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An Application of the Mnemonic Keyword Method to the Acquisition of a Russian Vocabulary

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The experiment reported here evaluated the effectiveness of a mnemonic procedure, the keyword method, for learning a foreign language vocabulary. The method used divides the study of a vocabulary item into two stages. The first stage requires the subject to associate the spoken foreign word with an English word, the keyword, that sounds like some part of the foreign word; the second stage requires him to form a mental image of the keyword interacting with the English translation. Thus, the keyword method can be described as a chain of two links connecting a foreign word to its English translation through the mediation of a keyword: the foreign word is linked to a keyword by a similarity in sound (acoustic link), and the keyword is linked to the English translation by a mental image (imagery link). The experiment compared the keyword method with an unconstrained control procedure using Russian vocabulary. On all measures the keyword method proved to be highly effective, yielding for the most critical test a score of 72% correct for the keyword group compared to 46% for the control group.

Mental imagery has long been used as a means of memorizing information; Roman orators employed the technique when memorizing long speeches (Yates, 1972), and entertainers use mental imagery to perform impressive feats of memory. In recent years, mental imagery has been investigated in the psychological laboratory both for theoretical reasons (Paivio, 1971) and because it offers an effective means of memorizing certain kinds of information (Bower, 1972; Bugelski, 1968). Raugh and Atkinson (in press) develop an application of mental imagery to the acquisition of a second-language vocabulary and report a series of experiments in which their *keyword* method proves to be effective for learning Spanish vocabulary items. The purpose of the work reported here was to test the effectiveness of the keyword method on a non-Romance language, namely Russian.

The keyword method divides the study of a vocabulary item into two stages. The first stage requires the subject to associate the spoken foreign word with an English word, the keyword, that sounds approximately like some part of the foreign word. The second stage requires him to form a mental image of the keyword interacting with the English translation. Thus, the keyword method can be described as a chain of two links connecting a foreign word to its English translation: the foreign word is linked to a keyword by a similarity in sound (*acoustic* link), and the keyword is linked to the English translation by mental imagery (*mnemonic* or *imagery* link). As an example, consider the Russian word *zvonók*,[1] meaning bell. Its pronunciation is somewhat like "zvahn-oak," with emphasis on the last syllable, and it contains a sound that resembles the English word "oak." Employing the English word "oak" as the keyword, one could imagine something like an oak

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[1] Printed Russian words are presented in a standard transliteration of the Cyrillic alphabet into the Roman alphabet; stress is marked.

with little brass bells for acorns, or an oak in a belfry, or perhaps an oak growing beneath a giant bell jar. As another example, the Russian word for "building" (*zdánie*) is pronounced somewhat like "zdawn-yeh" with emphasis on the first syllable. Using "dawn" as the keyword, one could imagine the pink light of dawn reflected in the windows of a tall building.

The keyword method is applied by presenting the subject with a series of spoken foreign words. Each foreign word is pronounced; while the word is being pronounced, a keyword and the English translation are displayed. During the presentation of each item the subject must associate the sound of the foreign word with the given keyword and generate a mental image relating the keyword to the English translation.

The preselection of keywords by the experimenter is an important aspect of the method. In preparing a test vocabulary a keyword is considered eligible if it satisfies the following criteria: (a) The keyword sounds as much as possible like a part (not necessarily all) of the foreign word; (b) it is easy to form a memorable image linking the keyword and the English translation; and (c) the keyword is different from the other keywords used in the test vocabulary. The first criterion allows flexibility in the choice of keywords, since any part of a foreign word could be used as the key sound. What this means for a polysyllabic foreign word is that anything from a monosyllable to a longer word (or even a short phrase that "spans" the whole foreign word) might be used as a keyword. The second criterion must be satisfied to make the imagery link as easy to master as possible. The third criterion is used to avoid the ambiguities that could occur if a given keyword were associated with more than one foreign word. For a large vocabulary that is divided into subvocabularies to be presented in separate sessions, the uniqueness criterion might be applied only to each subvocabulary.

In applying the keyword method to the acquisition of Spanish vocabulary, Raugh and Atkinson (in press) found large differences between the keyword method and various control conditions. Two of the experiments used a within-subjects design, and the results were especially impressive because subjects often used the keyword method in the control condition, thus diminishing the true differences between conditions. Moreover, many subjects had studied at least one Romance language and were able to learn some words in the control condition by recognizing them as cognates. The results suggested that it would be useful to evaluate the keyword method using a between-subjects design and a foreign language that was less obviously related to languages previously studied by the subjects.

Russian was selected for the work reported here. In addition to being a non-Romance language Russian posed a special challenge to the keyword method because it involves a number of frequently recurring phonemes that do not occur in English. Also, from a practical viewpoint, for many students the Russian vocabulary is more difficult to learn than is the vocabulary of, say, German, French, or Spanish; it would be useful if the keyword method proved to be an effective means of teaching Russian vocabulary.

A 120-word Russian test vocabulary was divided into three comparable 40-word subvocabularies for presentation on separate days. The subjects were run under computer control. They received instructions from a cathode-ray display scope, listened to recorded foreign language words through headphones, and typed responses into the computer by means of a console keyboard. The experiment began with an introductory session (Day 0) during the first part of which subjects were familiarized with the equipment; during the second part they were assigned to the keyword and control groups and given instructions on the appropriate learning method. On each of the following three days (Day 1, Day 2, and Day 3) one of the test subvocabularies was presented for study and testing. On each of these days three study/test trials were given. The study part of a study/test trial consisted of a run through the subvocabulary; each foreign word was pronounced and, depending upon the treatment group,

TABLE 1

A SAMPLE OF 20 ITEMS FROM THE RUSSIAN VOCABULARY WITH RELATED KEYWORDS

Russian	Keyword	Translation
VNIMÁNIE	[pneumonia]	ATTENTION
DÉLO	[jello]	AFFAIR
ZÁPAD	[zap it]	WEST
STRANÁ	[strawman]	COUNTRY
TOLPÁ	[tell pa]	CROWD
LINKÓR	[Lincoln]	BATTLESHIP
ROT	[rut]	MOUTH
GORÁ	[garage]	MOUNTAIN
DURÁK	[two rocks]	FOOL
ÓSEN′	[ocean]	AUTUMN
SÉVER	[saviour]	NORTH
DYM	[dim]	SMOKE
SELÓ	[seal law]	VILLAGE
GOLOVÁ	[Gulliver]	HEAD
USLÓVIE	[Yugoslavia]	CONDITION
DÉVUSHKA	[dear vooshka]	GIRL
TJÓTJA	[Churchill]	AUNT
PÓEZD	[poised]	TRAIN
KROVÁT′	[cravat]	BED
CHELOVÉK	[chilly back]	PERSON

either the keyword and English translation were displayed (keyword group), or the English translation alone was displayed (control group). A test trial consisted of a run through the subvocabulary in which each foreign word was pronounced and 15 sec were allowed for subject to type the English translation. A comprehensive test covering all 120 items of the vocabulary was given the day after the presentation of the last subvocabulary (Day 4). A similar test was given approximately 6 weeks later.

METHOD

Subjects. Fifty-two Stanford University undergraduates served as subjects (26 males and 26 females). All were native speakers of English, none had studied Russian, and none had participated in prior experiments using the keyword method.

Stimulus material. A test vocabulary of 120 Russian nouns with associated keywords was selected; a sample of 20 items is presented in Table 1. The test vocabulary represents a cross section of vocabulary items typically presented in the first-year Russian curriculum at Stanford University. English translations of the Russian vocabulary were ranked according to imageability as determined both by the judgment of the experimenter and the Paivio (Note 1) image values for those English words for which values were available. The average Paivio value for the 15 most imageable words was 6.72, and the average for the 15 least imageable words was 2.51. The keywords were selected by a four-person committee whose members were familiar with the keyword method. For some items, the committee chose keyword phrases rather than single keywords; a total of 38 keyword phrases were used in the test vocabulary. The test vocabulary was divided into three subvocabularies of 40 words each, matched in abstractness and imageability.

Procedures. During the first session (Day 0) the experimenter showed each subject how to start the computer program that conducted the experiment. The program itself explained all of the remaining procedures. After giving instructions on the use of the keyboard and audio headset, the program introduced keywords as a means of focusing attention on the sound of a Russian word. In order to provide all subjects with experience in the procedures, practice was given on a randomized list of 30 words (not included in the test vocabulary); a Russian word was spoken and its keyword was displayed in brackets for 5 sec. Afterwards, a test (randomized for each subject) was given in which each Russian word was spoken, and 10 sec were allowed to start typing the keyword. If a response was begun within 10 sec, the time period was extended from 10 to 15 sec; otherwise, the program advanced to the next item. A second randomized study of the 30 practice words was given, followed by a newly randomized test. Throughout the experiment, the same training and randomized presentation procedures were followed.

After the keyword practice, subjects were randomly assigned to the experimental and control groups with the constraint that both groups were to contain an equal number of males and females. They were given the appropriate written instructions on the method for associating Russian words and English translations. The experimental instructions were like the keyword instructions for Experiment III presented in Raugh and Atkinson (in press). They explain that while a Russian word was being pronounced, a keyword or keyword phrase would be displayed in brackets at the left-hand margin of the screen and the English translation would appear to the right. Experimental subjects were instructed to learn the keyword first and then picture an imagery interaction between the keyword and the English translation; the experimental instructions also stated that if no such image came to mind, they could generate a phrase or sentence incorporating the keyword and translation in some meaningful way. The control instructions explained that while each Russian word was pronounced, the English translation would be displayed near the center of the screen. Control subjects were told to learn in whatever manner they wished; they were not given instructions on the use of keywords or mental imagery.

After the instructions were given, a practice series of 10 Russian words was presented in which each Russian word was spoken while the English translation was displayed; for subjects in the experimental group the appropriate keyword was

also displayed with each English translation. Following this a test trial was given in which each Russian word was spoken and the subjects attempted to type the English translation. A second study trial was given and was followed by a second test trial, concluding Day 0. The subjects were told that practice on the 10-word list was like the procedure for the remainder of the experiment.

They returned the following day for the Day 1 session. For each subject the computer program randomly selected one of the three 40-word subvocabularies for presentation. Day 1 consisted of three successive study-test trials. The study trial was exactly like the study trial at the end of Day 0: Each Russian word was spoken while, depending upon the group, the cathode-ray tube displayed either the keyword and English translation, or the English translation alone. For both groups the presentation was timed for 10 sec per item. The test trials were identical for both groups: Each Russian word was spoken and the subject had 10 sec to begin a response. No feedback was given; an incomplete or misspelled response was scored as incorrect.

Day 1, Day 2, and Day 3 (which fell on consecutive days) followed identical formats. The only difference was that each day involved a different randomly assigned subvocabulary.

The comprehensive test followed on Day 4. The comprehensive test was exactly like a daily test trial, except that it covered the entire 120-word test vocabulary. For the sixth and final session (the delayed comprehensive test), subjects were called back about 30 to 60 days (average 43 days) from Day 0 to take a randomized repeat of the comprehensive test. They had not been forewarned that they would be tested at a later date.

Results

The Day 0 keyboard practice phase of the experiment was identical for both the experimental and control groups. The results of the keyword tests averaged over trials were 51% for male keyword subjects and 53% for male control subjects; the comparable scores for females were 59% and 58%, respectively. The average overall score for keyword subjects was 55% and the corresponding average for control subjects was 56%. The results indicate that the keyword and control groups were evenly matched so far as performance on the pretest was concerned.

Table 2 presents results of the comprehensive test in which the probability of a correct response is given as a function of sex, treatment group, and day on which the word was studied; for example, the table shows that on the comprehensive test females in the keyword group responded correctly to 76% of the words that they had studied on Day 2, whereas males responded correctly to 63% of the words studied on Day 2. A Sex × Treatment analysis of the comprehensive test data was made in which performances on the Day 1, Day 2, and Day 3 subvocabularies were viewed as repeated trials. It was found that keyword subjects were superior to the control subjects, F (1, 48) = 35.8, $p < .001$; moreover, the females performed significantly better than the males, F (1, 48) = 5.9, $p < .025$. No interactions between sex and treatment were found; the error mean square used in these tests was .023.[2] Because the subjects were volunteers we cannot say whether the sex differences reflect a sampling error or an actual difference between males and females. In any case, the results suggest that for vocabulary-learning experiments of this sort, care should be taken to insure that males and females are evenly divided among treatment groups.

TABLE 2

Probability of a Correct Response on the Comprehensive Test as a Function of Treatment Group, Sex, and Study Day

Study day	Keyword			Control		
	Male	Female	*M*	Male	Female	*M*
Day 1	.55	.73	.64	.27	.40	.33
Day 2	.63	.76	.70	.38	.47	.43
Day 3	.80	.82	.81	.60	.67	.63
M	.66	.77	.72	.42	.51	.46

Figure 1 presents the probability of a correct response on each of the three test trials for Day 1, Day 2, and Day 3. The keyword group in all cases obtained superior scores; in fact, on each day the keyword group learned at least as many words in two study trials as the control group learned in three trials.

An analysis of performance on the test vocabulary was made with respect to imageability. The vocabulary had been ranked

[2] An inspection of frequency histograms indicated unimodal distributions for both the keyword and control groups. There was no evidence to suggest that some subjects in the keyword group performed unusually well, whereas the others were comparable to control subjects.

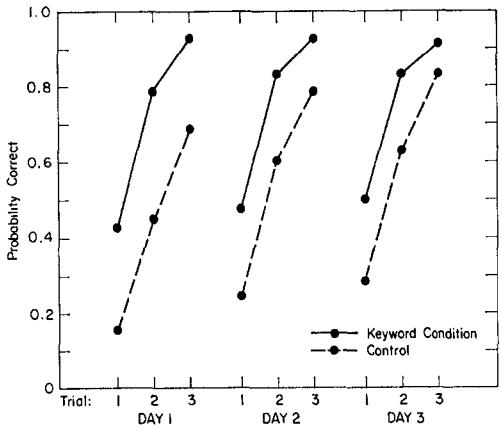


FIGURE 1. Probability of a correct response over test trials on Day 1, Day 2, and Day 3.

according to the imagery values of the English translations, and divided into four levels of imageability. Each level contained an equal number of words from each of the three subvocabularies. The 15 most highly imageable words (5 taken from each subvocabulary) were assigned to Level 1. The next ranking 45 words (15 from each subvocabulary) were assigned to Level 2, and the next 45 words were assigned to Level 3. The 15 least imageable words were assigned to Level 4. Table 3 presents the average probability that a word of a given level elicited a correct response on the Comprehensive Test for both the keyword and control groups. No significant difference was found across levels for the keyword group, whereas for the control group F (3, 100) = 3.1, $p < .05$; the error mean square was .037. Thus, image level did not affect performance in the keyword condition; on the other hand, it appears that high imageability facilitated learning in the control condition.

TABLE 3

PROBABILITY OF A CORRECT RESPONSE ON THE COMPREHENSIVE TEST AS A FUNCTION OF IMAGERY LEVEL

Imagery value	Probability correct	
	Keyword group	Control group
Level 1 (6.73)	.75	.55
Level 2 (6.31)	.71	.45
Level 3 (5.03)	.71	.48
Level 4 (2.46)	.72	.38

Figure 2 presents a scatter plot of the 120 words in the test vocabulary; each point represents performance for a particular word on the comprehensive test. The abscissa gives the probability of a correct response in the control group and the ordinate gives the same probability in the keyword group. For example, the word at (.35, .81) is *gálstuk* (where the keyword is "gallstone" and the English translation is "necktie"); its probability of being correct on the comprehensive test was .35 for the control group, and .81 for the keyword group. Points above the diagonal in Figure 2 refer to words that were learned more effectively in the keyword condition, whereas points below are for words that were learned more effectively in the control condition. The word at (.19, .81), *dvor* (keyword "divorce," translation, "yard"), did especially well in the keyword condition relative to its performance in the control condition, whereas the word at (.58, .27), *lápa* (keyword, "laughter," translation, "paw") did especially poorly. A reason for the poor performance could be that either the keyword link was difficult to learn or the imagery link was difficult to form, resulting in an ineffective memory chain between the Russian word and the English translation. We will return to this point later.

The results of the delayed comprehensive test are displayed in Table 4. The keyword group outperformed the control group in all male–male and female–female comparisons. Note that keyword subjects recalled more words from the Day 1 study list than from the Day 3 list, whereas the opposite relation held on the comprehensive test (see Table 2). Thus, a recency effect over days was exhibited on the first comprehensive test, whereas a primacy effect over days prevails on the delayed test. This result is somewhat surprising, although Schnorr and Atkinson (1970) obtained a similar finding in an experiment in which subjects used a mental imagery strategy to learn English paired associates; recency was observed on an immediate recall test, whereas primacy was observed on a delayed test one week later. Table 4 shows no serial position effect for the control group.

A question of some interest is whether keyword phrases facilitate learning as much as single keywords do. Our data cannot answer the question because we did not systematically vary the number of keywords used for each Russian item. Nevertheless, the data are suggestive. In the experimental condition 38 items involved the use of keyword phrases instead of a single keyword. For example, the keyword phrase "narrow road" was associated with the word *naród,* and "tell pa" was associated with *tolpá.* The average performance of the keyword phrase items on the comprehensive test was .74 in the keyword condition and .44 in the control condition. The corresponding averages for single keyword items were .71 and .45, respectively. Thus, the probability of learning a keyword-phrase item was about the same as the probability of learning a single-keyword item.

Discussion

Results using the keyword method raise a number of issues; some of these issues are discussed elsewhere (Raugh & Atkinson, in press) and will not be reviewed in this paper. Of special interest to the experiment reported here is the question: Should the experimenter supply the keyword, as we have done, or can the subject generate his own more effectively? The answer to this question is somewhat complicated. In an unpublished experiment similar to the one described here, all subjects were given instruction in the keyword method. During the actual experiment half of the items were presented for study with a keyword, whereas no keyword was provided for the other items. The subjects were instructed to use the keyword method throughout. When a keyword was provided they were to use that word; when no keyword was provided they were to generate their own. On the comprehensive test the subjects did better on the keyword supplied items than on the others, but the size of the difference was small in comparison to the difference between groups reported in this paper. Instruction in the keyword method was helpful, and somewhat more so if the experimenter also supplied the keywords.

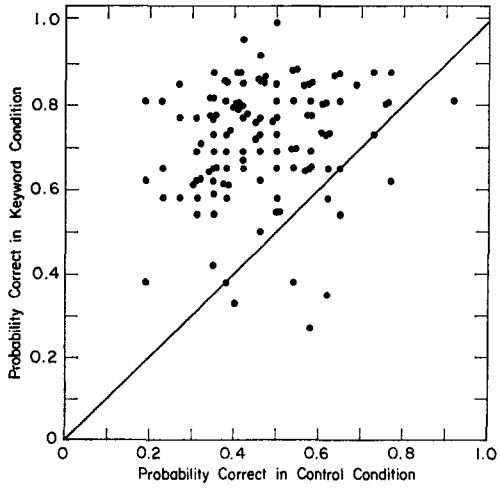


Figure 2. Scatter plot of performance levels on the comprehensive test. (Each point corresponds to an item; the ordinate gives the performance level when the item was studied in the keyword condition, and the abscissa its value when studied in the control condition.)

It should be kept in mind that our results are for subjects who have not had previous training in Russian. It may well be that supplying the keywords is most helpful to the beginner, and becomes less useful as the subject gains familiarity with the language and the method. We have run an experiment using a Spanish vocabulary where subjects were instructed in the keyword method, but during study of an item received a keyword only if they requested it by pressing an appropriate key on their computer console (Raugh & Atkinson, in press). We call this variant of the keyword method the free-choice procedure. When an item was initially presented for study a keyword was requested 89% of the time; on subsequent presentations of the item the

TABLE 4

Probability of a Correct Response on the Delayed Comprehensive Test as a Function of Treatment Group, Sex, and Study Day

Study day	Keyword			Control		
	Male	Female	*M*	Male	Female	*M*
Day 1	.38	.58	.48	.15	.34	.25
Day 2	.36	.51	.44	.19	.40	.30
Day 3	.30	.41	.36	.21	.36	.29
M	.35	.50	.43	.18	.37	.28

TABLE 5
CORRELATION MATRIX FOR THE VARIABLES A × I, K, C, A, AND I

	A × I	K	C	A	I
A × I	1.0	.73	.39	.68	.71
K		1.0	.38	.53	.49
C			1.0	.33	.19
A				1.0	.02
I					1.0

subject's likelihood of requesting the keyword depended upon whether or not he missed the item on the preceding test trial. If he missed it, his likelihood of requesting the keyword was much higher than if he had been able to supply the correct translation. Otherwise, however, the likelihood of requesting a keyword was remarkably constant from one day of the experiment to the next; that is, there was no decrease in keyword requests over the three study days, where on each day the subject learned a new vocabulary. It is interesting to note that performance on the comprehensive test for the free-choice group was virtually identical to the performance of a group that was automatically given a keyword on all trials. Not much of a difference would be expected between the two groups since the free-choice subjects had such a high likelihood of requesting keywords. Nevertheless, these findings suggest that the free-choice mode may be the preferred one. In the free-choice procedure subjects report that they generally wanted a keyword, but that there were occasional items that seemed to stand out and could be mastered immediately without the aid of a keyword. In summary, the answer to our question is that subjects appear to be somewhat less effective when they must generate their own keywords; but results from the free-choice procedure indicate that keywords need only be supplied when requested by the subject.

Let us now turn to a somewhat different issue. As Figure 2 indicates, some items are learned more readily than others. Poor performance on a given item in the keyword condition could be because the acoustic link, the imagery link, or both were difficult to master, thereby yielding an ineffective memory chain between the Russian word and its English translation. A test of this hypothesis involves having one group of subjects learn only the foreign word to keyword link and another independent group learn only the keyword to translation link. We have conducted such an experiment with the 120-word Russian vocabulary used in the study reported here. For each item an estimate was obtained for the probability of a correct response averaged over the first two test trials. We will denote that probability as A for the group learning the acoustic link, and as I for the group learning the imagery link. Finally, let K be the probability of a correct response averaged over the first two test trials for an item in the keyword group in our original experiment. The product of $A \times I$ (that is, the probability of knowing the acoustic link times the probability of knowing the imagery link) is a fairly good predictor of performance in the keyword condition. Table 5 displays the correlation matrix using rank-order data. Note that the correlation between A and I is near zero, indicating that the learning of the acoustic link is not related to the learning of the imagery link. Note also that the correlation between the product $A \times I$ and the variable K is .73; the product is an accurate predictor of performance in the keyword condition. The C entry in the table is comparable to the K entry, except that it denotes performance for the control group in our original experiment. Note that C is not as good a predictor of K as is the product $A \times I$.

A theoretical framework for interpreting these results is provided by Atkinson and Wescourt (1974). According to their theory, early in the learning process the memory structure for a given item involves only two independent links (what we have called the acoustic and imagery links). However, with continued practice a third link is formed directly associating the foreign word with its English translation. It is this direct link that sustains performance once an item is highly practiced. The subject may still have access to the keyword but the retrieval process based on the direct association is so rapid that the subject only recalls the keyword under special circumstances,

such as when he is consciously trying to do so or has a retrieval failure in the primary process. But the less direct chain of the acoustic and imagery links has the advantage that it is easily learned and provides a crutch for the subject as he learns the direct association; it facilitates the learning of the direct association by insuring that the subject is able to recall items early in the learning process.

There is some evidence to suggest that students use mediating strategies similar to the keyword method when learning a vocabulary, even if not instructed to do so. Ott, Butler, Blake, and Ball (1973), in a paper on the use of mental imagery in vocabulary learning, report that subjects not given special instructions when asked to learn a foreign vocabulary often resort to using English mediating words combined with imagery or other mnemonic aids. Their observation suggests that the keyword method is not essentially different from techniques commonly employed by students. The major difference, apart from the fact that the experimenter supplies the keywords, is the extent to which the method is applied.

Our experimental findings indicate that the keyword method should be evaluated in an actual teaching situation. Starting this year, we will be running a computerized vocabulary-learning program designed to supplement a college course in Russian. The program will operate much like our experiments. When a word is presented for study it will be pronounced by the computer and simultaneously the English translation will be displayed on a cathode-ray tube. The student will be free to study the item in any way he pleases, but he may request that a keyword be displayed by pressing an appropriate button on his console. Students will be exposed to about 800 words per quarter using the computer program, which in conjunction with their normal classroom work should enable them to develop a substantial vocabulary. We, in turn, will be able to answer a number of questions about the keyword method when it is used over an extended period of time. Many foreign language instructors believe that the major obstacle to successful instruction is not learning the grammar of a language, but in acquiring a vocabulary sufficient to engage in spontaneous conversation and read materials other than the textbook.

If the instructional application proves successful, then the keyword method and variants of it deserve a role in language-learning curricula. The keyword method may prove useful only in the early stages of learning a language and more so for some classes of words than others. The method may not be appropriate for all learners, but there is the possibility that some, especially those who have difficulty with foreign languages, will receive particular benefits.

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