Technology in the English Language Classroom
– Computer-Assisted Grammar Learning

Teknologi i det engelskspråkiga klassrummet
– Datorstödd grammatikinlärning

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Sammanfattning Summary (in English)
As technology advances so does the availability of computer-assisted learning software. Since the Swedish curriculum and syllabus in the subject English do not state how teachers should teach grammar or what grammatical items they should focus on, it is left to the teachers to decide themselves. This thesis aims to investigate how one can make use of CALL, Computer-Assisted Language Learning, when teaching grammar in the English language classroom. The following three research questions are posed:

- In what ways is CALL used in teaching grammar?
- Are any of the different ways of using CALL more successful than others?
- What are the students’ reactions to using CALL as a means of learning grammar?

The questions are answered by analyzing the theoretical background of second language acquisition, as well as by analyzing ten articles about learning grammar with the help of modern technology. The findings show that there are more ways of using technology in a teaching environment than there are articles about it, and this thesis only covers a few of the different means of using CALL to teach grammar. The findings also show that the results of computer-assisted teaching and learning are overall positive, but it cannot be concluded whether this is because of the software or the novelty of using CALL. Some software shows better results than other, such as error correction software. The overall perceptions of using CALL in the classroom are overwhelmingly positive from both teachers’ and students’ perspective. Furthermore, the results show that the students believe that using technology to learn helps them more than it actually does, showing how it helps motivate students to acquire new knowledge by making it more interesting for them. All in all, the findings of the research give teachers an overview of the current progress of CALL, as well as giving them suggestions about how to incorporate technology in their own teaching.

Nyckelord Keywords
CALL, Computer-Assisted Language Learning, Grammar, SLA, Second Language Acquisition
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1. Introduction

For a teacher in a Swedish school, the syllabus is one of the most important documents related to the teaching profession. It states what teachers must teach to students at all the different levels, as well as stating that the teacher must adapt in order to facilitate students’ different learning needs. The syllabus is relatively clear on what aspects of the four skills the students must learn, for example how they must learn how to work with different sources and how to properly write texts. However, it does not specify what sort of grammar should be taught in the English language classroom. This means that what is taught and how it is taught in Sweden differs between regions, schools and different teachers. The reason for this is that everyone must make their own interpretation regarding the goals and aims of the courses.

In addition, the classroom has changed over the years and is now becoming more and more technological. As technology is becoming increasingly available, computer-assisted language learning is becoming progressively more common. From being reserved to specific persons and computers stationed in a specific place, it has moved into everyone’s home and laptops (Beatty 2010: 19ff). Ken Beatty defines CALL, Computer-Assisted Language Learning, as “any process in which a learner uses a computer and, as a result, improves his or her language” (ibid.: 7). This means that the field of CALL is a very broad field, which consists of several different categories that might not be related to one and another. Areas such as ASR, Automatic Speech Recognition, as well as spellcheckers coexist in this definition. Furthermore, it can involve different sorts of elements, such as designs, modes of instruction, technologies, or materials (ibid.: 8). Many of these areas are relevant to the educational field, in one way or another, and many are useful when teaching and learning grammar.

However, technology is not always positive when it comes to education, teaching and learning. Despite providing opportunities to practice and develop knowledge, John Hattie has found that not all areas of CALL are positive in regard to learning. Furthermore, those areas of CALL that show positive effects usually depend on other aspects as well, such as content, pedagogical methods and environmental factors (Hattie 2011: 42ff).
1.1 Aim and Research Questions

Since CALL focused on grammar is more commonly used now, it is under constant development. This is something that is relevant both to me and to my future colleagues. Therefore, the aim of this thesis is to examine how grammar is and can be taught in schools using CALL by studying previous research in the field of CALL. This thesis aims to investigate this by answering the following questions:

1. In what ways is CALL used in teaching grammar?
2. Are any of the different ways of using CALL more successful, in terms of learning as well as student perception, than others?
3. What are students’ reactions to using CALL as a means of learning grammar?

1.2 Outline

This thesis is divided into five main sections. The first section is the Introduction where the aim of the research, as well as the research questions, have been stated. The second section is Background, where the Swedish curriculum and what it says about grammar will be discussed, as well as how grammar is traditionally taught in the classroom. The last part of this section will be a general discussion about computer-assisted language learning, or CALL. After the Background section, the third section, Method, will be discussed. This section describes how the sources were gathered and analyzed, and it also highlights some of the difficulties and problems that occurred during this process. The fourth and most important section is the Research Review, where the sources will be discussed and analyzed in a systematic way. Lastly, the fifth section is the Discussion and Conclusions, where the findings are discussed and suggestions are made for future research. In addition, this final section discusses the implications of the findings for me as a future teacher.

2. Background

This chapter provides the background for the thesis. It will start with a general description of how grammar is discussed in the Swedish curriculum and syllabus for English 5, 6 and 7.
Finally, the last part of this chapter will deal with a general discussion about CALL – Computer-Assisted Language Learning and technology in the classroom.

2.1 The Swedish Curriculum and Syllabus

The Swedish curriculum and syllabus for English 5, 6 and 7 do not directly mention grammar as an explicit knowledge requirement. However, the syllabus does state that “[t]hrough teaching[.] students should also be given the opportunity to develop correctness in their use of language in speech and writing” (Skolverket 2011: 1). This could easily be interpreted as involving grammatical aspects as well as vocabulary, spelling, and pronunciation. Nevertheless, the fact that grammar is not explicitly mentioned sometimes causes it to be neglected in relation to those aspects that are mentioned specifically. In English 5 the grading criteria for the grade E state that:

In oral and written communications of various genres, students can express themselves in relatively varied ways, relatively clearly and relatively coherently. Students can express themselves with some fluency and to some extent adapted to purpose, recipient and situation.

Students work on and make improvements to their own communications (Skolverket 2011: 4).

Being able to communicate clearly and coherently in a varied way requires some grammatical knowledge since it is an important part of communicating in any sort of context. Indeed, entire sentences can change with grammar. Although students might learn how certain grammatical aspects are used, that does not necessarily mean that they know the grammatical rules connected to it. Since it is not stated that students need to learn grammatical rules and how to apply them, it means that they have a gap in their grammatical knowledge, even if it does not affect their performance when communicating.

However, even though grammar is not mentioned in the syllabus itself, it is, however briefly, mentioned in the commentary document associated with it. Here it is stated that a multifaceted communicative ability requires a certain degree of linguistic confidence, meaning “vocabulary, phraseology, pronunciation, prosody, spelling and grammar” (Skolverket ämneskommentarer: 3, my translation). This means that the teacher might not focus solely on grammar, but it is embedded in almost everything that is taught, both in written and oral form. However, as previously mentioned, the gap in their knowledge regarding grammatical rules show that communication as a whole tends to take precedence over grammatical knowledge.
In order to guide teachers, the Common European Framework of Reference for Languages, CEFR, establish knowledge requirement levels by which a speaker’s level of fluency and effectiveness is described. Additionally, they describe the complexity of grammar and identify certain aspects such as elements, categories, classes, structures, processes and relations (Skolverket 2009: 109f). These references have been created to enable learners and teachers of language to have a solid foundation on which to base their learning or teaching. According to the website of the Council of Europe, CEFR was “designed to provide a transparent, coherent and comprehensive basis for the elaboration of language syllabuses and curriculum guidelines, the design of teaching and learning materials, and the assessment of foreign language proficiency” (Council of Europe n.d.). This ensures that the countries using said framework are working towards the same goals. It also means that teachers of the English language have this framework to refer to when they are creating their teaching material and their tests, but how often this is the case is something to examine at a different time.

2.2 Technology in the Classroom

Digitalization is an ongoing change in modern society and thus also within education. In the commentary document connected to digitalization published by the Swedish National Agency of Education, it is clearly stated that “students who have completed primary school or have an equivalent education should have developed such digital competence that they can manage in life and as members of society” (Skolverket 2017: 4, my translation). This means that not only do Swedish schools encourage the use of technology, they enforce it through knowledge requirements. Even though the requirements regarding digital knowledge have been left out in the syllabus, terms such as digital technology, digital tools, and digital media can be interpreted as incorporating this (ibid.: 8). Not only is technology used to convey knowledge, it is also used as a preparation for students’ future work and social life (ibid.: 10). In addition, one of the knowledge objectives of the Swedish curriculum is that the student “can use books, library resources and modern technology as a tool in the search for knowledge, communication, creativity and learning” (Skolverket 2013: 9).

Recently, the Swedish Government issued a press release stating that digital learning should be incorporated in a different and more distinct way in the Swedish curriculum and syllabus. They are going to emphasize the use of digital materials as well as digital tools.
However, the syllabus for English is not being updated with this (Swedish Government Offices 2017, information material). In the assessment support materials regarding digital reading comprehension, it is said that about half of the Swedish upper secondary schools provide students with their own computer and it is becoming increasingly common. The schools which do not provide their students with a computer, tablet or some type of similar technology often offer free Wi-Fi, allowing students to connect their own devices. According to a study about students’ use of technology conducted by Skolverket in 2012, students usually use their devices to search for information, but that technology is rarely used during English classes (Skolverket Digital Läsning: 5). This might show that the reason for implementing such change is not that the media of technology has a positive effect on student knowledge, but that it is a necessary step in order to prepare students for a life in a technology-based world.

3. Method

This chapter will discuss the nature of the sources used in this literature review, how the gathering process proceeded, how they have been analyzed, and some of the problems that occurred during the search and the analysis of the sources.

3.1 Gathering Sources

I began my search for relevant literature by manually looking through the journals Language Learning & Technology and Computer Assisted Language Learning to find articles vaguely related to the aim of the thesis, and from that point narrowed it down by searching specifically for articles related to computer-assisted grammar learning using the term “grammar” in the journals’ own search engines.

Since the manual search in the journals only gave a few relevant results, I broadened the search by using Linköping University’s own library search engine. I began by using the advanced features to make sure that the search only focused on peer-reviewed articles and searched for “computer-assisted language learning”, which I then specified more by adding terms such as “grammar”, “teaching”, “English”, “EFL” and “ESL”. Since this generated a large number of results there was a need to narrow it down. Initially one of the search questions was “how does using CALL to learn written grammar and spoken grammar differ?”. Therefore, I also
added the search string “speech or spoken or speaking or ASR or oral” to be able to find results related to literature focusing on CALL limited to grammar in a communicative, spoken context. A similar procedure took place using Google Scholar as well as the database ERIC, Educational Resources Information Center, which focuses on literature related to education, pedagogy and psychology.

The ten articles used in this thesis mainly focus on students in high school, college or at the university. This was not a deliberate delimitation. However, it was a positive one since it is more relevant to my future profession. A limitation to only high school students did not provide enough material, which is why other levels of education have been used as well. The articles used in this thesis are mainly empirical studies using different methods: quasi-experimental, observational and mixed-method. There is also one conference paper. I chose to make use of that because it provided information not found in any of the other studies. In order to answer my research question, it was necessary to include articles that, at first glance, seem very different from each other. Even though they cover different areas of CALL, they work together to provide the information needed.

None of the articles used in this thesis are from Sweden or focused on Swedish students. Despite a thorough search, I was unable to find articles about CALL and grammar with a Swedish or Scandinavian perspective. Because of this, it is unclear whether the results would be different if implemented here, although it is doubtful that they would because the similarities are greater than the differences.

3.2 Analyzing Sources

The first thing that was done, before analyzing the sources, was summarizing them using a fixed template (see Appendix 1). While reading the articles certain pre-determined categories were filled in the template. The categories were the focus of the article, who the participants were, the data used in their analysis, the method used while researching, a short analysis of the article and useful terms. The template provided an overview of the important parts of the articles, and it made sorting them into different categories less time-consuming since all the information needed was gathered and summarized in one place.

After the articles had been read, they were sorted into different categories so as to enable systematic analysis. The first categorization that was made was sorting them into groups based
on the method they use. The categories used were “quasi-experimental”, “observational” and “mixed-method”, which are established categories defined by Alessandro G. Benati in *Key Methods in Second Language Acquisition* (2015). The articles that were placed in the category quasi-experimental were based on experiments that examined the students’ results at the beginning and then again at the end. One of the articles used a pre-test and a post-test to examine this, while the other tested the students several times throughout the experiment and analyzed the completed tasks at the end. The articles placed in the observational category focused on a specific aspect or program, which mainly entailed how a specific program worked, or how students reacted to this. The last category was mixed methods, and this category describes articles that used two or more ways of gathering data, such as questionnaires, experiments, interviews, or observations. This created three rather large groups, which called for further categorization. Therefore, different sub-categories were added to make it clear what the studies focused on.

Under the category “quasi-experimental” the two sub-categories “written grammar” and “grammar instructions” were added. “Written grammar” includes an article which focuses on grammar in a written form (Abu Naba’h 2012), and “grammar instructions” describes an article in which the effect of instructions about grammar using CALL is examined (Đorđević 2016). The category “mixed methods” was divided into the sub-categories “written grammar” (Bikowski & Vithanage 2016; Ebadi & Rahimi 2017; Li & Hegelheimer 2013; Wang & Smith 2013), just as under the previous category, and “spoken grammar”, in which the article examined a program which made use of ASR, Automatic Speech Recognition (Chiu, Liou & Yeh 2007). Lastly, the category “observational” was divided into the two sub-categories: “programs”, with articles examining specific programs (Harvey-Scholes 2017; Kwon, Öee, Kim & Lee 2015), and “students”, where the students’ opinions were examined (Lavolette, Polio & Kahng 2014). To create an overview, I made a mind map using the website Mindmup (see Appendix 2).

### 3.3 Problems

When I first started the search for literature for this thesis, the results were overwhelming. Even if the search string “computer assisted grammar learning” is very specific, it yielded results from many different areas of CALL. By adding “grammar” to the search the results were specifically
targeting the aim of this thesis, but it was still very hard to sort through all of the results. Because of that, the initial plan was to focus on articles that were situated in Sweden or any of the other Nordic countries. This was mainly because my future as a teacher will be in Sweden. The Nordic countries all have similar curricula and school systems. Unfortunately, this did not yield any viable results, since there were hardly any articles that dealt with CALL and grammar combined in said countries. Furthermore, doing general searches with the search string “computer assisted language learning” and “grammar”, generated a plethora of articles that were not related to English as a second language. Many of them were about learning Dutch grammar. This showed a need to specify which language the articles aimed to examine.

When dividing the articles into sub-categories the original plan was to look at the two categories “written grammar” and “spoken grammar”. However, it was soon evident that the majority of the results on spoken grammar focused on pronunciation or on learning a language which was not English. Instead of trying to find more articles which could be used in this research, a decision was made to change the focus of this thesis. Because of this, the research question “how does using CALL to learn written grammar and spoken grammar differ?” was removed.

Furthermore, another aspect that was problematic is how broad a field CALL is. It is not as simple as saying that it has something to do with computers, even though it has. The term CALL, Computer Assisted Language Learning, has so much more than just a single method. There are several different methods, several ways of using different materials and several different technologies (Beatty 2010: 8). It is also a relatively new linguistic area, which means that it is still finding its own space. Furthermore, technology is not a fixed variable. It is under constant development and therefore the focus of studies within the area can differ a lot over a short period of time (ibid.: 2ff). This can cause some studies to be outdated and irrelevant, which is cause for further caution when gathering sources.

4. Research Review

Answering the research questions requires a broader perspective, thus this chapter will discuss some of the traditional ways of teaching grammar, the benefits of using computers to learn
grammar and some different ways of using CALL. Furthermore, this will be put into context by analyzing the empirical studies gathered for this review.

4.1 Teaching Grammar

There are several things one must take into consideration when teaching grammar, such as how to instruct and how to create assignments. Some of them will be discussed in this section.

First and foremost, it is important to remember that not all knowledge is taught explicitly by a teacher. Implicit grammatical knowledge comes from all sorts of sources, not only from lessons and assignments. Having said that, explicit and implicit knowledge is equally important since explicit knowledge can help the student internalize already implicitly known structures (Hedge 2000: 150f) This means that making students aware of any mistakes or errors they make enables them to make use of what they already know when correcting them.

However, explicitly teaching grammar does not mean that the teacher must stand in front of the whole class and teach them during lessons. It can also mean that the teacher prepares explicit exercises which are planned in a way that makes the students see the structures themselves, through inductive learning. These sorts of exercises, where the students form their own rules, can help them in regard to their linguistic confidence and cognitive abilities (Hedge 2000: 151, 60ff). Furthermore, Hedge explains that it is important to put grammar in a context when teaching it. This can be done by using examples relevant to the students learning the new grammatical item. By doing so, it is easier to make it understandable and to raise awareness of the rules on how to use it (ibid.: 159). Martha C. Pennington agrees that grammar should be contextualized, as the speaker and the hearer together work towards a cognitive environment in which their knowledge can develop (2002: 93f).

Nowadays, it is becoming increasingly common that students work together to create their own knowledge. Pennington agrees with this, and she believes that an approach where the students learn by themselves, such as the communicative approach, might be more suitable. The teacher’s role in this approach is to provide the students with opportunities for using the grammatical item they intend (Pennington 2002: 78). This might be problematic to some extent, since many of the communication-based textbooks available in schools lack some material. This forces the teacher to create extra materials and exercises to ensure that the students are given the
opportunity to learn. The teacher must also incorporate these exercises into a syllabus that might not allow it because of time constraints, which causes further problems (Fotos 2002: 136).

Furthermore, another important part of learning grammar is to practice using it. This can be done in number of ways, but one of the most common ones is the PPP model, Presentation-Practice-Production, in which the students are presented with new information, after which they are allowed to practice it, and then finally they produce something using the new knowledge. One negative aspect of PPP is that there is no way to make sure that the students use the grammatical item which was intended to be used during the freer part of it (Hedge 2000: 165f). Therefore, controlled forms of practice have become more common, enabling the students to practice the grammatical item the teacher intended them to learn. One argument in favor of controlled practice is that the students can give each other feedback, and when doing so they are able to notice the structures previously discussed. It also enables them to see a bigger picture where they can focus on syntax, which leads to the growth of their implicit knowledge (ibid.: 167).

Teachers, especially teachers of English, often make use of textbooks when teaching grammar. Rod Ellis (2002) examined some of the textbooks available for teachers. Most of them provided some form of explaining or instruction, where the students were told about certain grammatical rules. After the instructional section they were given exercises, in which they were practicing controlled production. Finally, usually there was some form of communicative exercise which was supposedly created in order for the students to produce the grammatical item freely. What Ellis also noticed was that very few of the textbooks provided an opportunity for the students to explore and notice structures themselves, as they do in an inductive learning environment. He believes that students benefit from inductive learning as well as explicit teaching, which would make textbooks without exercises providing opportunities for both controlled production and inductive learning less effective (ibid.: 160f). However, Ellis only studied some of the textbooks, and it is not stated if they came from the same country. Therefore, it is difficult to decide whether this is relevant for a Swedish context. Also, in order to claim this as an absolute truth there must be several sources stating the same thing, thus giving cause for caution when deciding the effectiveness of certain exercises and books.

In regard to deciding what level of grammar suit the student’s level of knowledge, there are two major linguistic comparisons within the SLA field. The first is contrastive analysis,
where a comparison is made between the native language and the second language. The areas expected to cause difficulties would then be mapped, and these were the ones that were taught. This comparison was mostly used during the 1960s and 1970s, since there are some flaws to it. Areas that might seem to be difficult because the differences between the native and second language were big might not be difficult at all, and minor differences might be harder (Hedge 2000: 170). The second comparison is error analysis, where the teacher maps out the students’ difficulties and decides what to focus on based on that. This is a better way of ensuring that the level and content of grammar teaching is correct, but it is not always what is done in reality. Usually, courses and materials are pre-made following a structure where the simpler grammatical items are taught first, and more complex grammatical items follow. This is not always the best way, but it is the simplest in terms of implementation (ibid.: 170f). Contrastive analysis coincides with constructive grammar, where grammar can be seen as building blocks that each have a predetermined place. With constructive grammar one starts by learning simple grammatical items, the foundation, and then move on to more complex items as time goes on. The contrast also helps draw attention to differences and similarities between languages, which can be a help for students learning new grammar. It can work as a starting point from which new conclusions can be drawn by the students themselves (Pennington 2002: 92f, 95f).

4.2 Theories of Learning in Relation to CALL
There are several things one must take into consideration when teaching grammar, as there are many different theories of how students and children acquire a new language. Some of them will be discussed in this section. The first theory is the longest and most thorough section, despite the fact that it is outdated and criticized. The reason for this is that the other theories were developed as a reaction to it, and they made use of the different aspects of the theory in their own theory.

4.2.1 The Comprehensive Input Hypothesis
Research on SLA, Second-Language Acquisition, accommodates many different theories. Three of these theories will be discussed in this thesis, and the first is the comprehensive input hypothesis coined by Stephen D. Krashen in the late 1970’s. He claims that comprehensive input is the most important aspect of second language acquisition (Krashen 1982). Before this
hypothesis was created, the scientific field of language learning leaned towards a behavioristic point of view, in which learners acquire new language by imitating and repeating received input, but very little focus was on the input itself. Just as the tendency to follow the behavioristic model has changed, this focus shifted and was aimed towards the input itself instead of the learner (Gass & Selinker 2008: 305f).

Krashen’s concept of comprehensible input is “that bit of language that is heard/read and that is slightly ahead of a learner’s current state of grammatical knowledge” (Gass & Selinker 2008: 309). He claims that for acquisition to be possible the students must be challenged in regard to their perception, and that what they already know is of little use when it comes to learning new language. He also claims that speaking is not a contributing factor to language acquisition; it is a result of it. In addition, grammar comes automatically when the learner understands new input. Therefore, it is not necessary to explicitly teach grammar. Because of this, the teacher’s role is not to teach selected grammatical items. Instead, it is to provide the students with opportunities to receive a sufficient amount of appropriate input. This can be problematic, since the amount of input that is sufficient might differ between learners, and there is no knowing what appropriate input is or not (ibid.: 309f).

When Krashen speaks about language acquisition, he makes a distinction between acquiring and learning language. He calls this the Acquisition-Learning Distinction (Krashen 1982: 10). Some second language researchers claim that the first language is acquired by children, whereas the second language is learned. The reason for this differentiation is that they believe that the first language is acquired implicitly, and one does not think about rules or grammatical items. Instead, there is a feeling whether something is correct. Furthermore, they believe that learners of the second language must learn grammatical items and rules by explicit teaching. Krashen disagrees with this and claims that both first and second language are acquired to a certain degree. For example, error correction as a way of raising consciousness is not learning new rules. Instead it is making the learner make use of the implicit knowledge they have already acquired (ibid.: 10f).

In addition, another important aspect of Krashen’s input theory is his natural order hypothesis, in which he claims that everyone learns language in a predetermined sequence, and it does not matter whether explicit teaching, or even an educational environment, is involved or not (Krashen 1982: 12f; Hedge 2000: 172). The Natural Order Hypothesis was the result of a study
on morpheme acquisition order, and it is connected to acquired and not learned language. Studies made more recently have both found evidence for the existence of the natural order, as well as evidence showing it to be incorrect (Gass & Selinker 2008: 377ff). The only thing that can be concluded is that this hypothesis requires more research, and that the teacher should provide ample opportunities to practice and learn, making sure that these suit as many needs as possible.

*The Monitor Hypothesis* is the third part of the comprehensive input hypothesis, and it “implies that formal rules, or conscious learning, play only a limited role in second language performance” (Krashen 1982: 16). Monitoring is what happens when learners uses the language which was learned as their own output. There are three aspects that must be taken into consideration when monitoring one’s output: there must be enough time to monitor, there must be a focus on form, and the learner must know the grammatical rules. By making sure that all of the three conditions are fulfilled, the conscious monitor can be a way of learning new aspects of a language (ibid.: 16f).

The part of the comprehensive input hypothesis that can be seen as most relevant to the theory is *the Input Hypothesis*, in which Krashen explains how this theory claims that language is acquired. In short, it can be said that “we acquire by ‘going for meaning’ first, and as a result, we acquire structure” (Krashen 1982: 21). Since this is almost what the entire comprehensive input hypothesis is about, it is not necessary to delve into details at this point. However, not everyone agrees with the input hypothesis, which will be evident in the next section of this chapter.

Lastly, the final part of Krashen’s theory is *the Affective Filter Hypothesis*, which is said to explain how affective factors influence second language acquisition and its processes. There are three affective variables which must be fulfilled in order for language acquisition to be possible: the learner must show some form of motivation; the more self-confidence the learner has, the better the acquisition; and the lower the level of anxiety is shown by the learner, the better. The reason Krashen relates this to acquisition rather than learning is that they are usually factors in environments where the learner must make use of their implicit knowledge (Krashen 2008: 30f).

Since the comprehensive input hypothesis requires sufficient and appropriate input, it is necessary to make sure that the learner is subjected to different forms of input. This can be created through CALL, for example by using different texts, videos, animations and sound. The problem that can be seen with using CALL for this is that the level of difficulty can be harder for
a computer program to adjust, than it is for a teacher. However, it is not impossible since programs can offer clues or hints which are learner-prompted, it can ask the students to set their own level of difficulty or it can adapt the difficulty accordingly to the students’ errors or correct answers (Beatty 2010: 90f).

Although it is possible to heed the comprehensive input hypothesis when teaching, it can be considered outdated and is criticized by later researchers. Firstly, as previously mentioned Krashen made a clear distinction between learning and acquisition. Although he does state that acquisition and learning can be achieved by all ages and levels of knowledge, he still claims that there is a difference between them. This is something later researchers disagree with (Krashen 1982: 10). Secondly, Krashen does not specify the different levels of knowledge that the learners gain, so when he says that the input should be a level above what the learner already knows, it is difficult to know what that specific level entails. Thirdly, Krashen points out that a sufficient quantity of qualitative input is necessary for language acquisition, but he does not specify how much a sufficient quantity is. Neither does he specify if the quantity needed changes over time or stays the same throughout the learner’s life and level of knowledge. Lastly, the hypothesis claims that learners learn by understanding, but it fails to explain how the knowledge moves from understanding a grammatical item to using it in a context (Gass & Selinker 2008: 310). One might understand certain aspects, but without more context than what is provided through input it might prove difficult to learn it completely.

4.2.2 The Output Hypothesis
The second important theory of second language learning is the output hypothesis, which claims that the production of language is an important part of the process of learning a second language (Swain 2005: 471). The output hypothesis was created as a reaction to Krashen’s input hypothesis, which had dominated the 1980’s when it came to Second Language Acquisition theories. Merrill Swain (ibid.: 472f) describes how she, among others, realized the need to revise the dominant theory of the time. After observations conducted in Canada she found the dominant theory lacking since second language students who were immersed in input still did not prove to be as knowledgeable as they should be. Furthermore, she realized that they only received input, and they lacked proper output. The students who communicated more in the target language were found to have gained more knowledge. Thus, she coined the output hypothesis, but in the
beginning, it was called comprehensible output hypothesis. However, since the focus landed on comprehensible instead of output, this was later changed from the latter to make it clear that there was more than one process going on when learning a language (ibid.: 472f).

Susan M. Gass and Larry Selinker describe the process of *pushed output* that occurs when learners are struggling when making themselves comprehensible in a dialogue. By noticing the structures and grammatical items missing in their speech learners can make use of their implicit knowledge and therefore adapt their output (2008: 326f). This might suggest that it is a monological perspective, but this is not the case. Noticing means that the learner mainly needs his or her own output in a communicative context, and that “new knowledge has been created through a search of the learner’s own knowledge, there being no other source” (Swain 2005: 474). According to her, the dialogue between learners is significant in second language acquisition. Thus, Swain connects the importance of communication with the importance of the individual noticing structures within their own output, and thereby increasing knowledge (ibid.: 474ff).

The phenomenon *Hypothesis Testing Function*, according to which learners use their output as a way of testing their hypothesis about how something is said, is closely connected to pushed output. By responding to confirmation checks and clarification requests they gain new knowledge about how to properly use grammar and vocabulary. It is important that this takes place in a communicative context, since learners react to other’s responses during their communication (Swain 2005: 476). However, not all of a learner’s output is a way of testing hypotheses, and not all feedback leads to a correction of the incorrect output. One reason for this might be the level of acceptance within the classroom, as well as the overall environment and willingness to speak and maintain a dialogue between the learners (Gass & Selinker 2008: 434f).

However, it is important to note that output does not only have to be spoken in dialogue with others, even though it is common to use dialogues as a means of producing language. It can also be writing, speaking quietly to oneself and verbalizing. *The Metalinguistic (Reflective) Function* is the idea that reflecting on one’s own, or others’, output helps the learner gain cognitive behaviors necessary for producing language and gaining new knowledge. These reflections can be made alone or in collaboration with other learners. By speaking about language, one gains knowledge about language and how it can be produced (Swain 2005: 478f).
Regarding the output hypothesis in regard to CALL it is very similar to the input hypothesis. Computer software is able to mimic or create output opportunities for the learners. The output can be in the form of writing, speaking through the use of ASR (Automatic Speech Recognition) or through reflection of the learner’s output alone or in groups. However, it might be more difficult for a computer to know what to correct than it is for a teacher, since some learners might benefit from only correcting certain grammatical items at a time. These complex decisions are easier for a human to make. Furthermore, there are other aspects that a computer may never be able to outrrival humans in, such as adapting the teaching to subtle changes in a group dynamic. Nevertheless, there has been considerable progress in developing programs which offer communication between learners in both written and spoken form through which learners can gain approximately the same amount of knowledge as if communicating with someone face to face (Beatty 2010: 90ff).

4.2.3 The Interaction Hypothesis
In a combination between the comprehensive input hypothesis and the output hypothesis there is the Interaction Hypothesis. This theory claims that there are three important aspects of language acquisition: input, output, and feedback through interaction. One way in which learners benefit from interaction is by being able to question each other or ask for clarification during moments of hesitation or stops in the communication (Gass & Selinker 2008: 317). They give each other feedback and show that there might be something wrong with their utterance.

One way of raising consciousness is the form of feedback called recasts, which is a subtle and less direct form of feedback in which the incorrect sentence is reformulated by the other participant in the conversation, thus allowing the first learner to correct him or herself in a following utterance. Research on this phenomenon shows that it might not be as effective as other forms of feedback, since it might be too subtle for learners, or they might mimic what the other learner has said without truly understanding it. There is no way of knowing if the learner understood or just said it because the other seemed to think that was correct (Gass & Selinker 2008: 335).

An important term connected to feedback within the interaction hypothesis is negotiation of meaning. This means that learners work out the meaning together, by for example asking questions or rephrasing what they say (Beatty 2010: 86). By working together when
communicating the learners are able to make themselves understood, either by trying different structures, words or pronunciations. When they are correct they receive immediate reinforcement, which ensures that they acquire the correct knowledge. It can be said that they receive negative evidence, which therefore pushes the learner towards changing (Gass & Selinker 2008: 331). There has been research on negotiation of meaning which shows positive results for groups and individuals who received corrective feedback. However, it is not unanimous, and some grammatical items have better results than others (ibid.: 333f).

At first glance, negotiation of meaning might seem impossible to accomplish through the use of computers. However, this is not the case as computers might be even better than teachers at providing opportunities to negotiate meaning. By relying on other students to provide the necessary communication, many opportunities can be missed. A computer program might be able to prompt communication at important stages, thus ensuring that more opportunities are created. Software can be programmed to analyze the student’s progress and learning style, and therefore tailor the interactions according to the needs of that student (Beatty 2010: 87f).

4.3 Ways of Using CALL
There are many ways of incorporating CALL into teaching. This means that a short thesis such as this would not be able to describe all the different ways available in a fair way. However, this section will describe some of the different ways CALL is used today, mainly in relation to learning grammar. The examples given are taken from different sources, and most of them are speculations about the different ways of using CALL instead of already implemented methods and tasks.

4.3.1 Instructions/Explanations
At first glance, the instructional aspect of CALL might seem rather narrow, but this is not the case. Instructions do not only have to be written, there are other ways as well. Instructions tend to be interactive, such as when a teacher instructs in a classroom, but it is not necessary. For example, it can also be in the form of digitized audio or video.
Nowadays, with sites such as YouTube, the accessibility of streamed material has skyrocketed. The teaching material available on streaming sites can be about explanations, instructions and tips on how to gain knowledge about certain subjects and areas. Instructions can also come in the form of saved files, which can be read, watched or listened to after a quick download (Levy 2009: 774). Another example of instructional CALL is online courses, where the whole or part of a course takes place online, without the participants ever meeting face to face. Communication can take place through different forums or online classrooms where students and teachers can meet through video and voice conferences (Chapelle 2009: 630). These sorts of telecollaborations also provide the students with opportunities to extend their cultural knowledge since the participants can partake in education from different parts of the world (Kessler 2016: 191).

Additionally, another useful way of using CALL when reading is the use of software which offers an instant explanation or clarification (Chapelle 2005: 749). One example of this is the Amazon Kindle, both the eBook-reader as well as the application, where a word is explained, translated or put into context when the reader highlights it. This enables the learner to continue reading unhindered, which in turn keeps the flow going.

John Hattie is generally critical to the positive effects of CALL, but when it comes to interactive video methods the results of his study show mixed results, but they were overall positive. However, not all ways of implementing such methods are positive, and it is highly dependent on the teacher and material provided. This means that video instructions with more communicative and interactive possibilities are generally positive in regard to student performance and learning (Hattie 2011: 42).

4.3.2 Error Detection

When one thinks of error detection, the first thing that comes to mind is usually spellcheckers. However, there is a multitude of error detection software available, and spellcheckers are just one example. However, most of the spellcheckers available are not intended for use in an educational environment. They do not focus on improving the English of non-native learners, but instead they are intended to help native writers (Beatty 2010: 59f).

Error detection software is under constant improvement; not only is it getting better at detecting the actual errors, it is also becoming more intelligent in regard to the feedback it
provides. There are, for example, programs that create an error priority queue, which logs errors and provides ranked feedback if the same errors occur more than once. Furthermore, some software is able to categorize different errors and provide feedback and examples from the student’s own texts to make sure that they are viewed in their context (Levy 2009: 770). Error detection can also come in the form of automation, where the software mines authentic and relevant information to provide even more context, much like Google and Facebook do with their personalized advertisements. This can be used to provide more lexical feedback as well as to add diversity to the examples given (Kessler 2016: 193).

Moreover, another way of practicing by using programs is to make sure that learners notice different structures while writing. By highlighting structures in their own text, they become aware of rules and patterns which they might miss in a standard classroom with paper-based exercises unless the teacher is very attentive and plans consciousness-raising activities in advance. The learners could also receive feedback on any errors made while practicing writing the grammatical items intended (Chapelle 2005: 747).

Not only can software be used in the detection of errors, it can also enable teachers to make use of the learner’s peers by letting them work in collaboration. Through peer-editing and collaborative writing, errors can be noticed, thus promote learning. This creates a more meaningful exercise for the students, and it provides a more authentic experience. It useful for the students themselves, as well as being helpful in giving the teacher more opportunities to focus on teaching instead of correcting errors (Kessler 2016: 189). However, peer-editing and collaborative work is not something that is exclusive to CALL. This can be done without involvement of technology, but technology may provide a variation to the material and method, thus promoting student motivation.

4.3.3 Practice
The different software and websites dedicated to letting learners practice their grammar, vocabulary, reading, and the like are numerous. In addition, many of them focus on different aspects, have different sorts of exercises and work in different ways.

In the beginning of CALL, one of the most common and valuable forms of exercises available was grammar-oriented tutorial exercises, such as fill-in-the-gap exercises. This has changed throughout the years, and nowadays sentence-based grammar-oriented exercises in a
more communicative context are being created, for example exercises that focus on something other than grammar but still allow the students to practice the intended grammatical item. (Levy 2009: 770). Another way of practicing spoken grammar, or language in general, is using voice chats and video conferences. By speaking to other people, learners are able to make use of the interaction in their own learning. Furthermore, different chatbots that allow the students to have something close to a conversation are available online, such as Leslie on the website Linguo. These can respond both in spoken and written form, thus enabling learning through conversation (ibid.: 775f).

Using social media as a mediator is another way of communicating through CALL. Not only are there plenty of opportunities for conversational practice, there are also ample opportunities to comment, receive feedback, identify different constructions and practice reading in general. This sort of practice can also be done by using other forms of websites, such as Wikis, forums and chat-sites (Jones 2016: 290ff). Furthermore, online gaming, both in the form of MMOGs (Massively Multiplayer Online Games) and games created specifically with the purpose of learning language can be used to offer a variety of learning opportunities. With games, students are able to practice all four skills: Reading, Listening, Speaking and Writing. It also gives the learner an opportunity to interact outside of the usual learning environment and lets them communicate with people from all around the world. Although most games only provide the students with short written prompts there are games, such as riddle or puzzle solving games, that provide the students with more complex texts (Jones 2016: 293; Beatty 2010: 60f).

Students nowadays are used to communicating digitally, which is something that teachers can take advantage of in the classroom. Contextualizing their learning and using media the learner prefers increases their intrinsic motivation, which in turn benefits their learning. Furthermore, adapting the exercises to something they find relevant and interesting, such as fanfiction or blogs, can benefit them in the long run (Kessler 2016: 188f). However, it is important to note that not every researcher agrees with this. Hattie’s study shows that web-based learning and computer-assisted home tutoring are two of the least effective ways of teaching. However, it is not stated what sort of web-based learning he examined, which is cause for caution when taking this into consideration (Hattie 2011: 45f).
4.4 Empirical Studies
This section will discuss the findings of the 10 empirical studies used as sources for this literature review. They have been divided into quasi-experimental studies, mixed methods studies and lastly observational studies, and within these categories they have been divided into sub-categories. This was necessary because the different methods are used to answer different research questions.

4.4.1 Quasi-Experimental Studies
The following two studies are both quasi-experimental in the sense that they both examine a specific aspect of CALL by analyzing tests done by test groups, and they tested more than one group to strengthen their results. However, they do not examine the same aspect of CALL, but they are related in the fact that they both focus on its effectiveness.

4.4.1.1 Written Grammar
The only quasi-experimental article focusing on written grammar was written by Abdallah M. Abu Naba’h (2012), who examines how using CALL affects Jordanian secondary school students’ achievement scores when it comes to grammar. This was done because Jordanian students generally show a low level of proficiency even though English is taught over a relatively long period of time (ibid.: 72).

When conducting the experiment, 212 students from two different public schools in Jordan were divided into eight groups, four of which were experimental groups and four of which were control groups. Since the researcher was unable to compose the groups himself this study qualifies as a quasi-experimental study instead of an experimental study. During the experiment, all groups were taught the same grammatical item, the passive voice, which the experimental groups were taught using computers, and the control groups were taught without it. (Abu Naba’h 2012: 75f). The students’ results were measured via an achievement test, which was used as both a pre-test and a post-test. By doing this it was possible to examine the difference in effect between the traditional method and a method using computers (ibid.: 76).

The program that was used for the experiment was created specifically for this study, and it follows a specific path. First, it introduces the passive voice. Following that there are several
sections consisting of instructions and explanations for different aspects of the passive voice. When the students are done with that, they move on to the exercise and practice sections, and lastly, a section where they can test themselves. Throughout all the exercises, the students are given continuous feedback and answers to the questions. To ensure the validity of the program, it was examined by a group of specialists in designing curricula, and the method used in the control classes was approved by specialists in English language teaching. The teachers who taught the control classes were also provided with a guidebook, which gave detailed instructions and explanations (Abu Naba’h 2012: 77).

The findings of the experiment shows that the students in the experimental groups scored approximately the same in the pre-test, which shows that they come from a similar background where they had the same pre-knowledge. Moreover, the students in the experimental groups scored higher on the post-test than the students in the control groups. Abu Naba’h concludes that one possible explanation for the results could be that the novelty of using the computer caused the students in the experimental group to have higher motivation, which in turn caused them to be more active and attentive. Furthermore, the results also shows that students who were enrolled in a program with a scientific focus scored higher than students who were enrolled in a program with a literary focus. One reason for the difference between the two fields could be that the scientific program had a higher grade for admission (Abu Naba’h 2012: 81ff).

### 4.4.1.2 Grammar Instructions

The only quasi-experimental article covering the instructional aspect of grammar using computers is written by Jasmina P. Đorđević (2016). The aim of Đorđević’s article is to examine whether or not instructions given in a CALL environment are as effective as those given in a traditional environment.

To achieve greater validity, the experiment was conducted twice with different English Language Departments, and there were 25 participants both times. Those participants were all second-year university students with a similar educational background. The experiment did not have both an experimental group and a control group. Instead, the students had three 90-minute lessons. During these lessons, computer-assisted instructions and traditional instructions were given, and they were continuously tested for the results of those instructions (Đorđević 2016: 362f). All in all, the students’ results were tested ten times in different ways, such as a pre-test, in
student-produced presentations, in practice-sessions, in what they produced and finally in a post-test. (ibid.: 369).

Since it was important that the grammatical item being taught fit both the traditional way of teaching and the computer-assisted way, Đorđević based both on the PPP-model, Presentation-Practice-Production. The grammatical item which the lessons focused on was modal verbs, and the students received detailed instructions and explanations. They also did fill-in-the-gap exercises and crossword puzzles. The computer-assisted exercises and the traditional exercises were very similar, but those that were computer-assisted offered immediate and detailed feedback, whereas the traditional way required the teacher to be present for explanations and feedback (Đorđević 2016: 366ff).

The results clearly showed that the activities completed in a traditional setting yielded more mistakes than the activities completed with the use of computers. A more thorough examination of the sort of mistakes that the students made showed that they repeated the same mistakes in the traditional setting, whereas the mistakes were more varied in the experimental setting (Đorđević 2010: 370).

4.4.2 Observational Studies
The three observational studies analyzed in this thesis are very different. Two focus on specific programs, one focuses on written grammar and one on spoken grammar. The third article focuses on how students respond to the feedback given by similar programs, as well as whether instant feedback is more effective than delayed feedback.

4.4.2.1 Programs
There are two observational studies focusing on specific programs and their effectiveness in helping students correct their written texts. The first article, written by Calum Harvey-Scholes (2017), examines how many errors computer software can detect while using the so-called N-gram method.

The N-gram method looks at longer word strings as well as single words, as opposed to regular spellcheckers which only look at the individual word and not the context it is written within. This causes several errors to be missed, such as homonyms that are actual words, but wrong in the context they are written in. Therefore, software that analyzes unigrams (one word),
bigrams (two words), trigrams (three words), 4-grams (four words) and 5-grams (5 words) together in a string uses the N-gram method (Harvey-Scholes 2017: 3). For this study, Harvey-Scholes used a total of 90 student compositions which had a total of 1310 errors. The students were native Spanish speakers who attended an undergraduate program and who studied a general English course. There was no screening of the students who participated, which meant that anyone who wanted could participate in the tests (ibid.: 6).

The software analyzed the students’ texts and the errors in them were sorted according to the N-grams. The N-gram errors consisted of 21% unigrams, 45% bigrams, 9% trigrams and 4% 4- and 5-grams. There were 1310 errors in 13644 words, which shows that the majority of the errors were not unigrams, i.e. single word errors. 21% of the errors were not N-grams. The errors were verbs, false friends, determiners or errors that were missed completely (Harvey-Scholes 2017: 7f). The results of the study were that the N-gram method could be used to find 79% of the errors and if the N-gram method was used together with another method 93% of the errors were found (ibid.: 10f).

The second study in this category was written by Oh-Woog Kwon, Kiyoun Lee, Young-Kil Kim and Yunkeun Lee (2015). Their focus was to examine the computer program GenieTutor and its effectiveness. The main difference between this program and the program Harvey-Scholes examined is that GenieTutor focuses on spoken grammar, whereas the other focused on written grammar.

GenieTutor is specifically optimized for non-native English speech recognition, and it targets semantic and grammatical correctness. The program acts as an interactive roleplaying tutoring game, where the student chooses the topic and scenario. When the student speaks, the program responds with feedback on grammar and semantics after having analyzed it. This program has been coded to use ASR (Automatic Speech Recognition), and it is optimized both for native English and Korean English (Kwon et al. 2015: 331f). The feedback given to the student is divided into two main categories, and they receive feedback based on either passing or failing what they say. The program uses several different methods for analyzing the errors, such as a rule-based approach, a machine learning approach, an N-gram approach and an edit distance approach. During the discussion with the program, it gives the students turn-based feedback, and after it is done, it summarizes the session and focuses on task proficiency, grammar accuracy, syntactic complexity as well as vocabulary diversity (ibid.: 333).
To test GenieTutor’s effectiveness Kwon, Lee, Kim and Lee analyzed 3024 semantic utterances that focus more on meaning, and 858 grammatical utterances that focus on grammatical structures. The success rate of the pass or try again evaluation was 94.1%, and the semantic feedback had a success rate of 85.5%. Lastly, the grammatical evaluation had a success rate of 91.3%, and the recall was 45.1% (Kwon et al. 2015: 334). Overall, the findings of this study show that GenieTutor showed great promise as a way for students to practice their dialogues to be more comfortable speaking a foreign language. However, whether or not it useful as a tool for students to learn new aspects of a language remains to be looked at (ibid.: 335).

4.4.2.2 Students

The only observational study regarding computer-assisted feedback and students’ responses to it is written by Elizabeth Lavolette, Charlene Polio and Jimin Kahng (2015). Their aim for this study is to research how accurate the feedback given by the computer program Criterion was, and whether or not as well as how the students acted on the feedback they were given.

The participants in the study were students from five different classes at a U.S. university, and they were divided into two groups. They wrote an essay which they had to submit after 40 minutes. One group received immediate feedback, and the other group received delayed feedback after one to three weeks. After the students received their feedback they had 20 minutes to revise it before they resubmitted their essays. This was done twice, to ensure that the students were satisfied with their results (Lavolette et al. 2015: 56). Criterion, the program which was used to analyze the students’ essays, highlighted the errors that it found and provided feedback and explanations when the students clicked on the error. It did not, however, provide the students with the correct alternative for their sentence (ibid.: 55).

The results of this observational study were that Criterion was correct when it coded an error 75% of the time. 14% of the time it coded something as an error but gave the wrong feedback or explanation, and 11% of the time it falsely marked something as wrong even though it was correct. It was correct 85% of the time when the error was of a simpler nature, such as capitalization or wrong words, but it was only correct 50% of the time when the error was of a more advanced nature, such as run-on sentences and wrong articles (Lavolette et al. 2015: 59f). The second part of this study’s aim was to investigate how the students acted when they received their feedback. The results showed that “[t]he number of related changes that the students made
ranged from 16 to 96% with a mean of 73% and a standard deviation of 18%” (ibid.: 61). This means that a few students rarely reacted to the feedback provided. The students reacted to the errors which can be considered to be of a simpler nature, such as a missing comma, 50% of the time. They reacted to the more advanced errors, such as subject-verb agreement errors, 85% of the time (ibid.: 61). Furthermore, there was an insignificant difference between the students’ responses when they received immediate or delayed feedback (ibid.: 63). This contradicts many of the arguments in favor of CALL, since many focus on the availability of feedback. If the faster feedback is not what causes the increase in success in results and motivation, it might not be the medium of computers or the specific software that are better for the learners, but the novelty and simply variation of exercises that is the reason for it.

4.4.3 Mixed-Methods Studies
The five articles which are based on mixed-method studies all use more than one method to gain their results. Usually, they have one quantitative part where the students’ results are tested at some point during the experiment, and one qualitative part where the students’ thoughts can be analyzed. For example, the data for the qualitative part of the study can be gathered by questionnaires or interviews. The articles in this section will be divided into two main categories. The first is Written Grammar, with the two subcategories Collaborative writing/Peer-editing and MALL (Mobile-Assisted Language Learning), and the second category is Spoken Grammar.

4.4.3.1 Written Grammar
The mixed-method category with a focus on written grammar contains four articles, two of which examine collaborative writing. The other two focus on MALL, Mobile-Assisted Language Learning. Even though these are not CALL, they are closely related in terms of the technology and methods used, and the programs used in the experiments are compatible with computers as well as mobile phones.

4.4.3.1.1 Collaborative writing/Peer-editing
The two studies related to the group activities collaborative writing and peer-editing both focus on how group activities affect individual writing skills. They also examine the students’ perception of these sorts of activities.
The first of the four studies is written by Dawn Bikowski and Ramyadarshanie Vithanage (2016), and it focuses on the effect collaborative writing has on the individual’s writing development. The aim of the study is to first examine whether the students’ overall performance in individual writing improves with the help of collaborative writing, and secondly, they wish to examine the teachers’ and students’ opinions when it comes to individual writing versus collaborative writing (Bikowski & Vithanage 2016: 82).

The participants in this experiment were 59 non-native English speakers studying an undergraduate writing class. Half of these students were divided into two experimental groups, and half was a larger control group. All the students wrote five take-home exams which were written individually and then graded. Furthermore, the experimental group wrote four ungraded collaborative texts in-class in addition to the exams which all the students wrote. The control group wrote four ungraded texts in-class as well, but these were individually written (Bikowski & Vithanage 2016: 83). The participants were tested with a pre-test and a post-test to measure their learning, and Bikowski and Vithanage assigned the students different tests to ensure that the testing-effect was not a factor. They were tested on content, organization, grammar and academic style. Furthermore, information about the participants’ opinions was gathered through an online survey which was anonymous, where the students answered questions regarding their experience. They also held interviews with the teachers and carried out classroom observations (ibid.: 83f).

The results of the tests showed that the students in the experimental collaborative groups had scored lower on the post-test, but that the difference between the pre-test and post-test was greater in those groups, because the results of the experimental group’s pre-test were lower. (Bikowski & Vithanage 2016: 86). Furthermore, the surveys and interviews showed that the teachers as well as students enjoyed the collaborative writing tasks and recommended the technique to other students. They also felt that it helped them develop their writing skills, just as they saw the benefit of working as a group instead of individually (ibid.: 87f, 90f). This is rather contradictory, since the results do not show that it did help them. However, the students’ perceptions are important as well, since it affects their willingness and attentiveness in the long run. The results also indicated that it is more effective if the learner’s pre-knowledge is low, which is very interesting, especially if one considers how it would apply in Sweden, where the pre-knowledge is relatively high amongst high school and university students.
The second article was written by Saman Ebadi and Masoud Rahimi (2017), and it has a very similar focus as the previous article. This article looks specifically at Google docs, and how peer-editing affects the students’ writing skills. It also examined what the students’ attitudes were towards working with online peer-editing.

The participants of the study were two classes from Iran, where one of the classes was the experimental group and one was the control group. They all had equal educational background, were considered equally proficient in English and all the participants were male. The students’ improvement was measured with a pre-test, a post-test and a delayed post-test, and they also held semi-structured interviews to examine the students’ attitudes towards peer-editing using Google docs (Ebadi & Rahimi 2017: 793f). Firstly, the participants in the experimental group were instructed in how to peer-edit using Google docs, as well as how to write a proper academic text. Secondly, they shared a Google doc with their groups, and each participant was asked to comment on and edit the others’ texts (ibid.: 794). The control group did the exact same thing, but they did it face-to-face (ibid.: 796).

The results of the experiment showed that both groups had benefitted by peer-editing their work. However, the experimental group showed a much larger improvement than the control group (Ebadi & Rahimi 2017: 799f, 802f). What the article fails to mention is how the control group provided their peers with feedback. If the feedback was verbal and not written down, it is natural that some of the received feedback are forgotten or missed. Furthermore, the interviews showed that the students had preferred commenting on grammatical accuracy, even if they had commented on other aspects of the text as well. Also, they found the comments very useful for their development (ibid.: 803). They were generally very positive towards online peer-editing since they found that they had more time to focus on the editing. However, sometimes they ignored the other students’ comments because they believed that their first version was better than the suggestion. Despite that, the participants said that they would continue using online peer-editing in the future (ibid.: 805).

Both of these articles found that the students, as well as teachers, enjoyed collaborating while writing. They felt that it helped them gain a greater knowledge of grammar, as well as improve their overall writing skills. However, only the result of one of the studies agreed with the students’ own perceptions, since the difference between the experimental group and the
control group was minimal. In general, even the slightest improvement is positive, especially if the students find it enjoyable. This might lead to better learning in the long run.

4.4.3.1.2 MALL (Mobile-Assisted Language Learning)
There are two articles related to MALL, Mobile-Assisted Language Learning. These two can easily be converted into CALL since they are interchangeable in these two cases. Even though they are related in that they can both be used on mobile phones, their focus differs. One of them focuses on written grammar, and one on learning grammar through reading. Both involve different grammatical exercises, but only one of them made these exercises mandatory.

The first study discussed in this section focuses on written grammar, and it was written by Zhi Li and Volker Hegelheimer (2013). It researches mobile-assisted grammar exercises and the effects these have on the students’ self-editing when writing in their second language.

The participants in this study were an intact class of ESL (English as a Second Language) students, who were enrolled in a writing class. The study ran over the course of a whole semester, and they met three times a week for the lessons. Throughout the semester, the students were required to use a mobile phone application called Grammar Clinic, which they did when they were not in class. This application worked for computers as well, but they were instructed to mainly use their mobile phones. The exercises in the application focused on run-on and fragment sentences, verbs, articles and prepositions (Li & Hegelheimer 2013: 140).

Before starting the study, the students did a pre-test to establish the starting level of their grammatical knowledge. The 20 questions from the test were taken from a pilot version of Grammar Clinic, and they resembled the exercises in the finished application. During the course, the students wrote four major papers in the English writing class. The four papers had a different focus and therefore required different adaptions to their writing. However, even though the students wrote four papers only two were used in analyzing the results: the first and the last paper. Also, data from the first attempt at any Grammar Clinic exercise was saved for future analysis. Furthermore, the participants were asked to fill in an online questionnaire at the end of the course, to be able to understand what the students thought about using this form of application and what they thought about the program in general (Li & Hegelheimer 2013: 140f).

The result of the analyses showed that the participants had a slightly higher correction rate on the last paper than they did on the first paper. The difference was highest, 10%, on
correcting verbs, such as tense, subject-verb agreement and form. The grammatical item that had the least change in correction rate was word choice, which only received a 3% raise. However, it is important to notice that the overall number of errors was less on the fourth and final paper (Li & Hegelheimer 2013: 143, 145). In addition, when analyzing the pre-test and post-test the finding was that the participants had only slightly improved their overall knowledge. Out of 19 students, only 11 had improved their scores. 2 had received the same score on the post-test as they had on the pre-test, and 6 had scored lower on the post-test than they had scored on the pre-test. The conclusion that could be made from the results was that those who scored low on the pre-test improved the most, whereas those who scored high on the pre-test improved less or scored even lower (ibid.: 144). Regarding the participants’ own perceptions of Grammar Clinic, they were found to prefer practicing grammar on their phones as compared to on their computers. However, the results showed that the majority only used it because they had to, and they did not use it to practice when they were not obligated to do so. Despite this, the overall attitude towards the program was positive (ibid.: 145f).

The fourth and final mixed-method article regarding written grammar is aimed toward reading and learning grammar through mobile phones, written by Shudong Wang and Simon Smith (2013). This study makes use of the portability of mobile phones, even though they use emails which can be accessed from a computer as well.

The aim of this study, apart from examining what the students want to practice using their mobile phones, is whether or not they choose to use it instead of a computer if given the chance (Wang & Smith 2013: 119). This was examined by allowing 208 participants to receive material sent to them by email (ibid.: 122). The material the students received was different types of student-made texts, such as short texts suitable for a variety of people, jokes, and anecdotes. Alongside the texts, they received sound files to enable them to listen while they read to further enhance learning. They also received grammar instructions and quizzes to test their knowledge (ibid.: 120). To gather data the study used several instruments: interviews, online surveys and server log analysis. Unfortunately, the response rate for the questionnaires was very low, only 27%. In addition, they only interviewed four students, which is a very low number in comparison to the number of participants (ibid.: 123f).

The answers to the questionnaire indicated that 64% of the students who answered liked the material provided, and the remaining 36% showed neutrality. None of the answers indicated
that they disliked it. Furthermore, the data log analysis showed that the participants enjoyed student-made texts and exercises since the participation increased. The results also showed that the students preferred to read texts instead of practicing or answering quizzes (Wang & Smith 2013: 124f). Regarding the use of mobile phones in place of a computer, the majority, 73%, answered that they had used mobile phones to access the material (ibid.: 125). All in all, the participants were positive towards the use of mobile phones to improve their English. 71% of the students felt that they had learned something from the experiment, and the same number of students answered that they had read almost all of the material provided. However, the number of participants who made use of the quizzes was very low, indicating that they were more inclined to do simple tasks on their mobile phones (ibid.: 126f).

4.4.3.2 Spoken Grammar

There is one article focusing on spoken grammar in the mixed-method category, and it was written by Tsuo-Lin Chiu, Hsien-Chin Liou and Yuli Yeh (2007). Since students often have trouble speaking in front of others the authors saw the need for programs that allow students to practice their dialogues alone, without having to be nervous.

The study uses the program CandleTalk, which is a web-based program using ASR (Automatic Speech Recognition), designed specifically for students to practice their conversations. The technology today does not allow free conversations, so CandleTalk’s dialogues are guided and have a pre-patterned route. The students are given a few openings to make sure that the dialogue takes the right direction. Depending on how the student chooses to reply, the program’s reply differs (Chiu et al. 2007: 213f). The program analyzes word strings instead of single words or sentences, and the input has been adapted to suit Chinese speakers of English. Moreover, the students’ progress was tracked to enable individual evaluation and self-reflection (ibid.: 215).

The experimental part of the study had 49 participants, of which 29 were English majors. To evaluate the results of the tests the researchers used both speech tests as well as two questionnaires. By doing this, they could examine both the effectiveness of the program as well as the students’ perspective on using it. The students could practice at home as much as they wanted (Chiu et al. 2007: 218f). The results that were gathered were given points depending on how correct their speech was. For example, if their speech had many grammatical errors it
received a lower score. These scores were later compared to the pre-test to see the progression of the students (ibid.: 219f).

The results of the tests showed that the students showed a better knowledge of conversational dialogues after they had practiced using CandleTalk. They had improved in both comprehensibility and the use of different speech acts. However, the difference was lower on the comprehensibility part, showing that grammatical structures and the like improved less than how they talked (Chiu et al. 2007: 220f). In spite of this, the questionnaires showed that the students had an overall positive attitude towards the use of the program. They also found it very suitable for their needs regarding conversational practice but maybe not in regard to structure (ibid.: 226f).

5. Discussion and Conclusions

This chapter discusses and draws conclusions based on the findings of the research and empirical studies. It will address the three research questions in order of appearance, and it will end with a section with implications for teachers as well as opportunities for future research. This section also holds speculations about the bigger impact of technology on society, other than just teaching grammar.

5.1 Ways of Teaching Grammar

As previously concluded, there is a wide variety of ways of teaching grammar with the use of computers, and only a limited number have been covered in this thesis. Hedge (2000) concludes that an important aspect of learning grammar is to provide the students with plenty of opportunities to practice, as well as with a variety of exercises to suit different needs. Pennington (2002) develops that thought by highlighting the importance of contextualization as well as the communicative approach, where the students can develop their own knowledge. Fotos (2002) discusses the problems with traditional materials and the communicative approach, claiming that many of the available textbooks are lacking in communicative exercises. This is rather contradictory to Ellis’ (2002) findings, where he claims that many of the textbooks do have some form of communicative exercise available. However, one reason for this difference might be that Fotos looked for exercises solely related to the communicative approach, whereas Ellis had a
wider field to examine. If teachers took a step away from teacher-centered teaching and instead made use of modern technology, this would be less of a problem.

There are more ways of learning grammar by using computers than there are articles examined in this thesis, but they show exactly how wide the field of CALL really is. When it comes to giving the learners instructions for grammatical items or exercises, only three of the selected articles discuss this. Abu Naba’h (2012) conducted his experiment by creating software which began by giving the students instructions on how the grammatical item they were intended to learn worked, and then allowed them to practice said item. Similar to this, Wang and Smith (2013) provided their students with short instructions on specific items and later tested them with quizzes. However, only one of the articles focused on instructions the way Đorđević (2016) did. She compared face-to-face and computer-assisted instructions and based the experiments on the PPP-model. The results were positive in favor of the computer-assisted instructions, thus legitimizing the use of CALL. Even though most of the instructions can be connected to the comprehensive input theory, they can work with other theories as well, depending on how the instructions are given. For example, if they work in a more interactive way, in which they are responding to the student’s output.

Another way of using CALL in a teaching environment is by using software do detect errors. Harvey-Scholes (2017) looked at software that analyzed N-grams, which are strings of one to five words. This sort of software can find more errors than a regular spellchecker, since it is able to detect more of a context. Kwon, Lee, Kim and Lee (2015) focused on a different aspect of error detection, namely a program equipped with speech recognition called GenieTutor. This program provided feedback based on the student’s oral output, and it analyzed grammatical and syntactic structures as well as vocabulary and task proficiency. Lavolette, Polio and Kahng (2015) examined more traditional error detection software, which gave the students feedback and explanations of their written errors. They found that the software was correct most of the time when it found simple errors, but only 50% of the time when marking advanced errors. Depending on how the students receive feedback on their errors, error detection software can be argued to be connected to the output hypothesis as well as the interactive hypothesis. There are many ways of providing feedback, and as technology develops so does the software.

The majority of the examined articles provided the students with opportunities to practice in order to consolidate grammatical structures and items. Abu Naba’h (2012) used software
which had many important components to teach a specific grammatical item, starting with an introduction, instructions, practice and tests. Kwon et al. (2015) allowed the students to practice by speaking, something that they have in common with Chiu, Liou and Yeh (2007), who focused on allowing the students to get used to speaking English, rather than on how they spoke. It did analyze certain structures, but their software focused more on the dialogues than on grammar or pronunciation. Bikowski and Vithanage (2016) as well as Ebadi and Rahimi (2017) made use of tools for collaborate writing, such as Google Docs. They allowed the students to practice writing and giving each other feedback, which is another way of practicing and learning grammar. The articles written by Li and Hegelheimer (2013) as well as Wang and Smith (2013) made use of portable technology, mainly mobile phones. Li and Hegelheimer (2013) used an application which only had grammatical exercises and examined the effect this had on students’ performance. Wang and Smith (2013) provided the students with a variety of content, such as texts, sound clips, exercises, and quizzes.

The answer to the first of the research questions, “in what ways is CALL used in teaching grammar?”, is a complicated and lengthy question which this thesis will be unable to answer in full. What can be said is that since the field of CALL is as broad as it is, there is almost an uncountable number of ways to use CALL when teaching grammar. This thesis has covered a few of them, but there are of course more than these, as well as varieties of those covered. Furthermore, none of the examined articles examined how CALL is actually used in schools today, since most of them implemented their own experiments to conduct their research. This means that they did not show the reality of teaching, which can be considered as contradicting to the research question. Instead, to achieve an answer to the research question a study on already implemented usage of CALL should have been made. Therefore, a more suiting research question for the studies used in this thesis would be “in what ways could CALL be used in teaching grammar?”.

5.2 Success of CALL Applications

How one defines the success of certain applications varies and depends on what sort of result one wishes to achieve. If success is to answer the question “does CALL work?” the short answer would be yes, but it is more complicated than this.
Abu Naba’h (2012) wished to examine whether CALL could be used to enhance the students’ general knowledge of English, and the findings showed a better result in the experimental group than in the control group. However, he was uncertain whether the results were due to CALL itself, or whether the novelty of using computers caused higher motivation, thus only working short term. Đorđević (2016) examined the impact of computers when giving instructions, and found that computer-assisted instructions and feedback were more successful than traditional feedback, and based that on the fact that the experimental group received more detailed and faster feedback.

Harvey-Scholes (2017) found that error detection software focusing on word strings was successful overall, and if it was used in collaboration with another method such as a regular spellchecker it had a 93% success rate. One such spellchecker is Criterion, which Lavolette et al. (2015) used in their study. Criterion was correct 75% of the times it marked something as an error. They also examined how students reacted to the marked errors, and found that they reacted more often when the error was of a difficult nature. Kwon et al. (2015) also used error detection software, albeit a different kind of software. The oral error detection program GenieTutor showed a very high success rate, meaning that the program was correct, and the students responded positively to it.

As previously discussed, collaborative writing is another way of using CALL to learn grammar, and Bikowski and Vithanage (2016) as well as Ebadi and Rahimi (2017) examined the effectiveness of this. Bikowski and Vithanage (2016) found that there was some difference between the experimental and the control groups. However, the most important find of this study was that both students and teachers felt overwhelmingly positive towards working collaboratively, and believed that it had helped their development more than the results actually showed. Therefore, one could argue that it was successful in terms of the perceptions of working together, which in turn is a very important aspect as well since it promotes motivation. However, it is unclear if the results would have been the same after a longer period of time where students and teachers were used to working with technology.

The results of Ebadi and Rahimi’s (2017) article showed peer-editing overall was beneficial for the development of language, but it was greater when using computers. Nevertheless, it is not clear whether the difference was due to a lack of thoroughness when giving feedback verbally. It is unclear if the results would have been the same if they had
received their feedback written on paper. However, it also showed that the students were more inclined to focus on grammatical structures instead of general feedback. At the same time, they had a tendency to ignore certain feedback if they felt that it was incorrect. It might be because of the sort of personal distance software offer.

Li and Hegelheimer (2013) examined how exercises on mobile phones could enhance the students’ ability to spot grammatical errors, and they found that students were better at noticing their own errors after practicing using the application. However, it is important to note that their overall skill of writing increased, causing the number of errors to shrink. The use of the application might be the cause of this, thus increasing the success rate. Wang and Smith (2013) also used mobile phones but had a wider variety of opportunities to practice. They found that the majority of the students enjoyed the materials and that they found them useful. However, this study only looked at the students’ perceptions of this and not the results, thus only examining the success of the students’ motivation.

Lastly, Chiu et al. (2007) examined how CandleTalk could improve students’ conversational skills, and found that the program had less impact on the structure and grammar of the students’ speech than it had on their motivation and overall communicative skills. Several important phenomena can take place during conversations like those offered by this software, such as negotiation of meaning, recasts, hypothesis testing and so on. Depending on how one rates the success of this program, it can be considered a failure in terms of improving their grammatical knowledge. However, if one rates the success based on the improvement in their language skills, it can be considered to be higher.

To address the research question “are any of the different ways of using CALL more successful than others?”, one must decide what aspect of CALL to focus on. Both students’ and teachers’ perceptions of using CALL are overall positive, and therefore it can be considered very successful in the aspect of student and teacher motivation and perception. However, if one looks at how effective certain CALL elements are in regard to teaching grammar, the results differ more. Generally, software aimed towards detecting errors has proven to be more effective than software allowing the students to practice their conversational skills. Furthermore, grammatical exercises have shown better results than collaborative writing and peer-editing. At the same time, comparing these different types of software might prove difficult, if not unfair. Furthermore, the lack of studies conducted over a longer period of time is something to take into consideration. It
is very likely that the novelty of computers, technology, and software affected the students’ and teachers’ perception and motivation, thus causing a different and more positive result.

5.3 Student Reactions to CALL

Only a few of the studies used in this thesis investigated how the students perceived using computers while learning grammar, while the rest focused on how well it worked. One of the articles was written by Bikowski and Vithanage (2016), where they found that the students believed that computer-assisted learning had helped them more than it actually had. This was the case in several other studies as well, showing that CALL might not be as useful as previously believed. However, as a means of creating a variation to promote student motivation, it shows positive results. The students in Bikowski and Vithanage’s study had enjoyed working with this tool and felt that it was of great benefit to collaborate with other students. They also felt that it would help them in the long run, not just when writing that specific assignment. Although the results of the experiment showed that the increase in knowledge was less than the students believed that it was, it is positive in regard to student motivation. By engaging them in their own learning, they have a foundation on which further learning is made possible.

The second article showing the students perception of CALL showed what they thought about peer-editing. Ebadi and Rahimi (2017) found that the students appreciated the extra time they could spend thinking about the errors and how to give feedback to the other students. By making use of other students’ knowledge they could increase their own knowledge about grammatical items they had not known about in the past, as well as get tips and help to improve their general writing skills. Their study showed very little difference between the experimental group and the control group regarding results, but just as in the previous study the students’ motivation and own perceptions of using certain tools and completing certain assignments is of great importance when it comes to retaining sustainable knowledge.

Other software focusing more on specific grammatical exercises was examined by Li and Hegelheimer (2013) and the students in this study preferred using the software on their mobile phones rather than on a computer. They told the authors that they generally enjoyed these kinds of exercises. However, when asked how they used the program, the majority answered that they only used it during times when it was mandatory, such as when it was ordained as homework or when it was used during classes. They did not use it voluntarily in their spare time, which can be
seen as somewhat contradictory. This might be because it did not motivate them to learn, or that they simply had better things to do.

Wang and Smith (2013) offered the students more varied materials to learn grammar. Their whole experiment was on a voluntary basis, and no parts of it were made mandatory. This resulted in many students dropping out of the study or simply not answering the questionnaire, but those who did were generally positive towards using these different kinds of materials to increase their knowledge. However, certain materials were more popular than others, showing that some areas and exercises are more effective. The students seemed to favor “simpler” tasks, such as reading texts, instead of dedicated grammatical instructions and exercises. Therefore, implicit learning appears to be more popular than explicit learning. Despite this, the majority of the students were positive towards this kind of learning and felt that they had learned something from it.

Programs aimed towards conversations, such as CandleTalk, proved to be well-liked, according to Chiu et al. (2007). The students were found to have increased their conversational skills, but did not improve their grammatical structures as much. This correlates to the students’ perceptions of the program, where they felt that they became more comfortable in using English when in a conversation with someone, but not as much in regard to their comprehension. They did show a positive attitude towards it despite that, but this might be due to cultural differences. The study took place in China, and the Chinese culture is different than Western culture, especially regarding openness and how one communicates. Since this difference in openness and communication can cause the students to feel uncomfortable in situations where they must use a foreign language, this sort of program can offer them some gain in self-esteem. However, it is unclear whether it would be as positive when used in a different culture. Despite this, there are always positive aspects of it. For example, it offers opportunities to practice during times where collaborative and communicative work is hard, for example when the students practice alone at home.

The final research question was “what are the students’ reactions to using CALL as a means of learning grammar?”, and the short answer would be overwhelmingly positive. However, all of the experiments and studies in this thesis were done over a relatively short period of time, during a time where technology is still something relatively new. It is hard to distinguish between whether their positive attitude is because of the superiority of using a
computer-assisted approach, or whether it is mainly due to the novelty of using new technology or simply anything other than traditional materials when learning. It is also important to realize that not all studies examined the students’ perceptions, which means that it could be different for different aspects of CALL.

5.4 Implications and Future Research
Since the Swedish curriculum and syllabus fails to specify what sort of grammar should be taught, and how teachers are supposed to teach it, it leaves everything to the teacher or school to decide. This can be both a blessing and a curse, but mainly it allows the teacher to adapt the teaching to the needs of the class. One thing this thesis has shown is that it is important to keep a varied approach, and to remember that there is more than one correct way of teaching and learning grammar. This is where CALL fits in perfectly, since it can offer some variation to already established teaching practices. Not everyone might benefit by working with CALL, but it is a good way of adapting to the students’ needs.

The research has also shown that not all forms of technology are positive in terms of learning, despite us living in a technological society. By allowing the students to find their own motivation, and by providing them with opportunities to gain both implicit and explicit knowledge they are given a chance to learn the way that is best for them. Another important aspect to keep in mind is to offer them opportunities to collaborate, communicate and work with other learners. However, it is unclear if the collaboration needs to make use of CALL in order to be successful, but rather the collaboration and communication in itself. The study showed that novelty played a big part of student motivation and learning, which in turn speaks in favor of using different kinds of material and methods. This can promote learning in several ways, as well as help them gain internal motivation to keep learning.

Furthermore, there is also the question about how technology will affect teachers and students in the long run. The Swedish Government has already started to implement mandatory use of technology, and it is already hard to keep up with the new directions the development is taking. This can turn into a discussion on cost-efficiency. Will schools be able to keep up with the advances and trends that develop at a faster and faster pace? And if not, how will this affect students? Technology, once developed, is harder to adapt, whereas a teacher is able to change according to new findings and trends. There is also the question of how big part technology
should take in the classroom. Can a computer truly take the place of a human being? There is more to teaching than to teach, and it is not probable that a computer can do the same thing a teacher can in terms of sensibility, adaption to a broader spectrum or simply acting as a role model for the students.

This thesis shows that there is a need to keep researching in the field of CALL, mainly because it is a field in constant development. New areas and technology create new opportunities for teaching and learning. It also shows that there might be a need to narrow down the field to different sub-fields in order to create some form of coherent research. The studies used in this thesis, as well as many of the other articles within the field, are short-term studies. There are few long-term studies showing the results of continuous use of CALL in a teaching environment, showing a need to examine the effects of this as well. There is also a need to examine how CALL is used in reality, in order to gain useful information about how it really works in a non-controlled environment.

For me, this thesis has provided a solid foundation on which to write my second thesis. It will not be possible to conduct a long-term study, but there are several areas that would benefit from further study and would make for an interesting thesis.
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## Appendix 1

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