Article

SAGE Open
April-June 2013: 1–14

DOI: 10.1177/2158244013487913
sgo.sagepub.com
SAGE

Influence of Native Language Vocabulary and Topic Knowledge on Foreign Language Vocabulary Learning in Health Care Providers

Marcia Foresee Drumhiller[1,2] and Paula J. Schwanenflugel[1]

Abstract

Adults attending short, language for specific purpose courses may have expertise not utilized in general foreign language courses. The present study investigates two factors that may influence the acquisition of medical Spanish vocabulary in such persons: native English vocabulary size and topic knowledge. Forty-four health care workers attended 12 hr of medical Spanish instruction. Prior to instruction, the Nelson–Denny Vocabulary Test, a Medical Spanish vocabulary test, and an English Medical Terminology Test (an indicator of topic knowledge) were administered. The Medical Spanish Vocabulary Test was readministered at posttest. Individually, both English medical terminology knowledge and English vocabulary size were significant predictors of medical Spanish vocabulary acquisition, but English medical terminology knowledge explained most of the variance in medical Spanish vocabulary acquisition. The results are discussed in terms of the impact of expert memory organization on the ability to learn new labels in a second language. A curricular shift toward content-centered vocabulary in language for specific purpose courses may be advantageous for some groups of foreign language learners.

Keywords

language for specific purposes, medical Spanish, second language, topic knowledge, vocabulary

The 21st century has brought dramatic growth in demand for foreign language courses for specific professional groups. More than 30% of hiring managers planned to increase hiring of bilingual businessmen, engineers, and medical personnel in 2006 (Lorenz, 2007). Traditionally, we have looked to academia to train and evaluate speakers of foreign languages. The problem is that academia has traditionally not done a very good job in training the populace to communicate in foreign languages (Jenkins, 2006). The need for foreign language instruction that is not general in nature is evidenced in professional areas such as engineering and medicine. A good general knowledge of the target language does not necessarily enable professionals to use the foreign language in specific areas key to the specialty (Dlaska, 1997). Technical and subtechnical vocabulary needed by professionals is rarely encountered in university foreign language classrooms (Douglas, 2000; Nation, 2001). In particular, doctors and other medical professionals in the United States have found that general Spanish knowledge does not always equip them with the vocabulary necessary for communicating with their patients (Burbano-O'Leary, Federico, & Hampers, 2003).

Such a need has motivated a growing number of medical schools and continuing education programs to offer Medical Spanish courses (Binder et al., 1988; Frasier, Davalos, Nusbaum, & Skinner, 2005; Prince & Nelson, 1995). Unfortunately, research describing the benefits of such programs is limited. However, Clapham (1996) has indicated that university students learn a foreign language faster in the area of their expertise. As the area of foreign language learning for professional purposes is relatively new, approaches to maximize acquisition of language for specific purposes (LSP) within these generally short courses have not yet been fully described.

[1]University of Georgia, Athens, USA
[2]Emory University, Atlanta, GA, USA

Corresponding Author:
Marcia Foresee Drumhiller, School of Nursing, Emory University 1520 Clifton Road, Atlanta, GA 30322, USA.
Email: hankdrum@aol.com

The Role of Native Language Vocabulary in Foreign Language Vocabulary Acquisition

Word knowledge is an essential component of communication, important for production and comprehension of language (Coady & Huckin, 1997). Language has been characterized as an amalgam of vocabulary and grammar (Lewis, 1997) that is combined with factors such as context, strategic and background knowledge, and pragmatics (Douglas, 2000). Vocabulary has been shown to be a good predictor of reading success (Laufer, 1991). Carver (1994) observed that if the proportion of unknown words in texts is too high, comprehension is disrupted. Probably more important to those who most often communicate orally, Nation (2001) posited that learners who listen need to know at least 95% of the words in oral input to have reasonable success at guessing from context. In fact, the theorists Dubin and Olshtain (1986) have postulated that possessing a good stock of vocabulary is what enables many learners to use their knowledge of language effectively and in ways that fit their specific needs. Vocabulary's importance to the typical language learner cannot be overlooked (Coady & Huckin, 1997; De Bot, Lowie, & Verspoor, 2005; Thierry, Vihman, & Roberts, 2003). Thus, it makes sense that the ability to communicate in a second language depends upon vocabulary also.

As the learner increases his foreign language vocabulary knowledge, both the learner's native and second language vocabulary base may facilitate the learning of new words. The facilitating effect on second language vocabulary acquisition has been attributed to shared storage in long-term memory. The second language version is stored in the same concept representation as the native vocabulary equivalent or connected adjacent to that representation affording economies of time and effort in language acquisition (Kroll & de Groot, 1997). Having a large vocabulary size appears to afford an advantage for adult foreign language learners, as they do not need to expend much effort on organizing the conceptual component of new vocabulary in memory. A further advantage of the established native vocabulary for linguistically related languages may be that it can expedite the entry of certain words which are similar in form and meaning (cognates) into the vocabulary base.

Recently, researchers have been in nearly uniform agreement that native language is the foundation upon which the second language is built, an idea popularized by Cummins's (1981) Linguistic Coding Differences Hypothesis. Cummins noted that elementary school bilingual children learned English only as well as they knew their native language. Since then, the relationship between the first and second languages has been shown in diverse groups, including adults (Nation, 2001). Therefore, second language researchers have investigated a number of factors contributing to native language acquisition: word memory, phonological memory, background knowledge, and the recognition of grammar. These have been found to hold true for second language acquisition as well (De Bot et al., 2005; Nation, 2001).

Native language may facilitate second language vocabulary acquisition through a number of routes. One is through perception of word forms. Gathercole and Baddeley (1993) have suggested that having a large vocabulary would enhance phonological skill by increasing the number of approximations to unfamiliar words in memory. Large native vocabularies in languages such as English include loan or root words that are written or pronounced in a similar enough manner as to aid acquisition of a second language vocabulary. Thus, language learners who have a large volume of word representations offered by orthographic and phonologic exemplars in the native language are able to use these to assist in their acquisition of a second language vocabulary.

Another route through which native language vocabulary may influence vocabulary acquisition is through the ability to identify those words possessing conceptual/vocabulary equivalents already in long-term memory and storing the new versions in the same or adjacent to the native concept. Indeed, recent models of bilingual memory posit that words in both languages are located in a shared conceptual memory (Kroll & de Groot, 1997). In such a model, it is predicted that vocabulary development in a second language would be more efficient for concepts already created in the native language. Thus, acquisition of a new second language word would simply involve relabeling rather than constructing new concepts. In sum, native vocabulary facilitates second language acquisition by circumventing the need for concept formation.

Some research demonstrates the facilitative effect of first language vocabulary on second language acquisition in general. Proctor, August, Carlo, and Snow (2006), in studying English reading comprehension in 135 Spanish–English bilingual fourth-grade students, found faster English reading by those children who had more Spanish vocabulary knowledge. A study by Sparks et al. (1997) of intermediate high school students studying in foreign language study showed that native language vocabulary as assessed by the Peabody Picture Vocabulary Test (PPVT-R; Dunn & Dunn, 1981) was a significant predictor, actually a better predictor, of overall proficiency than the Modern Language Aptitude Test (Carroll & Sapon, 1959). Masoura and Gathercole (1999) found that, once nonword repetition ability (a measure of phonological memory) was controlled for, acquisition of foreign language words was associated with native language vocabulary size. It is clear, then, that native language vocabulary itself contributes to foreign language acquisition, but its role in facilitating the acquisition of foreign language vocabulary per se has not been distinctly established. For example, native language vocabulary may not have as much of a facilitative effect when the two languages are linguistically distinct (Kahn-Horwitz, Shimron, & Sparks, 2005).

LSP

Specific-purpose language learners are distinct in their need for low-frequency vocabulary and subtechnical (formal vocabulary as in academics) and their depth of content knowledge in a specific realm. It has been said that LSP represent the interaction of language ability and background knowledge (Douglas, 2000). Second language learning traditionally covers a broad curriculum, characterized by the use of high-frequency words applicable to general communications. However, the focus on high-frequency vocabulary in the second language is not adequate for optimal functioning in most professional endeavors. Professionally specific vocabulary is needed as well. Furthermore, while traditional foreign language instruction does not provide appropriate vocabulary for learners for specific purposes, it also ignores the relative benefits of conceptual and topic knowledge which distinguishes the special purposes learner.

The potential advantage of capitalizing on the conceptual nature of professional vocabulary words and their related topic knowledge in instruction has been supported by a number of studies. Ganschow, Sparks, Javorsky, Pohlman, and Bishop-Marbury (1991) showed that adults who are poor foreign language learners access semantic representations of target words in their knowledge base to aid in foreign language acquisition. Furthermore, Lin (2003) has observed that the understanding of technical words facilitates English acquisition in Chinese university. Thus, both specific vocabulary knowledge and topic knowledge may be helpful and needed to expeditiously acquire a second language for specific purposes. While language ability in general has been highly researched, its relationship to background knowledge and expertise has not.

Topic Knowledge and Expertise

Vocabulary knowledge and topic knowledge are related (Bedard & Chi, 1992). For example, it is not unusual in a beginning science course for teachers to instruct the vocabulary in an area to promote understanding of topic knowledge. A specific concept is delineated in identifying those critical features that make each word unique. In addition to the convergence of specific semantic features, each word is situated in an organized vocabulary base in experts.

The conceptual linkages have been characterized as interacting knowledge structures stored in long-term memory, called schemata (Rumelhart & Ortony, 1977). These "building blocks of cognition" are the framework to which new information is linked (Rumelhart, 1980). They have been shown to guide comprehension and interpretation of events and their linguistic (oral and written) interpretation (Carrell, 1983).Whereas a disorganized conceptual schema will impede word retrieval (Crutcher, 1998), related schemas of associated words in a knowledge base will facilitate retrieval (Baddeley, 1990; Bedard & Chi, 1992). Schemata triggered by oral or written communication guide the listener as to how he should construct the intended meaning from his or her own previously acquired knowledge (Carrell, 1983). Topic vocabulary can trigger conceptual knowledge, or schemata in experts, making it no surprise that researchers have chosen topic vocabulary knowledge as an indication of expertise (Johnston, 1984).

The influence of topic knowledge on the learning of domain-related vocabulary in the native language was studied directly by De Marie, Aloise-Young, Prideaux, Muransky-Doran, and Gerda (2004) in undergraduate education and business majors. Students were asked to recall three lists of 20 general, education, and business terms. They were then categorized according to the number of courses students had completed in one of three majors. The greater number of courses taken in the domain predicted vocabulary recall of domain-related words. It makes sense that topic knowledge would be related to the acquisition of new second language vocabulary as well.

A Specific Case of LSP: Medical Spanish Learning and the Current Study

The acquisition of medical Spanish affords an opportunity to study facilitated foreign language acquisition as well as acquisition of LSP. It is known that first language vocabulary predicts second language vocabulary acquisition, but it is unclear how important first language vocabulary is to the learning of a second language vocabulary in contrast to other contributing factors such as general topic knowledge and expertise. The role of topic knowledge and expertise in the acquisition of a second language is unknown. Learners of foreign languages for professional purposes possess vocabulary-related advantages over other learners. First, many students of science already know words similar to target language words in their native language and they may have topic knowledge that will allow them to supply meaning when vocabulary is unknown. Second, as educated people, medical professionals are likely to have reasonably good native language vocabulary skills that they can bring to the acquisition of a second language, which has shown to be influential by previous research. Therefore, this article studies the acquisition of medical Spanish vocabulary in health care providers to address the following questions:

1. Is there a relationship between the vocabulary size of the adult learner whose native language is English and his or her ability to acquire beginning medical Spanish vocabulary?
2. Is there a relationship between the topic knowledge of an English-speaking health care professional and his ability to acquire beginning medical Spanish vocabulary?

3. Is topic knowledge or native language vocabulary more important in the acquisition of medical Spanish by English speakers? Do the two interact to produce better medical Spanish vocabulary learning?

In this study, employees of medical and public health facilities who wanted to acquire some basic facility in medical Spanish took a short course in medical Spanish. Participants were given a standardized test of English vocabulary to assess the extent to which general English vocabulary size predicted their Spanish vocabulary acquisition outcome. They also were given a medical terminology test in English to measure their background knowledge in medicine. Finally, they were given a pretest and posttest of medical Spanish vocabulary to measure their medical Spanish vocabulary acquisition. In this way, we were able to contrast the relative contributions of specific topic knowledge and general English vocabulary on the acquisition of medical Spanish vocabulary.

Method

Participants

The present study included 44 employees of two public health departments and one university hospital in Georgia. All individuals were native speakers of English between 18 and 64 years of age (90% female). According to a questionnaire completed at the beginning of the study, most had some previous Spanish language classroom experience, but not all. Some, but not the majority, had previous experience with Spanish-speaking patients. The majority of the employees were medical professionals as nurses and nutritionists but many also held clerical and technical positions. Of the sample, 13.6% completed high school, 27.3% either completed their associate degree or some college, 27.3% received their bachelor's degree, and 31.8% had postbaccalaureate graduate or professional training. Forty-eight percent had no formal schooling in Spanish ($M = 1.40$, $SD = 1.78$; range = 0-7 years), and 33% had no formal foreign language experience ($M = 2.64$, $SD = 1.81$; range = 0-7 years).

Participants were volunteers recruited through public health and hospital system Internet announcements. The courses were free to all participants, and major incentives for attending the class included enhanced job performance, continuing education credit, and personal enrichment.

Materials and Procedures

Participant testing and instruction occurred in rooms designated by the institutions for instruction. Participants attended at least 8 class sessions out of 10 offered over a period of 5 to 6 weeks with total instructional time totaling 12 hr. The English vocabulary skill test and medical Spanish vocabulary pretest were administered before the 1st hour of instruction, and the medical terminology test within the 1st hour of instruction. The instructor administered the medical Spanish vocabulary posttest on the final day of instruction. Students had as much time as needed to complete the test, which took approximately 20 min.

Classes were taught by the first author, an instructor of medical Spanish for more than 10 years who had advanced training in a health allied discipline and who is a certified medical interpreter. Classes generally began with the presentation of Spanish vocabulary by the instructor. Students were given two to three vocabulary lists of approximately 40 words total which they pronounced as a class. One list of 15 infinitives used in health care settings was first presented. Later, a list of nouns and adjectives/adverbs/prepositions used in health care was presented. The instructor subsequently supplied the meaning if no student volunteered it. Next, students were asked to translate five to eight English sentences containing those words in written and then oral format as a class. A grammar sheet covering the immediate future, present, or past perfect tense, requiring approximately 20 min to complete, was given to students on 5 days of the course. In general, only first- and third-person plural communications were presented. Classes emphasized medical Spanish listening and speaking skills, with vocabulary introduction involving the learners writing Spanish equivalents of English words separately or in short phrases.

Assessments. There were three main assessments of interest in the study: (a) the Nelson–Denny Vocabulary Test, which served as a measure of English vocabulary skill; (b) the Medical Terminology Test, which served as a measure of medical background knowledge; and (c) the Medical Spanish Test, an experimenter-constructed test. The vocabulary assessments were as follows:

a. *Medical Spanish Vocabulary Test.* Medical Spanish vocabulary can vary depending upon the specificity of the topic and its intended use. The professional status of medical Spanish interlocutors determines whether the vocabulary required is highly technical or merely subtechnical. Similarly, as speech tends to be less formal than text, the vocabulary requirements of conversation are less technical than those that may be read. Salager (1983), in analyzing a 100,000-word written Medical English corpus, made three divisions in medical English vocabulary— basic English, fundamental medical English, and specialized medical English. Unfortunately, no such corpus exists for oral medical English. Given the greater degree of informality in spoken language and the diminished need for technical (highly specialized medical) words when patient–health provider conversations are the focus, the heaviest vocabulary requirement is for semitechnical (fundamental medical) words. Accordingly, because the purpose of the course was for medical

professionals to be better able to communicate with patients, the Medical Spanish Vocabulary Test emphasized subtechnical words. All Medical Spanish Vocabulary Test words were taught explicitly by the instructor (the first author) during the course.

Because medical, oral Spanish has not been well researched, we relied on research on written technical communication, professionals functioning in the health care domain, and general oral Spanish in formulating the Medical Spanish Vocabulary Test. Nation (2001) identified technical vocabulary words as those not normally found in other domains or found more frequently in a particular domain than elsewhere that are particularly useful for communication in the domain. This technical vocabulary, he suggests, should be composed after consulting domain area experts. Thus, first, to create a medical Spanish vocabulary list, we composed a list of 300 words found in four currently used medical Spanish texts and translated these terms into English. We then asked 20 nurses and medical students to rate their importance to communication with patients on a scale of 1 to 5 with 1 being the most important. Next, all words with a mean rating of 3 or higher were selected to form a pool of potential test words, yielding approximately 200 medically related words. Only words that were not in the top 2,000 most frequent words in Spanish according to Davies (2005) were considered technical or subtechnical medical Spanish words to be used in this list. This list would later be used as a repository from which to select relatively technical and general vocabulary words for the Medical Spanish Test and for instruction. Forty-nine of these important, low-frequency medical Spanish terms were included in the Medical Spanish Vocabulary Test.

The number of items was kept low as to not overwhelm initial students in testing. To communicate, however, it is important to have nontechnical as well technical words in one's vocabulary. Nation (2001) suggested that the 2,000 most frequent words of a language be acquired prior to studying technical vocabulary in a foreign language. Commonly occurring words found in medical Spanish textbooks that occurred among the Davies (2005) list of 2,000 most common words were also selected for the assessment. Fifty randomly chosen items from this list of common words were included in the Medical Spanish Vocabulary Test.

Expertise in a foreign language may be demonstrated by the ability to produce communications through expressive vocabulary. Accordingly, the Medical Spanish Test used in this study (Appendix A) required the students to produce a Spanish translation of their English equivalent. The Medical Spanish Vocabulary Test was administered prior to and at the end of the course, and took approximately 25 min to complete.

b. *English Vocabulary Skill Test.* Because the learner population ranged from high school graduates to employees with graduate degrees, the Nelson–Denny English Vocabulary Test, Form G (Brown, Fishco, & Hanna, 1993b) was given as a measure of English vocabulary skill. This instrument is designed for secondary students and adults and is widely used in diverse settings to measure native English vocabulary knowledge. Test scale reliability ranges from .88 to .95 according to the test manual (Brown, Fishco, & Hanna, 1993a). The test includes 80 words and possible definitions presented in a multiple-choice format with five possible responses. It was administered immediately prior to the first class session. Participants were given 25 min to complete the test, as directed by the test manual.

c. *Medical Terminology Test.* To determine the extent of medical topic knowledge in these public health employees, a medical terminology test was administered prior to instruction in medical Spanish. The test (Appendix B) consisted of 50 items drawn from *Glossary of Technical and Popular Medical Terms in English* (1995). The first and fifth entries from each of 26 lists were selected, omitting words with multiple meanings or that were closely related. Students were asked to supply English written definitions for each single English medical term. Students were also asked to use the word in a sentence and this sentence was used in cases where the definition was not clear. Correct responses by the students were recorded, and medical background was determined by a continuum of scores from 0 to 50.

Results

Each test was graded against a key and the raw score totals on each instrument were calculated. Bivariate scatterplots were examined for outliers. Furthermore, studentized residuals, Df Betas, and Cook's *D* were calculated to identify outliers. Those residuals greater than 3.3 were considered to be outliers. Only one outlier was omitted from the data. Another participant was missing the medical English test and was also dropped from the analysis. Table 1 shows the descriptive statistics for the variables in the study. Table 2 shows the Pearson correlation matrix for all variables in the study. Descriptive statistics of the student scores on the tests reveal the heterogeneity of the study population in all but medical background. No excessive skewedness or kurtosis was found.

Hypothesis 1

The first hypothesis tested predicts that general English vocabulary skill should significantly influence medical Spanish acquisition. To test this hypothesis, we used a hierarchical regression analysis in which the Spanish pretest was entered in the first step to control for a priori Spanish

Table 1. Descriptive Statistics for the Variables Used in the Study (N = 42).

Variable	Minimum	Maximum	M	SD	Skewness		Kurtosis	
					Statistic	SE	Statistic	SE
English vocabulary raw	24	80	61.43	13.880	−0.976	.365	.519	.717
Medical Spanish	0	48	13.50	13.074	1.109	.365	.596	.717
Medical Spanish	3	87	35.38	18.342	0.898	.365	.722	.717
Medical English raw score	0	33	13.57	8.893	0.308	.365	−.715	.717

Table 2. Correlations Among Variables Used in the Analyses (N = 42).

		English vocabulary raw score	Medical Spanish pretest raw score	Medical Spanish posttest raw score	Medical English raw score
English vocabulary raw score	Pearson correlation	1.000	.369*	.502**	.449**
	p (two-tailed)		.016	.001	.003
Medical Spanish pretest raw score	Pearson correlation	.369*	1.000	.851**	.174
	p (two-tailed)	.016		.000	.270
Medical Spanish posttest raw score	Pearson correlation	.502**	.851**	1.000	.411**
	p (two-tailed)	.001	.000		.007
Medical English raw score	Pearson correlation	.449**	.174	.411**	1.000
	p (two-tailed)	.003	.270	.007	

*Correlation is significant at the .05 level (two-tailed). **Correlation is significant at the .01 level (two-tailed).

knowledge and regressed on Spanish posttest scores. Then, we entered English vocabulary scores on the Nelson–Denny Vocabulary Test in a second step in this analysis.

Table 3 presents unstandardized coefficients, standard errors of the coefficient, and R, ΔR^2, and F statistics for this model. As can be seen, English vocabulary skill accounted for substantial variance in medical Spanish acquisition beyond that accounted for by the pretest, as predicted by this model, $t = 2.613$, $p = .013$. The R^2 change upon the addition of the English Vocabulary variable was significant before the addition of the variable representing English medical knowledge. However, when English medical knowledge was added to the model, it was a significant additional predictor to the model, $t = 2.79$, $p = .008$, and English vocabulary skill was no longer significant, $t = 1.395$, $p = .171$. The R^2 change affected between addition of English vocabulary and medical English was significant. Thus, this analysis provides support for the view that native language vocabulary skill does influence the acquisition of a foreign language vocabulary, but not when other factors are considered.

Hypothesis 2

The effect of medical background knowledge on medical Spanish vocabulary acquisition was also investigated. That is, this hypothesis predicts background content knowledge should facilitate the learning of content vocabulary in a second language. It was predicted that English Medical knowledge would significantly predict Medical Spanish vocabulary acquisition. Those learners employed in a health care facility without an extensive background in the allied health disciplines were predicted to score significantly worse on the posttest for Spanish than those who had extensive medical training. The scores on the medical English terminology exam were used to serve as an indication of the medical background of the employees.

Table 4 presents unstandardized coefficients, standard errors of the coefficient, and R, ΔR^2, and F statistics for this model. As can be seen, English medical knowledge accounted for substantial variance in medical Spanish acquisition, beyond that accounted for by the pretest as predicted by this model, $t = 3.679$, $p = .001$. While the addition of medical English to the model produced a highly significant change in R^2, the change affected in R^2 was not significant with the subsequent addition of the English vocabulary variable. Thus, there is substantial support for the view that content knowledge influences the acquisition of a foreign language vocabulary, even when other factors such as native language vocabulary skills are considered.

Hypothesis 3

The third hypothesis investigates the nature of the relationship between medical terminology knowledge and English vocabulary size on two predictor variables on the acquisition of medical Spanish vocabulary. It was predicted that both English vocabulary and medical terminology would be significant predictors of medical Spanish vocabulary acquisition

Table 3. Unstandardized Coefficient (*B*), Standard Error of Coefficient (*SE*), *R*, and ΔR^2 for Test of Hypothesis 1.

Model and variable	*B*	*SE*	*R*	ΔR^2	*Model F*
Model 1					
Medical Spanish	1.194***	.116	.851	.725	$F(1, 40) = 105.370$***
Pretest raw score					
Model 2					
Medical Spanish	1.082***	.117	.875	.041	$F(2, 39) = 63.777$***
Pretest raw score					
English Vocabulary raw score	0.288*	.110			
Model 3					
Medical Spanish	1.079***	.108	.898	.040	$F(3, 38) = 52.517$***
Pretest raw score					
English Vocabulary raw score	0.156				
English raw medical score	0.461**	.165			

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4. Unstandardized Coefficient (*B*), Standard Error of Coefficient (*SE*), *R*, and ΔR^2 for Test of Hypothesis 2.

Model and variable	*B*	*SE*	*R*	ΔR^2	Model *F*
Model 1					
Medical Spanish	1.194***	.116	.851	.725	$F(1, 40) = 105.370$***
Pretest raw score					
Model 2					
Medical Spanish	1.128***	.103	.892	.071	$F(2, 39) = 75.962$***
Pretest raw score					
Medical English raw score	0.558**	.152			
Model 3					
Medical Spanish	1.079***	.108	.898	.010	$F(3, 38) = 52.517$***
Pretest raw score					
Medical English raw score	0.461**	.165			
English Vocabulary raw score	0.156	.112			

*$p < .05$. **$p < .01$. ***$p < .001$.

when entered into a combined model. Determination of how the two predictor variables influence medical Spanish acquisition, and how they would interact, if at all, was first investigated through multiple regression procedures. Interaction between the two major predictor variables of Spanish acquisition was investigated by introducing interaction as a predictor beyond the main effects of the variables entered individually. Table 5 presents unstandardized coefficients, standard errors of the coefficient, and *R*, ΔR^2, and *F* statistics for this model. When medical terminology knowledge was entered after the Spanish pretest variable into the model, the R^2 change was highly significant. The addition of the English vocabulary variable to the model did not produce a significant change in R^2, nor did the subsequent addition of the interaction variable to the model. As can be seen, when this interaction term is added, it does not account for additional variance beyond that accounted for by the other variables. Thus, we have little evidence that the interaction between the two variables account for the learning of medical Spanish beyond that accounted for by the contribution of the variables by themselves. In sum, from the analyses above, it seems that there is best support for Hypothesis 2, the view that medical background knowledge is the best predictor of vocabulary learning in the acquisition of medical Spanish.

Discussion

The purpose of the present study was to examine the influence of two factors believed to influence foreign language acquisition—native language vocabulary base and subject background knowledge. Specifically, we were interested in the influence of native English vocabulary size (as measured by a standardized test of vocabulary skill) and medical background knowledge (measured as knowledge of medical terminology) on medical Spanish vocabulary acquisition.

Both measures, medical knowledge and English vocabulary size, were significant predictors of medical Spanish vocabulary acquisition, by themselves. Although both

Table 5. Unstandardized Coefficient (*B*), Standard Error of Coefficient (*SE*), *R*, and ΔR^2 for Test of Hypothesis 3.

Model and variable	*B*	*SE*	*R*	ΔR^2	Model *F*
Model 1					
Medical Spanish	1.194***	.116	.851	.725	$F(40, 1) = 105.370$***
Pretest raw score					
Model 2					
Medical Spanish	1.128***	.103	.892	.071	$F(39, 2) = 75.962$***
Pretest raw score					
Medical English raw score	0.558**	.152			
Model 3					
Medical Spanish	1.079***	.108	.898	.010	$F(38, 3) = 52.517$***
Pretest raw score					
Medical English raw score	0.461**	.165			
English Vocabulary raw score	0.156	.112			
Model 4					
Medical Spanish	1.085***	.108	.901	.006	$F(37, 4) = 39.811$***
Pretest raw score					
Medical English raw score	1.141	.659			
English Vocabulary raw score	0.269	.154			
Interaction	−0.011	.010			

*$p < .05$. **$p < .01$. ***$p < .001$.

native English vocabulary and medical English vocabulary size predicted medical Spanish vocabulary acquisition when entered alone, most of the variance in medical Spanish vocabulary acquisition was accounted for by the learner's medical terminology knowledge. No patterns were found to suggest that a higher level of education alone was a predictor of medical Spanish vocabulary acquisition. Of course, English vocabulary size could be related to higher educational levels in some populations, but the majority of the learners in this study had postsecondary education. The finding that medical vocabulary knowledge is the primary predictor of medical Spanish vocabulary acquisition expands our knowledge of factors to be considered regarding individual differences in the acquisition of a second language.

An explanation of why general vocabulary size and to a greater degree topic knowledge influence second language vocabulary learning may lie in their processing for storage in memory. Levelt's (1989) speech processing model postulates that lexical representations in short-term memory are stored as units of meaning and phonological units. Furthermore, Coltheart, Curtis, Atkins, and Haller (1993) posited that phonological lexical representations in short-term memory are converted to semantic representations in long-term memory. This conceptualization is reflected in recent native language acquisition models that suggest that phonology ceases to become the major avenue for vocabulary acquisition after the establishment of a vocabulary base in long-term memory. Our study supports the view that medical professionals may utilize an elaborated semantic representational base in their native language (in terms of vocabulary size and medical knowledge) to accelerate second language vocabulary learning.

Another possible contributor to the demonstration that medical professionals rely on prior vocabulary and medical knowledge is the method we used to evaluate second language vocabulary growth in this study. Many studies evaluating the growth of vocabulary knowledge have used evaluations of receptive, rather than productive, vocabulary knowledge (Meara, 2005, Schmitt & McCarthy, 2005). Receptive vocabulary has been characterized by its feed forward relationship with phonology in short-term memory whereas productive vocabulary has been associated with prior lexical experience or long-term semantic stores (Coltheart et al., 1993). We measured Spanish acquisition through productive vocabulary which may have called on our learner's deep, elaborated conceptual organization and established vocabulary base.

This reliance by our participants on previously learned vocabulary and medical knowledge supports the view (De Bot, 1992) that bilingual conceptual memory is generally shared by the bilingual's two languages. The model predicts that second language vocabulary acquisition proceeds more efficiently for concepts already created in the native language because conceptual knowledge is not stored separately in the two languages. It is posited that because conceptual knowledge is easily retrievable in either language, the reduced load on working memory results in automaticity (fluency). Our results mirrored this model, finding that those learners with greater background knowledge in medical terminology relied on it more than on general vocabulary skills to learn Spanish.

Until recently, native language's phonological influence has been called upon to explain various aspects of foreign language acquisition. Sparks et al. (1997), for example, found that native language vocabulary was a significant predictor of overall foreign language proficiency (Spanish, French, and German) in high school students after 2 years of study, although after 1 year of study, decoding ability (a measure of phonological and orthographic knowledge) was a better predictor. Similarly, Masoura and Gathercole (1999) found that phonological memory skills in Greek children learning English were highly correlated to vocabulary knowledge in both languages, but that English vocabulary learning was related to Greek vocabulary in ways not accounted for by phonological memory alone. The present study, while agreeing with the importance of native language vocabulary on the acquisition of a second language, suggests that in some beginners, other factors such as topic knowledge might come into play and might be utilized in some instructional settings.

The influence of topic knowledge on foreign language vocabulary acquisition has been studied in multiple contexts. As early as 1937, Chapman and Gilbert noted that English speakers could more easily learn Hindustani nouns if they could define them in English. Similar results were found by Paribakht (2005) in Farsi-speaking college students when students were exposed in text to English equivalents of words known to them in their native language. The present study measured topic knowledge through medical terminology knowledge and did find a highly significant relationship between medical terminology knowledge and medically related foreign language (Spanish) vocabulary acquisition. All of these studies add credence to the model proposed by Kroll and de Groot (1997) that conceptually similar words sharing the same conceptual store are more easily acquired.

Depth of topic knowledge and its relationship to vocabulary acquisition has been investigated in the native language and in general foreign language learning. De Marie et al. (2004) found that native language vocabulary (English) learning could be predicted in university undergraduates by importance of vocabulary to their major area of study. De Marie et al. noted that there was a threshold for predicting vocabulary acquisition and that a sufficient amount of coursework needed to be completed to have an effect. Clapham (1996) found that specific topic vocabulary knowledge affected the second language text comprehension scores. Results of the present study agree with these studies in that specific topic knowledge is a highly significant predictor of Spanish acquisition.

This study indicates that language learners rely upon their background knowledge when they have expertise. Our findings suggest that current models of bilingual memory model must include information regarding the organization of native language concepts in long-term memory. Although most of the health care employees were not advanced foreign language learners, many of them were, on the whole, already acquainted with the concepts that the words represented. To date, most foreign language acquisition research has been devoted to the study of adolescents or college students, novices with little expertise in any area. While the students may have substantial experience with foreign language learning at the adolescent level, they are not experts in content knowledge. The present study indicates that increased foreign language vocabulary retrieval is in part dependent on the strength of conceptual structures in adults. Thus, prior research, by focusing on language learning in adolescents and young adults generally without extensive levels of expertise in subject matter area, has largely missed the key importance of content knowledge in the acquisition of LSP.

In sum, this study suggests that certain learner populations may profit from topic knowledge in learning foreign language vocabulary related to their areas of expertise. Extent of background knowledge in certain areas of expertise may predispose individuals to rely more on conceptual knowledge than, say, symbol/sound representations emphasizing phonology. Medical vocabulary requirements are likely greater than those of nontechnical disciplines. For example, Ulijn and Strother (1995) observed that content words were more important to the comprehension of scientific texts than that of general academic texts. Thus, learners with greater facility in medical terminology than the adult population in general, such as those in the present study, may profit more from their understanding of medical concepts over other factors such as native language vocabulary and phonology in acquiring Medical Spanish vocabulary.

The role of topic knowledge in the acquisition of medical Spanish vocabulary is supported by findings from studies of expert knowledge. Experts have been shown to have highly organized concepts in long-term memory. These highly organized conceptual structures may serve to free learners' working memory so that they can attend to and learn new labels in another language. Researchers have posited that expert content knowledge is characterized by an organization that promotes deep understanding and is thus more easily retrievable (Bransford, Brown, & Cocking, 2003). As Schneider and Shiffrin (1985) observed, novices must expend greater attentional effort and are substantially handicapped in learning new terms, and so may show a disadvantage here when both concept and foreign language label must be learned simultaneously. Therefore, the savings in attentional effort when the concept is well understood may be conserved for enhanced foreign language learning.

Implications for Pedagogy

Our findings have implications for foreign language educators and to training professionals. Our findings suggest that a curricular shift toward content-centered vocabulary may be

warranted for adult early foreign language classes. Instructors of LSP courses and ESL (English as a Second Language) programs may find that less emphasis on general vocabulary and more on the topic vocabulary needed in key communication scenarios encountered by professionals can secure more rapid acquisition of core vocabulary and, hopefully, subsequent fluency. Businesses contemplating training employees who will communicate with foreign language speakers may wish to include professional terminology knowledge as a key criterion for selection of LSP training personnel and identify with some clarity the vocabulary to be taught in the training programs.

Limitations and Generalizability of Findings

The present study evaluated a population of foreign language learners that has not yet been well studied. Unfortunately, our sample size, although acceptable, was not as large as we would have ideally liked. Increased sample size might have increased our ability to detect an independent effect of native language vocabulary, above and beyond the overwhelming influence of topic knowledge on medical Spanish vocabulary acquisition. The fact that the majority of learners were female may limit the transferability of the findings in male health care providers. On the positive side, though, our sample contained three separate groups of health care employees. Two public health departments and employees of a large private university hospital were represented. The learners' occupations ranged from clerks to technicians, nutritionists, epidemiologists, and nurse practitioners with varying levels of medical background and patient contact. The fact that the study included both hospital employees and public health employees allows us to generalize the study's findings to health care employees in general.

A second possible limitation is that we used an experimenter-created medical terminology test as an indicator of prior knowledge. However, terminology knowledge is only one aspect of expertise. Unfortunately, full assessment of our participants' expertise was not practical. Furthermore, the psychometric properties of this test were not as well established as in the Nelson–Denny Vocabulary assessment. On the positive side, there was a strong correlation between the Medical Spanish posttest scores and the medical terminology test. This would indicate that, to a great extent, the medical terminology test was a valid indicator of medical vocabulary knowledge. Furthermore, the reliability of the English Medical Terminology Test was excellent.

Differences in the format of the three tests may have impacted the study results. While the Spanish and Medical tests were both of short-answer format, the English vocabulary test was multiple choice. The form of the response, to a certain extent, determines the nature of the knowledge being assessed. The Spanish and medical tests measured productive knowledge. The Nelson–Denny Vocabulary test could be considered less a measure of receptive knowledge. It may be that productive vocabulary bears a greater relationship in learning vocabulary in a second language than receptive vocabulary does. Therefore, future research should determine whether our finding that topic knowledge is more important than native vocabulary size generalizes to native language productive vocabulary size as well.

The Spanish pre- and posttest results cannot be considered as indicators of Spanish vocabulary acquisition, but only as vocabulary learning. The attention required of the students to increase Spanish vocabulary scores was accomplished in a structured, rather than in an informal setting in the present study. Thus, the increases may not adequately reflect incidental vocabulary gains in a more authentic language setting.

Finally, the pre- and posttest used was a paper–pencil test and not the potentially more valid situation of using oral vocabulary to communicate with others. For example, a test evaluating the use of vocabulary in a medical setting would likely be a more valid indicator of vocabulary learning than the test used here. Therefore, the Spanish vocabulary test should be considered as exploratory. The intricacies of formal and informal oral interactions in health care settings have not been addressed in this study. The reliability and validity of the test in those settings cannot be claimed. It is possible that vocabulary deployed in a more realistic medical setting situation might be shown to be more differentially affected by general vocabulary skill than that was displayed in this study.

Directions for Future Research

The finding of the role of topic knowledge on the acquisition of foreign language vocabulary acquisition suggests that future research should be directed toward other expert populations outside of the university community to more closely ascertain how various types of expertise are exploited to facilitate the acquisition of new second language vocabulary during the working years. Second, this study had a relatively short duration between the acquisition of the vocabulary through coursework and testing. Future studies could examine the influence of topic knowledge versus general first language vocabulary skill acquired over a longer period of time. It may be that, at longer periods of time, general vocabulary skills come into play. Last, as long-term retention of a foreign language is important, future studies should include a long-term Spanish posttest to measure the amount and nature of the vocabulary retained.

In sum, we find that foreign language vocabulary acquisition is driven by the information that precedes it. Accordingly, all language learners are not alike; they chose

the path that is to their best advantage. Foreign language learning is the product of memory systems that preferentially select new information most compatible with that already stored.

Appendix A

Spanish Test

Please supply a one or two word Spanish translation.

1. hour _____
2. son _____
3. head _____
4. heart _____
5. hand _____
6. foot _____
7. eye _____
8. mouth _____
9. little (amount) _____
10. small _____
11. large _____
12. pain _____
13. day _____
14. (the) last _____
15. (the) next _____
16. good _____
17. bad _____
18. since _____
19. until _____
20. after _____
21. before _____
22. low _____
23. more _____
24. up/above _____
25. high _____
26. water _____
27. to break _____
28. to go up _____
29. to remove _____
30. to exit _____
31. to help _____
32. to live _____
33. to die _____
34. to know _____
35. to change _____
36. to feel _____
37. to open _____
38. to close _____
39. to have _____
40. to come _____
41. to sleep _____
42. to understand _____
43. to be able to (can) _____
44. to need _____
45. to take _____
46. to put _____
47. to run _____
48. to eat _____
49. to take out _____
50. to look at _____
51. nurse _____
52. wound/injury _____
53. pregnancy _____
54. stitches _____
55. liver _____
56. kidney _____
57. throat _____
58. lungs _____
59. allergy _____
60. rash _____
61. height _____
62. birthing _____
63. a drop _____
64. fever _____
65. a cold _____
66. flu _____
67. mumps _____
68. cough _____
69. pill _____
70. electrolyte fluids _____
71. treatment _____
72. vaccination _____
73. discharge (of fluid) _____
74. prescription _____
75. chills _____
76. gush/stream (of fluid) _____
77. navel _____
78. stroke _____
79. tremor _____
80. street drugs _____
81. pimple _____
82. fainting _____
83. dizziness _____
84. gallbladder _____
85. urinary bladder _____
86. tingling _____
87. numbness _____
88. IUD _____
89. To stick/sting/puncture _____
90. To breastfeed _____
91. To choke _____
92. To rape _____
93. To urinate _____
94. To suck _____
95. To exhale _____
96. To inhale _____
97. To swallow _____
98. To burp _____
99. To turn (over) _____

Appendix B

Medical Terminology

Please supply a **brief definition** and **a sentence** for each of the following terms.

EXAMPLE: **virus** Define: a nonliving microbe **Sentence:** The virus caused his cold.

1. epithelioma _____ Sentence _____
2. rhinorrhoea _____ _____
3. bacillus _____ _____
4. perianal _____ _____
5. cachexia _____ _____
6. calciuria _____ _____
7. curettage _____ _____
8. haemerolopia _____ _____
9. tympanemium _____ _____
10. maxillary _____ _____
11. faecal _____ _____
12. galactorrhea _____ _____
13. ganglion _____ _____
14. haematemesis _____ _____
15. piloerection _____ _____
16. iatrogenic _____ _____
17. idiopathic _____ _____
18. icterus _____ _____
19. articular _____ _____
20. stasis _____ _____
21. keratolyte _____ _____
22. labile _____ _____
23. anosmia _____ _____
24. maceration _____ _____
25. impregnation _____ _____
26. **vagal** _____ _____
27. nasolaryngeal _____ _____
28. obstipation _____ _____
29. occlusion _____ _____
30. arthralgia _____ _____
31. glossodynia _____ _____
32. QRS complex _____ _____
33. Quaternary _____ _____
34. Tachycardia _____ _____
35. Radiological _____ _____
36. Sigmoid _____ _____
37. Salpingitis _____ _____
38. Tardive _____ _____
39. **Laceration** _____ _____
40. Ulcerogenic _____ _____
41. Autonomic _____ _____
42. Nadir _____ _____
43. Fluor albus _____ _____
44. Ambulant _____ _____
45. Cloaca _____ _____
46. Xanthoma _____ _____
47. Xerophthalmia _____ _____
48. Entercolitis _____ _____
49. Catheter _____ _____
50. **Auricular** _____ _____

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

References

Baddeley, A. D. (1990). *Human memory: Theory and practice*. Hillsdale, NJ: Lawrence Erlbaum.

Bedard, J., & Chi, M. T. H. (1992). Expertise. *Current Directions in Psychological Science*, *1*, 135-139.

Binder, L., Nelson, B., Smith, D., Glass, B., Haynes, J., & Wainscott, M. (1988). Development, implementation, and evaluation of a medical Spanish curriculum for an emergency medicine residency program. *Journal of Emergency Medicine*, *6*, 439-441.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2003). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academies Press.

Brown, J., Fishco, V., & Hanna, G. (1993a). *Manual for scoring and interpretation, Forms G & H*. Chicago, IL: Riverside Press.

Brown, J., Fishco, V., & Hanna, G. (1993b). *Nelson–Denny English Vocabulary Test, Form G*. Chicago, IL: Riverside Press.

Burbano-O'Leary, S., Federico, S., & Hampers, L. (2003). The truth about language barriers: One residency program's experience. *Pediatrics*, *111*, 569-573.

Carrell, P. (1983). Some issues on studying the role of schemata, or background knowledge, in second language comprehension. *Reading in a Foreign Language*, *1*, 81-82.

Carroll, J. B., & Sapon, S. M. (1959). *Modern Language Aptitude Test (MLAT)*. San Antonio, TX: Psychological Corporation.

Carver, C. S. (1994). Cognitive processes and self-regulation: Determinants of concentration and distraction. *Applied Psychology*, *43*, 387-391.

Chapman, F. L., & Gilbert, L. C. (1937). A study of the influence of familiarity with English words upon learning of their foreign language equivalents. *Journal of Educational Psychology*, *28*, 621-628.

Clapham, C. (1996). *The development of IELTS: A study of the effects of background knowledge on reading comprehension. Studies in language testing*. Cambridge, UK: Cambridge University Press.

Coady, J., & Huckin, T. (Eds.). (1997). *Second language vocabulary acquisition*. Cambridge, UK: Cambridge University Press.

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading: Dual route and parallel distributed processing approaches. *Psychological Review*, *100*, 598-608.

Crutcher, R. J. (1998). The role of prior knowledge in mediating foreign vocabulary acquisition and retention: A process-analytic approach. In A. Healy & L. Bourne (Eds.), *Foreign language learning: Psycholinguistic studies on training and retention* (pp. 91-111). Mahwah, NJ: Lawrence Erlbaum.

Cummins, J. (1981). Age of arrival and immigrant second language learning in Canada: A reassessment. *Applied Linguistics*, *2*, 132-149.

Davies, M. (2005). *A frequency dictionary of Spanish and core vocabulary for learners* (3rd ed.). Florence, KY: Routledge.

De Bot, K. (1992). A bilingual production model: Levelt's speaking model adapted. *Applied Linguistics*, *13*, 1-24.

De Bot, K., Lowie, W., & Verspoor, M. (2005). *Second language acquisition: An advanced resource book*. New York, NY: Routledge.

De Marie, D., Aloise-Young, P., Prideaux, C., Muransky-Doran, J., & Gerda, J. H. (2004). College students' memory for vocabulary in their majors: Evidence for a nonlinear relation between knowledge and memory. *Canadian Journal of Experimental Psychology*, *58*, 181-195.

Dlaska, A. (1997). Suggestions for a subject specific approach to teaching foreign language to engineering and science students. *System*, *27*, 401-417.

Douglas, D. (2000). *Assessing language for specific purposes*. Cambridge, UK: Cambridge University Press.

Dubin, F., & Olshtain, E. (1986). *Course design*. Cambridge, UK: Cambridge University Press.

Dunn, L. M., & Dunn, L. (1981). *Peabody Picture Vocabulary Test–Revised (PPVT-R)*. Circle Pines, MN: American Guidance Service.

Frasier, P., Davalos, D., Nusbaum, M. R. H., & Skinner, B. (2005). Mini immersion in medical Spanish for family practice residents. *Teaching and Learning in Medicine*, *17*, 292-296.

Ganschow, L., Sparks, R. L., Javorsky, J., Pohlman, J., & Bishop-Marbury, A. (1991). Identifying native language difficulties among foreign language learners in college: A foreign language learning disability? *Journal of Learning Disabilities*, *24*, 530-541.

Gathercole, S. E., & Baddeley, A. D. (1993). Phonological working memory: A critical building block for reading. *European Journal of Psychology of Education*, *8*, 259-272.

Glossary of Technical and Popular Medical Terms in English. (1995). University of Ghent: Heymeus Institute of Pharmacology and Mercator School, Department of Applied Linguistics. Retrieved from www4.caes.hku.hk/mt/

Jenkins, K. (2006). Recognizing the value of foreign language skills. *Diverse Issues in Higher Education*, *22*, 35.

Johnston, P. (1984). Prior knowledge and reading comprehension test bias. *Reading Research Quarterly*, *19*, 219-239.

Kahn-Horwitz, J., Shimron, J., & Sparks, R. L. (2005). Predicting foreign language reading achievement in elementary school students. *Reading and Writing: An Interdisciplinary Journal*, *18*, 527-558.

Kroll, J. F., & de Groot, A. M. B. (1997). Lexical and conceptual memory in the bilingual: Mapping form to meaning in two languages. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 1-16). Mahwah, NJ: Lawrence Erlbaum.

Laufer, B. (1991). How much lexis is necessary for reading comprehension? In P. J. L. Arnaud & H. Bejoint (Eds.), *Vocabulary and applied linguistics* (pp. 126-132). Basingstoke, UK: Macmillan.

Levelt, W. J. M. (1989). *Speaking: From intention to articulations*. Cambridge, MA: MIT Press.

Lewis, M. (1997). *Implementing the lexical approach: Putting theory in practice*. Hove, UK: Language Teaching Publications.

Lin, S. F. (2003). Modeling a supplemental course web site for EFL vocabulary acquisition. *Dissertation Abstracts International*, *64*(01), 118A.

Lorenz, K. (2007). Getting ahead: Do you have today's hottest skill? *Careerbuilder.com*, *623*. Retrieved from http://careerbuilder.com/article/CB-623-Getting-Ahead-Do-You-Have-Todays-Hottest-Skill/

Masoura, E., & Gathercole, S. E. (1999). Phonological short-term memory and foreign vocabulary learning. *International Journal of Psychology*, *34*, 383-388.

Meara, P. (2005). Towards a new approach to modelling vocabulary acquisition. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 109-121). Cambridge, UK: Cambridge University Press.

Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge, UK: Cambridge University Press.

Paribakht, T. S. (2005). The influence of first language lexicalization upon second language lexical inferencing: A study of Farsi-speaking learners of English as a foreign language. *Language Learning*, *55*, 701-748.

Prince, D., & Nelson, M. (1995). Teaching Spanish to emergency medicine residents. *Academic Emergency Medicine*, *2*, 32-36.

Proctor, C. P., August, D., Carlo, M. S., & Snow, C. E. (2006). The intriguing role of Spanish language vocabulary knowledge in predicting English reading comprehension. *Journal of Educational Psychology*, *98*, 159-169.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In P. J. Spro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension: Perspectives from cognitive psychology, linguistics, artificial intelligence, and Education* (pp. 33-58). Hillsdale, NJ: Erlbaum.

Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), *Schooling and the acquisition of knowledge* (pp. 99-135). Hillsdale, NJ: Erlbaum.

Salager, F. (1983). The lexis of fundamental medical English: Classificatory framework and rhetorical function: A statistical approach. *Reading in a Foreign Language*, *1*, 54-64.

Schmitt, N., & McCarthy, M. (Eds.). (2005). *Vocabulary: Description, acquisition and pedagogy*. Cambridge, UK: Cambridge University Press.

Schneider, W., & Shiffrin, R. (1985). Categorization (restructuring) and automization: Two separable factors. *Psychological Review*, *92*, 424-428.

Sparks, R., Ganschow, L., Patton, J., Artzer, M., Siebenhar, D., & Plagenan, M. (1997). Prediction of foreign language proficiency. *Journal of Educational Psychology*, *87*, 638-655.

Thierry, G., Vihman, M., & Roberts, M. (2003). Familiar words capture the attention of 11 month olds in less than 250 ms. *Neuroreport*, *14*, 2307-2310.

Ulijn, J. M., & Strother, J. B. (1995). *Communicating in business and technology: From psycholinguistic theory to international practice*. New York, NY: Peter Lang.

Author Biographies

Marcia Foresee Drumhiller holds advanced degrees in nutrition and romance linguistics and PhD in educational psychology. She has more than 20 years experience as a foreign language teacher and health care worker. She has taught medical Spanish at Emory University for more than 10 years and is a certified medical interpreter.

Paula J. Schwanenflugel serves as a professor at the University of Georgia, Department of Educational Psychology. Her areas of expertise include applied cognition, psycholinguistics, and literacy.