



Figure 1

## LINKING THE LANGUAGE A Cross-Disciplinary Vocabulary Approach

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July 2008

Theoretically speaking, it should be relatively easy for educators to link the language by introducing related vocabulary in clusters that cross content domains. Rather than introducing a word in isolation, we might surround it with family members that share the same root. This approach should help diverse learners, including English-minority students, make important vocabulary connections and transfer core ideas across content.

Students are exposed to an abundance of terms across the K-12 continuum—words that might be linked in the mental lexicon to promote retention and retrieval (Reichle & Perfetti, 2003). For example, the word *thermometer* may appear in a second-grade science curriculum, the related words *thermal* and *geothermic* several years later, and *exothermic reactions* show up in middle school. Adolescents may read about *hypothermia* in literature selections or in health class. The high-school science text may include *thermonuclear* or *thermoelectricity*. Meanwhile, at home, families might speak of a *thermostat* or a *thermos*. At which point across the K-12 continuum does the learner recognize the pattern inherent in these meanings and spellings? Some may naturally figure out that all these words share the same root (*therm*) and pertain to ‘heat’. Others may never make that connection without help. They are unlikely to independently determine the meaning of *thermodynamics* through analysis of word structure. Such students are stymied until they learn the fundamental building blocks of the English language. We might begin teaching roots by fourth grade:

The end of third grade is the time to introduce students to the Latin roots and Greek combining forms used frequently in social studies, math, and science texts.... Learning these important patterns provides strategies for not only decoding and spelling but also for expanding expressive and receptive vocabulary. (Henry, 2003, p. 101-102)

The English language is potentially overwhelming. About 70% of the words derive from Latin, French, or Greek, and about 22% from German (Finkenstaedt & Wolff, 1973). Furthermore, the language is large, with nearly one million meaningful lexemes, including words, idioms (we can’t overlook figurative language), prefixes, roots, and suffixes (Crystal, 1995). Given the scope and complexity of the language, it behooves us to help students process and classify related concepts. One way we might do this is through meaning-bearing *morphemes*, such as roots, prefixes, and suffixes. Approximately 88,500 distinct root families of words appear in school texts (*credible, incredible, credibility, credulous*), and about 60% of the words encountered in varied textbooks may be deciphered by analyzing the morphemes inside the word and the context in the surrounding sentences (Nagy & Anderson, 1984). To promote this process, educators might expose the root in clusters of related words. For example, in Figure 1 each word shares the same root *-prim-* meaning ‘first or before’. This is a morphological family of words, and such relationships have been shown to facilitate reading (Carlisle & Katz, 2006).

## SEEKING CONNECTIONS

With just a little practice, recognizing roots becomes relatively easy. For example, the words *bat*, *battle*, *battalion*, *combat*, *combatant*, *combative*, *battering ram* and *debate* contain the root *-bat-* meaning ‘to beat.’ Approaching these related words through their shared root offers a way to decode, encode, and decipher meanings. In fact, most states publish academic standards that require students to analyze the morphemes to determine word meaning. However, there is inconsistency between academic standards and pre-service teacher education, so some educators do not understand morphology (Moats & Foorman, 2003); they may enjoy learning with their students. Thus, “Even while they teach, men learn” (Seneca).

Students needn’t become linguists—they need to become curious. A good deal might be accomplished by simply seeking root relationships in words. Each teacher thinks beyond his/her domain to broad common usage,

**“Teaching new words was subordinated to the goal of teaching about words— various kinds of information about words that could help [fifth-grade] children figure out meanings on their own”** (Carlo et al., 2004, p. 205)

providing for transfer of ideas and revealing root families. For example, the math teacher may expose the root *-equi-* meaning ‘same or equal’ in the terms *equate*, *equation*, *equidistant*, and *equivalent*, and link it to the geography term *equator* or the civics terms *equal rights* and *equity*. Likewise, the history teacher might draw from that same bank of words—including the math terms—when discussing *equality* or *inequity*. As applicable, the Spanish cognate *igualar* could be linked to its English counterpart *equal*. Working together, educators help students bridge the language by drawing attention to the root and revealing families of related words, as illustrated in Figure 2 for *photo*, meaning ‘light’.

Gradually, intermediate and secondary students should begin to understand that most words are structured according to logical patterns of meaning and spelling. Coupled with context clues, a morphological approach may benefit diverse learners, especially English Language Learners (Carlo et al., 2004; Kieffer & Lesaux, 2007). From a classroom perspective, Gloria Ramirez, ELL teacher, has successfully capitalized on morphemes and cognates in middle school instruction:

Personally, I have found that my intermediate-level ELL students can feel successful and are successful when they have learned the meaning of affixes and roots. I find that their spelling improves as well as their vocabulary. Cognates are very important. For instance, *sincere* in Spanish is *sincero*, *sincerity* is *sinceridad* and *sincerely* is *sinceramente*. The roots are the same and just as we add different suffixes to change the grammatical part of speech in English, so we do also in Spanish. The concept transfers easily. (personal communication, March 2, 2004)



Figure 2

**Prefixes.** Students benefit from learning the most common prefixes (Graves, 2004). These affixes contribute a great deal to meaning, as seen in the difference between the words *benediction* (blessing) and *malediction* (curse). Again, consider the power of the prefix in the related academic words *interior*, *exterior*, *posterior*, *anterior*, and *ulterior*. Science teachers might reinforce these prefixes as students examine and label parts of the brain, the atom, etc. Literature teachers might bridge to *ulterior motive*, while history teachers link to *Department of the Interior*, *interior exploration*, etc. Some of the more common prefixes are shown in Table 1.

English teachers might introduce common prefixes (such as *trans-* in *transfer*) and content teachers reinforce them. For example, history teachers may expose the prefix and reveal the relationship between *transportation*, *Transcontinental Railroad*, *Transatlantic Exploration*, and *Transcendental Meditation*, helping students deduce that all terms contain the prefix *trans-*, meaning ‘across’ or ‘through’. Health teachers could discuss *transfections*, *trans fatty acids*, and *blood transfusions*, while in science, students build lexical bridges to *transmitters* and *transponders*. All teachers would link the targeted vocabulary to related words beyond their domain. They needn’t know what other teachers are teaching; they simply need to make connections to related words. With this kind of ‘transdisciplinary vocabulary outreach’, the language may shrink as each student’s vocabulary grows.

**Numeric Prefixes.** As they naturally teach their subject matter, math and science teachers are strategically positioned to point out the meanings of numeric prefixes, such as *mono*, *bi*, *tri* as shown in Table 2. They might begin with easier words (*tricycle*, *triangle*, *monoxide*) and advance to more complex vocabulary (*triaxial*, *trilobite*, *trisoctahedron*, *polycarbonate*). Likewise, mythology teachers could expose the three prongs of Neptune’s *trident* while music teachers explain the difference between *monotone*, *duet*, *trio*, and *quartet*. History teachers could link to the Roman *triumvirate*. Taking another root, they might explain that the words *century*, *centurion*, *centipede*, and *percent* all share the root *centum* meaning ‘hundred’. With instruction in morphology, students might note the numeric prefix in words like *bicentennial*, *decades*, and *hemisphere*. Time invested in learning numeric prefixes should be worthwhile.

**Suffixes.** A few suffixes appear frequently in social studies. For instance, the suffix *-ism* meaning ‘belief or practice’ occurs in well-known words like *alcoholism* or *vandalism* and in lesser-known terms like *feudalism*, *fanaticism*, and *capitalism*. History students need to become comfortable with the derivational suffixes *-ist* and *-istic*, as in *separatist*, *abolitionist*, *communistic*, *socialistic*. Crossing domains, art teachers reinforce this suffix with the terms *photorealistic*, *pointillism*, and *impressionism*. There are at least a dozen derivational suffixes that appear frequently in words (see Ebbers, 2004; Henry, 2003; Moats, 2000).

**Linking Morpheme Clues and Context Clues.** Proficient readers look at context clues as well as morpheme clues to determine word meaning when reading independently. However, older students may not naturally know how to do this—some may not even realize that such clues exist, or they may not utilize context and morphemic clues together (Wysocki & Jenkins, 1987). In every domain, teachers might model this strategy. They could guide the process, encouraging learners to access the context outside the word and the morphemes inside the word. This strategy has been proven somewhat effective in reading subject-matter texts (Baumann et al., 2002). For an example of this method, see also Ebbers and Denton (2008).

**Table 1 Common Prefixes**

Prefix	Meaning	Examples
un-	not, opposite	unkind, uncertain, unchanging
re-	back, again	replay, regress, reform
in- (im-, il-, ir-)	not	inedible, immortal, illegitimate, irreversible
dis-	not, opposite	disagree, disharmony, disintegration
en- (em-)	to make, cause, put	enlighten, encompass, embark, empower
non-	not	nonsense, nonfiction, nonpartisan
in- (im-)	inside, within	insight, introvert, insert, implant, import
over-	above, superior	overlord, oversight, overarching
mis-	wrong, bad	mistrust, misnomer, misconstrue
sub-	under, less	subtract, submarine, substation, subset
pre-	before	preheat, predict, preposition
inter-	between	interstate, international
fore-	before	forewarn, forerunner, before
de-	remove, from	derail, dethrone, deduct
trans-	across, through	transcontinental, transfer
ex-, exo-, e-	out	exhale, exit, exoskeleton, evaporation
com (cor, col, con)	with, together	committee, correspond, colleague, congress

*Note.* Adapted from Carroll, Davies, and Richman, 1971.

**Table 2 Numeric Prefixes**

Meaning	Greek	Latin	Examples
1	mono	uni	monotone, monoxide, unicorn, unicycle
2	di	bi, du, duo	dioxide, dilemma, binoculars, bipartisan, duet
3	tri	tri	triangle, tricycle, triplicate, triumvirate
4	tetra	quad (quart)	tetrahedron, quadruplets, quartet, quarter
5	penta	quint	pentagon, iambic pentameter, quintuplets, quintet
6	hexa	sext	hexagon, sextuplets
8	octo	octo	octopus, October, octagon, octave
10	deca	deci	decade, decathlon, decimal, December, decimate
100	(hector)	cent	century, centipede, centurion, cents, percentage
1000	kilo	mille	kilometer, kilobyte, millennium, milliliter
part, half	hemi	semi	hemisphere, semicolon, semiconductor
many	poly	multi	polygon, monopoly, multiply, multilingual

## WORD-SAVVY STUDENTS

**“Vocabulary instruction needs to be more explicitly metalinguistic; word consciousness is an obligatory, not a optional, component” (Nagy, 2007, p. 54)**

Word-conscious students are somewhat primed to learn vocabulary. They are motivated, interested in language, and inquisitive about words. English or reading teachers might ignite such an attitude by sharing the humorous yet educational chapter book *Frindle* (Clements, 1996). This fast-paced plot is suitable for grades 4-8 and ought to motivate and engage the class. Motivation and engagement may well optimize instruction, resulting in higher achievement (Guthrie & Wigfield, 2000). In fact, according to Tseng and Schmitt (2008) motivation permeates all phases of the learning process, including the mastery phase, and success promotes not only the skill to learn new words but also the will to do so. This may depend somewhat on the ability to self-regulate, or to purposefully select the best vocabulary approach for the unknown word. Since a morphemic approach may only work for about half the words encountered in text, teachers could model self-regulation by thinking aloud as they decide which vocabulary tactic is best for a particular unknown word.

Thus, vocabulary lessons that engage and motivate the learner are likely to prove effective. By modeling an attitude of curiosity about language, educators could generate linguistic insight. To promote such a spirit, we strive for a learning atmosphere that is both lighthearted and directed. Students discuss word relationships, invent words, sort words, compare and contrast meanings, and simply enjoy the sounds of speech. Because the activated mind seeks word associations, lessons do not focus on isolated words, or dictionary lists, but on relationships. Beck, McKeown, and Kucan (2002) encourage discovery in forming word associations:

Another entry point for adding words to the environment is morphological relationships. For example, challenge students to compare *Tyrannosaurus* and *tyrant*; *pedestrian* and *pedal*; *duplicate* and *duplicity*. It can also be valuable to discuss when relationships seem to exist but do not, as in the case of *gargle* and *garden*....Including such ideas in discussions of words lets students see language as an open book rather than as mysterious and impenetrable with authority over them. (p. 128)

## PLANNING FOR SUCCESS

Working collaboratively, all teachers help students discover morphological links. The more systematic the plan, the more likely it will succeed. Content teachers could focus on the roots that apply to their domain. For example, science roots include *bio*, *therm*, *phono*, *photo*, *geo*, *hydro*, etc. This type of cross-content instruction is feasible, takes little time, and eventually becomes habitual. One middle school in Florida has been using this approach to vocabulary for several years. The assistant principal, M. Vertrees, explained the benefits:

One of the most important benefits of this type of instruction is that it gave students a deeper understanding of the word and it helped them remember it. For example, when I taught *Mediterranean Sea*, I taught it as *medi* = ‘middle’ and *terra* = ‘earth’--- *The sea in the middle of the earth*. Then they knew how the people felt about their world back then. That was the known world; it was all they knew. (interview, June 14, 2006)

Schools might focus on an academic word family each week. Academic words might be selected from the first five sublists of the *New Academic Word List* (Coxhead, 2000). For example, the academic word *benefit* could include *beneficial*, *benefactor*, *benevolent*, *benign*, and *benediction*. The meaning of the prefix *bene-* ('good') would be taught in English class but students would encounter related words across the curriculum, in science, math, art, etc. Every teacher would find a way to relate at least one of the words to a lesson that week. Schools might display the family-of-the-week in the halls, the library, and on classroom walls. This may yield positive school-wide community effects as well as vocabulary growth.

Cross-domain linkage is not likely to occur by happenstance. At first, this type of approach will require leadership, an interdepartmental focus team, collaboration, planning, and professional development—at least a professional learning community. Instructional leaders will need to promote and prioritize the vision. They will serve as metaphorical torchbearers, keeping the flame alive amidst the myriad distractions that occur over the school year.

Affirmation and validation is key. Teachers need to see that this approach is working and students need to feel more capable and confident around language. However, monitoring vocabulary growth is a thorny issue, as vocabulary grows slowly. One early indicator may be a heightened level of interest in words. Progress is evident when students spontaneously identify morphemes during shared reading: "Look! There's *bio-* again!" Furthermore, as students learn to recognize the shared root in large families of words, spelling and reading may improve. This is another indicator of progress. Gradually, eventually, growth in reading comprehension and perhaps in disciplinary knowledge should be reflected on summative state achievement tests.

Resources are necessary. Teachers may need a dictionary that includes word origins. In schools populated with English Language Learners, cross-language dictionaries may be needed to find cognates (*insect-insecto*). Much of this information is available online (see appendix). For parsing out essential roots and prefixes across the departments by grade level, see Henry (2003). See Moats (2000) for lists of common morphemes and a variety of teaching suggestions and exercises.

**Patience and Practice.** Vocabulary growth may not be immediately appreciated, just as a few drops in a bucket are easily overlooked. If progress is slow, resist the temptation to feel discouraged. Unlike learning the letters and sounds of the alphabet, vocabulary is an ongoing growth construct, never fully mastered. Adolescents may first need to overcome their sense of frustration and failure, which may manifest itself as apathy or anger. An accepting, humorous, engaging atmosphere of playful discovery is optimal. Validating partial knowledge (the student understands the word when hearing it) and demonstrating that meanings are somewhat flexible—as used in context—may offset years of intimidation. Also, ongoing review will secure a stronger sense of success. Distributed practice is more effective than massed cramming because retention of information is higher (Willingham, 2002). Eventually, with multiple exposures over time and through varied vocabulary strategies, a new level of linguistic insight, possibly even a new sense of self, should emerge.

## LIMITATIONS

A morphology approach is one important strategy in the vocabulary teacher's toolbox; it does not take long and it can be—and should be—integrated easily with context clues. But

**May you have the hindsight to know where you have been, the foresight to know where you are going, and the insight to know when you have gone too far (Irish blessing)**

it is not the only approach and it will not work for every word. Some words do not make sense through the root or do not belong to a large morphological family. Furthermore, morphology research, while promising, is not yet conclusive, especially with respect to learning disabilities (Reed, 2008). Moreover, the concept of a school-wide interdepartmental approach is theoretical, albeit based in principles of effective instruction. Thus, the vocabulary plan should include a variety of strategies, such as specific word instruction, semantic mapping with partner discussion, and wide reading. A comprehensive, multipronged vocabulary model has been hypothesized by Graves (2006) and confirmed in the classroom by Baumann, Ware, and Edwards (2007).

Finally, it's possible to go too far with morphology, to the point of diminishing returns. To avoid this, teach only the most common roots and affixes. A root approach should not overwhelm inquiry-based science or history lessons; rather, it should support such instruction. Norborn Felton, Emeritus Professor of Geology at San Jose State, explains the value of morphology even as he advises restraint:

Kids don't need to learn all of the prefixes and roots. They need to be exposed to enough of them so they can see how useful they are. That's the important thing. And they can make up new scientific words. It should be engaging. (interview, June, 2006)

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## Online Resources for Morphology

Etymology Dictionary [www.etymonline.com](http://www.etymonline.com)

Cognates [www.latinamericalinks.com/spanish\\_cognates.htm](http://www.latinamericalinks.com/spanish_cognates.htm)

Morpheme Puzzles [www.vocabulary.com/rootroutes.html](http://www.vocabulary.com/rootroutes.html)

Solve unknown words morphemically and reduce world hunger at [www.freerice.com](http://www.freerice.com)

Translations in Many Languages [www.freedict.com](http://www.freedict.com)

Webster's Dictionary of Prefixes, Suffixes, and Combining Forms: [www.spellingbee.com/pre\\_suf\\_comb.pdf](http://www.spellingbee.com/pre_suf_comb.pdf)

Wordsmith.org (subscribe for electronic Word a Day) <http://wordsmith.org/awad>

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