Facilitating Vocabulary Growth and Retention Through CALL

Findings within the field

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Abstract

This literature review compares vocabulary growth and retention when using computer-assisted language learning (CALL) in contrast to traditional non-digital aids. First, an overview of theories on vocabulary growth and retention is given, as these have been applied to CALL. Findings are then presented, showing that the efficiency and enabling of several features using CALL provides a higher increase in vocabulary growth and retention than in a traditional paper-and-pen setting. Vocabulary retention increased when using CALL, and these results subsisted in delayed post-tests. The studies treat, inter alia, the same L1 and proficiency level in the participant groups from the studies, which is not a realistic classroom setting in most locations. In addition, it has been proven essential that the CALL-program is user-friendly in order for successful vocabulary growth and retention to occur. Finally, suggestions for further research are provided, such as testing morphological knowledge as this has not been reported from the studies and is a significant factor in word knowledge, as well as a need for this kind of research to be carried out in a multi-contrastive classroom.

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1 Introduction

<div align="right">"Without words, there is no language"</div>

<div align="right">(Keller, 1923, p. 35)</div>

Having a decent vocabulary is essential in the process of language learning. As Keller in the quote above stated as early as 1923, in her article about the importance of vocabulary, language cannot be managed without the mastery of its vocabulary. The meaning of this quote remains as relevant today as it was then. Thus, studies of vocabulary growth and retention have been one of the major focuses in English as a second and foreign language (ESL, EFL) research. Not surprisingly, this field, with the aid of digital devices, has received a great deal of attention in recent years and has become an important subject in contemporary research. It is thus high time to summarize this research in the form of a literature review.

There are many reasons why this kind of research is important, among other things that today's adolescent learners are born in a digital age where the usage of computers has already been implemented in schools. Research within this field is needed in order to evaluate the effects, advantages, and other factors such as the CALL-programs usability. Since these programs develop rapidly, as anything with technology, the need for continuous research is necessary. In fact, findings show generally positive attitudes towards vocabulary learning through the use of computers amongst researchers of second and foreign language. These researchers state that both growth and retention is most likely to be promoted with the use of computers, among other things because of the several functions provided such as online dictionaries, and vocabulary practice (Fuente, 2003; Smith, 2004; Chapelle, 2001; Chun & Plass, 1996). Using CALL can increase motivation, allow learners to individualize their methods, try different strategies, and keep track of the process. Some researchers have also conducted surveys in order to see how students feel about the use of computers in the language-learning classroom. The reported answers show positive attitudes towards the use of CALL-programs as well as an increase in motivation when using them (Raígon Rodriguez & Gómez Parra, 2005; Yunus, Nordin, Salehi, Sun & Embi, 2013).

When research on CALL started to grow, researchers initially used comparisons as the methodology, between a control group (using traditional textbooks, paper dictionaries, and other classical classroom-resources) and an experimental group (using CALL). This type of method is still current in contemporary CALL-research. This is shown in a meta-analysis by

Grgurović, Chapelle, and Shelley (2013), where they collected studies conducted between 1970-2006 of CALL delimited to the effect on vocabulary.

The majority of the studies selected for this review are consistent with how research on CALL has previously been done with the comparative method. In addition, three studies which are not comparing traditional learning versus using CALL are also chosen for the reason that they show another view of how research on CALL has been carried out. A pre-test is usually used in the studies, in the form of word lists or multiple choice questions, to measure the vocabulary knowledge of the learners and to be able to exchange familiar words to unfamiliar ones. These words appear in the task, which often is to read a text. After the task, an immediate post-test is conducted to see which words have been acquired from reading. A delayed post-test is carried out between 2-3 weeks after the immediate post-test, to measure retention. If the delayed test takes place sooner than within two weeks, it is not considered as retention in an experimental setting (Gu, 2003). Moreover, multiple choice tests (henceforth MCT) is the general approach used in the post-tests.

This review uses some terms that need to be explained. Firstly, there are different types of terms which all implicate similar types of digital assistance in a language learning development: computer-assisted language learning (CALL) as mentioned earlier, mobile-assisted language learning (MALL), personalized digital assistance (PDA), and computer-assisted vocabulary learning (CAVL). For the sake of this review, the abbreviation used as a reference for the interaction with digital assistance will henceforth be CALL. *Acquisition* is another reoccurring term, which often connects to Krashen's Acquisition Theory, the term meaning that a learner acquires a word in an unintended and incidental manner, focusing on the meaning and achieving the understanding through context. However, it can also mean that a learner simply learns a word without referring to the type method used. This review will solely use the term acquisition as the latter definition to avoid confusion. Thirdly, intentional and incidental learning is mentioned throughout the review. The former connects to a learning method where the learner is purposely, and often through instruction, learning target words; it does not happen accidentally. The latter implies that the words learned are picked up accidentally, often through extensive reading and/or listening. It is the connecting words around the unknown lexical item that provide comprehension, and thus the meaning of the unknown word is also comprehended. Finally, the terms English as a second language (ESL) and English as a foreign language (EFL) have been used differently by the researchers in the field, as there is no agreed definition of the terms. This review will use the term EFL if the

location where the studies are conducted are not set in countries where English is used within the community, whereas ESL is used if they are.

This review will aim to explore whether the use of CALL-tools increases vocabulary growth and retention in comparison with traditional classroom settings without digital aids. This review will also treat some aspects that may factor in, such as students' motivation when using CALL, as well as possible issues, e.g. application handiness, to consider with CALL-programs. The structure of this review is as follows: first, the theoretical background for vocabulary growth and retention will be treated, not only within the field of CALL but also of the prominent theories of vocabulary growth and retention. After that, the results of the studies found are presented, as are their aims, results, and methods. Thereafter, a discussion is made based on the findings. Some pedagogical implications are also presented as well as suggestions for further research.

2 Theoretical Background

There is extensive research in the field of vocabulary learning theories, which are treated in the following sections. First, the implications of knowing a word are presented, as are some types of scales that measure vocabulary knowledge. Next, incidental and intentional learning are presented. Last, the use of dictionaries, both paper and digital, is treated.

2.1 Implications of Knowing a Word

Knowing a word involves more than being able to say the translation in the L1. A word can change function, meaning, have various definitions in different contexts and so on. There is a great deal of agreement in the definitions of understanding a word among different researchers. Nation (2001, p. 26, pp. 33-34, cf. Laufer, 1991, pp. 82-83) divides this knowledge into three levels, the first one being the form of the word (i.e. the spelling of it and how to pronounce it correctly). The second level entails knowing the meaning of the word since a word can change meaning depending on the context. The last level is the use of the word, i.e. morphological knowledge such as grammatical inflections and prefixes. Gass (2013, pp. 464-465) argues that the second level, the meaning of the word, requires active involvement as it is a very complicated and challenging process to achieve.

Paribakht and Wesche (1993, p. 15) produced a framework to see how well learners have acquired or retained a word called Vocabulary Knowledge Scale (VKS) with five

possible levels: 1) does not recognize the word 2) recognizes the word but does not know the meaning 3) have seen the word and can guess its meaning 4) knows the word and can provide definition/translation 5) can fulfill level 4 and also write an accurate sentence with the word. This scale is used by some researchers, for instance, Yuksel and Tanriverdi (2009) in their study of captioned movie clips and whether this improves vocabulary development. In addition, Ma (2007, pp. 316-317) has created some criteria, suggested to work as a helpful framework for researchers conducting vocabulary acquisition through CALL-studies. The criteria treat vocabulary acquisition and discusses different influential aspects of it. For instance, to which degree the learner has comprehended and understood the lexical implications of the word. In addition, the degree of various functions and their influence on the results are also treated. Ma suggests that these criteria will assist researchers if they want to understand the impact of the digital assistance, as she states that it is of importance to see which kind of strategies a learner uses with the CALL-programs in order to understand the cognitive process that occurs. Likewise, Chapelle (2003) argues that the cognitive process and the usage of the CALL-features are essential to observe and evaluate for further understanding of the correlation between CALL and vocabulary gain.

2.2 Incidental and intentional learning

From the studies described, a mix of incidental and intentional learning has been the general approach when trying to learn and retain words. Krashen's theory promotes incidental learning, which basically means a learner picks up words from context, without any instruction or intention of learning specific words. This theory is often applied to reading assignments, so the reader will learn the words from the context in which they appear and thereby acquire word knowledge. Krashen's prominent acquisition theories are still present in the field of vocabulary gain, and in how learners are thought to pick up words. One, in particular, is the input hypothesis which states that it is through reading a text that contains some unfamiliar words that the learner will acquire words from context. Krashen states "your conscious focus is on the message, not the form" (1989, p. 440). Accordingly, there is research agreeing that this kind of learning strategy is feasible through a process which requires the unknown word in question to be repeated 10-20 times throughout the text to achieve successful vocabulary acquisition (Nation, 2013). Notably, Krashen (1989) is positive of using incidental learning as a method for acquisition and insists that extensive reading is enough for successful comprehension. There has been some agreement from Laufer

and Kimmel (1997), as they pointed out that it is when a lexical threshold is reached, that is when the learner has achieved around 3000-5000 word families in their vocabulary, that they can begin to learn words from context. Krashen's theories have been proven successful in research on different types of vocabulary learning, such as reading or exposure to oral language, without instruction (Saragai, Nation & Meister,1978; Yuksel & Tanriverdi, 2009). However, there are arguments against incidental learning being enough for effective vocabulary growth, and these arguments instead promote intentional learning.

Intentional learning, as it may be clear from the name, means that the learning process is intended. Instructions are often needed, and the learner intentionally acquires word knowledge. The Zone of Proximal Development, a concept by Vygotsky (1978) is still relevant in contemporary language learning. The concept implies that it is dependent on prior knowledge and necessary scaffolding if the learner is to achieve successful vocabulary acquisition. Laufer (2005) argues it is easy for learners to skip the unknown word and still understand (or misunderstand and hence acquire an incorrect understanding of the word) the meaning of the sentence. She continues to argue that this is why instruction is needed in order to assure vocabulary acquisition. Similarly, Elgort and Nation (2010) claim that a word does not only bear one meaning but several, as it can change function which can create misunderstanding when picking up words from one specific context and they continue by implying that instruction benefits learners' vocabulary extension. In addition, Laufer and Hulstijn, and Hulstijn and Laufer (2001, p. 14-15; 2001, p. 543-544) suggest that the learner should be involved in the progress. The learner needs to search for the definition of the unfamiliar word from e.g. a dictionary, and not only guess the meaning from context. Stahl, Koschmann, and Suthers (2006) state that the strategies put to use when discussing the definition and function of a word, creating a shared meaning of it and thus accomplishing "interactional achievement" (p. 8) make it understandable in a way that cannot be achieved when working individually. This type of collaborative work in a language learning setting is described as "a natural way of learning" by Koschmann (1996, p. 10).

Different aspects should, according to research, be factored in when conducting studies about vocabulary. For instance, Shaw and McMillion (2008, p. 159) mention that reading pace is one aspect to consider when trying to acquire vocabulary through reading as they discovered in a study of Swedish advanced EFL-students. Students with a smaller vocabulary and slower word identification needed an additional 25 percent more time than native speakers given the same text for sufficient comprehension. This was also the case in Li's study (2009) where students, although at a beginner level, asked for more time when reading a

printed text. Students did not go through the trouble of finding definitions in a dictionary as they were bothered by the inconvenience of constant disruption when looking up words. Also, they did not understand the explanations provided from the monolingual dictionaries due to lack of vocabulary, and therefore ended up inferring meaning without aids which resulted in incorrect guesses. These observations confirm that there is a vital connection between incidental learning and vocabulary knowledge if students are expected to make correct guesses when inferring meaning to unfamiliar items. Laufer (1989) stated that 95 percent comprehension of the text is enough to be able to guess from context, a number that was revised by Hsueh-Chao and Nation (2000), and other researchers who agreed on the new number (Schmitt, Jiang, & Grabe, 2011). Hsueh-Chao and Nation suggest that 98 percent understanding is necessary for the possibility to infer meaning through context and argue that, even though 98 percent is a high number, the task of inferring meaning remains challenging.

2.3 The Use of Dictionaries

Many researchers agree that using dictionaries has had positive effects on vocabulary growth (Laufer & Hill, 2000; Nation, 2001; Gu, 2003; Gass, 2013) but it may be unrealistic to expect students to bring a heavy dictionary to class and the definitions may not always provide a comprehensible explanation depending on the learners' proficiency level (Song & Fox, 2008, p. 291). Also, it has been reported that students may avoid using paper dictionaries as it interrupts their reading. In fact, Bogaards (2001) and Hulstijn (1993) showed that some L2 learners decide not to use the paper dictionary at all when meeting unfamiliar words in a text. One of the reasons reported by students was the subsequent disruption caused and the time involved when turning pages to find the word through the dictionary pages. Online dictionaries on computers may provide a good solution for this problem since the ease of using them may encourage the learner to look up words. In fact, the majority of the CALL-programs presented involve online dictionaries as a feature where words have a built-in tag if the user clicks on the word while reading. In this way, the user does not need to change pages or disrupt the reading as the definition or translation appears on the very same page. Locky (2007) questions materials created for native speakers when they are used for L2 learners and states that it is beyond the learners' proficiency level (if they are below the advanced level) to be able to comprehend the meaning and consequently, they cannot acquire the vocabulary. Therefore, there is a need to show learners using CALL what kind of strategies are efficient

and Loucky (2007) suggests electronic and online dictionaries to make reading less of a struggle and more enjoyable for the learners.

Hulstijn (1992, p. 122) believes that extensive reading is challenging for learners who are at the beginner level, regardless of age, and argue they are not sufficiently skilled in learning words from context and should use aids instead of inferring incorrect meanings. The use of dictionaries can be seen as suitable in these situations, both monolingual, showing translations or definitions in the target language, and bilingual dictionaries, providing the same information in one's L1. In agreement with Hulstijn, Coady (1997, p. 229) argues that it sets students up to for failure when they lack the necessary vocabulary to be able to pick up words from context. This can be problematic and complicated to take into consideration as a teacher of a foreign or second language, as it means that aids, such as dictionaries, need to be examined to fit the learners' proficiency level. It will be shown later in this review how some students, using a difficult bilingual dictionary, end up not bothering to engage any further in the learning process. Although, there have been some critique against using vocabulary lists, as some researchers believe that when students are not given the opportunity to infer meaning from context and instead use glossaries, successful retention is not achieved to the same degree (Koren, 1999; Rott, Williams & Cameron, 2002). Moreover, it is important to consider the proficiency level of the learner. A meta-analysis conducted by Swanborn and Glopper (1999) showed how other aspects factor in for long-term vocabulary retention when acquiring words from context, among other things the learners' proficiency level. Indeed, this aspect will be found evident in some of the presented studies in the next chapter when interpreting the results between learners at beginner level and those at the intermediate level. The studies accounted for show a homogeneity of participants in their proficiency-range since only one study found compared beginning and intermediate level. According to Knight (1994), beginning level students may not be able to guess from context in the same way as higher levels because of their lower vocabulary proficiency. They are more dependent on the connecting words and are therefore the group that benefits most when using dictionaries or glossaries, especially operated electronically as it offers further aids than a paper dictionary. Keller (1923) argued that vocabulary learning cannot be achieved through one strategy alone. She suggests that the use of dictionaries should be taken into consideration, as should strategies such as incidental learning: "blind groping thru text- vocabularies or the labyrinthian paths of dictionary translations will never give the student the right conception and the true value of fundamental ideas." (1923, p. 37). Furthermore, she argues that the

teacher is vital in the vocabulary learning environment, and the teacher needs to consider pedagogical aspects such as the student's weaknesses or strengths and work from that.

3 Results

In this section, the studies found for this review are presented. First, the studies using comparative methods are treated. The majority of the studies are chosen because they are consistent with the conventional method of using a comparative setting between CALL and traditional pen-on-paper environment (Li, 2009; 2010; Kilickaya & Krajka, 2010; Lin, Chan & Hsiao, 2011; Amirian & Heshmatifar, 2013; Lee, Lee & Lee; 2015). The aim is to see whether the use of CALL provides with higher vocabulary growth and better long-term retention. Next, studies that differ in method are presented, as they show an overview of how alternative research on CALL can be conducted (Raigón Rodríguez & Gómez Parra, 2005; Ma, 2008; Yuksel and Tanriverdi, 2009). These studies treat other areas than the former studies, such as application handiness, or audiovisual media in CALL.

Li (2009) conducted a study with the aim of finding out how strategies of vocabulary learning vary in an experimental setting using a CALL-environment, e-Lective, versus a control setting using traditional paper material. The participants were 24 Chinese ESL-students in Canada at beginning and low-intermediate level. They were to alternate between the two environments when reading ten fables by Aesop. The experimental condition used e-Lective, an online CALL-program which consists of different features, the most relevant ones for this review being a well-established monolingual dictionary with explanations, characteristics and synonyms, a bilingual dictionary, a database that saves the word searches which made it easier for the students to go back to these unknown words and to have their learning progress tracked, and a practice-oriented feature which could be adjusted to the students' proficiency level. The results from the post-tests showed that the experimental condition provided a higher increase in both vocabulary growth and retention than the control setting. A noteworthy occurrence was that the participants felt the time frame given was enough when conducting the procedure in e-Lective, whereas they asked for extended time in the paper condition (and were given additional time in order to complete the procedure). Even though they spent more time on task in the control setting than the experimental setting, the acquisition, and retention results were still more successful from using the CALL-program. The participants were more organized with their note-taking in the CALL-group. The unknown words were given detailed explanations, the learners realized some grammatical

differences (e.g. how a word can be used in different ways due to context), and thus making the word meaning coherent for themselves. It appeared as the students were more active and engaged in their learning process when interacting with the e-Lective program which the author considered one of the approaches required in order to achieve long-term vocabulary retention. The strategy identified when the students used the computer program was presented in two levels, 1) micro-level and 2) macro-level. The students started on the micro-level, by using the online dictionaries, which later led to their recognizing the word easier. After that, the students would reach macro-level, being able to infer the correct meaning of the words when not using dictionaries. They were also able to connect the words to different meanings, i.e. see how the lexical item functions in different contexts and could carry out a discussion using the word.

In 2010, Li carried out another study which aimed to see the difference in vocabulary growth and retention between different proficiency levels. The method was consistent with the former study, using an experimental and control setting which the participants were to alternate between when reading the ten fables. The participants, 20 Chinese ESL-students in Canada, were divided into groups according to their proficiency level (beginner and intermediate level). The CALL-program from the former study, e-Lective, was used and this study focused more on the effects of mono- and bilingual dictionaries than the other functions the program offered. However, the findings presented more surprising results than the former study. While both groups showed an increase in vocabulary growth and recognition when using CALL, hardly any retention was shown in the delayed post-test by the beginner group. Retention was better achieved in the paper condition for this group. In addition, the intermediate group improved further when using a monolingual dictionary in the CALL-program, in contrast with the beginner group, who gained more in vocabulary when using the bilingual dictionary. Li suggests some explanations for the results by the beginner group, among other things that they may not have established a sufficiently developed skills system, such as reading strategies and how to manage the word acquisition process in order to attain long-term retention, consequently resulting in insufficient vocabulary growth. She also found, when interpreting the participants' strategies throughout the procedure, that the beginning level students seemed confused when given a number of meanings to choose from in the CALL-dictionary. Ellis states that beginners prefer uncomplicated learning settings such as writing and repeating lists of words, while intermediate and advanced learners would rather work in a more challenging environment and thus learn faster by this (1994, p. 541). Accordingly, the researcher noted how the students in the beginner group felt that the

program was too complicated, were not active in the learning process when using e-Lective, in contrast to when they were in the traditional condition where they seemed more involved, committing to the task through thoroughly searching for word meaning and discussing it with their peers.

Another comparative study was made by Kilickaya and Krajka (2010) which aimed to see if vocabulary learning was more effective when using the CALL-program WordChamp, an online web-reader that offers the creation and usage of flashcards and reading online with glossaries showed. The study compared the digital environment with a control group using cognitive strategies (note-taking, cards, using a paper dictionary). The participants were 38 Turkish advanced level university students. The participants took part in a pre-test and then carried on with the assignment which was to read ten academic segments and perform an MCT consisting of five questions involving the target words. The experimental group achieved greater vocabulary gain than the control group in the immediate post-test, and this difference was maintained in retention in the delayed post- test. The authors believe that the mixture of vocabulary activities in the form of immediate word definition, note-taking and flashcards was what produced the outperforming results by the experimental group. The learners' use of the program improved progressively during the on-going procedure, and so they were more involved and active in their learning process. Accordingly, Liu (2005, p. 705) states that the more time spent on a CALL-program, the better the usage of it will be. Liu continues to argue that this leads to better results, and students will understand what functions and strategies are most useful for successful vocabulary growth. Liu believes that this will also lead to better reading skills as soon as they have learned how to use the program in a sufficient way.

Lin, Chan and Hsiao (2011) carried out a study to see whether vocabulary acquisition and retention improves when working collaboratively, and if so, if digital aids help improvement further. Three groups were created in which the participants were divided into, and the results of these three groups were compared. The groups were: 1) an independently-learning group without digital assistance, 2) a collaborative working group without digital assistance, and 3) a collaborative working group with digital assistance (computer). The study was in the form of one pre-test with the target words, followed by an immediate post-test, and after that a delayed post-test. The participants were 78 lower-intermediate 8th graders from Taiwan. The different groups got to work with the target words in different exercises, such as filling the gap, crosswords, separating the word from sentences. Group 1 had worksheets with different exercises, whereas group 2 discussed the exercises on the worksheets and the

possible answers with each other. The participants in group 3 were given computer-facilitated posts, such as searching for answers, finding visual aids, or writing the answers, making every participant active in the exercises. In their findings, the group who worked collaboratively with computers showed better long-term vocabulary acquisition. The immediate post-test showed that the group who worked independently without digital assistance had achieved the highest score while the collaborative group without computers got the lowest scores on both the immediate and delayed post-tests. The researchers believe that the study shows that learning vocabulary is an independent process if one wants to acquire a lot of words in a short span of time. However, the computer collaborative group performed the best in vocabulary retention. Though the researchers' purpose of the study was to see how vocabulary acquisition was connected to collaborative learning, they instead discovered that digital assistance promoted with long-term vocabulary acquisition and therefore suggested further research on collaborative and individual groups working with digital assistance, insisting that the collaborative factor is an important aspect to consider in the field of vocabulary learning. Conducting research within collaborative computer-environments has been seen as a vital and developing field by researchers, such as Koschmann (1996) who claims that the dialogue about lexical items that occurs between learners provides a certain effect cognitively that is not possible when working individually.

A study conducted in Iran was carried out by Amirian and Heshmatifar (2013). Their purpose was to investigate whether electronic or paper dictionaries provided better vocabulary growth and retention. This was done in a comparative study, with an experimental and a control group. The participants, 60 female low-intermediate students between 17-19 years old, were all native Persian speakers. They were asked to answer the pre-test, consisting of 40 lexical items, with a definition in Persian (5 out of the 40 words were excluded from the study as they were known to the students). The study carried on with a reading procedure, where participants familiar with the use of a computer were chosen for the experimental group, and those with no prior or not enough experience remained in the control group. The task was divided into five sessions, and every session focused on seven different target words because the researchers believed that this number equals the limit for successful retention in such a short period of time. In the procedure, the students were asked to read a text containing the 35 unfamiliar words and look them up in the dictionary. The electronic dictionary had visual and auditory aids, definitions and translation in L2, the display of words in different contexts, antonyms, crossword-games etc., and the control group was not offered any other aid than the traditional paper dictionary. The participants were not notified about either of the post-tests,

the first one being taken immediately after the last session and the delayed post-test was conducted two weeks after. The post-tests were in the form of an MCT consisting of 30 target words and appeared in a different order from the immediate and the delayed post-test. The experimental group using the electronic dictionaries outperformed the control group in both the immediate and the delayed post-tests. The researchers believe the reason for the results in the experimental group are due to the kind of strategies the learners are involved in when looking up words in the electronic dictionaries. Apart from having visual aids, which help with the association when learning a new word, using different kinds of approaches is thought to be helpful for vocabulary extension and retention (Chun & Plass, 1996, p. 187).

Lee, Lee, and Lee (2015) carried out a study, aimed to see the difference in vocabulary growth and retention when working with different aids: a CALL-dictionary, paper glossaries, or no aids at all. The 80 intermediate level participants were Korean undergraduates studying EFL. The researchers were thorough when selecting unfamiliar words as they originally chose 30 words in the pre-test. However, out of those 30 words, only 10 words were unknown to almost all students (they were not unfamiliar to 8 students). The different groups were given a text consisting of 893 words, 50 of which were replaced with low-frequency words (Nation, 2001). The experimental group using CALL-assistance read the text on the computer and were able to click on the unfamiliar lexical item, from which a small box would appear with the definition in the target language. The other experimental group, using paper glossaries, were asked to use their word lists when encountering unfamiliar words. Thereafter, students conducted an immediate post-test in the form of an MCT and after another two weeks, a vocabulary test (none of which were mentioned to the students beforehand). The participants using the CALL-dictionary gained more in vocabulary growth than the other two groups in the immediate post-test and showed retention of these words in the delayed post-test. Furthermore, the results also showed that the electronic dictionary group put in most cognitive effort in their process than the other groups, which may be one of the reasons for better retention scores. The researchers also note that these participants were experienced computer users, and, therefore, instructions were easy to follow.

Several contextual appearances are needed for a word to be acquired, according to Raigón Rodríguez and Gómez Parra (2005). They conducted a study aimed to see if vocabulary could be acquired through exercises when repeating the words and practicing them in contextualized manners. Their participants were 19 teacher-students at the upper-intermediate level, sharing Spanish as their native language. A software program online called Hot Potatoes was used. The program was set with templates of an MCT, crosswords, "fill the

gap" exercises etc., which the users can use to upload content such as texts, questions and answers, pictures, definitions, and so on (in this case study, the researchers managed the content). The words selected in the pre- and post-test were on the topic of assessment, as the authors believed it to be relevant for teacher students to have knowledge of these words. The pre-test was in the form of a list containing the target words and students were instructed to state if they knew the word, if they had heard of it, or if they did not know the meaning. The results showed that 56 percent of the words were known to the participants. The post-test showed that 86 percent of the words were known, thus a 30 percent increase. In short, 173 words were acquired by the 19 participants. After the conducted study, participants were asked to answer a questionnaire and almost all students reported that the use of a computer simplified the process of vocabulary learning. The program was reported as user-friendly by most participants. The authors stated that the exercises need to be contextualized if the students are to understand the full meaning of the word and for successful long-term retention. Also, as the participants were to-be-teachers, using words that are relevant for them to comprehend may be another reason for the vocabulary growth that occurred. The authors were aware that it is unconventional to not change the target words when the knowledge of them was as high as 56 percent in the pre-test. However, they still interpreted the results as successful.

In a study tracking learners' use of CALL for vocabulary growth, Ma (2008) investigated what functions learners prefer, and what functions are most likely to provide retention. The researcher believed that it is not only the acquisition and retention that is important to evaluate, but also in what way it occurs. The participants were 50 Chinese intermediate university students. As in the conventional studies, the pre-test contained vocabulary questions in order to see the students' former knowledge of the target words. The students were to use a CALL-program called "WUFUN", with different exercises which all included the targeted items from the pre-test. The numerous functions included a selection of reading passages, dictionaries, visual and auditory aids, and exercises which presented the items in different contexts. All the functions were not available at once: the students had to pass some exercises in able to "unlock" next function or exercise. The design of the program followed the "CALL efficacy model" (Ma, 2008, p. 111), which includes theory, the use of the computer, the way students use the computer program, and information about the student. The researcher used a tracking feature in the CALL-program to see which strategies were most popular to use, which strategies were often combined, and what kind of results each strategy seemed to give. In the results, it was shown that when unknown words appear in

different contexts and settings, retention is most likely to occur. Word memorization exercises were often used by the participants, but this did not provide any noteworthy results for retention. The author argues that if the learners know how to use the program and if the program is adaptable with a variety of features, it can offer the learner suitable functions. Thus, the program is useful, even to the learners at beginner level and those who are not familiar with CALL-programs. Ma found the four components from the "efficacy model" (2008, p. 111) necessary for the language program as they provide guidance for less proficient students of English. In addition, technological guidance is given for those not familiar with computers, and the means to track how different students prefer to use the program.

A study about possible vocabulary growth when using subtitles in movie clips was carried out by Yuksel and Tanriverdi (2009). The purpose of the study was to investigate whether movies with or without captions provided a higher increase in vocabulary growth. The participants were 104 Turkish university students at intermediate level. Before the procedure, they were given a Vocabulary Knowledge Scale (VKS), which measures what type of word knowledge a learner has, ranging from not knowing the word to knowing how to use it in a sentence (Wesche & Patribakht, 1996). The VKS consisted of 20 words (all nouns) that would be used in the episode. The procedure continued with watching half of an episode of the TV-show Seinfield, twice. Another VKS, consisting of 10 words, was given a month after the procedure. They found that both groups improved considerably which led to the conclusion that the captions do not necessarily provide vocabulary development, and that the results are in favor of incidental learning. The words chosen had made several contextual appearances in the episode, which the researchers believed to be important for successful vocabulary acquisition and retention. There have been positive reports for how this study has used CALL in a different way, for instance Yunus et al. (2013) who conducted interviews with teachers. Some teachers implied that various teaching tools for vocabulary growth that are motivating for students are necessary (for instance, movies). The teachers stated these tools, such as movies use for vocabulary growth, should be facilitated more often in schools since vocabulary proficiency is connected to reading. Furthermore, the interviewers relate these statements to the study by Yuksel and Tanriverdi (2009), implying that because the participants have achieved vocabulary growth and retention, they have increased their reading skills as well.

4 Discussion

There are three main factors to consider when evaluating these results, which are treated in the following sections after a brief summary of the main findings is given. In the first section, there will be a discussion about the use of dictionaries, as these have been a popular aid in many of the studies (Ma, 2008; Li, 2009; 2010; Kilickaya & Krajka, 2010; Amirian & Heshmatifar, 2013; Lee et al., 2015). The next section is about how user-friendly CALL-programs are and application handiness are treated, and how students' involvement is effected by this. Finally, the limitations and the reliability of the mentioned studies are discussed, as the successful results when using CALL have been consistent in the studies may create a halo effect.

      The main findings of this review have answered the questions if vocabulary growth and retention is more likely to occur using CALL rather than traditional classroom material. Overall, the studies have shown that using CALL has not only led to a higher increase in vocabulary growth, but retention was also sustained to a larger extent. These results can be due to the many functions the CALL-programs offer; visual aids, online dictionaries, practice sessions, etc. The online dictionaries have been particularly useful, as they are often embedded within the program so when a learner is reading a text, the translations will appear next to the text, or right over the unknown word when clicked on. They are offered to try different strategies in the programs, which have helped students engage more in their own learning process when using CALL. In addition, CALL-programs frequently develop, thus the need for research is constant.

4.1 The Use of Dictionaries

This overview of research has shown that the experimental groups using CALL-dictionaries outperform the non-CALL groups both in vocabulary growth and retention (e.g. Li, 2009; 2010; Kilickaya & Krajka, 2010; Amirian & Heshmatifar, 2013; Lee et al., 2015). The variety of different functions from the CALL-programs (such as visual aids, translations, dictionaries in L1 and/or L2) have provided better word recognition than paper dictionary. Students have been able to remember words through association, contextual appearances, or the use of dictionaries that appear on the same page, or next to the text in the CALL-program. As found in Li's study (2009), the students who first used dictionaries to understand unknown words were later able to infer meaning into other unknown items. The use of dictionaries is a

strategy that many researchers agree will improve vocabulary understanding. However, some aspects have been presented that do not make a paper dictionary as useful as expected. They interrupt the reading flow and may not give such a coherent or pedagogical explanation depending on the understanding of the learner. In addition, CALL has provided vocabulary growth in a broader sense, in contrast to paper dictionaries. No indications of interruptions of reading flow have been reported, as the translation/definition appeared in a pop-up over the lexical item when clicking on it, or on the same page, next to the text. Therefore, comprehension was achieved without the struggle and extra time needed (cf. Shaw & McMillion, 2008; Li, 2009), or without the students giving up because of the struggle and risk of inhibited motivation which may lead to the students not using the dictionary at all (Boogards, 2001; Hulstijn, 1993; Li, 2009).

It is advisable to consider if the dictionaries are in agreement with the students' proficiency level, so students do not give up because of too complicated definitions. This issue occurs, as stated earlier, when the bilingual dictionaries do not fit the student's proficiency level. As it was shown in Li's study (2010), if the dictionary is too complicated, students are not as involved as needed. The beginner level group were not able to sift out and examine the bilingual definitions provided and eventually did not bother to involve themselves in the process. It is important not to set students up for failure by providing too complicated aids for their proficiency, which end up not working as helpful aids at all. The successful results can be interpreted in that way since students, because of the variety of features, can try out the different strategies (such as word lists, definitions in either L1 or L2, translation, visual aids, exercises with the target item in contextual presentations etc.) and can get a better understanding of what kind of strategy suits them best. The most conductive way of understanding the function of the learner's vocabulary gain and retention in correlation to CALL is to observe and investigate the approaches used, in order to find successful learning strategies. Accordingly, Li (2009) detected two strategies that developed from each other when students used the CALL-program's dictionary feature: the students started off with getting the instant meaning of the words through the dictionary (intentional learning), which eventually developed to contextual guessing of unfamiliar words and being able to decode the meaning of unfamiliar lexical units (incidental learning). Furthermore, the outperforming results from the electronic dictionary-group in Lee et al. (2015) should be taken into consideration, as the authors note that the participants are experienced computer-users. The results could yield different results if the same study was conducted with beginner participants with little or no computer experience. There is a variety of dictionaries to choose

from, and nearly all dictionaries are constantly updated with definitions and words. Since the dictionaries constantly develop and change, the research within this field needs to keep updated with how these changes may effect vocabulary learning.

The function of a bilingual dictionary is applicable in the aforementioned studies as all participants share the same L1. These dictionaries are found useful when monolingual dictionaries are not able to provide comprehension, for instance, if the student does have enough knowledge to understand the explanation in English. However, the use of bilingual dictionaries may not be applicable in certain countries such as Sweden, as students do not always share the same L1. It is still possible that the majority will benefit from a bilingual aid. Thus it can provide an advantage to some more than others. Therefore, it may be advisable not to limit the CALL-program to one or two features, but instead include as many as feasible and necessary as possible so all students, regardless of proficiency level and disadvantages, have the opportunity to succeed. However, it may not be possible to adjust the monolingual dictionaries according to every students' L1. Students without a bilingual dictionary might therefore need guidance in finding what functions are most suitable for them, if it is not possible to offer a bilingual dictionary.

A question rises of the usefulness between monolingual dictionaries in comparison to bilingual dictionaries. Monolingual dictionaries provide more exposure to the target language than bilingual dictionaries. Since the studies above focus on specific target items in both the pre- and post- test, the actual acquisition in the form of an amount, not specific items, may be different than observed and examined. Learners may have acquired additional words from bilingual dictionaries that have gone unnoticed and it would, therefore, be interesting to see the usefulness between monolingual and bilingual dictionaries.

4.2 User-friendly CALL

CALL-tools need to be user-friendly. If learners do not have computer skills, or sufficient knowledge of how to use the program, it will no longer be helpful. This was the case from the mixed results of Li's study (2009). While many students showed a significant increase in involvement when using CALL, such as tidier definitions and notes of their own progress, some beginner students did not find the program helpful at all. These beginner students reported that the CALL-program was too complicated for them to operate, which decreased in involvement. Also, Li's results from 2010 showed a difference in results, where intermediate students showed more skills when using the computers whereas the beginning level

participants experienced the variety of all functions to be confusing, thus finding the traditional setting to be more of use. In contrast, Kilickaya and Krajka (2010) found the more time the participants spent on the program, the better they understood how to use it, which improved their strategies and with it, improving their vocabulary. Therefore, it is necessary to involve students in a thorough run-down of the program in order for them to learn the features for the best possible use of the CALL-tool.

According to researchers, the learners' process is important to track in order to understand what kind of strategies seems to be the most successful (Chapelle, 2003; Ma, 2007). Using different strategies may be positive, creating a stimulus and may increase motivation by e.g. alternating between different functions. In addition, it increases the students' involvement in the learning process. When doing so, long-term retention may, in fact, be possible, as it has shown successful results in the studies of this review. In the study by Amirian and Heshmatifar (2013), the authors believed the reasons for the good results by the experimental group were due to the learners' involvement in the process which is in accordance with the theory mentioned earlier about involvement in the learning process being needed in order to achieve successful vocabulary growth (Hulstijn & Laufer, 2001). Some CALL-programs used in the studies offered a tracking function, so students could see the previously searched words (Li, 2009; 2010; Ma, 2008). This involves the students in their own learning process. If there are unknown words in a text and the learner has searched for translation/visual aids/exercises on all ten words, it is unlikely that the learner will remember all ten unknown words. With a tracking feature, the learner is able to "go back" in the search history after successfully learning one word, and move on to the next word. In addition, the learner becomes attentive of how many words s/he has learnt.

It is important to note that the CALL-program itself cannot be too complicated so it consequently inhibits students' involvement. In addition, the teacher needs to have an adequate digital proficiency to be able to guide students through the program. The first session may not provide as successful a gain as we wish, but as students spend more time on the program, the results will develop in proportion. Also, as Ma (2007) argues, the vital aspect of the program is that it needs to be user-friendly. It is important to use or design a program that does not include too many complicated, and frankly unnecessary, features. Some of the programs presented offer the possibility of inserting and editing the program, which is necessary as students rarely find themselves on the same proficiency level as their peers. A teacher needs to take this into account, considering that in a real classroom with a group consisting of approximately 30 students may include some on a beginning level, others at the

intermediate and maybe even advanced. It seems advisable if learners are able to adjust the difficulty level of the CALL-program, or if teacher and student can do this together. In this way, the teacher will also be able to get a clearer picture of the difference in proficiency level among the students.

4.3 A Halo Effect?

The results of the studies are overall successful in terms of vocabulary growth and retention when using CALL, which may create the possibility of a halo effect. The studies may have shown different results if the participants had been younger/older, at another proficiency level, or if the studies were located in another country. However, additional studies on the different CALL-programs used (e.g. e-Lective, WordChamp) were not found, which would strengthen the validity of the programs' successful results and functionality. This can become problematic when these methods and results are interpreted for a classroom in Sweden. These procedures may not be applicable in Sweden for different reasons (for instance, the use of bilingual dictionaries as discussed above). Another limitation when interpreting the results of the studies is whether the vocabulary growth itself has been thoroughly examined. As previously mentioned, there are several implications of knowing a word (Nation, 2001; Laufer, 1991; Gass, 2013). The results found are not investigating the words acquired further than knowing the definition/translation. There are other implications of knowing a word, such as morphological or inflectional understanding. Because of this, it would be necessary to examine if morphological knowledge becomes acquired to some extent when conducting an empirical study.

In conclusion, this literature review has shown that CALL-tools have a great usefulness in the field of vocabulary growth and retention. Vocabulary learning limitations have been reduced with the help of online dictionaries, visual aids, and other helpful functions provided from the CALL-programs. Overall, the students using CALL have increased more in vocabulary growth and retention than those using traditional classroom material, such as paper dictionaries. The studies have indicated that students using CALL are generally more involved in their learning process. However, results have also shown that the proficiency level is an important aspect to consider when introducing CALL. The approaches to increase vocabulary growth in a computer-mediated environment have been many, ranging from contextual appearances to monolingual and bilingual online dictionaries. Offering a variety of functions has shown to be productive. However, teachers need to take into consideration what

proficiency level students are at and if limitations are needed. Some features may only be confusing to beginning level students and therefore become counter-productive, whereas intermediate or advanced students may take advantage of these. Using CALL does not eliminate the importance of the teacher's role. In contrast, the teacher is vital to this method. CALL offers the teacher a different approach of observing students, making it possible to understand their cognitive processes in the form of note-taking in the program or strategies chosen. Some CALL-programs, with their tracking functions, can help teachers understand their students' proficiency level. In this way, future classroom tasks have the possibility to be adjusted and individualized. Moreover, studies have failed to report if students have learned the words to a greater extent than translation and/or definition, such as morphological knowledge. Also, there were no studies found where CALL was used for vocabulary growth in Sweden. The participants from the studies in this review shared the same L1, so there is a need for this type of research, with participants who do not share the same L1. In short, incorporating CALL into classrooms helps students to begin to strengthen their vocabularies. Thus, there is language.

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