Mnemonic Techniques in L2 Vocabulary Acquisition

Advanced Study in English

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Abstract

Students in high school have a need to be able to remember a lot of information during their years of schooling. The purpose of this study was to investigate if mnemonic techniques could help the participating students to become more efficient in recalling new English vocabulary. If the results were to indicate an increase in efficiency with either of the two techniques selected, it would make a case for using this technique in foreign- and second language learning contexts.

The students who participated were taught the reminiscent technique and the loci method because these techniques focus on connecting vocabulary to existing memories, thus enabling encoding to long-term memory. Research within second language studies recommends using mnemonic techniques as a help to retrieve words. The students’ recall of vocabulary was tested after an introduction to each technique. They were given three initial tests containing 15 new English words each, a total of 45 words. The first such set tested the efficiency of the students’ own techniques, while the second and third set tested the reminiscent technique and loci method, respectively. After a period of three weeks there was a final test on all the 45 new words at once, testing the possible encoding to long-term memory. The most interesting results were found regarding the percentages of lowest difference in “decrease of retrieval rate” of each vocabulary item between the first initial tests and the final test. The smaller the decrease could indicate a stronger encoding to long-term memory. The top two recalled words were linked to the reminiscent technique and the one in third place to the loci method. Thus, there was some indication that these helped to achieve a stronger encoding to long-term memory. However, when comparing the total number of recalled words, the students’ own technique came out as the winner.

Key words: mnemonic techniques, long-term memory, loci method, reminiscent technique, vocabulary acquisition, second language acquisition, English vocabulary, foreign language, didactics.
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Appendix
1 Introduction

In order to function well in our modern society, it is important to have a good memory. There is an intense exposure to information and also a need to remember a lot of data. The majority of all sensory impressions are sorted out by the brain before they reach our consciousness. This function is called memory inhibition and is regulated by sensory memory (Derwinger, 2005). According to Klingberg (in Carling, 2011), only 20% of the information which is encoded into short-term memory will pass on to be stored as long-term memory without repetition. Among the roles of long-term memory is the storage of linguistic knowledge and its retrieval in appropriate contexts.

High school students are dependent on their memory skills due to all the new information in several subjects that needs to be processed and remembered. Foreign- and second language, L2, acquisition and learning involves a large input of new vocabulary into long-term memory, thus the knowledge of words is important for good communication skills. As is well known, there are different techniques that are said to improve our memory functions. Therefore, the question is: could mnemonic techniques help students to remember new vocabulary more effectively?

Derwinger (2005) and Klingberg (2007), among others, say that new information is stored as a long-term memory when it can find a context among other permanently stored information. For example, the reminiscent technique and the loci method have been developed to help learning through structure and context. Mnemonic techniques are recommended within the field of L2 acquisition as a tool to remember vocabulary (Nattinger, 1988).

This study aims to investigate if students in high school can improve their vocabulary knowledge in English studies with the help of mnemonic techniques. In the cause of this study, the students are taught two different techniques to learn new English vocabulary. Through different tests, the results will be measured, and then compared and discussed in relation to previous research.
1.1 Purpose and research question

The question to be investigated is whether two different mnemonic techniques can help students to remember new English vocabulary more effectively in a long-term perspective than they would otherwise be able to. If the results of this study indicate an increase of remembered L2 vocabulary due to the use of mnemonic techniques, they will help to make a case for teaching such techniques in English as well as other L2 learning contexts.

2 Memory studies

There is no specific region in the brain that works with memory functions. Different parts of the brain work together in order to store and retrieve a particular memory (Derwinger, 2005). However, there are different theories that address the various steps of memorization, i.e. the process from sensory impression to storage in long-term memory. In this study I will simplify the complex features related to the brain and the memorization process and focus on the concepts of short-term memory, working memory and long-term memory. These have an interactive relationship and, together with processing speed, form an important part of one’s learning ability.

2.1 The memory process

Before the memory process begins there is the implicit function of memory inhibition by sensory memory. This function filters all the impressions in our surroundings and can sense what information lies in our interest and focus of attention. The selected impression reaches our short-term memory, STM, where it becomes conscious. STM is only active for a few seconds and this part of the process can be described as what is currently on our mind. It is a sudden thought or an idea that can easily disappear if we do not anchor it to something more permanent (Derwinger, 2005).
2.1.1 From short-term memory to working memory

Working memory, WM, is like an extended version of STM function and also remembers information for a couple of seconds. It is central in a number of mental tasks, for example controlling one’s attention and solving logical problems. In Klingberg’s studies, he points to the fact that WM is considered to be a working space of limited storage capacity but that its efficiency can be trained (Klingberg, 2007).

While STM can be a first thought, for example the idea of making a phone call, WM comprises the ability to execute the idea through different steps. It can hold several memories active simultaneously while it connects information and encodes it as long-term memory (Derwinger, 2005). Klingberg (2007) explains the function of WM by illustrating the following situation: if one were to search for a stamp in a messy drawer, there is a need for WM to concentrate and keep in mind what you are looking for. Since the drawer is messy there are a lot of objects that compete for attention, thus attention needs to be controlled. If the mess of the drawer is too distracting, one can forget the initial instruction to look for a stamp. Hence, WM has lost that information due to its limited storage capacity.

WM and its features form a complex area of ongoing investigation with great controversy among researchers. In general, it is linked to language processing; however, Baddeley (2007) suggests several important functions and components of WM, including some that are non-language based. Thus, a component of WM and the memory process is the role of processing speed. “Processing speed refers to the speed at which a broad range of cognitive information processing steps can be completed by an individual” (Nelson, Barlieb, Heimann, Khan, Ronnberg, Rudner, Tjus, Vance Trup, 2012, p.187). A person’s learning ability can be reflected by measuring different components and capacities of WM. Research concerning WM and processing speed will be presented under section 2.2.1 below.

2.1.2 Long-term memory, explicit and implicit.

Long-term memory, LTM, can store an almost unlimited amount of information, which can be retrieved after several minutes or years (Klingberg, 2007). It contains a “number of perceptual-motor skills and cognitive skills” (Tulving, 2007, p.8) as well as a variety of knowledge such as “the recording and subsequent retrieval of memories of personal happenings and doings,” and also, “with the knowledge of the world that is independent of a person’s identity and past” (Tulving, 2007, p.9). It embraces several aspects of memory.
functions, such as explicit and implicit memory. Explicit memories are what can be consciously retrieved whilst implicit memories instead work automatically, without a conscious thought. Anderson (1995) describes the process from one state to another in the following quote:

One dimension of learning is the acquisition of better and better strategies for dealing with complexity. One way of coping with complexity is to automate more and more of the skill. When part of a skill is automated, it no longer requires cognitive involvement, which frees the cognitive systems to focus on the most problematic aspects of the skill. (p.314)

Anderson (1995) suggests that when one cannot describe a skill verbally, it has become an implicit memory. He gives the example of his wife trying to teach him to drive with a stick shift. Unconsciously, she knew how to drive with her hands and feet but could not verbally explain to him what she did. Thus, her knowledge of driving a car has progressed and developed from a cognitive (explicit) state to an autonomous (implicit) state.

Semantic memory is a subgroup of LTM’s explicit memory and stores facts such as the meaning of a certain word. Additionally, it contains the function of collective memory, which stores the knowledge of how to use a language within a certain culture (Derwinger, 2005). In other words, semantic memory comprises the ability to retrieve the appropriate vocabulary in a given situation or context (Klingberg, 2007). Derwinger (2005) explains that language is an elementary tool for us to describe our surroundings and our knowledge about them. Together with all our knowledge and experiences it supports us in the encodement of new memories.

2.2 Memory and learning

Derwinger (2005) discusses the essential elements in the process that leads to LTM. Foremost it is the ability to concentrate on what is to be remembered, which is supported by motivation and interest. Our motivation is a key factor in how much effort we want to put into a certain task. If we find something interesting it is also easier to remember it. Carter and McCarthy (1988) agree with Derwinger (2005) concerning the importance of motivation and connect it to L2 vocabulary: “Learning words in another language cannot be easily divorced from motivational factors such as how important or useful lexical items are perceived to be by learners themselves” (p.17). Derwinger (2005) adds that for LTM, it is important to associate new information with what we already know and also to understand the meaning of what is to be remembered.
Anderson (1995), on the other hand, questions the claimed relationship between learning and motivation suggested by Derwinger (2005) and also by Carter and McCarthy (1988). He points to research that shows that reinforcement contingencies, like small bribes, do not affect remembrance of processed material. Thus, Anderson (1995) concludes that motivation fails to affect learning and argues:

The failure of motivation to affect learning can be seen from the viewpoint that people cannot learn what is important to them or from the viewpoint that they cannot avoid learning things that are unimportant. The latter interpretation seems more appropriate. People are best viewed as storing in memory everything they attend to, whether they want to remember it or not. (p. 209)

Instead, Anderson (1995) states that the most crucial element for memory is how the material is processed (see 2.2.1). He maintains that research shows no difference in incidental versus intentional learning; rather, a large positive effect on memory derives from how the subjects process the material. An often seen result of these studies is that subjects who process a material in the same way, “will recall the same amount whether they intend to learn or not” (p.209). Thus, Anderson argues that when subjects intend to learn and are able to recall more material, it is “only because they engage in processing more conducive to learning the material” (p.209).

### 2.2.1 Information processing and speed

Many researchers (e.g., Anderson, 1995; Nattinger, 1988) mention the importance of processing speed when acquiring new information and languages. However, there is a rapid progress within this field of brain and memory research and Nelson et al. (2012) reveal one of the latest findings. They maintain that a person’s learning ability can be reflected by measuring different components and capacities of WM.

Nelson et al. (2012) observe that earlier research (e.g., Baddeley & Hitch, 1994) show several “clear cut associations between learners’ higher measures of information processing capacities and concurrent higher performance levels in L2, but most of these have looked only at working memory” (p.186, original emphasis). However, Nelson et al. state that their study has a new approach where they maintain that learning ability also has to do with processing speed. Their research indicates that “initial individual differences in information processing affect later progress in second language acquisition” (p.185). Thus, an awareness of individual differences in WM and its complexity can help solve many educational problems that have to do with memory (Baddeley, 2007).
Nelson et al. (2012) categorize the capacities of both working memory and processing speed in high, medium or low. They conclude from their research that high processing speed in combination with high working memory does not result in greater skills in L2 learning; in fact, people with that combination even show a decline in working memory. Instead, the results favor individuals with lower information processing capacities. There is a better outcome for LTM within the group of participants with low processing speed in combination with medium working memory or high processing speed with low working memory. However, the group with the combination of low processing speed and low working memory scored the lowest results in the test.

To clarify the procedure of the experiment above, high working memory is associated with those who showed a high performance in L2 skills during the instructional sessions. In contrast to earlier research (e.g., Baddeley & Hitch, 1994), a demanding posttest of long-term retrieval was executed. Nelson et al. (2012) conclude that a combination with a lower performance in either capacity had better effects in a long-term perspective. In addition, the results also indicate the strong influence by the subjects’ prior cognitive skills.

2.2.2 Aspects of memory improvements

Anderson (1995) addresses the proverb practice makes perfect. In one of his experiments, subjects were requested to learn 20 so-called paired associates that had no natural connection. As an example of a paired associate he gives the word dog paired with the number 3. Among other things, his results show that “memories continue to improve with practice even after recall is perfect” (p.194). His subjects succeeded to recall the paired associates perfectly, but after more training their speed (i.e. time) of memory retrieval became faster.

Klingberg (2007), like Anderson (1995), addresses the proverb above with the explanation that the brain is shapeable. However, there is a controversy surrounding the ability to improve different memory functions through exercises. Weeks (2012), quotes Klingberg and Restak in his article that are of two different opinions. Klingberg is quoted as stating that “‘certain cognitive functions, such as attention, working memory and possibly reasoning ... can be affected by training.’ But he is less certain that exercises will strengthen long-term memory” (in Weeks, 2012). Restak, on the other hand, is quoted as maintaining that “we are constantly adding to our long-term memory, and learning to associate images or emotions with those
memories will increase the chances of retrieval”. In other words, Restak promotes exercising not only WM but also sensory memory and LTM.

2.3 Memory and vocabulary

Carter (1998) refers to research (e.g. Nation, 1982) that suggests that similarities in sound, morphology and etymology between languages can assist memorization of vocabulary. If the new word can be associated with another word, either in the target language or the mother tongue, it would be an important learnability factor. “One important element in learning new words is the degree of effective formal linking learners can establish between a word in the target language and a cognate word in the mother tongue” (Carter, 1998, p.195). For this reason, there is a better chance of retrieval the more frequent the opportunities are for linking words through its form.

An example of association with similarity in sound that could possibly assist an English speaker learning Malayan is the word buku, which means book in English. Thus, linking through sound would assist memorization of that word. Another possibility is to produce “clang associations” (Carter, 1998, p.199, original emphasis), which is a response that is “motivated more by phonological than semantic resemblance, e.g. dog ? [sic] clog, frog” (p.199, original emphasis). The two words that are associated in the target language and the mother tongue do not necessarily have the same meaning.

2.3.1 Consideration of word form

Scholars seem to agree that concrete words and function words are the easiest to learn and retain, whereas abstract words are more difficult (Nattinger, 1988; Carter, 1998). Nattinger (1988) explains it further that function words are easier to remember because they are few and frequent. Content words that stand for abstract concepts, on the other hand, are more difficult to remember. He observes that most problems occur with nouns, verbs, and adjectives that are abstract and thus cannot be represented with a picture, yet are nevertheless necessary for understanding a text. However, Carter (1998) argues that what is to be considered difficult in word form has a lot to do with the learners’ understanding and perception.

Nattinger (1988) suggests that a possible way to help students memorizing vocabulary is to gather the individual items into different families. In spite of the meaning of the words being different, association could help when the words are clustered into groups.
Saarman’s (2005) study on vocabulary acquisition includes experiments with different mnemonic techniques (she defines them as communicational strategies) in different learning contexts. Her study is introduced with the hypothesis that some words are more difficult to learn than others. Yet her results indicate that the aspects of frequency, expression, content or context do not seem to have any influence on word retrieval. Not even word class seems to have any importance for how well the words are recalled. However, she admits her own study to be non-reliable because of the small number of participants in the study.

2.4 Context verses repetition

Krashen and Terrell (2000) question the effects of repetitive training when learning new vocabulary. Krashen (1985) states that memorizing vocabulary and grammar rules has not worked in L2 teaching because we acquire words when we understand the message, i.e. receive “comprehensible input” (p.101). If we do not understand and recognize the meaning of vocabulary and the key elements of utterances, there will be no acquisition. Krashen and Terrell (2000) argue that “…‘memorized’ or ‘drilled’ vocabulary does not stick, words learned by rote or drill do not enter permanent memory storage. True vocabulary acquisition with long-term retention occurs only with meaningful exposure in situations in which real communication takes place” (p.156). Another researcher, Kramsch (1993), also promotes real life communication as the best way to contextualize L2 learning, though she does so in reference to grammatical exercises.

Since comprehensible input is so important for L2 acquisition, Krashen and Terrell (2000) recommend teachers to work with context. As an example, they suggest visual aids and pictures for classroom practice. This idea is supported by Carter and McCarthy (1988), who observe that images and other associations enrich the context of the vocabulary to be learned, which, consequently, is more likely to be retained. However, they conclude that positive recall of the L2 learners’ contextual learning is age-dependent and proficiency dependent. “Thus, the more advanced the learners, the more likely they are to benefit from learning words in context” (p.15). In the early stages of language learning it is difficult to understand meaning of words in contextual sentences when the general knowledge is still poor.

The notion of context is also mentioned in Saarmans’ (2005) study. She refers to a Finnish study by Kristiansen (1998) where it is claimed that people learn a sentence more easily than a word, a passage easier than a sentence. Kristiansen discusses her ideas in relation to the first
investigations in this field by Craik and Tulving in 1975 studying how one could remember words in very simple sentences and in long complicated ones. Kristiansen concludes that the longer and more complex the sentences the better the recall; consequently, length, versatility and complexity of the context have an influence on the recall of words (Kristiansen in Saarman). A possible reason for this would be that it creates a situation where deeper processing is needed, as Nattinger (1988) suggests.

2.5 Mnemonic techniques

Mnemonic techniques provide structure and organization as a help to memorize certain material (Derwinger, 2005). An area of the brain that is used for a certain skill and trained for it becomes better at its task. As mentioned in an earlier section, the reason for this is that the brain is shapeable; thus, to play the piano, for example, improves the area responsible for fine motor skills. However, each mnemonic technique has only been proven to be efficient for its specific field (Klingberg, 2007). Therefore, the mnemonic techniques chosen for this study is claimed to assist vocabulary acquisition with the help of context through visualization and old memories (Derwinger, 2005).

2.5.1 Rehearsal

Although rehearsal is not one of the chosen mnemonic techniques for this study, it is an important one to mention. Rehearsal is the most frequently used technique for encoding information into LTM, which is memorizing material with the help of repetition. According to Klingberg (2007), it has also proven to be the most effective technique for memorization and retrieval. His research is especially devoted to the spacing effect, which is repetitive training on a set schedule of time intervals and repetitions. It has shown to change the brain provided the training is intense, repetitive, takes place on a daily basis, and the exercises involved are hard enough.

2.5.2 The reminiscent technique

The reminiscent technique is a strategy that connects new information to an old memory. The main idea is that context is important for LTM and by anchoring new information to what is already known, like a past experience, it helps storage (Derwinger, 2005). Nattinger (1988) also points to the importance of remembering words in a context of associations. To
effectively learn a word we need to find something in our minds to attach it to, such as previous experiences.

Hypothetically, one could practice the reminiscent technique by connecting a new word to a childhood memory. Students in a Swedish high school know from childhood about the author Astrid Lindgren’s character Emil i Lönneberga. Therefore, a made-up example could be that they can connect a new English vocabulary like tureen with the situation where Emil gets stuck with the tureen on his head.

2.5.3 The loci method

Another mnemonic technique that is encouraged by researchers (e.g., Derwinger, 2005) is the loci method, which can be helpful in remembering lists of words and retrieving vocabulary through visualization. The loci method combines the technique of active visualization with already known structures and experiences. In other words, vocabulary or digits that you want to remember are connected to a well-known path that gives them inner life with pictures.

The purpose of the loci method is to learn a well-known path with loci (locations) until it can be more or less automatically remembered. This path can be a room or a familiar sequence such as the morning routine (Derwinger, 2005). “To memorize an item, one forms a visual image of it and places it at one of the loci in one’s imagined scene. Retrieval of these items then comes about effortlessly when the entire scene is brought back to mind” (Nattinger, 1988, p.65). Derwinger (2005) states that a positive outcome of this technique is that the memory can be triggered as a domino effect where each vocabulary item appears as the scene or sequence of events unfolds.

A made-up example could be as follows, using the morning routine as a well-known path: The first thing you see when you open your eyes in the morning is the ceiling, so that can become a locus with a word attached. Next you see the alarm clock on the bedside table, representing another locus for a word. After that you sit up with your feet on the floor, on the floor is another locus with a word linked to it. Thus, for students to learn loci could help them not only to remember English vocabulary but memorization of things in general.
In a Swedish study on memory training, magnetic resonance imaging (MRI) measured the changes in brain activity after employment of the loci method among people of different ages, showing that the younger people had more active brain areas than the older. The study showed better average results after training and reported a higher metabolic activity than earlier in the hippocampus area, which is central in encoding new memories (Derwinger, 2005).

3 Method

This study essentially adopts a quantitative approach with data in the form of written tests. This was considered to be the most appropriate since the purpose is to investigate a change that can be measured. As research strives to be impartial, the use of percentages demonstrated with bar diagrams could possibly make the results more objective and reliable.

Mnemonic techniques were taught to high schools students in order to test the possibility of improving their memory efficiency in L2 acquisition. They were presented with new English vocabulary that they tried to memorize with different strategies, two of which were new to them. Their knowledge of the new vocabulary was tested both after a couple of days and also after a three-week period to measure possible encodement to LTM. They took a total of four written tests in the course of this study. The purpose of this set-up was to be able to detect changes in word retrieval by comparing the students’ own, established way of studying vocabulary to the help they might get from the newly introduced techniques. Indications as to which technique enabled the retrieval of the highest number of words after three weeks were investigated, but also which words were most strongly encoded to LTM with the help of which technique.
3.1 Participants

The participants were 33 students attending a high school (Swedish: gymnasium) in a small town in central Sweden. They were from two different groups who were studying English at different levels, English 5 and English 6, and were between the ages of 16 and 17. Both groups were enrolled in theoretical study programs, focusing on social science and economy, respectively. The participants were picked randomly but with the common denominator that they all attended the same L2 class at the same high school. Thus, the primary criterion for inclusion was being a high school student with English as a second language.

3.2 Procedure of the tests

The first three initial tests each comprised 15 difficult nouns (see 3.2.1). Thus, there was a total of 45 nouns. The final and fourth test featured all the words, i.e. the vocabulary of the first three tests combined. Each set of words was taught either together with a new mnemonic technique or with the exhortation that students used their own personal strategy to learn the items. All tests were written, with the words given both in Swedish and in the form of pictorial representations, the task for the students being to write the English translations.

It was deemed important to keep the introduction procedure equal for all the words, so that the effects only of the taught mnemonic techniques would come into play. In other words, the only difference regarding the students’ work with the vocabulary items in class was the last stage where they applied three different techniques to three different sets of vocabulary items. In addition, all the participants were presented with the same list of words in the same random order.

All three tests in class started with the same procedure where the English words were written on the whiteboard. The students then translated them with the help from Google Translate or a paperback dictionary. After settling on correct Swedish translations and hearing the pronunciations of the English items, they wrote everything down and added a visual representation with the meaning of the word. The reason for the latter was that some of the words included were uncommon even in Swedish, which was why pictures could help in the memorization of the words’ meaning.
Apart from the students using their own freely chosen technique for the first set of items, they were also introduced to the reminiscent technique and the loci method for the second and third set of items (cf. 2.5.-2.5.3 above). These latter techniques were taught during class and the work with them, such as writing sentences or writing down their well-known path, were also completed during class. There was one hour available to teach and learn each technique. As mentioned, the students were introduced to all vocabulary items in the same way, including translation and making a visual representation. The difference was that for the reminiscent technique they wrote down sentences with their words and linked them to a past memory, whilst with the loci method they wrote down a well-known mental path of their choice to memorize and connect vocabulary to.

The three sets of words were each tested after a couple of days. After the completion of one set, another set of vocabulary items was presented together with its technique. The final and fourth test was administrated after three weeks and the students were not informed priory regarding its occurrence. A time of 15 minutes was set for this test, which was more than enough. The purpose of this time frame was to give the students room for contemplation of their actual knowledge instead of them rushing through the test to get it over with. On the whiteboard they received reminders about each technique to help them remember, associate and connect a word with it. The vocabulary was also identical in terms of order and form to the first three initial tests.

All participants were given a number that followed them throughout the study in order to help keeping track of them. If any participant was not present in all four tests, the tests that were actually completed by that person were disregarded in the study.

3.2.1 Selection of vocabulary

The vocabulary items were selected according to the criteria of being one unit (see Carter, 1998) nouns, possible to draw and visualize, as well as infrequent. The purpose of the latter was that this increased the chances that the vocabulary was in fact new and unfamiliar to the students. In addition, it was also less likely that they would learn the words elsewhere while the study was in progress.

Nattinger (1988) suggests giving students a clustered selection of vocabulary to learn. This would help the students to associate a word to others within that group, and consequently assist them in memory retrieval. As much as possible this idea was kept in mind when
choosing the vocabulary for the tests. The words may appear as randomly chosen, yet a clustered selection was the basic intention. There was a focus on clothes and items in the garage in the first test. Kitchen utensils and furniture were in the second test and mostly food vocabulary in the third. In addition, the technique to be used for memorization was kept in mind as the sets were compiled. One thought was that *rhubarb* pie, for example, might be something that all Swedish children could link to a memory from childhood whilst *rivet* might be harder. Therefore, there was an idea behind the seeming randomness. However, selecting the vocabulary was not an easy process since it partly builds on a researcher’s judgment and guessing what the students might or might not know.

As indicated above, the vocabulary items selected also follow the criteria discussed by Carter (1998) of representing “minimum meaningful units” (p.5) and single word nouns only. The nouns have a clear meaning in order to avoid misunderstandings due to the Swedish translation; they can also stand on their own without having to be contextually attached to another word. The words that were chosen for this study can be found in section 4 and also in the appendix placed last in this essay.

**3.2.2 Choice of techniques**

The first test was meant to test the efficiency of traditional vocabulary learning. The students were responsible for learning the vocabulary at home using their own freely chosen technique. Interesting to mention is that the large majority of students ordinarily use rehearsal as their own mnemonic technique and that only two out of 33 participants use associations, according to the students’ own claims in an oral survey in class.

The reminiscent technique and the loci method were chosen because of their focus on connecting vocabulary to existing memory. In addition, they would be possible to teach to a class during the limited time frame available for this project. Another important factor was that they did not rely completely on the students’ own effort outside of class, as would have been the case with repetitive training in the spirit of the spacing effect (see 2.5.1). In other words, although rehearsal has proven to have a positive effect, it was not chosen as a technique in this study due to lack of time and possibilities to control and supervise training.
3.2.3 Correction of the tests

The answers suggested by the students were categorized into three categories: correct, partly correct and incorrect. A “correct” answer is if the Swedish word had been identified and translated into English with correct spelling. The category of “partly correct” comprises essentially correct but misspelt translations into English. This only applies, however, if the misspelling does not interfere with the comprehension of the word if pronounced orally or if the answer cannot be mistaken for another word. An “incorrect” answer can be an entirely wrong suggestion, a seriously misspelt word or a non-translation, i.e. a blank.

For each word and category percentages were calculated. The results are presented in figures and tables in section 4.

3.3 General observations

There were some general observations made in class during the work with this study. These are interesting to mention since they are relevant for the discussion and the results as a whole.

Firstly, what cannot be shown through figures and tables is the students’ motivation while working with the different learning techniques in class. When working with the reminiscent technique, there was an overall happy atmosphere with an active sharing of childhood memories. This motivated atmosphere was also noticeable during the work with the loci method. However, with the latter, the verbal activity was generally lower, even though all students seemed to have a desire to share their well-known path with their peers.

Secondly, they worked with associations when trying to understand the meaning of the new vocabulary and for memorization. In general the new vocabulary lacks potential for associations in the form of semantic, phonological and etymological links. However, the students tried to produce clang associations (see 2.3) for the English word for the fish sole, which they linked to the Swedish word sula. The English word sconce was associated with the bread called scones. Although the familiar word horse constituted a part of one of the items to be learned, horseradish, this was not expressly observed in class.
3.4 Ethical aspects

The study respects the ethical principles that are included in Vetenskapsrådet’s (2004) *Forskningsetiska principer inom humanistisk-samhällsvetenskaplig forskning*. The demands stipulated regard the notions of information, consent, confidentiality and usage. For example, the students who participated in this memory study were informed of its purpose and the ethical principles by Vetenskapsrådet. They also learnt that their participation was voluntary and that the tests would be used exclusively to answer the research questions of this study. Thus, both tests and identities are kept confidential. The study was not expected to have any negative consequences for the participants.

4 Results

The students’ test answers have been put into three categories, which are each linked to a color: correct–green, partly correct–yellow and incorrect–red. The words are presented in the same order as the students saw and worked with them during class.

The results of the initial tests are presented in Figures 1.1-1.4, whilst those of the final test are summarized in Figures 2.1-2.4. The reason behind the figure numbers is to clarify which set of tests the figures belong to. The words that received the highest scores of retrieval are presented in section 4.3.

4.1 Results of the initial tests

Figure 1.1 shows the results from the first initial test where the students used their own technique to remember the vocabulary. In Figures 1.2 and 1.3, the results from learning new vocabulary with the reminiscent technique and the loci method are given. In the figures, the percentage points are shown to the left, whilst the bottom row shows the vocabulary in the same order in which it was presented and tested. Finally, the results shown in Figures 1.1-1.3 are combined into a total percentage for each technique presented in Figure 1.4, in order to permit a more direct comparison between the techniques.
Figure 1.1 – Initial test 1: Retrieval rate of the students’ own technique.

As Figure 1.1 shows, the words *pew*, *cot* and *pliers* were the ones with the highest scores of “correct” answers. The word *pew* ended up with a score of 100 per cent retrieval in the initial test. *Awning*, with 94 per cent, joined the group of most readily recalled words with the students’ own technique when also counting the “partly correct” answers.

Figure 1.2 – Initial test 2: Retrieval rate of the reminiscent technique.
The highest retrieval rate with the reminiscent technique, as shown in Figure 1.2, was achieved for the words *ointment*, *vanity*, and *sieve*. When combining the “correct” answers with the “partly correct” ones, this changes the top three results of recall to: *ointment*, *rhubarb* and *currants*. The word *rhubarb* was often misspelled as *ruhbarb* and this form would be put in the category of “partly correct” answers.

The loci method yielded the highest percentage of positive retrieval for the words *sole*, *millet* and *pantry*, as shown in Figure 1.3. However, when the “partly correct” answers were included in the count, this changed the order to *pantry*, *sole* and *halibut*. The majority of the “partly correct” answers for *halibut* had an additional “l”, i.e. *hallibut*. Answers where *millet* was misspelt as *mallet*, which is an entirely different word, were put into the “incorrect” category. Note that *mallet* was part of the first set of vocabulary to be memorized with the students’ own technique.
The results given in Figure 1.4 indicate a better encoding to LTM with the help of the students’ own technique, to judge by the retrieval rates a couple of days after the introduction of the new English vocabulary items. The loci method is yielded the poorest results of memory retrieval, with only 47 per cent “correct” answers. When combining the “correct” answers and the “partly correct” ones, the students’ own technique yields 77 per cent retrieval, whilst the reminiscent technique yields a recall of 73 per cent, as compared to the loci method’s 52 per cent.

4.2 Results of the final test

After a three-week period the students had a final test on the entire vocabulary from the initial tests, a total of 45 words. Since the vocabulary was presented on different occasions and on different days, there was a certain difference in time between the original presentations and the final test. To be precise, the first 15 words (to be memorized with the students’ own technique) had been presented two-three days before the words to be learnt with the reminiscent technique and seven-eight days before those linked to the loci method, yet they were all tested at the same time in the final test. However, as will be seen, the results do not show a better outcome for the last technique, the loci method, which might otherwise have been expected due to the shorter period of time that had elapsed.
Figure 2.1 shows an overall decrease in vocabulary retrieval after the three weeks that had passed since the initial test of the efficiency of the students’ own technique. As shown in Figure 1.1, the word *pew* had 100 per cent retrieval rate after a couple of days, but in the final test it was not even among the top three of recalled words. Another word with a high retrieval percentage on the initial test was *awning*, which scored 94 per cent then, but only 12 per cent later. The items that most students answered correctly or/and with a “partly correct” answer after three weeks were *cot*, *hinge*, *dungarees* and *pliers*. 
Figure 2.2 shows the result from the final test for the words to be memorized with the reminiscent technique. The words *ointment*, *rhubarb* and *vanity* were the ones most often remembered with correct spelling. When the category of “partly correct” answers was combined with the “correct” answers, the word *atomizer* had a slightly better retrieval percentage than *vanity*, however, not a single student could remember *colander* in the final test, and the scores for *tuffet*, *decanter*, *armoire* and *grater* were also very low.
The final test showed a strong average decrease in vocabulary retrieval for the loci method. The highest percentages for recalled words, according to Figure 2.3, are for halibut, pantry and parsnip. The words turnip, sifter, barley and millet were not remembered at all.

Figure 2.3 – Final test: Retrieval rate of the loci method.

Figure 2.4 Final test: the results for each technique as a total percentage of recall.
Figure 2.4 shows the combined total results of the final test. The loci method, with a total of eight per cent “correct” answers, yields the lowest results of total positive retrieval. As to the category of “incorrect” answers, there is an equal 79 per cent for both the students’ own technique and the reminiscent technique. Conversely, there is an advantage of only one percentage point for the students’ own technique compared to the reminiscent technique if the “correct” category and the “partly correct” one are combined.

4.3 The best retrieved vocabulary over time

The above results of the tests are in some ways misleading when it comes to comparing the initial and final tests. If one were to look only at retrieval in terms of overall percentage points, it would not truly reflect the strength or quality of encoding to LTM. The most interesting results can be found when comparing the vocabulary retrieved in the initial test and the lowest difference in memory decrease after the final test. This can be seen in Tables 1-3 and in the appendix.

In Tables 1-3, the five words with the best results for each technique are presented in a row each: the smaller the decrease of the retrieval rates, the better the encoding to LTM, and the higher up in the table a word will appear.

To understand the tables, it needs to be made clear what the various column headings mean. This will be explained first by a table and a mathematical calculation to clarify how to read the columns in Table 1-3.

Values in each column are rounded off to two significant figures. The most relevant results are found within column D, which presents the difference in the percentage and the decrease in retrieval rate between the initial test and the final test. The words with the lowest decrease in retrieval rate in column D can be assumed to be the ones with the best encoding into LTM since it possibly shows storage that has lasted over time. Column C also presents the decrease in retrieval rate, but in percentage points rather than percentages.
Example 1: How to read Tables 1-3.

<table>
<thead>
<tr>
<th>Word X</th>
<th>Initial test Correct &amp; Partly correct [%]</th>
<th>Final test Correct &amp; Partly correct [%]</th>
<th>Decrease in retrieval rate [% points]</th>
<th>Decrease in retrieval rate [%]</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>cot</td>
<td>97</td>
<td>61</td>
<td>36</td>
<td>38</td>
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<td>hinge</td>
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<td>39</td>
<td>57</td>
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<tr>
<td>chemise</td>
<td>67</td>
<td>24</td>
<td>42</td>
<td>64</td>
<td>3</td>
</tr>
<tr>
<td>dungarees</td>
<td>79</td>
<td>27</td>
<td>52</td>
<td>65</td>
<td>4</td>
</tr>
<tr>
<td>pliers</td>
<td>88</td>
<td>27</td>
<td>61</td>
<td>69</td>
<td>5</td>
</tr>
</tbody>
</table>

(Column C [% point] = Column B [% points] – Column A [% points])

(Column D [%] = \( \frac{\text{Column C [% points]}}{\text{Column A [% points}}} \))

Table 1 shows the results of the students’ own technique, where cot was the best retrieved word after the final test. In the initial test, a couple of days after the introduction of the new words, the best retrieved word was pew with 100 per cent, but in the final test it is not even among the top five. A word that only had an average rate in the initial test was hinge, but it proved to have the second lowest decrease in retrieval rate after the final test.

Table 1: Results of the student’s own technique.
Table 2 shows the results for the reminiscent technique. *Ointment*, *rhubarb* and *currants* were the words best retrieved in the initial test. If the focus is on the decrease in retrieval rate, as in Table 2, these are still among the top five of recalled words.

Table 2: Results of the reminiscent technique.

<table>
<thead>
<tr>
<th></th>
<th>Initial test Correct &amp; Partly correct [%]</th>
<th>Final test Correct &amp; Partly correct [%]</th>
<th>Decrease in retrieval rate [% point]</th>
<th>Decrease in retrieval rate [%]</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>ointment</td>
<td>91</td>
<td>73</td>
<td>18</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>rhubarb</td>
<td>88</td>
<td>64</td>
<td>24</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>atomizer</td>
<td>82</td>
<td>33</td>
<td>48</td>
<td>59</td>
<td>3</td>
</tr>
<tr>
<td>vanity</td>
<td>79</td>
<td>30</td>
<td>48</td>
<td>62</td>
<td>4</td>
</tr>
<tr>
<td>currants</td>
<td>85</td>
<td>27</td>
<td>58</td>
<td>68</td>
<td>5</td>
</tr>
</tbody>
</table>
The results of the loci method in Table 3 show a very low decrease in retrieval rate for the word *horseradish*. This indicates that it had the strongest encodement to LTM among the words taught with the loci method (for those students who had managed to encode it to LTM at all). Interestingly, *horseradish* only scored 21 per cent in the initial test, thus being the word least recalled then.

Table 3: Results of the loci method.

<table>
<thead>
<tr>
<th></th>
<th>Initial test</th>
<th>Final test</th>
<th>Decrease in retrieval rate</th>
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<td>Correct &amp;</td>
<td></td>
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<tr>
<td></td>
<td>Partly correct</td>
<td>Partly correct</td>
<td>% point</td>
</tr>
<tr>
<td>horseradish</td>
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<td>6</td>
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<tr>
<td>halibut</td>
<td>73</td>
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<td>39</td>
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<tr>
<td>parsnip</td>
<td>42</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>pantry</td>
<td>76</td>
<td>24</td>
<td>52</td>
</tr>
<tr>
<td>sole</td>
<td>73</td>
<td>15</td>
<td>58</td>
</tr>
</tbody>
</table>

4.4 Analysis of results

The best retrieved word of all the vocabulary items tested is *ointment* with 20 per cent decrease in retrieval rate. In second place is *rhubarb* with 28 per cent decrease. Both of these words were learnt with the reminiscent technique. In third place is the word *horseradish* from the set with the loci method, with 29 per cent decrease in retrieval rate from the initial to the final test. *Horseradish* had one of the lowest scores of all vocabulary tested in the initial test, but was retained well in LTM by those who had learnt it. Important to mention is that the students who could identify *horseradish* in the final test also belonged to the group who could identify the word in the initial test. This was also the case for all the results measured by decrease of retrieval rate.

The students’ own technique has the best total percentage of words recalled, both in the initial test and the final test. However, this is not reflected in any of the final top three of best
retrieved words. The students’ own technique is behind the fourth place when it comes to decrease of retrieval rate, *cot* with 38 per cent, and the seventh place, *hinge*. Here, there is a difference of 18 per cent between the first and fourth item remembered best, i.e. *ointment* and *cot*. The words in-between, fifth and sixth place, were learned with the loci method and the following ones, eighth and ninth place, with the reminiscent technique. From these figures, that show the percentages regarding the decrease of retrieval rate rather than absolute retrieval per se, it could be concluded that the reminiscent technique is the best, followed by the loci method.

**5 Discussion**

Although other theories of L2 acquisition exist, prominent research (e.g., Nattinger, 1988; Anderson, 1995) suggests that the use of mnemonic techniques is one of the most effective ways to acquire a new vocabulary. For this study, three sets of new English words were learnt in combination with a mnemonic technique. The first set was taught with the students’ own freely chosen technique, whilst the other two sets were learnt with the reminiscent technique and the loci method.

The purpose of this study was to investigate if two specific and, to the students, unknown mnemonic techniques can help high school students to become more efficient in L2 vocabulary acquisition. The majority of the students say that they use repetition as their own mnemonic technique. The results from the students’ own technique are considered being the effects of normal circumstance vocabulary acquisition and are used to compare the efficiency of the two unknown techniques. A positive outcome would make a case for teaching mnemonic techniques in English studies and other L2 contexts. As it is, an overall comparison of the techniques (cf. Figure 2.4) shows a slightly higher number of retrieval for words learnt with the students’ own technique (usually repetition). However, when it comes to the decrease in the retrieval rate for single items (Tables 1-3), the other mnemonic techniques yield a better outcome.

According to previous research (Derwinger, 2005), the loci method is one of the most successful techniques for vocabulary learning. This technique should preferably become automatic, i.e. implicit, to let the mind focus on the items to be learned instead of the path
with the loci as such. The participants achieved the lowest scores with the loci method, and a reason could be that this was a new way of using visualization for them. In addition, it took longer to learn than the time available in class, which is why the procedure most likely never progressed from a cognitive state to an automatic one. Unfortunately, the set-up of this study did not allow the loci method to develop its full potential. Looking back at the process linked to this method, most of the study time in class was used to work out and remember the path, rather than to learn the vocabulary attached to the loci. This would be one of the key elements to improve in future studies when using this method.

Although the students’ own technique yielded the highest number of retrieved words, there is another aspect that reflects the effect of the mnemonic techniques. The most interesting results can be found with respect to a number of individual words and their connected mnemonic technique. The best remembered words (in relation to the results of the initial tests) were taught with the reminiscent technique, followed by words learnt with the loci method (See Tables 1-3 or appendix). Thus, the students’ own technique actually had the least impressive results with regard to LTM. This indicates that mnemonic techniques could help students to better encode vocabulary in LTM.

Even though the experiment indicates a positive encodement to LTM with the reminiscent technique, there might be improvements that can be made. A hypothesis for a future investigation could be that the technique might benefit from focusing on using a really old memory rather than a newer one. A made-up but comparable example would be the situation with the tureen in Emil i Lönneberga, to the memory that the soup in the tureen from Friday night’s dinner was not that good. Both would be a part of LTM but the latter will probably be forgotten in a longer perspective. Thus, to exclusively use old and established memories might improve the outcome of using the reminiscent technique and help students remember vocabulary more effectively. No information could be found specifically connected to the reminiscent technique and the quality or type of memories.

There are several important aspects of memory and learning that could not be measured in this study. Derwinger (2005) states that motivation and interest are crucial to how much effort we put into learning something. The notion of motivation could only be observed on a general level in class during this study, in the form of high verbal activity. However, there may well have been a lack of motivation to learn the new vocabulary (as opposed to the techniques
themselves) since this study was not a part of the participants’ regular studies and thus not graded.

The criteria applied when selecting vocabulary for this study correlate with many ideas in L2 acquisition research. The basic intention was to use a clustered selection of concrete nouns that had the possibility of being represented visually. Among others, Krashen and Terrell (2000) as well as Carter and McCarthy (1988) promote contextual learning with images and other associations to help vocabulary retrieval. These ideas were taken into consideration to help the students to memorize the new words in the initial process before applying each technique. However, there was no possibility to investigate if this aspect had influenced the results in any way.

Nattinger’s (1988) suggestions regarding clustered elements and word form was taken into consideration when selecting the words for the initial tests. However, these ideas does not seem to have any importance for the results of this study. In addition, even though Saarman (2005) conducted her study with a wider range of vocabulary, there are no indications there either that word difficulty is a crucial aspect of LTM development. Nevertheless, the following results of the tests are interesting. On the initial tests, the words pew (100% retrieval) and cot (97%) were the best retrieved items with the help of the students’ own freely chosen technique. One might conclude from this that since they are short they are easily remembered. In a short-term perspective, this may well be the case; however, pew and cot are not among the top three in terms of the lowest decrease in retrieval rate after the final test. This could indicate that short and easy vocabulary does not imply easier encoding to LTM. The three words with the lowest decrease in retrieval rate, ointment, rhubarb and horseradish, rather indicate the opposite. So, is the complexity that is recommended for contextual learning by Kristiansen (in Saarman, 2005), where research suggests that the recall of words is better from long complicated sentences, also applicable to single words? Both Nattinger (1988) and Anderson (1995) could also suggest that more commitment has been put into learning these words because they are more complicated, thus leading to deeper processing and possibility of retrieval.

The reason why horseradish is one of the words best encoded into LTM is a question to consider. On the one hand, it could be a case of association to something that the students already know, in this case horse. On the other hand, if this is the case, should there not be a higher retrieval of this word on the initial test?
Carter (1998) mentions sound, morphology and etymology as aspects that can help in the memorization of a new word. In the present experiment, the good results for *rhubarb* could possibly be explained by association through sound with the Swedish word *rabarber*. What was observed in class was the association by clang (see 2.3) when the students verbally expressed the link between the English fish, *sole*, and the Swedish word *sula*. However, the results in the final test did not show a clear effect of this kind of association but rather a considerable decrease in retrieval rate.

Another interesting question that remains to be considered is why *ointment* became the overall best retrieved word. The Swedish word *salva* is not easily associated with *ointment* in terms of any of the aspects discussed by Nattinger (1988) or Carter (1998) in section 2.3. And while there is a Swedish word that is close in sound and meaning, *liniment*, which is the same also in English, it is doubtful whether the students knew this word and could use it to recall *ointment*.

Recent insights regarding processing speed and information processing in WM give a broader perspective of how complex and individual learning can be. As a teacher, these new findings are important in understanding each individual student and their capacity for learning in general. Nelson et al. (2012) show how progress in L2 acquisition is affected by individual differences in WM components. These recent results of individual capacities are important to consider in future research within L2 acquisition and other learning contexts in general. As in the case of this study, most research within mnemonic studies show the collective results from a certain group.

Overall, the results of this study must be considered non-reliable even though the concept could, after improvement, lead to interesting and valuable results in future research. There was a limited amount of time available for this study, which of course affected the results. The introduction of, and training in, the mnemonic techniques could have been more thorough, for example. However, it would not have been possible to take more time from the students’ ordinary schedule to spend on this study, nor could a final test be administered after, say, six months. More reliable studies would test LTM later and also ensure that a technique such as the loci method has become automatized before executing a test.

Another aim for future studies would be to correlate medical insights regarding brain function and memory to students’ ways of learning in school. It would also be beneficial if each student could become more aware of their own memorization process and of which
techniques would be best to use. At the moment there are few occasions for high school students in general to think about their memory and learning process. Therefore, it would be interesting to bring the new knowledge within brain studies to the theory and practice of learning at school.

Generally, there should be further empirical studies on the effects of mnemonic techniques in combination with high school English vocabulary acquisition, among other learning tasks. The results of this study indicate that there could be a positive effect from mnemonic techniques when it comes to the quality of storage of single items. Thus, strategies that could help students in any way to structure and organize information should be of interest in all teaching situations.
References


## Appendix

Table 4: Total results all vocabulary of the students’ own technique.

<table>
<thead>
<tr>
<th></th>
<th>Initial test</th>
<th>Final test</th>
<th>Decrease in retrieval rate</th>
<th>Decrease in retrieval rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct &amp; Partly correct</td>
<td>Correct &amp; Partly correct</td>
<td>[% point]</td>
<td>[%]</td>
</tr>
<tr>
<td>culottes</td>
<td>79</td>
<td>18</td>
<td>61</td>
<td>77</td>
</tr>
</tbody>
</table>
| dungarees      | 79           | 27         | 52                         | 65                         | 4
| chemise        | 67           | 24         | 42                         | 64                         | 3
| pew            | 100          | 24         | 76                         | 76                         |
| cot            | 97           | 61         | 36                         | 38                         | 1
| rivet          | 73           | 18         | 55                         | 75                         |
| bloomers       | 70           | 12         | 58                         | 83                         |
| trowel         | 61           | 12         | 48                         | 80                         |
| mallet         | 70           | 18         | 52                         | 74                         |
| brad           | 64           | 15         | 48                         | 76                         |
| cummerbund     | 76           | 3          | 73                         | 96                         |
| stoop          | 79           | 12         | 67                         | 85                         |
| pliers         | 88           | 27         | 61                         | 69                         | 5
| awning         | 94           | 12         | 82                         | 87                         |
| hinge          | 70           | 30         | 39                         | 57                         | 2

Table 5: Total results of all vocabulary of the reminiscent technique.
<table>
<thead>
<tr>
<th>Item</th>
<th>Initial test Correct &amp; Partly correct [%]</th>
<th>Final test Correct &amp; Partly correct [%]</th>
<th>Decrease in retrieval rate [% point]</th>
<th>Decrease in retrieval rate [%]</th>
<th>Rank</th>
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</thead>
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<tr>
<td>currants</td>
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Table 6: Results of vocabulary of the loci method.

<table>
<thead>
<tr>
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<th>Initial test</th>
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<th>Decrease in retrieval rate</th>
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</thead>
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