



GÖTEBORGS  
UNIVERSITET

# Reading comprehension

Digital versus paper based environments

Joakim Norman  
Ämneslärarprogrammet



Uppsats/Examensarbete: 15 hp  
Kurs: LGEN1G  
Nivå: Grundnivå  
Termin/år: HT/2015  
Handledare: Chloé Avril  
Examinator:  
Kod: Ht15-1160-008-LGEN1G

---

Key words: Reading comprehension, digital reading, upper secondary school

## **Abstract**

This article reviews the literature on teaching reading comprehension to second language learners in the upper secondary school. The aim of this review is to support L2 teachers in the Swedish upper secondary schools' higher education preparatory programs. This review examines if there are any differences in how reading comprehension should be taught when using paper based or digital material. The results are divided into three parts, reading comprehension in general, methodological concerns and reading comprehension in a digital environment. The similarities and differences between the models used in traditional and digital are compared and discussed. Finally, future research topics are suggested.

# Contents

- 1 Introduction.....2**
  - 1.1 A note on terminology.....4
  - 1.2 Content and structure of the review .....5
  
- 2 Results .....6**
  - 2.1 Reading comprehension .....6
  - 2.2 Digital comprehension .....8
  - 2.3 Methodological concerns ..... 11
  
- 3 Discussion .....13**
  - 3.1 Limitations.....15
  - 3.2 Suggestions for future studies .....16
  
- 4 Conclusion .....17**
  
- 5 Reference list .....18**

# 1 Introduction

One of the tasks given to the Swedish upper secondary school by the steering documents is to help students achieve knowledge and skills to prepare them for the future. An important part of this is building a foundation for lifelong learning (Skolverket, 2011). Six of the programs in the Swedish upper secondary school are called higher education preparatory programs.

Their aim is to help the students be well prepared for the demands of higher education. One of the requirements needed to graduate a higher educational preparatory program is a pass grade in both English 5 and 6. In a background study done in preparation for LGY11, the Swedish colleges and universities presented key areas they thought were important for the students to learn in the upper secondary school. Amongst the presented key areas were the ability to read longer texts in English and developing digital competences (Skolverket, 2011, p. 27).

Reading digital text is on the increase both in society at large as well as in schools because of the availability of digital resources as well as a heavy focus on computers in modern society (Chou, 2012). College students in particular also felt that, while they still used traditional books and paper notes, they were dependent on digital sources to get their work done (Nicholas, Rowlands, Clark, Huntington, Jamali, & Ollé, 2008). In light of this, it can be anticipated that students need to be competent in both types of information handling to manage the demands of college.

This review looks at the methods used in the teaching of reading comprehension and at whether these methods are or need to be adapted when applied to digital texts. The aim is to support teachers in the Swedish upper secondary schools' higher education preparatory programs who are facing an increasingly digital world for which they have to prepare their students.

Scholars have not been able to agree on a single definition of what reading comprehension actually is. One well established definition is presented in the NICHD (The National Institute of Child Health and Human Development): "Intentional thinking during which meaning is constructed through interactions between text and reader" (2000, p. 4-5). This definition fits well in with McKeown, Beck, & Blake (2011) who report that reading is not a passive process but the reader must be active and engaged in order to comprehend the text. They furthermore claim that it is important for the reader to know, and develop reading skills in order to interact efficiently with the text and have a successful comprehension. As with the definition itself, determining if a student has good reading comprehension or not is not an easy task. Hughes (2003) reasons that there are too many skills involved in reading and

reporting understanding of the text to know which skill is actually tested. While there seems to be a consensus around the necessity to teach reading strategies, how and what to teach is still controversial. McKeown et al. (2011) argue that the teaching of reading strategies can be divided into two different types, strategy instruction and content instruction. Strategy instruction focuses on mental processes and how to execute strategies while content instruction engages the student in the content of the text. Another way to divide strategies is explicit and implicit reading strategies. Explicit teaching is when a teacher explains both the concepts and how to apply them, implicit teaching is on the contrary when the students are helped to figure something out without being introduced to a concept (Mobalegh & Saljooghian, 2012). A final commonly used way of dividing them is to focus on how the text is interpreted by the learner is provided by Nassaji (2003). He divides them in to low level processing strategies, such as decoding print and encoding visual configurations, and high level processing strategies such as syntax, semantics, and discourse.

Another reason that it is hard to determine if a L2 user has good reading comprehension or not is because reading is not an isolated activity, it is typically divided into two main types of reading, namely intensive and extensive that require different skills (Hughes, 2003). As presented above, one of the most important skills in higher education is to be able to read and comprehend large amounts of text. As we will see below, comprehending and finding ones way around large amounts of text is increasingly important in a digital society especially for college students since a majority of academic texts can be accessed in digital versions (Vandenhoeck, 2013).

Liu (2005) claims that reading digital text is different enough from paper-based reading that literacy needs to be redefined in a digital society. The basis for this claim is that fragmented reading such as scanning, searching for key words and selective reading were found to be far more common when reading digital text than when reading on paper. This is also supported by Nicholas et al. (2008) who argue that it is normal for students to read just short parts of electronic texts and that this is one of the things that are found to be beneficial with digital texts. On the other hand, Nicholas et al. (2008) claim that digital books might reveal the reading pattern that always has been the norm with college students, namely scanning the text and reading parts of it. While the previous research does not imply that comprehension would be altered when reading digital texts instead of traditional, the extra dimensions that apply to digital text must be taught in some way.

The difference in how digital information is handled and dealt with gives the medium a number of advantages over traditional reading according to Liu (2005). Some of the

advantages are the direct access to information such as word-books and hyperlinks. Research done by both Lysenko & Abrami (2014) and Murray & McPherson (2006) found that the skills needed in order to engage digital texts were different from methods used on paper. Students reading digital texts had a disadvantage, partly because of an absence of specific pedagogy and partly because of a lack of IT skills in general. In a study examining screen reading habits among university students, Vandenhoeck (2013) reported that only fifty per cent of the participants knew how to annotate when reading digital texts. The same participants used multiple forms of annotation techniques on printed paper, so the concept itself was not foreign to them. Murray et al. (2006) found that students who received instructions on how to annotate and engage digital texts were more open to read them than those who had not received instructions. Furthermore, Chou (2012) claims that students are more likely to read digital texts in their L1 than in their L2. He concludes that teaching L2 students skills to help them with reading comprehension is extra important "if ESL students' L2 proficiency level increases, it is highly possible that they may be more willing to read on-screen materials" (Chou, 2012, p. 428). However, some research claims that Swedish students have a better comprehension when reading digital texts than paper based ones. The Swedish participants in the 2009 PISA study did not only perform better than the OECD average on the digital reading part, they also performed significantly better than on the paper based test (Frønes, Narvhus & Aasebø, 2013).

A reflection of the importance of reading comprehension in the L2 is found in the core content of the courses English 5 and English 6. They require that the teaching should cover techniques and strategies to search for relevant information in larger bodies of text (Skolverket, 2011). The Swedish colleges have good reason to want the students to be proficient readers. Reading proficiency was found by Chou (2012) to be highly correlated to successful academic studies. Furthermore, his study suggests that comprehending academic texts is harder and requires much more of the student than simply reading for pleasure. On top of this, L2 users also have to deal with "difficulties with processing information in a second language" (Cook, 2008, p. 124) when reading academic texts in the L2.

## 1.1 A note on terminology

Reading digital texts is always facilitated by some sort of digital device such as a computer, smart phone or tablet. Because of this, research on reading digital texts is mostly found under the heading of CALL (Computer Assisted Language Learning). However, the term CALL is problematic and has been much criticized during the past years for being too inclusive and

vague. Krashen & Jarvis (2014) claim that it is necessary to use another term than CALL since it is all too associated with early use of programs based on traditional language learning. The way in which digital devices are used today and how it enables users to use an L2 is clearly different from how it was when the term was invented. They instead favor the term MALU (Mobile Assisted Language Use) since it clarifies that more than language instruction is involved. The term MALU is also a more accurate representation of the devices that are used since most learning on digital devices happens on mobile ones. (Wu, Wu, Chen, Kao, Lin & Huang, 2012). Others, Burston (2014) amongst them, favor the term MALL (Mobile-Assisted Language Learning). Since there seems to be many conflicting abbreviations on the subject, variations of the term digital text are used when referring to interaction with text through a digital source such as a computer or a smartphone. The term "traditional" is used as a reference to paper based reading, annotating, book marking and note taking.

Another important term regularly used in this review is regarding the learner of a second language. Some different terms are used about the learner, mostly depending on the circumstance in which the language is taught. Second language (L2) is used in contrast to foreign language learner (FL) where the later means that the language in question is not meant to be used in the same country as the one where it is taught (Cook, 2008). A similar distinction can be made between second language user and second language learner. Both terms can be used regarding the same person and at the same time depending on the viewers' aspect. The term L2 is used in this article to represent both foreign- and second language since some of the reviewed papers use the terms interchangeably.

## 1.2 Content and structure of the review

This literature review examines experimental studies as well as literature reviews. Some of the studies are done with college students as participants. Apart from being relevant to the subject in this review, those studies are chosen because they represent what students actually know when they have finished upper secondary school. They are also chosen because they provide an insight into what is necessary to learn in upper secondary school. Studies that are done on another age group than college students are included when they are both relevant and when the age of the participants is not having a great impact on the results of the study.

The results are presented in three separate sections, the first is on how paper based reading comprehension can be taught. The second part is on research regarding digital reading and reading comprehension. Finally, in the third part some key elements of L2, reading comprehension and testing are examined.

## 2 Results

### 2.1 Reading comprehension

In a summary of research on instructed language learning, Ellis (2005) suggested several principles for L2 learning. Only those who cover reading comprehension will be mentioned here. His sixth principle claimed that extensive L2 input is necessary for successful instructed language learning. He suggests that there often are few extensive input opportunities outside the classroom for L2 students. This means that teachers must focus on two main points to ensure that students receive enough input: "maximiz[ing] use of the L2 inside the classroom" and "creat[ing] opportunities for students to receive input outside the classroom" (Ellis, 2005, p. 217-218). This is in his opinion best done by mostly speaking the L2 in the classroom and by providing the students with extensive reading programs. The seventh principle presented in the same article states that "successful instructed language learning also requires opportunities for output" (Ellis, 2005, p. 218).

Extensive reading is according to Yamashita (2008) often excluded from L2 teaching since it can be hard to see the the benefits after a short period of time. Furthermore, he warns about the fact that students develop different skills and abilities at different speeds. However, in a fifteen-week study on extensive reading, he tried to determine which skill it is that improves the quickest for L2 students: reading comprehension or linguistic ability such as vocabulary, spelling or morphosyntax. The participants in the study were thirty-eight Japanese first year college students who attended no other classes in English during this period. The instructions during the classes were held in the students' L1 to ensure that few other L2 influences helped the students develop their abilities. Furthermore, the participants reported that the total exposure to English, both in and outside school were almost non-existent. The class met once a week for ninety minutes and only read for forty-five of those. The other time in class was spent on administration and activities to maintain the students' motivation. Apart from the reading done in class, the students were also encouraged to read at home. No limit was given on how many or how few books they should or could read. In contrast to many other studies, the contents of the books were not discussed in class. Instead, the students had to write a book report in their L1 on each book. When the students read in class, the teacher would answer questions individually with the students. This meant that the participating students were not guided by or instructed in reading strategies on a predetermined level. The findings show that reading comprehension was the first of the tested abilities to improve and suggest that lower level abilities will follow (Yamashita, 2008).

An earlier experimental study by Lao & Krashen (2000) compared the difference in impact on L2 reading comprehension between two approaches to learning. The participants in the study were first year students enrolled in two different programs at Hong Kong Baptist University, a university that uses English as their teaching language. Most of the students had studied English as a subject in school for fifteen years prior to their university studies. The experimental group consisted of ninety-one students from six classes enrolled in a EFL (English as a Foreign Language) class. The experimental group read a total of six books, one every two weeks. Each book was then discussed at the end of the second week during class. The teacher also introduced reading strategies during these sessions and encouraged the students to read for pleasure. This contrasts this study against Yamashita (2008) who did not introduce any specific reading strategies in his study. The comparison group consisted of thirty-nine students enrolled in a class in development of traditional academic skills. Even though the class was held in English it was not a EFL class. The skills covered in the class were note taking from academic texts as well as while listening, organization of essays, editing and proof reading amongst many other skills. The experimental group was found to have a significant increase in reading speed as well as vocabulary growth after the study. These findings are somewhat in contrast to Yamashita (2008) who did not see an increased vocabulary. The differences in the findings between Lao & Krashen (2000) and Yamashita (2008) might originate from the exposure to spoken English. While Lao & Krashen (2000) exposed their participants to a lot of English, the participants in Yamashita (2008) were shielded from L2 exposure during the study. The comparison group in Lao & Krashen (2000) did make progress but significantly less so than the experimental group. These findings are in line with the principles presented later by Ellis (2005). The participants that increased most in reading comprehension were those who had most exposure to both text and instructions in the L2.

Engaging the problem, what it is that helps the development of reading comprehension best, McKeown et al. (2011) did a long term, two year, study where they compared two different types of reading instructions, namely strategy instruction and content instruction. They divided six classes, 119 fifth year students, into three groups: a control group, a content instruction group and a strategy instruction group. The groups were given the same type of lessons during the span of the study, all three approaches, reading instruction, strategy instruction and content instruction, used group reading with interruptions for questions and discussions. The lessons were scripted on when and where in the text the teacher should ask questions, insert discussion points and do other monitoring exercises to make sure that only

the given approach was used. The content groups' questions were about the text and where and when key events happened in the text. The questions were open ended and designed to draw attention to the most important ideas or events. The questions and discussions brought up in the strategy groups were summarizing, predicting, drawing inferences, question generation, and comprehension monitoring. The control group used the basic questions provided by the teachers' edition of the book. The results of the study followed the same pattern both years, no significant statistical differences were found between how effective the three methods were. However, the control group and the content instruction group performed better than the strategies instruction group throughout the study. McKeown et al. (2011) claim that the reason for the small difference was the stringent design with scripted lessons. They think that the difference in results from the methods would be greater without these limitations. They do however not think that strategy instruction is unnecessary, even if the content instruction group performed better. Instead, they infer that there still are too many unknown parts of how to teach the strategies to make any suggestions on which to use. Finally, they conclude that there are four major resources teachers should use in order to enhance students' reading comprehension regardless of which approach is used: supply students' with background information related to the context of the text, strengthen the students' vocabulary, and have the students answering questions related to the text, both alone while reading and in a group discussion after reading sessions.

## 2.2 Digital comprehension

Problematizing the use of digital devices in teaching, Stoop, Kreutzer & Kircz (2013) investigated what influences the efficiency of the reader and if it differs between traditional paper reading and digital. 196 college students were split into two groups, one using interactive software on computers and the other one using a traditional paper based learning system. Both groups read texts and had the ability to check their learning progress with rehearsal questions. After having read and rehearsed, the students did a test using the same platform as when they studied. Right after the tests were done thirty-one students were also questioned in group discussion to gain more insight into what might have influenced the outcome. Results show that the group that studied using computers scored significantly better on 75 per cent of the questions. Furthermore, the discussion revealed that the group that used computers preferred to read chunks of texts instead of long consecutive texts as the material was presented in the paper version. The texts were the same but the rehearsal questions were placed at the end of the chapter in the paper version. In the digital text they were placed on the

same page. Even though they were more successful, most students felt that it was too difficult to summarize and annotate on the computer. This led them to use scrap paper to take notes instead. Stoop et al. (2013) have some conclusions relevant to this behavior, firstly the students that used the digital approach more likely to use aids such as dictionaries and other interactive tools. Secondly, the more relevant interactions are provided between the text and rehearsal questions, the better the learning: "just packing together different technologies does not improve the learning experience" (Stoop et al. 2013, p. 380). Thirdly, it is important to educate the students on how to use the programs in order to get the optimal learning. This highlights possibility that the students who used computers might have performed even better if they had received training on how to annotate in the digital environment.

As presented in the introduction, digital devices are used more and more frequently in schools. The results from the 2009 PISA study show that most Swedish participants performed significantly better on the digital tests than on the paper based ones (Frønes et al. 2013). This indicates that most Swedish students are well equipped to use digital devices. In a literary review on the impact of digital devices in schools, Wu et al. (2012) showed results consistent with this. Almost ninety per cent of the reviewed studies found that there is a positive correlation between computers in schools and learning (Wu et al. 2012). In a study by Eden & Eshet-Alkalai (2013), ninety-three college students were had their reading comprehension assessed on both paper based reading as well as while reading digital text. Almost all the participants were experienced computer users and spent at least one hour in front of a computer each day. Their study found no significant difference between how well the participants performed either in reading digital text or on paper. Despite a lack of difference in overall comprehension when reading, when the participants read digital text they finished the tasks faster than when reading on paper (Eden & Eshet-Alkalai, 2013). On the other hand, in a qualitative interview study on five first year college students using their L2 in their education, Chou (2012) found that they both preferred and thought that they performed better when reading and annotating on paper.

This might indicate a shift in how technology impacts schools or it might just be that the needs of a college student are different and more demanding than the needs of younger students. In a literature review of the field of technology in L2 teaching, Golonka, Bowles, Frank, Richardson & Freynik (2012) analyzed 350 published articles. They found that only automatic speech recognition and chat had a positive impact on learning. However, the review excluded many of those systems and devices normally used such as computers and access to the internet. Despite this, it suggests that not all devices and programs can be seen as

beneficial to learning. This makes the conclusion by Macaro et al. (2011), that most technology programs are run top down and poorly integrated in schools even more important. It might be that many schools are equipped with digital devices that actually have a small impact on learning.

Traditional paper based extensive reading has good impact on several factors that improve reading comprehension in the participants. Successful methods favored by Ellis (2005) as well as Lao & Krashen (2000) and McKeown et al. (2011) are to engage the students in the text as well as providing them with reading strategies. This type of interactions is often referred to as the social aspect of learning (Chen & Chen, 2014). In a study that investigated this type of social learning in a digital environment, Chen & Chen (2014) researched how shared notes impact reading comprehension. The fifty-three participants were fifth grade L2 learners who were divided into two groups. The experimental group read texts, shared notes and annotations as well as discussed the text in a digital environment. The participants in the control group read the same texts but shared notes and annotations on paper and in person. Results show that the participants in the experimental group were more likely to collaborate and interact in discussions than the control group. They also were more likely to stay on subject while in discussions. The participants in the experimental group outperformed the control group in increased reading comprehension. The results were clear but not statistically significant. Even though reading comprehension did increase in both groups during the study, there were many other findings that Chen & Chen (2014) highlighted. One of these findings was that many participants in the experimental group responded that “the annotations contributed by other readers are very helpful to my learning” (Chen & Chen, 2014, p. 76). This was not the case for the control group that compared notes and helped each other in person. They also report that the experimental group used reading strategies significantly more often than the control group. Since the use of various reading strategies are usually connected with successful readers, Chen & Chen (2014) think that a long term study that monitors reading comprehension would show clearer result in favor of the experimental group. These findings are in contrast with Golonka et al (2012), who concluded that electronic tutoring and collaboration are not effective for L2 teaching. Chen & Chen (2014) do however note that the long term differences in impact on reading comprehension between paper and digital reading is yet to be determined.

In a similar study that used mobile devices to teach and test reading comprehension, Chang & Hsu (2011) tested how reading comprehension in L2 studies can be improved with the use of technology. Eighty-five college students did reading activities on PDAs in the

classroom while sharing notes and annotations within smaller groups. All participants were taught how to use the PDAs as well as how to annotate and take notes prior to the study. The program that was used in the experiment allowed for annotation of the text, instant translation and a way to share notes with other persons. A control group that only used the PDAs but did not collaborate in groups was also established. The experimental group that cooperated in small groups by sharing notes and annotations improved their reading comprehension significantly more than those who only used the PDAs. Furthermore, while not statistically significantly verifiable, groups containing three persons outperformed those consisting of four and five persons. In the same study Chang & Hsu (2011) also set out to find how well the participants responded to the digital environment. The findings presented show that the number of participants that found the system to be useful went from about 47 per cent to 67 when extra collaborative functions were added to the PDAs. This shows a similarity to how the participants in Chen & Chen (2014) felt about collaborating with digital devices.

## 2.3 Methodological concerns

As presented by McKeown et al. (2011), the familiarity with the conditions and contents of the text impacts on reading comprehension. In a study by Bråten, Ferguson, Anmarkrud, & Strømsø (2012), interference from topic knowledge was removed from the equation. This was done by screening the participants for knowledge of the subject prior to the study. By doing this, they could test how word recognition skills, strategic reading approach and reading motivation influenced reading comprehension. In their study, a group of students in secondary school in Norway read multiple texts with different views on the same topic. When they had finished the texts, they would then answer short essay questions. Even though all three, word recognition skills, strategic reading approach and reading motivation, had an impact on reading comprehension, word-recognition had more impact than the others. As an explanation for this, Bråten et al. (2012) claim that proficient word recognition makes more mental resources available to comprehend the text.

In light of the findings on the differences between how proficient learning happens in a digital setting versus a paper based one, some authors have expressed their concern that the tests do not measure the same thing (Rasmusson, 2014). In a study focusing on this issue, Rasmusson (2014) researched this by testing 215 Swedish students aged fourteen and fifteen. The participants did a reading comprehension test both on paper and on a computer. The participants retook the test again after six weeks, this time they used the other method than last time. Those who had done it on computers used paper and vice versa. About one half of

the students did the paper based test the first time and the computer based one the second time. The results were somewhat surprisingly found to be in favor of the paper based version and only a minor difference was found depending on in which order the tests were taken. The difference was consistent and independent from the length of the texts but not statistically significant. Rasmusson (2014) therefore claims that the same thing is tested regardless if a traditional method or a digital one is used.

Dealing with some of the same concerns but from another angle, Liu (2014) did a literature review on the differences in L1 and L2 reading and what types of implications the differences might have. In his review, Liu (2014) looks at four models of reading processes, the bottom-up, the top-down, the interactive and the interactive-compensatory model. In a summary of the four models he concludes that there is no clear indication that any model is more successful but all models have their merits. However, he claims that if the L2 user is both proficient in the language and has or is provided with enough background information on the topic of the text, there is no significant difference in how the text is comprehended from how a L1 user would. He further suggests that 100 per cent understanding of a text is an ideal not even feasible for most L1 users. This closes the gap between how much a L1 and L2 user comprehends from texts. One unanswered question raised in the review is that it seems like L2 users tend to use different strategies from when they use their L1. Liu (2014) does not investigate the impact of this in any depth.

### 3 Discussion

In this review I set out to summarize the research on effective ways to teach reading comprehension. I also tried to find if and in that case how the changes from traditional paper reading to reading digital texts might affect the pedagogical approach. This discussion is split in several sections: apart from dealing with the three parts mentioned in the results section I also discuss the ethics of the studies as well as the limitations found in this review.

In a summary of the major findings on what is important in teaching traditional, paper based, reading comprehension Lao & Krashen (2000), Yamashita (2008) and McKeown et al. (2011) give us some main areas to be focusing on extra carefully. The first is to actually take time to do extensive reading, this must be done simultaneously with teaching explicit reading strategies to the students. An example of how effective this combination can be is presented in the results by Lao & Krashen (2000). The participants in the study managed to make significant improvement in both reading speed and comprehension even with fifteen years of L2 studies prior to the study. When it comes to comprehending the text itself, Liu (2014) brings up an interesting topic. He claims that much of what determines if the reader comprehends the text or not comes from the understanding of the subject of the text. If provided with enough background information about what the text discusses, it is only the readers' linguistic proficiency that limits comprehension. The differences between what McKeown et al. (2011) and Lao & Krashen (2000) studied give us an interesting but worrisome problem. While Lao & Krashen (2000) found that it is important to teach reading strategies to improve reading comprehension, McKeown et al. (2011) found content strategies to be even more effective. There does not seem to be many researchers that are implementing this finding in their pedagogical research, instead most of them only focus on the importance of reading strategies.

The studies that bridge the gap between traditional paper-based teaching and its digital counterpart are Stoop et al. (2013) and Rasmusson (2014). Their findings suggest that it is the same mechanisms that are both governing what is learnt and respectively what is tested when using traditional paper based methods as well as digital. This seems to alleviate the fear that comparisons between digital and paper based reading comprehension lack reliability and validity.

The studies on how to teach reading comprehension with digital tools give us some different focus points. The main conclusion that can be drawn from the research on reading comprehension in a traditional and digital environment is that they are very much the same.

The big difference is not in the reading skills but it is instead both the method for applying those skills that differ and how easy it is to do some of them. Most of the research that investigates strategies to teach reading comprehension with digital tools such as Chen & Chen (2014) and Chang & Hsu (2011) does not seem to utilize the full potential of the benefits that the digital methods offer, however. This is surely to be able to keep both the validity and reliability high. However, this must surely limit the possible advances that the participants can achieve. This is also discussed by Stoop et al. (2013) who suggest that even students think that most digital texts are under-utilized. They think that too much text is treated as “books on screen” and do not use all the advantages that the digital devices offer. Stoop et al. (2013) therefore propose that in order to utilize the full potential of digital text it could be accompanied by hyperlinks, images, audio and video. This would however separate electronic texts from traditional ones even further. The use of images and other types of media in order to increase reading comprehension is already a problem we are dealing with in this study. Since one of the aims for this paper is regarding reading comprehension for future college students, reading supported by rich media is not of interest. This is because at the moment, course books, academic journals and other texts used in higher education rarely contain anything but text.

There are concerns with the ethics in two studies used in this review. In both cases, the participants were constricted in their education by participating in the studies. The control group in Chang & Hsu (2011) was told not to use the full capacity of the PDAs they were using. The same concern with limiting the participants’ education is found in Yamashita (2008). To be able to control the parameters they excluded spoken L2 from the classroom. This is in direct contrast with the principles presented by Ellis (2005) who states that the more students are exposed to the L2 the better.

One of the findings by Chang & Hsu (2011) and Chen & Chen (2014) indicates that reading, sharing notes and annotations in small groups, preferably three persons, are most beneficial for the development of reading comprehension. This type of sharing is not something that is unique to using digital technologies, it can also be achieved by traditional paper based methods. However, it should be much simpler for the teacher to administrate, monitor progress and give feedback when using digital technologies. This ease of use is discussed by Chen & Chen (2014) who found that the participants that shared notes digitally liked the method. On the other hand, those who shared notes face to face did not like it. This is also discussed by Wu et al. (2012) in regards to why collaboration is better appreciated in

digital format. They claim that one factor can be that the students appreciate the independence they feel when using digital devices.

Even though the extensive literature review by Golonka et al (2012) claimed that digital learning is not very successful, the studies by Frønes et al. (2013) as well as Chang & Hsu (2011) and Chen & Chen (2014) give us a different picture. One major theme in the presented articles is that those studies who showed a better result for the participants that used digital devices to read – Chang & Hsu (2011) and Chen & Chen (2014) – all took time prior to the study to teach the students how to use the programs and devices. This might be why the presented studies are in contrast to Golonka et al. (2012). If the participants are not familiar with how to use a program or device they likely have to overcome that obstacle first, then focus on learning. One of the potential problems with Golonka et al. (2012) that might be the reason for the opposite conclusions with those presented here are the surveyed studies. The speed in which new digital technologies are incorporated in society as well as in schools creates a need for updated research. One third of the studies reviewed by Golonka et al. (2012) were a decade old or older at the time of their review. The technology advances between 1993, when the oldest used study where published, and 2012 are so big that the results are almost incomparable. This problem with earlier studies is also discussed by Chang & Hsu (2011). They claim that many early studies suffered from bad technology and programs as well as a lack of support.

### 3.1 Limitations

There are three major limitations with this review. The first is that some of the articles presented here has participants in middle or secondary school. The second limitation is that some of the used articles are done on L1 speakers and not L2. Despite the mentioned limitations, the studies containing either limitation have been included and used in this review if a corresponding study involving either the right age group or L2 students could not be found. However, the study by Liu (2014) showed that the impact on comprehension between L1 and L2 readers does not have to be different. The third limitation is one mentioned earlier and discussed by Chang & Hsu (2011). The rate in which technology improves is really high. This has the implication that even really successful studies might use what has become obsolete technology when the study is published. Chang & Hsu (2011) is a perfect example of this. Their study used PDAs, a technological platform no longer in use only four years later. This problem is however something that cannot be avoided and much time has been spent on finding the latest relevant articles.

### 3.2 Suggestions for future studies

Future studies might continue the work on content strategies explored by McKeown et al. (2011). This might establish a foundation on how both content and reading strategies can be taught for a synergistic improvement of reading comprehension.

One of the research gaps identified in this review shows that future studies could focus on using the full potential that digital environments can provide. Stoop et al. (2013) discussed the potential impact on learning the integration of rich media into digital text could have. By doing this, research could show if rich media helps digital text improve reading comprehension more than traditional methods. As shown in this review, the current research does not show that either traditional or digital is better.

Other areas to explore are how students in the Swedish upper secondary school experience the teaching they receive on reading comprehension. If they are reading on digital devices, are they receiving training on how to use them? Also, how familiar are the students with reading strategies and do they know how to apply them to digital environments?

## **4 Conclusion**

The first thing to be learnt from this study is the importance of extensive reading for the development of reading comprehension. It is important no matter how much prior teaching in the L2 one has received. One theme can be said to sum up the results discussed in this paper. This overall theme is the need to supply information to the learner. When using new tools such as digital devices, it is important to teach the learner how to use them effectively. The same rule applies for giving the learner background information on the text and engaging them in the text using reading strategies. The same theme can be said to be valid when learners share notes and annotations. The only major difference between digital and paper based methods found here is that it seems to be more proficient to use some reading strategies in a digital environment.

## 5 Reference list

- Bråten, I., Ferguson, L. E., Anmarkrud, Ø., & Strømsø, H. I. (2012). Prediction of learning and comprehension when adolescents read multiple texts: the roles of word-level processing, strategic approach, and reading motivation. *Reading and Writing, 26*(3), 321-348.
- Burston, J. (2014). MALL: the pedagogical challenges. *Computer Assisted Language Learning, 27*(4), 344-357.
- Chang, C.-K., & Hsu, C.-K. (2011). A mobile-assisted synchronously collaborative translation–annotation system for English as a foreign language (EFL) reading comprehension. *Computer Assisted Language Learning, 24*(2), 155-180.
- Chen, C.-M., & Chen, F.-Y. (2014). Enhancing digital reading performance with a collaborative reading annotation system. *Computers & Education, 77*(C), 67-81.
- Chou, I-C. (2012). Understanding on-screen reading behaviors in academic contexts: a case study of five graduate English-as-a-second-language students. *Computer Assisted Language Learning, 25*(5), 411-433.
- Cook, V. (2008). *Second Language Learning and teaching*. London: Hodder Education.
- Ellis, R. (2005). Principles of instructed language learning. *System, 33*(2), 209–224.
- Frønes, T. S., Narvhus, E. K., & Aasebø, M. C. (2013). Nordic results from the PISA digital reading assessment. *Nordic Journal of Digital Literacy, 1-2*(8), 13-31.
- Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2012). Technologies for foreign language learning: a review of technology types and their effectiveness. *Computer Assisted Language Learning, 27*(1), 70-105.
- Huges, A. (2003). *Testing for language teachers*. Cambridge: Cambridge University Press.
- Yamashita, J. (2008). Extensive reading and development of different aspects of L2 proficiency. *System, 36*(4), 662-673.
- Krashen, S., & Jarvis, H. (2014). Is CALL Obsolete? *The Electronic Journal for English as a Second Language, 17*(4), 1–4.
- Lao, C. Y., & Krashen, S. (2000). The impact of popular literature study on literacy development in EFL: more evidence for the power of reading. *System, 28*(2), 261-270.
- Liu, S. (2014). L2 Reading Comprehension. *Journal of Language Teaching and Research, 5*(5), 1085-1091.
- Liu, Z. (2005). Reading behavior in the digital environment. *Journal of Documentation, 61*(6), 700-712.

- Lysenko, L. V., & Abrami, P. C. (2014). Promoting reading comprehension with the use of technology. *Computers & Education*, 75(C), 162-172.
- McKeown, M. G., Beck, I. L., & Blake, R. G. K. (2011). Rethinking Reading Comprehension Instruction: A Comparison of Instruction for Strategies and Content Approaches. *Reading Research Quarterly*, 44(3), 218-253.
- Mobalegh, A., & Saljooghian, M. (2012). The Effect of Teaching Reading Strategies Explicitly on Students' Understanding of Cohesion in Reading. *Journal of Language Teaching and Research*, 3(6), 1180-1185.
- Murray, D. E., & McPherson, P. (2006). Scaffolding instruction for reading the Web. *Language Teaching Research*, 10(2), 131-156.
- Nassaji, H. (2003). Higher-Level and Lower-Level Text Processing Skills in Advanced ESL Reading Comprehension. *The Modern Language Journal*, 87(2), 261-276.
- National Institute of Child Health and human Development NICHD. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence Based assessment of scientific research literature on reading and its implications for reading instruction*. Washington, DC: U:S. Government Printing Office.
- Nicholas, D., Rowlands, I., Clark, D., Huntington, P., Jamali, H. R., & Ollé, C. (2008). UK scholarly e-book usage: a landmark survey. *Aslib Proceedings*, 60(4), 311-334.
- Rasmusson, M. (2014). Reading Paper–Reading Screen. *Nordic Studies in Education*, 35, 3-19.
- Skolverket. (2011). *Läroplan, examensmål och gymnasiegemensamma ämnen för gymnasieskola 2011*. Retrieved 2015-10-02 from <http://www.skolverket.se/publikationer?id=2705>
- Stoop, J., Kreutzer, P., & G Kircz, J. (2013). Reading and learning from screens versus print: a study in changing habits. *New Library World*, 114(9/10), 371-383.
- Vandenhoeck, T. (2013). Screen reading habits among university students. *International Journal of Education and Development Using Information and Communication Technology*, 9(2), 37-47.
- Wu, W.-H., Wu, Y.-C. J., Chen, C.-Y., Kao, H.-Y., Lin, C.-H., & Huang, S.-H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers & Education*, 59(2), 817-827.