Tapping the Linguistic Resources of Spanish/English Bilinguals: The Role of Cognates in Science

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Abstract

This paper explores the existence of and relationship between a set of Spanish/English cognates that have the potential for assisting Spanish/English bilinguals' experiences with science texts. Due to their common ancestral bond of Latin, Spanish and English share many cognates, including some that are highly frequent in Spanish but less frequent in English, specifically in science text. Consequently, Spanish/English bilinguals possess a linguistic resource that includes many words that, while commonplace in Spanish (e.g., enfermo), are reserved for scientific and academic registers in English (e.g., infirm). For first language Spanish students these words might well aid in accessing core English words and understandings of science texts. An analysis of the frequency of key vocabulary in three science units revealed a substantial number of these frequency-imbalanced cognate pairs; that is, the Spanish member has a higher frequency than the English counterpart.

Tapping the Linguistic Resources of Spanish/English Bilinguals:
The Role of Cognates in Science

Vocabulary is unarguably a critical factor in building proficiency in reading. This role of vocabulary in reading is one that reading researchers have long recognized with Whipple (1925) stating that growth in reading means "continuous enriching and enlarging of the reading vocabulary and increasing clarity of discrimination in appreciation of word values" (p. 76) and Davis (1942) describing comprehension as comprised of two skills: word knowledge or vocabulary and reasoning.

Words vary on many dimensions, with frequency of use (how likely are language users to encounter it in oral and written discourse), complexity of meaning (how concrete or abstract is the underlying concept represented by the word), and ambiguity of meaning (how many possible meanings must be considered in order to settle on a precise meaning for the local context) being but three of the most salient in determining the difficulty students will encounter in learning new words. Words must be understood in particular contexts, some oral and some written. Other things being equal, everyday oral texts tend to be limited to a few thousand common words that we use to get through the business of life and communicating with others on everyday affairs. Written texts complicate language comprehension by introducing students to words that they will not necessarily have encountered in everyday oral discourse. But there is a silver lining to the cloud of difficulty introduced by written texts—written texts also provide a rich resource for expanding vocabulary, particularly in elaborating the set of words that can be used to name a given concept (e.g., adding gorgeous, stunning, and dazzling to the description of a painting).

Not only are students expected to understand words in texts, but texts also introduce students to many new words. The vocabulary of written language is much more extensive and diverse than the vocabulary of oral language (Hayes, Wolfer, & Wolfe, 1996).

The degree to which vocabulary of texts serves as an obstacle in the reading of American schoolchildren is difficult to establish because effects of vocabulary are often difficult to separate from reasoning in assessments. However, according to the National Assessment of Educational Progress (Donahue, Finnegan, Lutkus, Allen, & Campbell, 2003), a fairly consistent number of American fourth-graders—around 40%—fail to comprehend a grade-level text at a basic level and approximately one in four comprehends at a proficient level. The profile of the NAEP on science is quite similar (O'Sullivan, Lauko, Grigg, Quan, & Zhang, 2003).

Closer examination of these data indicates that traditionally marginalized students (i.e., low-income and racial or linguistic minority students) are more likely to perform at the below-basic level and less likely to perform at the proficient level or higher in either reading comprehension or science achievement. A breakdown of the data by ethnic group indicates that Hispanic and Black students account for a disproportionate percentage of the below-basic group, while White students account for a disproportionate percentage of the proficient and above group. The racial gap is even wider in NAEP science achievement (compared to reading), with approximately 10% more non-White students in the below-basic group and 10% more White students in the proficient category (O'Sullivan et al., 2003).

Numerous policies have been initiated to narrow this gap between Hispanic and Black students and their White counterparts. In this chapter, we examine a set of linguistic resources that bilingual Latino students bring to the task of learning English— the shared cognates of Spanish and English, and we propose that if these resources were made a centerpiece of

educational initiatives in the states where significant numbers of children speak Spanish as their native language, it might dramatically increase access to academic language and learning for this sizable population. Particularly in a content area such as science where the performance of Latino students is substantially discrepant from their English peers, this potential resource deserves consideration. As a content area, science is unforgiving in terms of the constant need to build knowledge and the terminology needed to express that knowledge. Native Spanish speaking students need to use every resource available to them to make meaning and build control over science vocabulary and conceptual knowledge; cognates seem a ripe area to exploit as a fundamental building block.

In the first section of this chapter, we review the relevant literature on cognate learning to develop the empirical and theoretical arguments for examining cognates as a resource for enhancing science learning. In the second section, we present the findings of an analysis of the core words of an elementary science program to assess the viability of the cognate strategy. In the final section, we unpack some of the ideas we have developed for moving the cognate agenda along, proposing needed research and plausible practices for teachers to include when teaching science to first language Spanish speakers.

<div align="center">Theoretical and Empirical Foundations</div>

Our work is based on three areas of scholarship: (a) the nature of science vocabulary, (b) the nature of English, and (c) the nature of instruction and learning for students at risk for failure, (i.e., those students whose achievement lags behind expected standards).

The Nature of Science Vocabulary

Vocabulary in science texts differs from vocabulary in narratives, and it is our claim that these differences demand different allocation of attentional resources while reading. To illustrate

these differences, consider these two text excerpts taken from the middle portion of the

appropriate content-area, sixth-grade textbook of the same publisher.

> *Excerpt A (Science):* In a transverse wave, energy moves in one direction, while the
>
> crests and troughs move at right angles to that direction. Sound energy travels in
>
> compressional waves. In a compressional wave matter vibrates in the same direction as
>
> the energy waves that travel through it. (Cooney, DiSpezio, Foots, Matamoros, Nyquist,
>
> & Ostlund, 2003, p. B141).
>
> *Excerpt B (Reading/Language Arts):* Ten thousand eyes were on him as he rubbed his
>
> hands with dirt; Five thousand tongues applauded when he wiped them on his shirt. Then
>
> while the writhing pitcher ground the ball into his hip, Defiance gleamed in Casey's eye,
>
> a sneer curled Casey's lip. (Thayer, 2003, p. 17).

Science texts deal with aspects of the world with which students may have daily contact

but that have never been consciously analyzed or addressed. An overwhelming majority of the

students who read the science text in Excerpt 1 have heard sounds throughout their lives. Surely

they have experienced sound waves thousands of times. But they are not likely to have examined

sound waves as "an object of intentional study." Few are likely to have either the concept or the

vocabulary for "compressional" wave of sound energy. Their introduction to the concept will

likely co-occur with their introduction to the vocabulary. Understanding of compressional wave

involves much more than pronouncing the word; it requires understanding a complex, conceptual

construct. In this manner, science texts contain many words of the most difficult of the three

word-learning tasks described by Graves (2000): words that represent new concepts for students

rather than words that are synonyms for concepts that students already have or words that

students know at some level but that have multiple meanings. Science texts also involve many

words of the latter type where known words need to be given nuanced or new meanings. An excellent example of this type of word is the word *energy* in the science excerpt. While sixth graders will be familiar with the use of the word energy to imply *level of activity* ("I have lots of energy today"), most will not have the technical understanding that is implied by the use in "energy moves in one direction." In science, words such as *energy* have precise meanings that differ from the manner in which the words are used in narrative text or everyday use. While synonyms can be given for *energy* in a narrative text—*lively* or *full of life*—students need to understand a particular and precise meaning of *energy* in science texts.

The easiest type of word to learn is the first of Graves's (2000) categories where students already have a concept but are confronted with an unfamiliar synonym. These synonyms are likely to imply a nuance or connotation that is different from the original word, but students will have some background knowledge for the concept. Many of the new words in the narrative text are of this type. While some students may not have background knowledge of baseball (the setting for the narrative text in Excerpt 2), most sixth graders are likely to understand the stance of an arrogant athlete. Thus, while they may never have encountered the words *defiance* and *sneer*, they will get the gist of the text. And, should the word *sneer* be unfamiliar, a quick explanation by teacher that *sneer* is the same as *laughing at* could provide access to the word.

Another aspect of science vocabulary that makes it difficult is that a new topic typically involves a number of unknown concepts and vocabulary. In science texts, new words come in groups since complex concepts are situated in a semantic network that includes related words. Gaining active control of these words is achieved when students know where the word fits in relation to other words. Since science is a discipline with a host of complex concepts (e.g., *erosion, decomposition, dissolving* in our units) and because students need these concepts to talk

about the science they experience, we feel students should learn concepts as organized networks of related information. Further, because ideas are developed in a science text, the new vocabulary is repeated more often than in narrative text (Hiebert, 2003). Thus, if a student does not know what *compressional* means, the gist of the text will be difficult to establish. Words such as *defiance* can be glossed over in a narrative. Words such as *energy, compressional, angles, vibrates* in a science text cannot be ignored, if meaning is to be gained.

The learning of science vocabulary is particularly challenging since there are few contexts other than the school lesson in which the technical vocabulary of science is used or heard. A word such as *applauded* in a narrative text may be heard on a television program or at a school assembly. For science vocabulary such as *erosion* and *decomposition*, students simply do not have the background knowledge nor can they build experiences with the concept without the support of classroom lessons. Science has never received much of the curricular pie in elementary schools, and it is receiving even less time as a result of recent reading mandates gaining an even greater slice of the pie (Spillane, Diamond, Walker, Halverson, & Jita, 2001). As a consequence, students have few opportunities to engage in the inquiry-based science that will provide the background to understand the vocabulary when they see it in a text. Without real experiences, the words may mean little to students when they do encounter them (Carlisle, Fleming, & Gudbrandsen, 2000).

If students are lucky, they will gain this conceptual knowledge in a rich, hands-on, inquiry-based science curriculum. If they are even luckier, they will also have a teacher who will connect the visual form of the word with the rich experiential examination of the phenomenon. And if they are still luckier, they will also be reading texts in which this new vocabulary is encountered with sufficient frequency and clarity to stabilize both the pronunciation and meaning of these

new terms. Unfortunately, as we have suggested, we see too few curricular opportunities for this highly integrated approach that mixes experience and text to achieve conceptual understanding.

The Nature of English

While English has its linguistic roots in the Germanic languages of the Angles and the Saxons, it also borrowed heavily from its Romance language neighbors and thus has many Latin-based words. The nature of the Latin-based English words deserves attention in thinking about the task of the vocabulary of texts for all children, but it has unique applications for children whose native language is Spanish.

Latin-based words in English have two sources—the use of Latin words in science and French. The former source is common to many languages. Because of the use of Latin among scholars and the clergy during the medieval ages, the early language of science was Latin. The tradition of attaching Latin names (that often drew on Greek) to new discoveries in science continued for many centuries.

These Latin-origin words for science and technical vocabulary are similar in English and Spanish. The following examples from the life sciences illustrate these similarities: *hydroponics, hidroponía; deciduous, deciduo; ecology, ecología; penicillium, penicilium*. Thousands of additional examples could be given. For most schoolchildren, whether speakers of English or Spanish, these terms will be unfamiliar until they encounter this vocabulary in school contexts. Latin-origin words that are used in science and technical fields account for a large number of the cognates that are listed in compilations of English-Spanish cognates (see, e.g., Nash, 1997). Spanish-speaking students do not necessarily have an advantage over their native-English-speaking peers when they are introduced to these words. Yet, the translation process for these cognates is transparent for speakers of Spanish: once they know the word in either language,

producing or recognizing it in the other language is easy. As an aside, notice that the speaker of English trying to learn Spanish has the same advantage.

Spanish-speaking students may have an advantage, however, with another group of Latin-derived words that have come into English through another route. Historically these words came into English from the use of French as the language of the aristocracy and government when French-speaking Normans became the ruling class of England after 1066. Commoners continued to use English but, within the court, clergy, judiciary, and other facets of life related to the upper classes, French was dominant. This pattern continued for over 200 years until, in 1399, a native English speaker again assumed the English throne (Barber, 2000).

Even after English regained its dominant position among the upper classes, the influence of French remained in the form of vocabulary. Historians of the English language note that the French loan words that remained were many (Barber, 2000). In particular cases, the French vocabulary became the dominant vocabulary of the cultural and political domains of the ruling classes: ecclesiastical matters (e.g., *religion, saint, sermon, service, parish, clergy*), the law (e.g., *court, attorney, accuse, justice, judge, crime, prison, punish, verdict, and sentence*), hunting, heraldry, the arts and fashion (e.g., *apparel, costume, dress, fashion, romance, column, music*), and administration (e.g., *council, country, crown, government, nation, parliament, people, state*).

French loan words can also be found in the domain of hearth and home. Because commoners continued to use English after the Norman conquest, these French loan words exist alongside the Germanic-origin words of English. Take, for example, the English-French pairs of *doom*/*judgment, folk*/*nation, hearty*/*cordial*, and *stench*/*odor*. As these examples show, the German-origin words are typically used in colloquial or everyday settings, while the French words are typically used for purposes that might be regarded as more formal or refined.

Because written language typically employs more formal vocabulary, these French-origin words are often found in literary and academic texts. For example, a writer of literary or academic text may use the word *frigid* rather than *cold* to describe the temperature of a building; a crawling creature may be described as an *insect* rather than as a *bug*. For native Spanish speakers, these literary words are close to the common words in their native language: *frío*, *insecto*. These cognates can be useful in the learning of English, particularly academic English.

The Nature of Learning and Instruction

Students with home languages and dialects that differ than the language of school are frequently evaluated on their inadequacies, rather than on their strengths (Allington & McGill-Franzen, 1991). This perception has too often led to lowered academic expectations for these students. Lower academic perceptions, in turn, lead to lower academic performances (Moll & Ruiz, 2002).

The funds of knowledge perspective of Moll and his colleagues (Moll, Amanti, Neff, & Gonzalez, 1992) directs attention to the intellectual resources that students, particularly culturally or linguistically different students, bring to school. The funds of knowledge that Moll and his associates have emphasized pertain to the bodies of knowledge that are essential to a household's functioning and well-being. For example, some members of a Latino/a community have knowledge about auto or bicycle mechanics that they share with other community members, while others are knowledgeable about home improvement (e.g., electrical wiring, plumbing). As these funds of knowledge are shared within the community, children observe and participate as community members perform tasks, such as measuring the opening for replacing a faucet. Such funds of knowledge create "zones of possibilities," in which classroom learning might be enhanced by the bridging of community ways of knowing with the expected classroom

curriculum.

Spanish-English cognates can also be regarded as a "fund of knowledge" that can be used to bridge community with classroom ways of knowing. As the preceding review of the history of English showed, academic English contains vocabulary that has close connections to a Romance language such as Spanish. To date, researchers have examined the "transfer" value of these cognates, but they have not studied whether interventions that capitalize on this resource deliver benefits for learning English.

For example, research by Nagy and his colleagues has shown that, when students are aware of Spanish-English cognates, they do better on vocabulary tasks (Nagy, García, Durgunolgu, & Hancin-Bhatt, 1993). However, students' ability, even among upper-elementary students, is not fully developed or an automatic condition of bilinguals (García & Nagy, 1993). There does appear to be a developmental trend (Hancin-Bhatt & Nagy, 1994), with older students more aware and capable of using cognates than younger ones. Some of this developmental effect appears to be a function of English proficiency, but it also appears to be a function of the degree to which the word is understood in Spanish (Nagy et al., 1993).

Research has yet to be conducted on how this linguistic knowledge can be consistently recognized and drawn upon. While instructional studies exist in cognate use in learning French as a foreign language (Treville, 1996) or even in learning Spanish as a foreign language (Cunningham & Graham, 2000), there have been few studies aimed at developing cognate understanding among native Spanish speakers learning English. Even among the teachers' manuals of programs that were adopted for use in the state of California (and that provide the foundation for the Reading First initiative in the state), we can find no evidence that cognates are listed or even emphasized as a strategy. We can, however, assume that the literary and academic

texts that students encounter in school contain at least some cognates. Evidence for this conclusion comes from a vocabulary intervention conducted by Carlo, August, McLaughlin, Snow, Dressler, Lippman, Lively, and White (2004). Even though Carlo et al. did not choose texts based on the presence of cognates, approximately 68% of the challenging and targeted vocabulary in the trade books and newspaper articles used in the intervention consisted of cognates.

Our particular interest in the cognate question came about because of our work on a science curriculum project aimed at increasing literacy and science connections. A portion of this work involved identifying a set of conceptually challenging words that would be introduced to students through both first-hand (active science investigations) and second-hand (reading science texts) inquiry. When the language and literacy members of the team viewed the words chosen by science educators for explicit teaching within each unit, a hypothesis was quickly formed: namely, that many of these critical science words were English-Spanish cognates. In particular, we thought that many of the Spanish cognates might fall into that category for which Spanish speakers have a distinct advantage—where the rarer academic word in English (e.g., frigid or insect) is a cognate for an everyday word in Spanish (e.g., frío or insecto). These words, we thought, could be a resource for bilingual students who are being asked to learn science content in English.

We also knew from our reviews of both reading and science textbooks that, even in states with large number of Spanish speakers (specifically, California, Texas, and Florida), state adopted curricula do not highlight cognates as a strategy for native Spanish speaking students. It seemed such a transparently inviting practice, we wondered why. One possibility is that we have no research documenting the efficacy of the practice of emphasizing cognates in introducing

academic vocabulary. This may be especially true when it comes to science texts. To gauge the potential benefits of embedding an English-Spanish cognate strategy into large-scale science curriculum and instruction efforts, data on the size and kind of the vocabulary in particular areas of science are needed; after all, if the cognate strategy could be applied to only a handful of words for a given topic, it might not be worth the energy and effort to create a special strand. Further, an understanding of the diversity of cognate types is also essential in designing curriculum and instruction for bilingual students. The cognate strategy works only if the language of science in English classrooms relies on a substantial set of words that appear infrequently in English but frequently in Spanish. Thus, the present study was designed to test the potential efficacy of the cognate strategy by examining the types and number of English-Spanish cognates among a critical set of science words that might well be taught explicitly in a science curriculum.

An Examination of English/Spanish Cognates in Science Curriculum

The purpose of this study was to identify and classify the English/Spanish cognates within a set of words that science educators had identified as critical to the learning of three science topics. This analysis was set within a larger curriculum development process aimed at increasing literacy and science connections. A portion of this work involved identifying a set of conceptually challenging words that would be introduced to students through both first-hand (active science investigations) and second-hand (reading science texts) inquiry. The current study provides a linguistic existence proof on the kind and number of English-Spanish cognates in science content.

Methods of the Study

The development of the classification scheme and the identification of words for this

linguistic analysis involved three steps: (a) establishing the critical science word list (b) developing the cognate classification scheme, and (c) identifying the frequency of words in English and Spanish.

Cognate classification scheme

Cognates were defined as words with a similar spelling and meaning across languages. The classification of cognate types began with a study of the available databases including Nash's (1997) grouping of 20,000 Spanish/English words. The analysis yielded the following cognate types:

1. no shared cognate

2. false cognate (*globe/globo*)

3. low-frequency English word: low-frequency Spanish word (*organism/organismo)*

4. high-frequency English word: low-frequency Spanish word (*question/cuestión*)

5. high-frequency English word: high-frequency Spanish word (*animal/animal)*

6. low-frequency English word: high-frequency Spanish word (*frigid/frío*)

If the cognate strategy is to work, there must exist a substantial pool of words in categories 3 through 6 but especially in categories 5 and 6; in the final analysis there must be a sizable pool of words that Spanish speakers are likely to know from everyday Spanish use.

Identification of critical science words

The analysis of critical science words occurred as part of a federally funded grant to increase the quality and quantity of literacy activities within a nationally recognized science curriculum—the Great Exploration in Math and Science (GEMS) at the University of California's Lawrence Hall of Science. For prototypes of literacy-science connections, a set of three topics was chosen from among the 70 science curriculum units that have been published by

GEMS. These three topics were chosen for their relevance to the curricula of the primary grades and representations of each of the three areas identified within national science standards: life, earth and physical sciences. The three content areas and topics were: life science—Terrarium Investigations; earth science—Shoreline Science; and physical science—Designing Mixtures.

For each topic, a team of four science educators with graduate degrees in the area and considerable material and professional development experience met to identify a group of critical words. These words were to be emphasized in the subsequent creation of student materials, books, activities and teacher guides. Over at least three meetings that occurred over a six-week period, each of these three teams identified from 20 to 26 words. In addition, all teams contributed to a group of words that described science processes across all three of the units. Across the three topics and the science process words, 86 words were represented: (a) science process: 14; (b) Shoreline Science: 26; (c) Terrarium Investigations: 25; and (d) Designing Mixtures: 21.

Some words appeared in more than one topic and some appeared with several derivatives within a topic (e.g., *decompose, decomposer, decomposition*). However, because the teams of science educators represented different disciplines and had conducted independent analysis of the critical words in their content area, all forms and occurrences of words were regarded as distinct words.

Establishing the frequency of Spanish and English words. The 86 English words were translated into Spanish by one of the principal investigators, who is a native-Spanish speaker with three degrees in language related study. The translations were checked with two on-line resources: (a) the on-line database of the Real Academia Española (2003), the official agency of the Spanish government that regulates the Spanish language and (b) English-Spanish On-Line

Dictionary (2000).

Frequency of words in written English was established by consulting Zeno, Ivens, Millard, and Duvvuri (1995). Zeno et al. based their frequencies on approximately 17.25 million words drawn from a representative sampling of grade levels (kindergarten-college) and content areas. Criteria for establishing the word frequencies were as follows: (a) high frequency: words that occur at least 10 or more times per one-million-word corpus and (b) low frequency: words that occur less than 10 times per one-million-word corpus. There are approximately 5,500 words that occur 10 times or more per one-million-word corpus. These words have been reported to account for approximately 90% of the words that students read from grades three through nine (Carroll, Davies, & Richman, 1971).

The Spanish word frequencies were tabulated using the online *Corpus del Español* (Davies, 2001). The corpus is based on 100 million words containing both spoken and written Spanish. Two thirds of the corpus comes from the written register, while one third comes from spoken Spanish. Approximately half of the spoken corpus comes from transcriptions of natural conversations from eleven different countries. The written corpus includes newspaper articles, essays, encyclopedias, letters, and humanistic texts from both Latin America and Spain. All texts were written between 1975-2000. Criteria for establishing the word frequencies was as follows: (a) high frequency: words that occurred 10 or more times per million word corpus in written form and (b) low frequency: words that occurred fewer than 10 times per million word corpus in written form.

Results

The distribution of different cognate types among the words for each topic as well as for the entire corpus of words is provided in Table 1.

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Insert Table 1 about here

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Of the 86 critical science words, a large number were Spanish/English cognates (76%). Within the entire corpus, 38% (or half of the words with cognates) were high-frequency words in Spanish. By contrast, the percentage of cognate pairs with a high-frequency English word was considerably less: 13% of the entire corpus.

Extensions and Implications

This analysis addressed a corpus of science vocabulary from the three disciplines that are central within national science standards (National Research Council, 1996) and those of large states: life, earth, and physical sciences. It included as well process words that extend across topics. Within this sample of words, three of every four words shared a Spanish/English cognate and, in one of every three words, the cognate was a common word in Spanish but not in English. This prima facie test suggests that the corpus of cognates is sufficiently large to merit adopting an explicit cognate instruction strategy. The paucity of existing research means that information on the amount of instructional time that needs to be devoted to this strategy is uncertain. However, we can point to two projects to illustrate the nature of research that has begun.

While the Vocabulary Improvement Program of Carlo et al. (2004) was not specifically focused on cognates, the set of target words included cognates. The intervention included lessons on vocabulary tools that were aimed at promoting general word analysis strategies, not specific knowledge of the target words. For three of the 15 lessons of the intervention, the cognate strategy was the tool of focus. Thus, in the Carlo et al. intervention, students were provided information on cognates in the texts that they read and were also introduced to a strategy that

they were encouraged to use independently. While application of the cognate strategy was not assessed as a separate measure, the English Language Learners who received the intervention consistently outperformed their peers in the control group.

A second example comes from the implementation of the science/literacy curriculum that we have been involved in designing. At the present time, data collection continues on the effects on simultaneous participation in the science and literacy the curriculum. However, we can outline what we believe to be imminently straightforward and also justified, based on our findings: the identification of cognates within science vocabulary and a reminder in the teachers' manual of a metacognitive strategy related to cognates. This metacognitive strategy is presented in a series of simple steps, including identifying a word (e.g., *plant*), asking students to look carefully at the spelling of the word and to identify a word in Spanish that sounds or looks like the target word and giving a hypothesis about the meaning of the Spanish word and the new word.

Application of this strategy requires either teachers or program developers to identify cognates in advance of instruction. Inclusion of such lists as part of textbook programs would not place undue demands on program developers and could increase both teachers' and students' awareness of the linguistic derivations of words. However, more extensive and elaborate policies and practices for teaching cognates must await additional research. The replication of the analysis to a more extended corpus is needed and, as we have already described, studies of the level of instructional time and consistency that students require to use the strategy. Research also needs to consider the effects of such a strategy on the learning of native English speakers and English Language Learners whose native language is not a Romance language. Even when students' native languages do not have many high-frequency words that are cognates to words in academic English, understanding the manner in which Latin-based words work in science vocabulary is essential for all students.

As the current analysis showed, a significant portion of science vocabulary does relate to high-frequency Spanish words. To fail to capitalize on native language knowledge to support academic English language use would be to miss an opportunity to enhance the performance of a group of students who lag behind their non-Hispanic peers in science (Moll & Ruiz, 2002). Transforming these linguistic differences into funds of knowledge (Moll et al., 1992) and infusing them into state standards and into both science and reading programs should be a high priority, especially since L1 Spanish speakers comprise the fastest growing sector of the U.S. school-age population (U.S. Census, 2001).

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Table 1. Distribution of Words From Four Science Topics Across Six Cognate Categories

Science Topic	Number of Words	Cognate Type					
		No Shared Cognate	False Cognate	LF[1] English/ LF Spanish	HF English/ LF Spanish	HF English/ HF Spanish	LF English/ HF Spanish
Shoreline	26	5	0	11	1	3	6
Terrarium	25	7	0	10	0	1	7
Designing Mixtures	21	5	1	6	0	1	8
Process	14	1	1	4	1	4	3
Entire Corpus	86	18	2	31	2	9	24