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Educational practitioners frequently lament that laboratory studies of human learning do not easily translate into actual classroom practice. The tasks and the materials that the learning psychologist uses have little to do with those encountered in the classroom, critics complain. The present study confronted the practitioner's lament. The learning task here came directly from an elementary-school social studies curriculum that requires students to learn and remember the capital cities of the USA. This task was linked to a technique that has proven extremely effective in a number of investigations.

The technique, the keyword method, was developed by Richard Atkinson (1) for learning foreign language vocabulary. The components of the keyword method are not new. Indeed, they have long been part and parcel of the memory expert's "bag of tricks" (2). These components have even been submitted to scientific scrutiny (3). Atkinson's formalization of the keyword method, however, stimulated renewed interest in memory techniques. Our own research program has focussed on elementary-school children's success with the method (4, 5, 6). In the present study, the basic components of the keyword method were adapted to learning the names of state capitals.

The original version of the keyword method (for learning foreign language vocabulary) is a two-step process. First, the learner must form a stable association between the foreign word to be learned and a keyword, a familiar English word that looks or sounds like part of the foreign word. Then, a meaningful link must be formed between the keyword and the English translation of the foreign word. For example, for the Spanish word *pato*, pronounced something like "paw-toe" and meaning *duck*, a good keyword might be *pot*. The learner could visualize a duck with a pot on its head or construct a verbal relationship as one of our second-graders once did: "Duck, here comes the pot!"

The Keyword Method in the Classroom: How To Remember the States and Their Capitals

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Either type of elaboration serves to link the keyword and, thus, the foreign word to the English translation.

Our adaptation of the keyword method to the states-and-capitals problem involves three steps. First, the learner forms a stable association between the name of the state and a keyword for that state. Then, using a different keyword, the learner forms a stable association for the name of the capital city. Finally, the two keywords are linked together by a visual image, in this case, a line drawing in which the two keyword referents are related to one another.

The purpose of the present study was to determine whether this adaptation of the keyword method would improve children's learning of states and their capitals. Included in the study was an assessment of the effect of the keyword method on a performance test administered immediately after learning and on a test administered three days later. A crossover design was used in which the keyword students in one testing session became the control students in the second session and vice versa. This design had two major purposes, one related to the research and one to the students themselves. The research-related purpose was to permit an investigation of spontaneous transfer of the keyword strategy from one testing session to the next. If the keyword method is beneficial and is perceived as beneficial by first-session keyword students, then these same students might think to use the keyword method in the control condition of the second session. Should they use the method, then in the second session the difference between the performance of keyword and control students would be smaller than in the first session. The student-related purpose for selecting a crossover design was to give all students tested experience with the keyword method. If beneficial, the students might use the method not only to remember the names of the specific states and capitals learned here, but also in other similar learning situations in which a keyword-like technique might be helpful.

Method

Subjects

Twenty-two children in a combined fourth- and fifth-grade classroom in a rural midwestern community took part in the study. Each student was paired with another student on the basis of the teacher's estimate of his or her general ability. One student in each pair was randomly assigned to the keyword condition for the first experimental session; the other student in the pair was assigned to the control condition. These assignments were reversed in the second experimental session. Students were paired only for convenience in implementing the study, not for reasons related to analysis of data. We simply wanted students who were perceived to be similar in ability to receive the same amount of instructional time. As a result, the basis for pairing will not be considered further.

As already noted, two experimental conditions (keyword and control) were included and all students were exposed to both conditions in a crossover design. The students in a given pair were randomly assigned to one of two experimenters and were tested simultaneously in one of the two experimental conditions. Each student was tested by the same experimenter in the two experimental sessions.

Children in both conditions were asked to learn the capitals of 12 northeastern states on the first day and the capitals of 13 southern states on the second day, three days later. During each session, after the study period the students were tested immediately on their memory for the capital cities. After the test on the southern capitals the second day, the students were asked to recall the northeastern capital cities learned on the first day as well.

Materials and procedure

Instructions for both the keyword and the control conditions were given orally. All students were given a practice item (*Wisconsin: Madison*) to instruct them on

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the requirements of the experimental condition to which they were assigned. At the beginning of each session, students were told that they were going to learn the capitals of 12 northeastern states (Day 1) or the capitals of 13 southern states (Day 2). The students had previously learned about these 25 states in their regular curriculum during the six months immediately preceding the study. Though the capital cities had been introduced along with other "important" cities of the states, the classroom teacher had not directly related the states to their capitals. Thus, it can be assumed that the names of the capital cities were somewhat familiar to the students—a potentially important consideration when interpreting the results of this study.

Students in the keyword condition were taken through three distinct phases. First, they were asked to learn keywords (word clues) for each of the 12 (or 13) states. Each keyword sounded like some part of the name of the state (for example, *marry* for *Maryland*). The entire list of state-keyword pairs was read to each student, one pair of words at a time. As the experimenter held up a set of index cards five inches by eight inches (12.7 centimeters by 20.3 centimeters) with the states and the keywords typed on them, she said, "The word clue for _____(state) is _____(keyword)." Each time the cards were presented the items were in a different random order (accomplished by shuffling the deck of cards before each presentation). After all the states and the keywords had been read once, each child was shown the name of the state typed on another deck of cards and was asked to supply the appropriate keyword. If a student gave an incorrect response, the experimenter immediately displayed and pronounced the correct keyword typed on the back of the card and instructed the student to remember the item because he or she would be tested on it again. Once tested on all items, students were retested until they remembered all the keywords on a single trial or until the end of three test

trials, whichever came first. The order of the states on each test trial was randomized by shuffling the deck of cards for each student.

After the completion of the first phase, students were asked to learn a word clue for the capital city of each state. The entire list of capitals and keyword pairs was read to each student. For the capital of Maryland, the experimenter read, "Annapolis: apple." The procedures and the materials used were similar to those used in learning the state-keyword pairs. However, because the students would ultimately be tested on their recall of the correct capital for each state, in this phase the process was reversed. During this phase of the experiment students had to produce the name of the capital city when presented with the associated keyword (rather than to produce the keyword, given the capital). This issue is discussed elsewhere in conjunction with learning foreign language vocabulary (6). If a student could not provide the name of the capital city, or if the student mispronounced the name, the experimenter immediately displayed the name of the capital city, which was typed on the back of the card. Because it has been found in the foreign language task that "backward" keyword learning is more difficult than the "forward" process (6), students were given up to five test trials (in contrast to three trials in the state-keyword phase) to produce all the capital cities upon presentation of the keyword.

After the second phase was completed, the students were told that the final step would be to learn the states and their appropriate capitals. They would be shown a picture displaying the previously learned word clue for the state and the word clue for the capital city, displayed together. The students were told that they should remember these pictures to help them learn the state capitals, for later they would be asked to name the capital city for each state. Then, each student was presented with a series of colored line drawings that related the keywords for the states to the

corresponding keywords for the capital cities. The names of the states and the capitals, as well as the keywords for each, were printed in black letters across the top of each picture, as in Figure 1. As a picture was displayed, the experimenter gave a brief description of what was illustrated in the picture. For the picture in Figure 1, the experimenter said: "The capital of *Maryland* is *Annapolis*. Here is a picture of two apples getting married." After the description, students were given 15 seconds to study the picture. This process continued until all 12 (or 13) pictures had been presented.

During the entire time that a keyword student was receiving the instructions just described, the yoked control student was being instructed to use his or her own method of learning the capitals of the states. Three sets of materials were provided to help the control students learn the capitals. First, the experimenter gave the students a list of the states and their capitals, printed in black letters on a laminated sheet of paper eight and a half inches by

eleven inches (21.6 centimeters by 27.9 centimeters). Second, students were given paper and a pencil to practice writing the names or whatever else they wanted to do to help them learn. Finally, students were provided with a stack of laminated cards three inches by five inches (7.6 centimeters by 12.7 centimeters). Each card had a state name on one side and the name of its capital on the other. It was suggested to the students that they use these cards to test themselves on the state capitals. To familiarize the students with the correct pronunciations of the states and the capitals, the experimenter read the printed list twice before allowing the students to work on their own. Each control student was given as much time to study as his or her yoked keyword student required to complete the keyword procedure, usually about 20 to 25 minutes. Equating of study times was accomplished by signals between the two experimenters.

Immediately after the state-and-capital learning phase, students in both groups were given a test on the capital cities. Just

FIG. 1.—Sample item

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before the test, keyword students were told: "Think back to the pictures you were shown for each state-capital pair in order to remember the capital city for each state." The control students were instructed: "Try hard to remember the capital city for each state."

During the testing, the state names were read aloud and displayed in print on index cards five inches by eight inches (12.7 centimeters by 20.3 centimeters). The test list was presented in a different random order for each child. The students were given up to 15 seconds to respond to each item. The experimenters recorded all responses. If a student provided only the keyword for the capital city instead of the city name, the student was told, "No, I do not want the word clue, I want you to tell me the capital city of this state."

After the testing on Day 1, the two students returned to their classroom. On Day 2, the procedures of Day 1 were used (with the experimental assignment of each child reversed) for learning the 13 southern states. Once finished, the students were also given a surprise test on their recall of the 12 northeastern capitals that they had learned on Day 1. The procedures and the materials used for this test were identical to those outlined earlier. On Day 2, after both tests had been given, all students were asked to explain briefly how they had tried to learn the 13 southern states and capitals presented that day. As the students were shown a card with the name of the state printed on it, the experimenter asked, "What did you do to learn that the capital of _____(state) was _____(capital)?"

Results

Recall of the 12 first-session capitals and of the 13 second-session capitals was converted to percents. A response was counted as correct when the student provided the complete name of the capital city. The results are summarized in Table 1.

In the analysis of the data from the

TABLE 1. *Mean Percents of Correct Responses**

Condition	Initial Test		Retest on Day 1 Items
	Day 1	Day 2	
Keyword	78.0	84.6	71.2
Control	65.9	73.4	36.4

*Keyword subjects on Day 1 were control subjects on Day 2. The initial test data were analyzed according to the appropriate procedures for a crossover design. However, the data are displayed differently in this table, for ease in communicating the treatment effects.

immediate test on both days, a significant treatment effect was detected, with students in the keyword condition correctly recalling about 81 percent of the capitals, in contrast to about 70 percent by control students, $t(20) = 2.71, p < .01$. There was a tendency for performance to be higher on Day 2 than on Day 1, $t(20) = 1.64, p = .10$. However, it must be remembered that such improvement is completely confounded with differences in materials, inasmuch as the northeastern states were presented on Day 1 and the southern states on Day 2. Finally, there was no hint of a treatment by time interaction, $|t| < 1$.

The effect of the keyword method was even more striking when students were asked to recall the capitals of the states they had learned three days earlier. As Table 1 shows, students in the keyword condition recalled nearly twice as many capitals as the control students did, $t(20) = 3.30, p < .01$. Equally interesting is the extremely high level of retention exhibited by the keyword students. When results were analyzed student-by-student, it was found that keyword students retained an average of 96 percent of what they had initially learned, while control students retained an average of only 51 percent, $t(19) = 4.35, p < .001$. (One control student could not be included in this analysis, because he did not recall any items on the initial test of the previous day.)

Discussion

The effects of the keyword method, as

applied to the learning of state capitals, are clearly impressive enough to warrant further attention. The finding of large effects on the longer term (three-day) recall measures are encouraging, given the objective of “permanent” learning that would be desired for content of this kind. Additional comments about this investigation are in order.

First, as noted earlier, the students who took part in this study had been introduced to the names of the capitals during their regular course of study, even though the classroom teacher had purposely avoided direct instruction on the states’ capital cities. The previous exposure to the names of the capitals may well have been responsible for the high level of performance by students in both conditions. With no previous exposure, the level of recall might have been more in line with the results obtained when elementary-school children are asked to recall foreign words (6). In that situation, very few students can recall entire words. However, students in the keyword condition are able to recall more keyword syllables of the foreign words than control students are. Thus, for students who have no knowledge of the names of the capitals, one might expect a much lower level of completely correct recall and a larger incidence of partial recall (for example, the *apple* syllables of *Annapolis*) for keyword students. Pressley, Levin, Hall, Miller, and Berry (6) have found that additional study and test trials elevate recall of foreign words, especially for students in the keyword condition.

Second, unlike several other previous investigations, the present procedures gave students in the control condition every opportunity to do well. They were not required to adopt some possibly interfering learning strategy (6, 7), but they were supplied with a few potentially helpful aids, namely, paper, pencils, and flashcards for self-testing. Indeed, our control students had ample time (from 20 to 25 minutes) to study the 12 or 13 states

and capitals given during a session, and they apparently could recall them quite well (70 percent correct). But keyword subjects could learn—and certainly retain—the capitals even better.

Third, the complete absence of a treatment by time interaction was a surprise. As noted earlier, it was thought that some spontaneous transfer might well have been observed among Day 2 control students (that is, the keyword students of Day 1). If they recognized that what they had done previously was helpful, they might have tried to generate keywords and images to learn the capitals on Day 2, even though not instructed to do so. Evidence from the students’ recordings on paper, as well as from the post-session interviews, however, suggests that these students did not use a keyword strategy with the materials for Day 2. The one student who tried to do so applied the method ineffectively. Even though he generated keywords for some states and capitals, he never tried to link the corresponding elements (he “forgot that part of it”).

With older students—who are more prone to apply learning strategies spontaneously (8, 9)—unprompted transfer might occur. Some transfer might also occur among students of the present age if hints to continue to use the previously learned method are explicit enough. We are appropriately cautious in offering this speculation, however, inasmuch as the process of generating meaningful, concrete keywords, as well as an interaction between the two, is not simple and straightforward—as the constructors of the present materials can attest!

Finally, about the practitioner’s lament: We have demonstrated here that a task with considerable educational validity can be coupled with the systematic use of an appropriate memory strategy. As noted at the outset, the chore of learning state capitals was part of the social studies curriculum of this school. It is safe to say that the keyword approach of the present study

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served to ease that chore. And, if comments students made after the experiment are admissible evidence, it is also safe to say that the present approach made the chore more fun. Indeed, on completion of the study, our materials were actively recruited by the students. These materials were last seen "hanging out" in the classroom, where they were being used to help the students learn all the state capitals. The fact that the results of previous laboratory-learning research shaped the particulars of the strategy, the materials, and the procedures adopted here should be duly noted (1, 10). In this regard, it is a good bet that the keyword method as applied to social studies content can be readily incorporated into an elementary-school classroom—as has already been found for learning words of a foreign language (4).

References and Notes

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The ex-basketball player, Jerry Lucas (*Ready, Set, Remember* [White's Creek, Tennessee: Memory Press, 1978]) has a set of materials that are similar to, though more complex than, the materials we describe here. To date, how-

ever, Lucas' materials have not been scientifically tested.

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