples, words that represent new or complex concepts).
3. Teach words while working with the reading texts that they come from. Teach at the point of contact; use discussion around texts to teach vocabulary.
4. Read aloud to students and draw their attention to key words while reading.
5. Develop procedures for selecting words to teach.

6. Teach a limited set of key words for depth, precision, and multiple encounters.
7. Focus on word relationships (parts-of-speech variations, word families, synonyms, antonyms, graded relations).
8. Provide word instruction that combines contextual information and definitional information (word-part information, cognates, context cues, affix information, flash cards, imagery).
9. Help students learn word-part information and apply it to greater word awareness.
10. Use visual supports and mapping techniques.
11. Work with dictionary definitions and rewrite more accessible definitions.
12. Develop activities that recycle a lot of words at one time (e.g., sorting words into lists, semantic mapping, matching activities, word-recognition fluency activities, repeated reading practice).
13. Create a vocabulary-rich environment.
14. Raise student awareness of words: Have students collect, keep, use, and share words they want. Talk about words and build word consciousness and word interest.
15. Recycle vocabulary over time to ensure multiple exposures to words throughout vocabulary instruction (rereading prior texts for new purposes, having students nominate words to work with, adding words from prior units as part of sorting, classifying, and connecting activities).
16. Give students some choices in word learning.
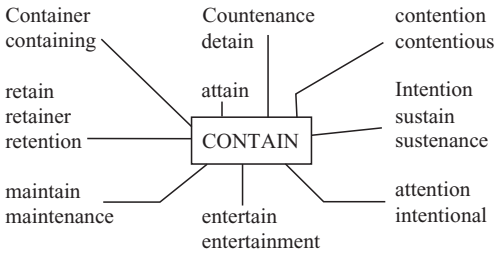17. Develop student motivation for word collecting and provide a supportive learning environment.

These principles represent important implications from vocabulary research for building a vocabulary-learning curriculum (that will also support reading-comprehension development). In summary, a coherent approach to direct vocabulary learning must combine some understanding of how students are likely to learn words as a result of direct instruction, a systematic approach to appropriate word selection, many opportunities for students to practice and use the words being learned, and a vocabulary-rich environment in the classroom. Students also need to develop effective independent word-learning strategies, become metacognitively aware of the power of words, and be strongly motivated to learn words, both through instruction and independently. The end goal is to ensure that key words are overlearned, that large numbers of related words are learned, that students appreciate the power of words, and that they become life-long collectors of words.

APPENDIX: VOCABULARY ACTIVITIES

Semantic Map

tigers
frogs
apes
condors

poachers
danger
loss
oil companies
global warming

ENDANGERED

parks
protection
Panatanal
Galapagos Islands
Rain forests
Greenpeace

biology
environment
species
evolution

Word Map

Container
containing

Countenance
detain

contention
contentious

retain
retainer
retention

attain

CONTAIN

Intention
sustain
sustenance

maintain
maintenance

entertain
entertainment

attention
intentional

Concept-of-definition Map

Presence of many different
life forms

Nature
 Conservancy
Greenpeace
Amazon
 Forest

BIODIVERSITY

McDonalds
Oil refineries
Acid rain
 forests

Variety of species
Different habitats
Interdependence
Symbiotic relationships