The Effect of Motivation Level on Retention of Information Encoded Using the Keyword Method

Stephanie Amrine
Marietta College
The effect of Motivation Level on Retention of Information Encoded

Using the Keyword Method

Stephanie Amrine

Marietta College

The thesis has been approved for the

Department of Psychology of Marietta College

By

________________________________________

Dr. Jennifer McCabe, Ph.D.
Thesis Committee Advisor

________________________________________

Dr. Ryan May, Ph.D.
Thesis Committee Member
Acknowledgements

This researcher gratefully acknowledges the support of the following individuals who assisted with this project. Without the support and assistance of these professors this project would not be completed.

Dr. Jennifer McCabe, whose supervision and ample knowledge on the subject were detrimental to the completion of the project. Her continuous assistance with the proposal, revisions, and final draft were very consequential to the outcome of the project.

Dr. Ryan May contributed time and knowledge as a member of the thesis committee. His assistance and suggestions were very influential.

Dr. Mark Sibicky, who allowed me to use his Introduction to Psychology class in order to collect data.

Dr. Alicia Doerflinger, who also allowed me to use her Introduction to Psychology class in order to collect data.
Abstract

The goal of this study was to determine the relationship between long-term retention of material learned using memory strategies (i.e., the keyword mnemonic) and level of motivation. The participants studied foreign vocabulary words by means of rote rehearsal (i.e., repeated definition condition) and the keyword method, and were tested for immediate and delayed recall. Motivation was manipulated by informing half of the participants that they would be re-tested at a later date and adding a monetary incentive to perform well, while withholding the information and reward from the other half of the participants. One hypothesis of this research was that there would be an interaction between the motivation and time of test variables, such that the motivation group would perform significantly better than the non-motivation group only on the
delayed test. It was also predicted that there would be a three-way interaction, such that for immediate recall, the keyword condition would elicit better performance than the repeated definition condition, regardless of the motivation condition. For delayed recall only, the keyword condition was expected to show higher performance than the repeated definition condition, but only for the motivated participants. The primary hypotheses were not supported by the analyses, but an investigation of the means showed a pattern that was at least numerically consistent with the predicted results. Only in the motivation group did the keyword encoding condition have a slight advantage in test scores compared to the repeated definition encoding condition. Future research is needed to determine if the keyword method should be recommended for use by students.
The Effect of Motivation Level on Retention of Information Encoded Using the Keyword Method

It is important to investigate the factors that are involved in the usefulness of study strategies such as mnemonic devices, in order to benefit learning in a variety of classroom and non-classroom situations. Cognitive resources must be allocated to the study materials if learning is to take place. Individuals have a certain amount of control over these cognitive resources used to assist in memory encoding and retention. The level at which individuals control these resources is one definition of motivation (Pintrich & Schunk, 1996). It is the hypothesis of the current study that motivation is an important factor in the effectiveness of study strategies.

In order to understand study strategies, it is necessary to discuss the cognitive mechanisms behind retaining information. Short-term and long-term memory are the storage areas that interact to allow for the learning of new information. Memory, as theorized by the Atkinson and Shiffrin (1968) model, requires that input information is initially received by sensory registers, where the information is kept for only a second or two. In order for the information to move to short-term memory, it must be attended to. All of the unattended information simply decays. The short-term store can only hold six or seven items, or chunks of information, and these must be rehearsed in order to transfer to long-term memory (Miller, 1956). The transfer of information from short-term memory to long-term memory, called encoding, also occurs as a result of coding, which is adding extra information from long-term memory to the presented information (Eysenck, 1993).

Baddeley (1974) proposed an update to the Atkinson-Shiffrin (1968) model, in which the concept of short-term-memory is replaced by working memory (WM), which both holds on to the information and also actively processes and/or manipulates it. In addition, WM is conceptualized
as the area where newly input information is coded with previously stored information from long-term memory (LTM). WM performs these activities with the use of the **visuospatial sketchpad** and the **phonological loop**. The visuospatial sketchpad processes visual and spatial information, whereas the phonological loop processes verbal information. In fact, the phonological loop has also been suggested as a system for supporting language learning in childhood (Baddeley, Gathercole, & Papagno, 1998). The two sources of information (i.e., verbal and visuospatial, from the phonological loop and visuospatial sketchpad, respectively) are combined by means of the **central executive** (Baddeley & Hitch, 1974), which is thought to oversee and allocate attention to the contents of the two ‘slave systems.’ Based on this memory theory, it should be beneficial to use an encoding technique that maximizes the amount of information stored in working memory and also facilitates the combination of long-term memory information with the to-be-learned information. Also, any technique that facilitates the integration of verbal and visuospatial information should result in more successful memory.

Consistent with these recommendations based on memory theory, a **mnemonic device** is any technique that helps with the encoding and retention of information. It pairs to-be-learned information with information already stored in long-term memory (Anderson, 2005). Thus, mnemonics necessarily utilize the actions of WM components. This combination of information can be achieved in a variety of methods. With **reduction**, the amount of information is reduced in order to remember it. For example, **ROY G BIV** is a reduction of *red, orange, yellow, green, blue, indigo, and violet,* to describe all of the colors of the rainbow. **Elaboration** is another method. The information is elaborated in order to remember the particular information. For example, in order to remember the letters of each line on a sheet of music (*E,G,B,D,F*), the saying “**Every Good Boy Does Fine**” is used as a tool to remember the list of letters. A third basic method is to
use loci. This technique enables people to remember a large number of items in correct order (Eysenck, 1993). With this technique, a mental route through a familiar place is used. Each stop on the mental route is associated with something that is to be remembered (Anderson, 2005).

Part of the effectiveness of mnemonic devices is due to the fact that humans are more successful in recalling organized rather than unorganized material. Indeed, the contents of long-term memory are stored in an organized way, which makes the success of retrieval cues more likely. We can recall a mass of organized details by memorizing the underlying rule or structure that holds them together (Manis, 1966). Mnemonics use a principle of methodically arranged classifications and associations, thereby providing a useful organizational structure (Eysenck, 1993).

Mnemonics appear to be especially useful when they involve visual imagery, which relies on the retrieval of information from long-term memory and the manipulation of information in the visuospatial sketchpad of WM. The use of imagery has been found to increase learning in many different contexts (Eysenck, 1993). Memory is strongly enhanced if people imagine the information to be remembered, and this encoding strategy is exploited by many mnemonic techniques, including the method of loci and the keyword method (Magnussen & Helstrup, 2007).

Various researchers have investigated imagery as a memory tool. In one study, groups given peg words (which involve imagery) and groups instructed to link items with a bizarre image performed better on a subsequent memory test than a control group given standard free recall instructions (Wood, 1967). Images are supported by many subsystems of memory, having both verbal and visual representational systems, whereas words are simply supported by one (verbal) system (Magnussen & Helstrup, 2007). The multiple codes involved with images helps to explain why they are so helpful when remembering information (Paivio, 1971).
Generating images in other types of relational encoding is also an effective encoding strategy. For example, it can be used for paired-associate learning, in which a person learns a word or piece of information, and also another word, number, or piece of information that is associated with it. When the first word or piece of information is retrieved, the associated word, number, or piece of information will also be retrieved from memory (Anderson, 2005). Research conducted by Cramer (1981) showed that participants in an imagery condition performed better in recalling paired-associate information than those in a non-imagery condition. It has also been shown that children as young as 7 or 8 years old were able to employ an induced visual–imagery strategy in order to facilitate paired-associate learning. They were able to use imagery instructions in order to remember items for a subsequent test. These induced imagery effects were found for both recognition and recall methods of testing (Levin, Davidson, Wolff, & Citron, 1973).

It has been suggested, however, that greater success is obtained from joint verbal and pictorial elaboration than from either singly (Levin et al., 1973). For example, picture and phonic mnemonic devices have been successful in helping children increase early literacy skills. Three kindergarten students participated in a study by Agramonte and Belfiore (2002), which examined the effect of a mnemonic strategy on initial consonant letter sounding identification. Pictures were used to illustrate a letter. For example, the letter $U$ was integrated into the handle of the picture of an umbrella. The letter $U$ was enhanced by using a thicker font, and the remainder of the picture was drawn with a thin black line. The teacher would show the students the picture of the umbrella, pronounce the name, and verbally prompt the students with the sound of the letter. Results showed that all three students increased in both the number of consonant sounds spoken correctly, and the number of consonants named correctly. Students benefited from the mnemonic
flashcards because they knew what each picture was. If the object on the picture was simply
spelled without a picture, the students did not know what it was. The picture and the verbal
prompt from the teacher paired the known pictorial elements with the unknown element of the
consonant sound and the letter integrated into the picture (Agramonte & Belfiore, 2002). The
pairing of both verbal and visual information resulted in better recall of information.

The keyword method is similar to the previously discussed mnemonic method, and is
often used to learn new vocabulary words (Atkinson & Raugh, 1975). There are two stages. The
learner first acquires a keyword, which has no relationship to the word that is to be learned
except that it is similar in sound. This is called the acoustic link stage. For example, when
applying the method to remembering Spanish vocabulary, the learner must find an English word
that sounds like part of the Spanish word. The second stage is the imagery link stage. This
requires the learner to form a mental image of the keyword interacting with the meaning of the
information to be learned (Raugh & Atkinson, 1975). For example, a learner could use the
Spanish word *libro*, which means *book*. The keyword could be *librarian*. The interaction could
be imagining a librarian putting books on a shelf. The keyword method can be used in a variety
of situations, but a majority of the research has investigated the keyword method with learning
foreign vocabulary words (Hall, 1988). The keyword method is effective because of the use of
both the acoustic and imagery properties of memory, a dual-code system (e.g., Magnussen &
Helstrup, 2007). When unique mental images are generated and integrated with verbal
information, later retrieval of the material is enhanced.

The keyword method has shown success in school-aged children. When Pressley (1977)
provided second-and fifth-grade children with interactive pictures for vocabulary items when
learning simple Spanish vocabulary, more items were remembered than for control students
instructed to use only rote rehearsal. Children in the experimental condition were provided with keywords and pictures of the keyword referents and a translation of the referents. The imposed imagery keyword method was more effective than rote rehearsal at both grade levels (Pressley, 1977).

One factor that may be related to the success of the keyword method is age. The positive effects of the keyword method have differed somewhat between high school and elementary school students. Levin, Pressley, McCormick, Miller, and Schriberg (1979) showed that students in a high school setting did not show any improvement using the keyword method compared to a control group not using the method. When the experiment was conducted in the classroom setting for fifth-graders, however, the keyword condition significantly surpassed scores of those in the control condition when learning Spanish vocabulary. The results were not different whether the experiment was conducted in a small group setting or a large group setting (Levin et al., 1979). However, other research has shown a benefit of the keyword method in college students (e.g., Balch, 2005), so it is not clear the exact relationship between age and utility of this mnemonic device.

Jones and Hall (1982) found that the utility of the keyword method extends well beyond the foreign language task. The tests that researchers found the keyword method effective for are typical of school tasks commonly found in late elementary grades through high school. The tasks that were successful using the keyword mnemonic technique include but are not limited to learning state capitals (Jones & Hall, 1982). They have also been shown to be beneficial in college-level tasks, including the learning of new psychology terms (Balch, 2005). The conditions of the research have closely approximated classroom conditions.
The effectiveness of the keyword mnemonic is heavily dependent on circumstances of study and on the characteristics of the items to be learned. Items that contain obvious concrete words and definitions are better for the keyword method (Hall, 1988). The keywords must be selected using empirical criteria. When formulating materials for a research study, it is recommended that a committee of individuals familiar with the keyword method and the foreign language help select the keyword (Atkinson, 1975). Research also shows that the keyword method requires slow presentation rates for effectiveness (Hall, 1988), and that it can be effectively administered in either a small or large group context (Levin et al., 1979).

Raugh and Atkinson (1975) suggested that it is better to have experimenter-generated keywords rather than subject-generated keywords. This is especially true if the phonetics of the foreign language are unknown to the participant. Research has shown that experimenter-generated keywords are more beneficial in immediate recall than subject-provided keywords. The self-generation of keywords does not appear to facilitate immediate or long-term retention. Participants seem to have difficulty generating keywords that will be as effective as experimenter-provided keywords. This may be especially true when stimuli for good keywords are difficult to generate, such as with low-vividness words (Thomas & Wang, 1996).

Related to this topic, one study showed that a peer-generated keyword group had better one-week recall of words than a subject-generated keyword group, but only for high-vividness words. Neither immediate nor one-week recall of low-vividness words differed between the two groups (Campos et al., 2004). Visual mnemonic methods are more effective with high-vividness words than with low-vividness words in general, which makes sense given that subjects tend to use visual strategies for learning high-vividness words, but verbal associations for low vividness words (Paivio, 1971).
Some researchers have found that for secondary school students, the effectiveness of the technique was not dependent on supplying the keyword. The students were able to produce their own appropriate keywords and images after some training. There was also a transfer of the method to similar tasks over a period of several weeks, which occurred without prompting (Jones & Hall, 1982). This is obviously a beneficial outcome of learning the keyword method, and is a worthy educational goal.

Interestingly, other research has found successful transfer of the keyword method in high school students, but not for younger (i.e., 12-year-old) students, unless they were instructed to use a technique similar to the keyword method (Pressley & Round, 1980). The 12-year-olds in the general instruction condition, who were instructed to use a technique that is like the keyword method previously shown, out-performed the control subjects within the same age group. The transfer occurred in the general instruction condition but not in the no-instruction condition. It seems that more explicit prompts are needed when instructing younger adolescents compared with high school students. The performance in the complete instruction conditions for both age groups, who were given detailed instructions on applying the keyword technique, was higher than those in the general instruction and no instruction conditions for both age groups. Therefore, complete instruction may be beneficial for both preadolescents and high school students (Pressley & Round, 1980). It is important to give a detailed, full explanation of the keyword method and its application to the material being learned in order to maximize the retention of the material and aid in future transfer of the technique.

One potential drawback to the keyword method comes from studies of long-term recall. Although there are clear short-term benefits of the keyword method, long-term forgetting seems to be greater for learners instructed to use the keyword mnemonic than for learners engaged in
The Effect of rote rehearsal (Wang, Thomas, & Ouellette, 1992). In a study conducted by Fritz, Morris, Acton, Voelkel, and Etkind (2007), the keyword group recalled significantly more vocabulary words after a 3-day delay than the rote rehearsal group. The same findings were present in a study by Carney and Levin (1998) that administered an unannounced delayed test after two days, namely that participants in the keyword mnemonic groups performed significantly better than participants in the control group. Results showed that college students using the keyword method outperformed students using repetition on an immediate test; however, after a 7-day delay, the mnemonic advantage had disappeared on an unannounced test. To summarize this area of research, the benefits of the keyword mnemonic may still be present after two or three days, but there is a rapid decline in mnemonic advantage by the seventh day when using a delayed, unannounced test (Carney & Levin, 1998; Carney & Levin, 2000; Fritz et al., 2007). There appears to be a need for further research to determine whether there are factors that may enhance the retention of keyword mnemonic information after this longer delay.

From a conceptual standpoint, the keyword is an effective retrieval cue initially, but over time it seems that the episodic nature of the keyword image and pre-experimental associations may hinder the retrieval of the mnemonic image after an extended period of time, such as one week, when compared to rote rehearsal (Wang et al., 1992). Imagery-based encodings are especially susceptible to interference over time and therefore are prone to forgetting, while rote-based (verbal) memories are not as susceptible (Campos et al., 2004). Considering the phenomenon of proactive interference, in which information that has been learned earlier interferes with the learning of new information (Anderson, 2005), the similar information already stored in long-term memory may hinder the ability to recall new information (Manis, 1966). Retroactive interference, in which information learned more recently interferes with less recent
information (Anderson, 2005), may also play a role in this type of forgetting. Over a week or more of delay after the study period, newer information that is encoded into long-term memory may cause the forgetting of the mnemonic imagery information.

It is interesting that the keyword method can be so successful over the short-term, but that its benefits would decline so rapidly over a delay. It was the hypothesis of the currently proposed research that the success of mnemonic training may be dependent on motivational factors.

Motivation to Learn

Motivation has been found to be an important process in learning (Salonen, 2005). In order for learning to take place, a person needs to have working memory resources available for the learning task. Individuals have at least some control over whether or not to allocate resources to learning by the use of motivation. Therefore, motivation may be best defined, for the purposes of this study, as a process in which a learner consciously or subconsciously allocates working memory to a learning task (Pintrich & Schunk, 1996).

It is important to understand meta-cognitive processes involved in memory, as well as how these processes interact with strategies for remembering information when examining long-term retention of information. Learning involves coordination of cognitive, meta-cognitive, affective, and motivational processes, along with interpersonal and social control processes (Salonen, 2005). Meta-cognitive knowledge is knowledge about cognition and is similar to other kinds of knowledge in LTM. This type of knowledge is usually about a task, or strategy variables, and their interactions. Motivational variables contribute to self-regulated learning (Flavell, 1979). People engage in a variety of meta-cognitive processes when they are motivated to learn new material or when they receive information that they want to use in the future (Magnussen & Helstrup, 2007). These processes necessarily involve the storage and processing of information
in working memory because the central executive is needed to maintain the activation of information relevant to the current task. Distraction of attention away from elements of focus will allow activation to drop below levels needed for retrieval. Under conditions of high interference it is important that the details of the current task be maintained in the active state (Engle, Tuholski, Laughlin, & Conway, 1999). Motivation can assist the process of focusing attention and avoiding interference, thus maximizing memory performance.

The more complex the material being studied, the more elaborate the monitoring and control processes are. Meta-cognitive processes are assumed to supervise the working memory processes that take place, regulate them, and navigate them towards one’s own goals. Meta-cognition reflects a shift from the traditional view in which people’s behavior is assumed to be driven by stimuli, to a more active view in which the person is assumed to have some degree of control over cognitive process and behavior (Magnussen & Helstrup, 2007). In the current study, this degree of control was hypothesized to be a factor in long-term retention of foreign vocabulary words when using the keyword method.

Both motivation to succeed on a test and self-efficacy for learning the material were positively related to the amount of meta-cognitive activity in a study conducted by Clause et al. (2001). Meta-cognition was associated with both overall effort for test preparation and the amount of deeper information processing strategies used in the study. The findings support the idea that meta-cognition during test preparation involves directing the use of cognitive efforts to activities. This goes beyond just monitoring and regulating the overall effort exerted. Although this study was conducted using adult applicants for an entry-level position in a state law enforcement agency, the findings can likely be generalized to a classroom context since the study used standard learning and testing situations. The results of the study show that study strategies
require initiative, and that there is a relationship between motivation and strategy use in order to influence memory of material for a subsequent test. Based on these findings, the use of motivation is a factor being currently investigated in the success of encoding information using the keyword mnemonic. No studies to date have explored motivation as a variable of interest in the success of using mnemonic devices for encoding for long-term retention.

*Overview of the Study*

The present study examined the relationship between motivation and long-term retention when using the keyword mnemonic. It has been found that long-term retention when using the keyword method diminishes after 7 days (Carney & Levin, 1998). However, the use of motivation as a variable has not been investigated, and it is possible that motivated participants will encode the information more successfully using the keyword mnemonic, and remember it better over longer delays. The experiment is a 2 (Motivation: present, absent) × 2 (Type of encoding: repeated definition, keyword) × 2 (Time of test: immediate, delayed) design. The motivation variable was manipulated between-subjects, while both encoding method and time of test were manipulated within-subjects.

Participants were instructed to use either the keyword method or a repeated definition (i.e., presumably utilizing a rote rehearsal strategy) for learning a list of foreign vocabulary words. Half of the students were informed that the information would be tested both immediately and again in 1 week, and were told that the top two scorers on the delayed test would win a gift certificate, whereas the other half were not informed of the delayed test or the reward. This manipulation of knowledge about the delayed test, and the offer of a reward, was hypothesized to affect motivation levels. After the study phase, participants completed a vocabulary test for the foreign words they studied. One week later, all students were retested on the vocabulary words.
There were several empirical predictions, based on prior research findings. I hypothesized that for the immediate test, the vocabulary words studied with the keyword encoding method would show better memory than the words studied with the repeated definition encoding method, and the motivation conditions would not differ. Also, the immediate test was predicted to show higher scores overall than the delayed test. Another hypothesis was that there would be an interaction between the motivation and time of test variables, such that the motivation group would perform significantly better than the non-motivation group only on the delayed test. I also predicted that there would be a three-way interaction, such that for immediate recall, the keyword group would perform significantly better than the rote rehearsal group regardless of the motivation condition. For delayed recall, the keyword condition was predicted to perform better than the rote condition only for the motivated participants.

Method

Participants

Participants were 77 undergraduate introductory psychology students from Marietta College. They consisted of students in two Introduction to Psychology courses. The students were given credit for participating in the study. There were 36 students who participated in the non-motivation group and 41 who participated in the motivation group. Due to participants not attending class on the second testing date, a total of 9 participants were omitted from the study. Two were from the non-motivation group and seven were from the motivation group. Of the participants, there were 53 freshman, 16 sophomores, 6 juniors, 2 seniors, and 1 participant that classified himself or herself as “other.” There were 47 females and 31 males. The mean GPA was 3.0 (SD = 0.86).

Materials
The Effect of 19

Study Booklet

The first page of the study booklet contained training instructions on how to use the keyword method and an example was provided (Lawson & Hogben, 1998). It was important that the study booklet contained definitions of vocabulary not likely to be known by the students; as such, the booklet contained 20 moderately difficult German words and definitions (Fritz et al., 2007). Considering the previous research, it was necessary to establish high-vividness keywords to associate with the vocabulary being learned by the students. The keywords and the meanings must be concrete and generated by a group of people knowledgeable about the keyword method and the language being learned (Pressley, 1977). The words were chosen using two criteria, namely that they were simple in meaning and structure, and were commonly used in everyday language. There was a keyword for each term and an imaginable interaction between the German word and the keyword (see Appendix A).

For the keyword items, a German word, corresponding English definition, and imaginable interaction were presented on a page. The keyword condition was presented for half of the vocabulary words. For the other half of the vocabulary words, rote rehearsal instruction was given using a repeated definition. For these items, the word and its definition, which was repeated again on the page to equate the amount of text read in each condition, were the only information provided. The order in which each participant received the repeated definition or keyword information for each word was counterbalanced. Each participant received a booklet containing the keyword and repeated definition items in a different order. At the end of each page, the participants were asked about the probability of remembering the translation later.

Test
Performance on the test was the dependent variable for the study. It consisted of 15 items in which participants were required to supply the English translation for each of the German vocabulary words (see Appendix B). Each test had a German word and an area where the English translation was to be written. The items were listed in a random order, not identical to ordering of the vocabulary words in the study booklet. This format is similar to a study using Italian vocabulary words (Lawson & Hogben, 1998).

Procedure

The study design was a 2 X 2 X 2 factorial, with the factors consisting of motivation (present, absent), encoding condition (rote rehearsal, keyword method), and time of test (immediate, delayed). The motivation variable was manipulated by having half of the participants informed that the information they were studying would be retested in one week. They were also be informed that the participants receiving the top two scores on the delayed test would be given gift certificates redeemable at the campus book store. The other half of participants were not told of any other use for learning the information other than for the research at hand. I used two different Introductory Psychology classes for the between-subjects condition of motivation. I first ran the entire study with the non-motivation group, including both immediate and delayed tests, and then ran the study with the motivation group at a later time, in order to diminish any potential confounding due to diffusion. The participants were tested as a group in a classroom setting. Each study booklet contained both repeated definition and the keyword encoding strategy instructions for different words.

The procedure for study times and testing was drawn from Lawson and Hogben (1998). The researcher read aloud instructions on how to use the keyword mnemonic and repeated definition (see Appendix C). Because the rate of presentation must be slow enough to ensure the
effectiveness of the keyword (at least 10 seconds per word) (Hall, 1998), participants were given 30 seconds to study each of the 15 pages in the study booklet and another 10 seconds to complete the question of self-rated probability of remembering the translation, which was found at the end of each page. After participants completed the study phase, they were given the immediate test. They were informed that they would be given as much time as needed to provide the appropriate English translation for each German vocabulary word and to complete the questionnaire following the test. Once they had completed the test and questionnaire (see Appendix D), they were thanked for their participation.

One week from the initial test, the students were retested, using the same testing procedure but with a different ordering of the words. This was a surprise test for the non-motivation group, but was expected by participants in the motivation group. When they finished the test, they were instructed to complete demographic questions and other questions concerning the conditions of the study at the end of the booklet (see Appendix E). Afterwards they were again thanked and fully debriefed.

Results

In order to eliminate a recency effect, and to allow for the analysis of an even number of words for each encoding condition, a post hoc decision was made to exclude the final word from each study booklet and the same word on the corresponding test from all data analyses. The primary dependent variable was therefore the number of words translated correctly on the test, out of seven for each condition. A preliminary descriptive analysis, including box plots, revealed an outlier who scored extremely low on all tests, including the immediate test, suggesting that this person was not attending to the task. Therefore, all data analyses were conducted with the outlier removed.
The alpha level was set at .05. Eta-squared ($\eta^2$) is reported as an effect size measure, where $\eta^2 < .09$ is considered small, $.09 < \eta^2 < .25$ is considered medium, and $\eta^2 > .25$ is considered large (Cohen, 1988).

A 2 (Motivation: present, absent) X 2 (Encoding condition: repeated definition, keyword method) X 2 (Time of Test: immediate, delayed) mixed-factor analysis of variance (ANOVA) was used to analyze the data. The main effects of encoding condition, motivation, and time of test were examined first. There were no main effects for motivation level, $F(1, 8) = 2.40, p = .126, \eta^2 = .04$, or for encoding condition, $F(1, 62) = 0.55, p = .460, \eta^2 = .01$. There was, however, a significant main effect of time of test, $F(1, 62) = 204.62, p < .001, \eta^2 = .77$, with the immediate test ($M = 4.56, SD = 0.24$) producing significantly higher scores than the delayed test ($M = 2.64, SD = 0.20$) (see Table 1).

The two-and three-way interactions among the three variables were also examined. The predicted interaction of encoding condition and motivation level was not significant, $F(1, 8) = 2.98, p = .089, \eta^2 = .05$. None of the other two-way interactions were significant, $ps > .05$. There was also no three-way interaction of encoding, time, and group, $F(1, 8) = 1.37, p = .246, \eta^2 = .02$.

Because the preceding two-way interaction of encoding condition and motivation level approached statistical significance ($p = .089$), follow-up $t$-tests compared encoding condition for the non-motivation and motivation group, collapsing across time of test. Results showed that for the non-motivation group, the repeated definition encoding condition had a slight numerical advantage in test scores ($M = 3.47, SD = 2.04$) compared to the keyword encoding condition ($M = 3.24, SD = 1.78$), but the difference was not significant, $t(34) = -0.72, p = .479$. For the motivation group, the keyword encoding condition showed a slight numerical advantage in test scores ($M = 3.44, SD = 2.01$) compared to the repeated definition encoding condition ($M = 3.20, SD = 1.77$), but the difference was not significant, $t(34) = -0.51, p = .612$.
The Effect of 23 scores ($M = 3.91$, $SD = 1.92$) compared to the repeated definitions encoding condition ($M = 3.65$, $SD = 2.14$), $t(38) = 1.00$, $p = .326$. Although the tests did not produce significant results, the pattern of means was at least consistent with the prediction of an advantage for the keyword instructions only in the motivation group.

A second 2 (Motivation: present, absent) X 2 (Encoding Condition: repeated definition, keyword method) X 2 (Time of Test: immediate, delayed) ANOVA was conducted on self-ratings of the probability of remembering each word, which were measured on a 5-point Likert scale. This revealed a main effect of encoding condition, $F(1, 71) = 15.33$, $p < .001$, $\eta^2 = .18$, with participants rating their probability of remembering the words higher for the keyword encoding condition ($M = 3.25$, $SD = 0.74$) than for the repeated definition encoding condition ($M = 2.98$, $SD = 0.71$). There was no main effect of motivation, nor any interactions, $ps > .05$.

A final 2 X 2 X 2 ANOVA was computed using the dependent variable of helpfulness ratings, which were measured on a 5-point Likert scale. There was a main effect of encoding condition, $F(1, 62) = 4.64$, $p = .035$, $\eta^2 = .07$, with the keyword method having significantly higher ratings ($M = 3.04$, $SD = 0.11$) than the repeated definition encoding strategy ($M = 2.71$, $SD = 0.12$). There was also a main effect of time, $F(1, 62) = 33.57$, $p < .001$, $\eta^2 = .35$, with higher ratings of helpfulness at the immediate test ($M = 3.18$, $SD = 0.10$) than the delayed test ($M = 2.58$, $SD = 1.00$). There was no main effect of motivation level, nor any two or three-way interactions, $ps > .05$.

Discussion

The present study examined the relationship between motivation and long-term retention when using the keyword mnemonic. The keyword mnemonic has been shown to be an effective tool for immediate recall of information (Carney & Levin, 1998; Carney & Levin, 2000; Fritz et
al., 2007). Although there are clear short-term benefits of the keyword method, long-term forgetting seems to be greater for learners instructed to use the keyword mnemonic than for learners engaged in rote rehearsal (Wang et al., 1992). It was the present study’s hypothesis that motivation may be a factor in whether people actually pay attention to and make efficient use of the keyword mnemonic during the study phase. Participants studied German vocabulary words using either the keyword mnemonic or a repeated definition encoding strategy, and then completed an immediate and one-week delayed recall test. Only one group of participants was told about the delayed test and that they would receive a reward if they earned the highest scores on the delayed test, in order to manipulate motivation level.

It was hypothesized that there would be an interaction between the motivation and time of test variables, such that the motivation group would perform significantly better than the non-motivation group only on the delayed test. The rationale for this hypothesis was that motivation has been found to be an important process in learning (Salonen, 2005). Past literature has shown that study strategies require initiative, and that there is a relationship between motivation and strategy use in order to influence memory of material for a subsequent test. Research has shown that individuals have a certain amount of control when engaging in learning tasks. Individuals are able to allocate resources needed for learning, by the means of motivation (Pintrich & Schunk, 1996). Results of the current study indicated no such interaction, however. There was also no main effect of motivation overall, suggesting the two groups performed similarly. Therefore, the first hypothesis was not supported.

The second hypothesis would have been supported if there was a three-way interaction between encoding condition, motivation, and time of test, such that the motivation condition had an advantage over the non-motivation condition, but only for the keyword method condition and
only on the delayed test. This interaction was not found. However, the two-way interaction between encoding condition and motivation group approached significance ($p = .089$). An investigation of these means showed a pattern that was somewhat consistent with the predicted results: only in the motivation group did the keyword encoding condition have a slight numerical advantage in test scores compared to the repeated definitions encoding condition, when collapsing across the time of test variable. This suggests that with a larger sample size the results may have reached significance in the hypothesized direction, to show that the motivation group may have been paying more attention to the keyword mnemonic information, and could have been utilizing it more effectively.

Supplemental analyses were conducted using participant ratings about their estimated probability of remembering a translation after studying each word, and their overall helpfulness ratings of the methods of encoding used in the study. There was a main effect of encoding condition for both dependent variables, with participants rating their probability of remembering the words, and their ratings of perceived helpfulness, higher for the keyword encoding condition than for the repeated definition encoding condition. No other main effects or interactions were found. These analyses indicate that the participants perceived the keyword method to be more helpful, and predicted that using the keyword method would result in better memory for the vocabulary words, compared to using only a repeated definition.

In light of prior analyses showing no benefit for the keyword method on the vocabulary test, there was a substantial discrepancy between the participants’ ratings of helpfulness and their actual memory performance. One possibility is that people are not good at predictions and self-assessment. The participants did not seem to be very good judges of which techniques would help them learn the required material. They believed the keyword instructions should help
memory, when in reality it did not. Related to this pattern, although research conducted by Perfect (2004) showed that there are clear relations between confidence and accuracy for general knowledge, confidence ratings from vocabulary tests showed overconfidence in a study conducted by Stankov and Crawford (1997). The latter finding is consistent with the current research. Other studies have also shown that the correlation between confidence levels and accuracy is low (e.g., Zakay & Tuvia, 1998). It is also possible that the discrepancy in the current results may be due to some limitations of the study.

Initially there was potential for a sample of 92 students, yet due to repeated testing, attrition was inevitable. The students were selected from Introduction to Psychology courses at Marietta College. Larger classes or more than one class for each condition may have yielded different results. The testing format used in this research also posed a potential problem. The participants were required to write the English translation to every German vocabulary word. An informal examination of the tests revealed that many of the participants were identifying the keyword correctly, but were confusing the keyword with the English translation. The fact that many participants answered with the keyword suggests that they may be effectively utilizing information presented in the keyword conditions. However, they were not accurate in determining which recalled English word was the keyword and which was the correctly translated word. Using a free recall test as the dependent measure may not be truly assessing the participants’ effective use of the keyword method. Participants may be more accurately tested on use of the keyword method if they are able to use a recognition test rather than a free recall test.

Another limitation of the study is concerned with external validity. The manipulation of motivation consisted of informing half of the participants of a delayed test and adding a monetary incentive, while withholding this information from the rest of the participants.
Although the incentive may have motivated some of the participants, it is not the same type of motivation that is typically found in classroom settings. Only two participants were able to receive an incentive for doing well in this study. However, any student within a classroom setting has the opportunity of receiving an incentive for doing well, by means of the grades they receive. Due to the lack of similarity between the incentive used in the current study and incentives in an actual classroom, another tactic for manipulating motivation may be needed.

Future research is needed and will be useful in providing assistance for students in classrooms or other settings in which the keyword method can be effectively used in order to enhance long term retention of information. Further exploration of the discrepancy between what students think is helpful and what is actually helpful is also of importance. Research on the topic of meta-memory, which is the belief or degree of confidence in one’s memory (Magnussen & Helstrup, 2007) will help determine which types of encoding tools are believed to be most beneficial and which are actually beneficial. It is imperative that students have effective study strategies in order to reach optimal academic achievement.
References


Flavell, J. (1979). Metacognition and cognitive monitoring: A new area of cognitive-


Appendix A

Keyword Mnemonic Information for German Vocabulary Words

(Fritz, Morris, Acton, Voelkel, & Etkind, 2007)

1. The German word for DITCH is GRABEN. Imagine GRABBING the side of a ditch to stop falling in.

2. The German word for DINNER is ABENDESSEN. Imagine A BENT’ S ‘IN icing in the middle of your dinner plate.

3. The German word for ALRIGHT is IN ORDNUNG. Imagine thinking that having ORDINARY people around is ALRIGHT.

4. The German word for LADDER is LEITER. Imagine feeling LIGHTER after putting your heavy ladder down.

5. The German word for SHARP is SCHARF. Imagine cutting a German flag with SHARP scissors.

6. The German word for LIGHTHOUSE is LEUCHTTURM. Imagine people LOITERING near a lighthouse.

7. The German word for BOTTLE is FLASCHE. Imagine a bottle FLASHING past your head.

8. The German word for PEAR is BIRNE. Imagine BURNING a pear.

9. The German word for STRAIGHT is GERADE. Imagine going up a STRAIGHT GRADIENT.

10. The German word for LIGHT (WEIGHT) is LEICHT. Imagine finding a German flag LIGHT to lift.
11. The German word for SPRING (METAL COIL) is FEDER. Imagine the springs are made with FEATHERS.

12. The German word for LOCK is SCHLOSS. Imagine you are so SLOSHED that you can’t open the lock of your car.

13. The German word for HOLE is LOCH. Imagine a hole in a door lock.

14. The German word for LAZY is FAUL. Imagine a LAZY football player commits a FOUL because he can’t be bothered tackling.

15. The German word for SAUCER is UNTERTASSE. Imagine a tassle under a cup, and a saucer UNDER the TASSLE.
Appendix B

Test of German Vocabulary Words

(Lawson & Hogben, 1998)

Please provide the English translation for each German vocabulary word.

1. LOCH ____________
2. BIRNE ____________
3. ABENDESSEN ____________
4. FAUL ____________
5. LEITER ____________
6. GERADE ____________
7. GRABEN ____________
8. UNTERTASSE ____________
9. SCHARF ____________
10. FLASCHE ____________
11. SCHLOSS ____________
12. FEDER ____________
13. IN ORDNUNG ____________
14. LEUCHTTURM ____________
15. LEICHT ____________
Hello. First of all I would like to thank you for your participation in this study. This study will consist of a study phase and a test phase. You will be tested directly following the study phase and again in one week (the last five words only for experimental condition). Hand out study booklets. For the first task you will be presented with 15 German words and English translations that you will study, and later be tested on. Go ahead and open your study booklets. On the first page you will see an example of what other pages will look like. For each word you will be given a German word with its English translation and either a repeat of the word and translation, or a keyword and imaginable interaction for the word. For the sample word “libro”, you will see the English translation, which will be given for every vocabulary word. Below this you will see additional information. If you see a repeat of the translation you will need to read and study that information. If you see the keyword and imaginable interaction, you will need to read the sentence and produce an image in your mind of what you have just read. For example, the Spanish word for BOOK is LIBRO. Imagine a librarian placing books on a shelf. Keep in mind that your overall goal is to learn the English translation for each German vocabulary word, in preparation for a test. At the bottom of the page, you will rate your probability of remembering the translation. You will be given 30 seconds to study each page in the study booklet. When the 30 seconds are up I will say “Rate” and you will have another 10 seconds to complete the level of comprehension question at the end of each page. When the 10 seconds are up I will say “Turn the page”. There are 15 vocabulary words total. After they have all been studied and rated I will collect your study booklets and hand out the test page.
After collecting study booklets, hand out test page. The test page contains 15 questions. Each item has a German word and an area where the English translation will need to be written. You will be given as much time as needed to provide the appropriate English translation for each German vocabulary word and also to complete the questionnaire following the test. Do you have any questions? You may begin.
Appendix D

Questionnaire Following the Immediate Test

Sex (circle one): MALE  FEMALE

College Year Status: FRESHMAN  SOPHOMORE  JUNIOR  SENIOR  OTHER

Estimated GPA: __________

How familiar were you with the German words used in the study?

<table>
<thead>
<tr>
<th>Not Familiar</th>
<th>Somewhat Familiar</th>
<th>Very Familiar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

To what extent do you think that the keyword method (i.e., associating the German word with a keyword to form a mental image) helped you in learning the German vocabulary words for the test?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

To what extent do you think that rote rehearsal (i.e., simply repeating each German word and definition to yourself) helped you in learning the German vocabulary words for the test?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

Questionnaire Following the Delayed Test

To what extent do you think that the keyword method (i.e., associating the German word with a keyword to form a mental image) helped you in learning the German vocabulary words for the test you took today?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

To what extent do you think that rote rehearsal (i.e., simply repeating each German word and definition to yourself) helped you in learning the German vocabulary words for the test you took today?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

_For the motivation group:_

To what extent did your advance knowledge about the test that took place today make you try harder to learn the words last week?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

_For the non-motivation group:_

To what extent do you think you would have tried harder to learn the words last week if you had known about the test today?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 1

*Means (Standard Deviations) for Number of Correct Answers (Out of 7) with Different Methods of Encoding and Motivation Levels for Immediate and Delayed Recall Tests*

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time of Test</strong></td>
<td><strong>Keyword</strong></td>
<td><strong>Repeated Def</strong></td>
</tr>
<tr>
<td>Immediate</td>
<td>5.16 (2.02)</td>
<td>4.38 (2.32)</td>
</tr>
<tr>
<td>Delayed</td>
<td>3.06 (1.85)</td>
<td>2.84 (2.13)</td>
</tr>
</tbody>
</table>