TOWARDS A MODEL: INVESTIGATING PREDICTORS OF ONLINE READING COMPREHENSION

A Dissertation

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Doctor of Philosophy

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by

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Executive Summary

Dr. Michael McKenna, Advisor

The complexities associated with new literacies make it difficult to determine the skills required to be literate in the 21st century. New literacies are the consequence of digital technologies (the Internet and other Information and Communication Technologies) that shape and re-shape the definition of literacy (Leu, Kinzer, Coiro, & Cammack, 2004). These literacies, unlike print-based traditional texts of the 20th century, are dynamic, multifaceted, and structurally unpredictable texts that can be introduced in new texts formats, and can provide both new purposes for reading and new ways to interact with information (International Reading Association, 2007). Thus, to comprehend the new literacies, students must develop and employ skills to navigate the Internet and other ICTs that not only change daily, but also change the ways in which students read, write, communicate, and learn new information (see Leu et al., 2007). In consequence, it is difficult to conceptualize what it means to be literate, and to ascertain the skills that reinforce reading and discourse.

The purpose of this study was to a) examine the extent to which cognitive factors (decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) contribute to online reading comprehension outcomes, and b) investigate the role of skills related to the Internet and ICTs in online reading comprehension outcomes. Results from a series of hierarchical regression models revealed that online reading

comprehension (ORC) was best explained by linguistic comprehension and prior knowledge among a group of 269 sixth-grade Dutch students. Vocabulary, nonverbal intelligence, and decoding did not explain any additional variance beyond that which was explained by linguistic comprehension and prior knowledge. Additionally, a moderation analysis revealed that skills related to the Internet and ICTs did not moderate the relationship among linguistic comprehension, prior knowledge, and online reading comprehension.

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APPROVAL OF THE DISSERTATION

This dissertation, ("Towards A Model: Investigating Predictors of Online Reading Comprehension"), has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dedication

In honor of Mr. Fred China, Sr., & Mrs. Genetha M. China

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The complexities associated with new literacies make it difficult to determine the skills required to be literate in the 21st century. New literacies are the consequence of digital technologies (the Internet and other Information and Communication Technologies) that shape and re-shape the definition of literacy (Leu, Kinzer, Coiro, & Cammack, 2004). These literacies, unlike print-based traditional texts of the 20th century, are dynamic, multifaceted, and structurally unpredictable texts that can be introduced in new texts formats, and can provide both new purposes for reading and new ways to interact with information (International Reading Association, 2007). Thus, to comprehend the new literacies, students must develop and employ skills to navigate the Internet and other ICTs that not only change daily, but also change the ways in which students read, write, communicate, and learn new information (see Leu et al., 2007). In consequence, it is difficult to conceptualize what it means to be literate, and to ascertain the skills that reinforce reading and discourse.

Prior to the evolution of the new literacies, the National Assessment of Adult Literacy (NAAL) defined literacy as skills-based and tasks-based (Kutner, Greenberg, & Baer, 2005). Basic reading skills range from word recognition to drawing appropriate inferences about continuous print-based texts (e.g., newspaper articles). Those skills support tasks such as searching, comprehending, using information from continuous print-based texts and non-continuous print-based texts (e.g., maps, job applications), and identifying and performing computations embedded in printed materials (e.g., balancing a checkbook). However, this skills- and tasks-based theory, though sufficient for comprehending traditional print-based texts, is considered insufficient for comprehending online texts (Coiro & Dobler, 2007). According to the new literacies theory of online reading comprehension, beyond the skills required to comprehend traditional texts, online texts demand that readers employ five unique competencies: 1) identifying important questions, 2) locating information, 3) analyzing information, 4) synthesizing information, and 5) communicating information (see Leu, Kinzer, Coiro, Castek, & Henry, 2013).

There can be no doubt that reading in digital settings requires skills that lack clear print analogues. Following a series of links, for example, or using a browser are unique to the Internet. Such skills have been catalogued and investigated with care (see the ORCA studies of Donald Leu and his colleagues). What is less well understood is whether competencies important in print settings (competencies such as those proposed by the NAAL for traditional texts) are important to the same extent in digital environments (see Coiro, 2011). That is, do the skills that underlie the comprehension of print texts contribute in the same manner to comprehension in online environments? For example, is the role of prior knowledge equally important in both print and digital settings, given the affordances offered by the Internet, such as quick access to definitions and background sites? Although it is common to assume that these competencies contribute in the same manner, it is just an assumption. I argue that important questions remain to be explored if we are to understand the competencies needed for online comprehension and that these questions involve more than the obvious new skills of the new literacies.

Statement of the Problem

A well-established line of research grounds our understanding of the developmental processes of reading (e.g., Chen & Vellutino, 1997; Dreyer & Katz, 1992; Gough & Tunmer, 1989; Hoover & Gough, 1990). These insights have provided guidance for research (e.g., Catts, Hogan, & Adolf, 2005,), theory (e.g., Vellutino, Tunmer, Jaccard, & Chen, 2007), and practice (e.g., Vaughn et al., 2007), but they may not be applicable to new literacies, or they may be applicable in different ways. That is to say, much of what is known about the developmental process of reading is based on traditional, print-based texts that are fixed, stable, and linear (McKenna, 2002). Given what we know about the composition of digital texts, traditional definitions and theories, and the research findings they have occasioned may be insufficient when considering the complex processes required for online reading comprehension (see Leu, Kinzer, Coiro, & Cammack, 2008).

Purpose of the Study

The purpose of this dissertation is to: a) examine cognitive factors (decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) that contribute to online reading comprehension outcomes, and b) investigate the role of skills related to the Internet and ICTs in online reading comprehension outcomes. I anticipate that findings from this study will inform: a) instruction, b) the current theory of online reading comprehension, and c) future research related to online reading comprehension outcomes for adolescent readers. I seek to answer the following questions:

1. To what extent do cognitive processes such as decoding, linguistic comprehension, vocabulary, prior knowledge, and nonverbal reasoning predict online reading comprehension outcomes?
2. To what extent do Internet skills moderate the relationship between predictors of online reading and online reading comprehension?

Significance of the Study

The use of the Internet and ICTs is obviously becoming more prevalent. In a study conducted by Statistics Netherlands (2014), findings revealed that the number of Dutch people who access the Internet daily increased by 28% between 2005 and 2014. This increase mirrored increases in users reading online newspapers and magazines, listening to the radio, watching television, shopping, and banking online. But an especially notable finding was that the Dutch acquired more of their information through online sources (newspapers, magazines, radio, and television) in 2014 than they did in 2005. This is not atypical. Similar patterns of knowledge acquisition can be found in other developed nations (see Miller and McKenna, 2016). The upward trend of acquiring knowledge online underscores the importance of understanding the competencies required and how they can best be instilled.

In a survey conducted by the Pew Research Center (2014), the number of Americans who attributed their knowledge acquisition (i.e., problem solving, and inquiry about a specific topic) to the Internet increased by 29% between 2007 and 2014. In fact, most Americans considered the Internet a primary source for learning new information. In addition, results of the survey revealed that Americans were not only seeking information online, but also sharing their knowledge in one or more online media formats

(Pew Research, 2014). Given these findings, it is logical to conclude that ICTs and the Internet are reshaping reading and discourse. As a consequence, the definitions and theories of reading and discourse may also require reshaping.

However, it is still not clear what it means to be literate in the 21^{st} century. There is evidence to suggest that the demands of online texts (which will be discussed in a later section) require additional, unique skills beyond those required to read and understand traditional print-based texts (e.g., Leu et al., 2013). On the other hand, as more research attention focuses on the new literacies, there is also evidence to suggest that there may be different relationships between traditional reading skills and online reading comprehension than originally purported (Coiro, 2011). Researchers have given little consideration to the ways in which competencies central to print comprehension influence online reading comprehension. Moreover, the available evidence for online reading comprehension varies. As a result, it is difficult to disentangle the new literacies theory of online reading comprehension, and, ultimately, to inform research, theory, and practice. Therefore, it is essential to establish a model that can be tested in replication studies.

Much of research focused on expanding the theory of online reading comprehension is qualitative in nature, and, thus, difficult to replicate (e.g., Afflerbach & Cho, 2008; Coiro & Dobler, 2006). There are, however, two quantitative studies (e.g., Coiro, 2011; Leu et al., 2005) that contribute to what we know about new literacies of online reading comprehension. However, the results from those studies are contradictory (see Leu et al., 2005; see also Coiro, 2011). Without clear definitions of the online reading processes and without theories of the new literacies of online reading comprehension, it will be difficult to understand the skills required to extract and construct meaning from online texts. Given the increasing number of people that are accessing information on the Internet and through ICTs, it is important to understand whether, and to what extent traditional theories and research apply to online reading comprehension outcomes. Therefore, in this study, I aim to investigate the relationship between predictors of offline reading comprehension and online reading comprehension outcomes.

Key Term

I have provided a definition of *online reading comprehension* for the reader. Unless otherwise noted, the definition is the premise for which I will view online reading comprehension, and, therefore, should be applied by the reader accordingly.

Online Reading Comprehension: Comprehension that occurs as a result of inquiry about a specific topic (Leu et al., 2007). Thus, meaning construction occurs as a result of: a) gathering relevant information from online texts, b) identifying relationships among concepts related to a specific topic, and, c) constructing situation models that aid reconstruction of and elaboration on ideas and perspectives about a specific topic (see Taboada & Guthrie, 2006).

CHAPTER 2

REVIEW OF THE LITERATURE

In this chapter, I will highlight the theoretical perspectives that inform the present study. I will then review the existing literature on determinate factors of reading comprehension outcomes for traditional, print-based texts and online texts.

Theoretical Framework

This study is informed by two closely related literacy perspectives and one perspective related to literacy and technology. One is the notion that fluent reading is a necessary but insufficient condition of reading comprehension (Gough & Tunmer, 1986; Laberge & Samuels, 1974). Another is the Interactive Model of Reading, which builds upon the Simple View of Reading by suggesting that reading comprehension is a result of two distinct interactive processes: a) word decoding and b) language comprehension processing. The other perspective is that of the new literacies of online reading comprehension, which posits that skills required to read and comprehend traditional, print-based texts are not sufficient for online reading comprehension.

The Simple View of Reading

According to the Simple View of Reading, reading comprehension occurs as a result of two distinct processes: a) word recognition and b) language comprehension (Gough & Tunmer, 1986). Though the roles of these processes change as readers transition between reading stages (Chen & Vellutino, 1997; Dreyer & Katz, 1992; Vellutino, et al., 2007), empirical evidence is clear that reading comprehension cannot occur in the absence of either of these processes (Hoover & Gough, 1990). Therefore, readers with significant deficits in either domain will find it difficult to extract enough information from text to establish a conditional meaning that will allow them to make decisions and draw conclusions about the text (Gough & Tunmer, 1986; see also Kintsch, 2004). Given these points, it is reasonable to conclude that these processes may influence online reading comprehension.

The Interactive Model

The second theory, the Interactive Model of Reading (Rumelhart, 1994), builds upon the simple view of reading by highlighting the complex interaction required between word recognition and language comprehension to facilitate reading comprehension (Gough & Tunmer, 1986; Kintsch, 1998; Plaut, McClelland, Seidenberg, &, Patterson, 1996; Stanovich, 2000). According to this model, meaning construction occurs as a result of both word identification and language comprehension processes interacting in an iterative, bidirectional, nonlinear way, which allows the reader to continuously update his or her general knowledge as new information is evaluated by and integrated with preexisting knowledge (Perfetti, Landi, & Oakhill, 2005). As a result of this interdependence, limitations in either of these domains would make it difficult for a reader to engage in the type of problem solving and planning required to make inferences and draw conclusions about text (see Kintsch, 1998).

New Literacies

The third theoretical perspective is that of the new literacies of online reading comprehension. Researchers in this area argue that skills and strategies used to extract and construct meaning in traditional printed text are not sufficient to gain meaning and transfer knowledge from online text (Coiro & Dobler, 2007; Leu, Kinzer, Coiro, & Cammack, 2004). More specifically, in traditional text the reader relies on decoding skills and the integration of prior knowledge and new information to construct meaning from printed text (Gough & Tunmer, 1986; Kintsch, 1998; Perfetti, Landi, & Oakhill, 2005). These skills, however, are thought to be insufficient to support the complex analysis required to comprehend the non-linear, multidimensional, multi-modal, and structurally unpredictable texts online (Brunner & Tally, 1999; Cromley & Azevedo, 2009). Instead, according to this theory, the online reader will also need to employ additional skills and strategies that will support the cognitive flexibility (Spiro & Jehng, 1990) required to: a) locate, evaluate, synthesize and communicate online information (see Leu et al., 2013) and, b) read critically across multiple nonlinear sources in a single online text (McKenna, 2002; Leu, et al., 2004). It is nevertheless important to determine the cognitive processes (i.e., decoding, linguistic comprehension, vocabulary, and nonverbal intelligence) that support these skill and/or strategies, and, ultimately, contribute to online reading comprehension outcomes. For this reason, in this study, I seek to understand the cognitive processes that influence reading comprehension for adolescent readers in online informational text.

Review of Literature

In this section, first, I will highlight five cognitive processes that are related to reading comprehension—decoding, linguistic comprehension, prior knowledge, vocabulary, and non-verbal intelligence. For each process, I will: a) define the process, b) discuss the role it plays in reading comprehension for print-based texts, and c) discuss the role it plays in online reading comprehension. Lastly, I will discuss Internet skills as a construct and highlight the role these skills play in online reading comprehension.

Decoding

According to Gough & Tunmer (1986), proficient decoding is the ability to "read isolated words quickly, accurately, and silently" (p. 7). That is to say, decoding is not "sounding out" words (see Chall, 1976), nor is it context-dependent word recognition (see Goodman & Goodman, 1979). Rather, it is a process that requires: a) knowledge of the orthographic cipher (see Gough & Hillinger, 1990), and b) the ability to quickly and effortlessly link printed words, stored spellings, and associated auditory equivalents (see Rumelhart, 1994; see also Perfetti, 1985). This premise is empirically supported by and is widely accepted by both reading and speech scholars (e.g. Catts, Adolf, & Weismer, 2006; Gough & Tunmer, 1989; Hoover & Gough, 1990). Thus, it shall be the premise from which I view decoding in the present study, as I examine the relationship between decoding and online reading comprehension outcomes.

The relationship between decoding and reading comprehension in print-based texts has been studied extensively (e.g., Chen & Vellutino, 1997; Dreyer & Katz, 1992; Gough & Tunmer, 1989; Hoover & Gough, 1990; Singer & Crouse, 1980; Tilstra, McMaster, Broek, Kendeou, & Rapp, 2009). As a result, it has been well established that: a) decoding is a determinant of reading comprehension outcomes, and b) the strength of the relationship between decoding and reading comprehension performance decreases over time (Savage & Wolforth, 2007; Tilstra, McMaster, Broek, Kendeou, & Rapp, 2009). To illustrate, Chen and Vellutino (1997) examined the strength of the relationship between decoding and reading comprehension outcomes among a group of children in grades two, three, six, and seven. Findings revealed the strength of the relationship between decoding and reading comprehension were .71, .62, .34, and .00, respectively. Such findings suggest that decoding is a stronger determinant of reading comprehension outcomes in early grades than it is in later grades.

Tilstra et al. (2009) found similar results among 271 children in grades four, seven, and nine, for whom decoding accounted for 42%, 13%, and 17% of the variance in reading comprehension, respectively. These results, along with others (e.g., Singer & Crouse, 1980; Stanovich, Cunningham, & Feeman, 1984), underscore the notion that decoding is less significant over time. However, this understanding should be interpreted with caution because the small, but significant, variance that decoding accounts for in reading comprehension outcomes in later years is still notable. In other words, children in secondary school who struggle to decode may experience some level of difficulty constructing meaning from print-based texts (see Perfetti, 1985; Adlof, Catts, & Little, 2006). To that end, decoding is a significant determinate in reading comprehension outcomes for print-based, traditional texts.

According to scholars of the new literacies of online reading comprehension (e.g., Coiro, 2011; Leu et al., 2004), decoding is also a determinant of online reading comprehension outcomes. However, there is no available evidence to suggest that this is in fact true. Rather, it seems to be a reasonable but axiomatic assumption. On the other hand, to the extent that digital texts and offline texts differ, it is difficult to know the extent to which decoding contributes to online reading comprehension and if its contribution differs from that which is contributed to traditional texts read by adolescents. For example, online texts, unlike traditional, print-based texts, require readers to synthesize information across multiple, interdependent texts. As a condition of synthesis, readers must be able to decode the message(s) of two separately developed texts (McKenna, 2002). Therefore, it may be premature to suggest that decoding skills contribute to online reading comprehension in the same way it contributes to offline reading comprehension.

Linguistic Comprehension

Linguistic comprehension, also known as linguistic comprehension and/or language-comprehension,[1] is also a well-established determinant of reading comprehension outcomes (Catts, Adolf, & Weismer, 2006; Gough & Tunmer, 1986; Hoover & Gough, 1990; Vellutino et al., 2007). According to Rumelhart (1994), the language process is an iterative, bidirectional, nonlinear cycle of parsing, bridging, and discourse building (see also Kintsch, 1998). Specifically, the reader relies on grammatical knowledge to parse strings of words and tentatively link them into propositions, which are subject to constant revision as the sentence unfolds (Kintsch, 1998). The reader aims to build a hierarchy of propositions by first determining the meaning of each sentence and then constructing intersentential bridges in an effort to perceive text coherence (Perfetti, Landi, & Oakhill, 2005). As these subcomponents (i.e., parsing, bridging, and discourse building) interact, the reader simultaneously uses preexisting knowledge to evaluate and synthesize new information while drawing conclusions (i.e., inferencing) about the new information.

The complex interactions that occur between parsing, bridging, and discourse building make it difficult to examine the relationship between linguistic comprehension

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[1] These alternate designations are because of the underlying oral vocabulary components (e.g., phonology, morphology, syntax, semantics) associated with the construct (see

and reading comprehension. This difficulty is, in part, because parsing, bridging, and discourse building are predicated upon a web of language-related skills such as vocabulary (see Ouellette & Beers, 2010; Tannenbaum, Torgesen, & Wagner, 2006; Stothard & Hulme, 1992; Nation & Snowling, 1998), syntax, inference making, schema construction (see Kirby & Savage, 2008), morphosyntax, semantic, and nonliteral aspects of language (see Nation et al., 2004). However, some research has focused on the contribution of linguistic comprehension to reading comprehension (e.g., Catts, Adlof, & Weismer, 2006; Nation et al., 2004). For example, Vellutino and his colleagues (2007) conducted a study of elementary students (second and third grades) and middle school students (sixth and seventh grades) to investigate determinants of reading comprehension outcomes. They also explored the relationship between reading-related oral language skills and reading comprehension outcomes. Although the relationship between language comprehension and reading comprehension was significant for both age groups, linguistic comprehension was found to be a stronger determinant of reading comprehension outcomes for middle school students (.85) than it was for elementary students (.36). The researchers also reported that semantic knowledge (vocabulary) was more strongly related to the language comprehension of older readers (.86) than younger ones (.70). Syntax (grammar knowledge), on the other hand, did not have a significant relationship with language comprehension for either age group. It did, however, have a significant relationship with semantic knowledge for both groups, one that was much stronger for older children (.70) than it was for younger children (.30). Given these findings, it is reasonable to conclude that these elements of oral language significantly contribute to reading comprehension outcomes, and that their contribution varies with age.

Unfortunately, the nature of the relationship between linguistic comprehension and online reading comprehension is less clear. New literacies researchers suggest that linguistic comprehension contributes to online reading comprehension in the same way it contributes to reading comprehension for offline texts. However, there is little evidence suggesting that these contributions are similar. For example, Coiro (2007) explored reading behaviors and/or processes that contributed to online reading success among 11 sixth-grade students. Analysis of think-aloud protocols, field observations, and interviews suggested that elements of linguistic comprehension—prior knowledge, inferencing, and self-regulation—promoted "successful reading experiences." On the contrary, Coiro (2011) investigated skills that contributed to online reading comprehension outcomes among a group of children in grade seven. A hierarchical multiple regression statistical analysis revealed that relationship between prior knowledge and online reading comprehension was not significant. As a result, Coiro concluded that prior knowledge might contribute less to online reading comprehension than to offline reading comprehension. More specifically, she surmised that her findings related to the relationship between prior knowledge and online reading comprehension might be explained by the vast amount of information available and the abundant opportunities the reader has to access information about a subject on the Internet through different modalities. In view of these findings, it is reasonable to conclude that online reading comprehension outcomes may be difficult to predict without full consideration of the linguistic comprehension process and its influence on reading comprehension outcomes.

Prior Knowledge

According to Dochy (1992), prior knowledge is “the whole of a persons knowledge.” More specifically, Dochy purports that “prior knowledge is dynamic in nature; is available before a certain learning task; is structured; can exist in multiple states (i.e., declarative, procedural, and conditional); is both explicit and tacit in nature, and contains conceptual metacognitive knowledge components”. Available evidence suggests that prior knowledge accounts for 30-60% of the variance in reading comprehension (see Tobias, 1994; see also Dochy, 1992). However, the term prior knowledge is vague and is often used to mean different things (see Dochy et al., 1996). Consequently, it can be difficult to draw conclusions and make inferences about research findings and implications. To that end, for the purpose of this study, I will focus on a derivative of prior knowledge—domain-specific knowledge.

Domain-specific knowledge is knowledge about a specific topic within a particular domain (Glaser, 1984). Scholars (e.g. Stahl, Hare, Sinatra, & Gregory, 1991; Shapiro, 2004; Wolfgang, Korkel, & Weinert, 1989) suggest that domain-specific knowledge contributes significantly to learning. For example, among a group of third, fifth, and seventh graders, Wolfgang et al. (1989) investigated whether general intelligence (low aptitude versus high aptitude) influenced participants’ ability to recall texts, make inferences, and detect contradictions with in the text. Findings revealed that aptitude did not have a significant effect on either of the three outcome variables. However, domain-specific knowledge did have an effect on all of the three outcome variables. Interestingly, participants with low aptitude but high levels of domain–specific knowledge did not differ significantly from students with a high aptitude and a high-level of domain specific knowledge.

Stahl et al. (1991) examined the effects prior knowledge (domain-specific) and vocabulary on text comprehension among tenth-graders. Findings revealed that both vocabulary and prior knowledge explained a significant amount of the variance in text comprehension. However, the contributions differed based on the level of comprehension being measured—macrostructure versus microstructure (see Kintsch, 1998). For example, domain-specific knowledge had more explanatory power than did vocabulary when measuring macrostructure comprehension. In fact, domain-specific knowledge accounted for approximately 10% of the variance explained in text comprehension, whereas vocabulary accounted for less than 1% of the variance. In contrast, vocabulary explained 15% of the variance in comprehension tasks that focused on the microstructure of the text, whereas domain-specific knowledge accounted for a little less than 3% of the variance.

Recht & Leslie (1988) investigated the effects of reading ability and prior knowledge on text comprehension among seventh and eighth grade students. Findings from this study revealed that prior knowledge had a significant effect on text comprehension, $F\ (8,\ 53) = 20.8$, $p < .001$. However, reading ability did not have a significant effect on text comprehension, $F\ (8,53) = .043$, $p > .05$. A deeper analysis also revealed that participants with a high level of prior knowledge and a high level of reading ability did not recall domain-specific information better than students with a high level of prior knowledge but a low level of reading ability. Therefore, prior knowledge is a stronger predictor of domain-specific knowledge than it is reading ability (see also Shapiro, 2004).

To the contrary, the role of background knowledge in online reading comprehension is not as clear as it is in offline reading. Some researchers suggest that prior knowledge plays a significant role in online reading comprehension outcomes (see Calisir & Gruel, 1997; Coiro & Dobler, 2007; Lawless, Schrader & Mayall, 2007; Rouet et al., 1997). Others suggest that prior knowledge does not contribute significantly to online reading comprehension (see Bilal, 2000; Coiro, 2011). For example, Coiro (2011) found that topic specific prior knowledge (i.e., domain-specific knowledge) accounted for 7.4% of the variance beyond that which is explained by offline reading comprehension for a group of seventh grade students. However, the final beta was not statistically significant. Therefore, this result should be interpreted with caution. A statistically insignificant beta might suggest that the measure of online reading comprehension may not be dependent on the measure of prior knowledge.

Calisir and Gurel (2003) investigated the effects of text structure and prior knowledge on online reading comprehension, browsing, and self-regulation among 30 university students. The text structures included traditional linear texts, hierarchical hypertext, and mixed hypertext (a combination of traditional linear texts and hierarchical hypertext). Results revealed that students with higher levels of prior knowledge performed better on reading comprehension outcomes in linear texts than did students with lower levels of prior knowledge. However, there was not a statistically significant difference in online reading comprehension outcomes between students with high levels of prior knowledge and students with low levels of prior knowledge in hierarchical hypertext and mixed texts. It should be noted though that students with low levels of prior knowledge benefited from digital environments that were unrestricted (i.e., mixed hierarchical hypertexts). These students performed better on reading comprehension than did students with low levels of prior knowledge that read linear, traditional texts. On the other hand, students, despite their level of prior knowledge, found it difficult to answer domain-specific questions that were not straightforward. Findings from this study are remarkable given that prior knowledge was not measured beforehand but was assumed based on whether or not a participant participated in a course that presented information that was aligned with the texts in the study. Rouet, Favart, Britt, & Perfetti (1997) also found that prior knowledge benefited students in online environments. They investigated the effects of prior knowledge on 19 graduate students' ability to read, evaluate, and communicate about multiple hyperlinked history documents (i.e., a textbook, official documents, historian essays, and personal accounts) that presented opposing views on historical controversies. They found that prior knowledge had a statistically significant effect on students' ability to navigate hyperlinks as well as an effect on their comprehension of the texts. Students with lower levels of comprehension (i.e., psychology majors) relied on sources that helped to build background knowledge (e.g., textbook sources) regardless of the task—recall or integration. However, students with a higher level of prior knowledge (i.e., history graduate students) were more apt to choose documents based on the task. For example, both students with high and low levels of comprehension found textbook sources and official documents to be the most reliable sources to gather facts. However, to write an opinion piece, students with higher levels of prior knowledge found personal accounts useful, but students with lower levels of prior knowledge did not trust these sources even when producing an opinion piece. As a result, students with higher levels of prior knowledge were able to produce elaborate opinion pieces based on the documents reviewed about controversies in history, but students with lower levels of prior knowledge produced simple straightforward responses about controversies in history.

In contrast, Rouet (2003) did not find prior knowledge to benefit students in online environments. Rouet (2003) investigated the influence of prior knowledge on search strategies for a group of fourth year university students. Results revealed that prior knowledge did not have a strong significant effect on document search strategies. Instead, students relied less on prior knowledge and more on the characteristics of a question to search a document for information. More specifically, students were more likely to search a document extensively for an answer to a general question than they were to search for an answer to a domain-specific question. While these findings are inconsistent with other studies that suggest that prior knowledge has benefits in online environments, it should be noted that participants in this study, as is the case with other studies (e.g., Calisir & Gruel, 1997; Lawless, Schrader & Mayall, 2007; Rouet et al., 1997), are older students that have a significant amount of academic experience. Therefore, these findings may not be reliable for younger students (e.g., middle school students and high school students) with less academic experience.

Vocabulary

Attaining vocabulary, word knowledge, is a complex, incremental process (Beck, Perfetti, & McKeown, 1985; Dale, 1965; see also Nagy & Scott, 2013). During this process, the reader receives visual stimuli (words), and, then, phonologically encodes these lexical representations while simultaneously connecting meaning to them (see Mezynski, 1983). As a consequence, the mental lexicon, which is the nucleus of the vocabulary process, is established. The mental lexicon is the hub of stored, categorized words that are distinguished by and connected to their meanings (see Bonin, 2004). However, the complexities associated with developing a mental lexicon make the role of vocabulary in reading comprehension outcomes uncertain (Tannebaum et al., 2006). For example, the meaning associated with a word during an initial encounter is generally insufficient for reading and production (Carey, 1978; Dale, 1965), especially given the heterogeneous, multidimensional, and polysemic nature of word meanings (see Nagy & Scott, 2013). However, these meanings and associations can be refined over time through exposure to print (see Stanovich, 1986) and oral vocabulary (see Hart & Risley, 1995). Because of this, the extent to which vocabularies develop is thought to play a unique and significant role in reading comprehension outcomes (Ouellette, 2006).

Several hypotheses have been advanced to account for this relationship. Anderson & Freebody (1981) proposed a few of these hypotheses—the instrumental hypothesis, the knowledge hypothesis, and the aptitude hypothesis. The instrumental hypothesis suggests that a reader who knows more words will be a better reader. That is to say, knowing the meaning of words has a direct relationship with reading comprehension outcomes. This hypothesis seems like a plausible explanation and is aligned with other plausible hypotheses.

For example, the knowledge hypothesis is the idea that knowing the definition of a word is not enough to improve reading comprehension. Rather, it is the knowing of concepts that relate to a word that improves reading comprehension. To put it another way, a reader who has knowledge about *whales* will more easily understand a passage about *orcas*, even if the word *whale* is never mentioned. The premise of this hypothesis is similar to the assertion that prior knowledge supports and improves meaning extraction and construction (see Kintsch, 1998). It is also closely related to the premise of the third hypothesis proposed by Anderson & Freebody (1981)—the aptitude hypotheses.

The aptitude hypothesis states that verbal ability and reading comprehension are related. This suggests that a reader with high verbal proficiency will be a better learner, and, thus, have larger vocabularies. That is, a reader with a high verbal aptitude is able to read a range of material, despite the demands of the vocabulary, and, adequately, extract and construct meaning. Further, a reader with this type of verbal ability has the propensity to learn new words. A plausible explanation for this type of aptitude and comprehension may be the *metalinguistic hypothesis* (Stahl & Nagy, 2006).

According to the metalinguistic hypothesis, vocabulary knowledge and reading comprehension are influenced by language awareness, which is developed through exposure to vocabulary and print. For example, Metsala and Walley (1998) proposed the *lexical restructuring hypothesis*, which suggests that vocabulary exposure influences phonemic awareness. Phonemic awareness influences early reading, and, ultimately, later comprehension (Hulme, et al., 2002). The essence of the hypothesis is that children with larger vocabularies, which were obtained through reception, have higher phonemic awareness, and higher levels of comprehension in later years. It is important to highlight that higher levels of comprehension in later years may be explained by the awareness of the morphological structure of words (see Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003), the awareness of the polysemic nature of words, and the awareness of figurative language (e.g., similes, metaphors, hyperboles, idioms). In essence, verbal proficiency is the consequence of early exposure to vocabulary.

Others have proposed hypotheses for the relationship between vocabulary knowledge and reading comprehension. Mezynski (1983) proposed the access hypothesis. The access hypothesis states that the automaticity of word knowledge influences reading comprehension outcomes. Readers who have the ability to access words and their meanings quickly have a better chance of comprehending texts (see also LaBerge & Samuels, 1974; see also Perfetti, 1985). This hypothesis extends the instrumental and knowledge hypotheses by suggesting that knowing words and the meanings of words may not be sufficient. Rather, it is the automatic connection of words with their meanings that is key to the relationship between vocabulary knowledge and reading comprehension.

On the other hand, the relationship between vocabulary knowledge and reading comprehension is thought to be reciprocal. According to the reciprocal hypothesis (Stanovich, 1986), both vocabulary knowledge and reading comprehension contribute to each other. Accordingly, people who have large vocabularies tend to be better readers. People who tend to read well, generally, read more often. The more you read, the more expansive your vocabulary. As a consequence, both vocabulary knowledge and reading comprehension influence each other.

Taken together, these hypotheses are not mutually exclusive. Rather, they inform the complex relationship that exists between vocabulary knowledge and reading comprehension outcomes. Among these hypotheses, there is consideration for the development of vocabulary and its influence on reading comprehension over time. There is also consideration for the influence that continuous exposure to print and vocabulary has on vocabulary knowledge and reading comprehension outcomes. Therefore, these hypotheses expose the need for research attention focused on the relationship between vocabulary knowledge and reading comprehension.

Investigators have examined the relationship between vocabulary and comprehension both with respect to age and with how vocabulary knowledge is defined. Word knowledge can be considered to include all words about which an individual has even superficial knowledge (vocabulary breadth) or only those words about which one's knowledge is elaborate and polysemous (vocabulary depth). Ouellette and Beers (2010), for example, investigated the relationship between oral vocabulary and reading comprehension outcomes for children in grades one and six. They reported that oral vocabulary did not predict reading comprehension beyond linguistic comprehension for children in grade one, but it did account for unique variance in reading comprehension scores for children in grade six. Specifically, vocabulary breadth accounted for 55% of the variance of reading comprehension, and explained an additional 15% of the variance beyond that which was explained by linguistic comprehension. Notable, however, was the fact that vocabulary depth, which was measured using a definition task, did not contribute significantly beyond the variance accounted for by vocabulary breadth (see also Ouellette, 2006).

Interestingly, however, Tilstra et al. (2009) examined the relationship between vocabulary depth and reading comprehension outcomes for children in grades four, seven, and nine. Findings revealed that vocabulary depth, which was measured using a definition task, explained 5%, 8%, and 12% of the variance in reading comprehension in grades four, seven, and nine, respectively, beyond that which is explained by linguistic comprehension. These findings suggest that the strength of the relationship between reading comprehension and oral vocabulary, specifically vocabulary depth, increases over time. Although these may be skewed because vocabulary breadth was not considered in conjunction with vocabulary depth as it was in the study that was previously mentioned, it is notable that some aspect of oral vocabulary contributes to reading comprehension outcomes beyond that which is explained by linguistic comprehension. To that end, these relationships should be given further consideration.

Though the relationship between oral vocabulary and reading comprehension outcomes has been investigated for offline reading, the relationship has not been examined for online reading. Because this is a process that is closely linked to reading comprehension outcomes for traditional, print-based texts, the assumption, that I gather from new literacy scholars of online reading comprehension (e.g., Coiro & Dobler, 2007; Leu et al., 2013), is that this process contributes to online reading comprehension in the same manner that it does for offline reading comprehension. On the other hand, comprehending in online settings may draw on vocabulary knowledge in ways that differ from print environments. Online readers must locate information relevant about a specific topic in a boundless social (Lankshear & Knobel, 2006) and informational (Kuiper & Volman, 2008) environment, and extract relevant information from online texts that lack well-defined text structures and the uniformity that traditional texts afford readers (Coiro, 2006; Coiro & Dobler, 2007; Cromley & Azevedo, 2009). That being said, online readers may need an extended lexicon to: a) initiate a search that returns relevant information (Bilal & Kirby, 2002), and b) identify outdated sources of information and quickly pinpoint a clear path to current information (Walraven, Brand-gruwel, & Boshuizen, 2008). Therefore, the ways in which a reader depends upon vocabulary for online learning differs drastically from the ways in which s/he depends upon it for offline reading comprehension. In view of these findings, word knowledge may have different consequences for online reading comprehension than it does for reading offline texts.

Nonverbal Reasoning

Nonverbal reasoning, sometimes referred to as nonverbal intelligence, is the ability to analyze and solve complex, abstract/and or concrete problems, without relying on language (see Navarro & Poynter, 2011). Children with at least average nonverbal reasoning skills are able to: a) draw conclusions about visual sequences and concepts, b) extract information from diagrams and apply it to a novel situation, and c) recognize causal relationships in visual information. In effect, one would expect a person with at least average nonverbal reasoning abilities to exhibit the ability to: a) think critically about a concrete and/or abstract problem and generate a reasonable solution, and b) form judgments about novel information.

Stanovich et al. (1983) investigated the developmental trend in the strength of the relationship between nonverbal intelligence (along with other measures) and reading comprehension in a sample of children in grades one, three, and five. Findings revealed that the strength of the relationship between general intelligence and reading comprehension outcomes increases substantially over time. For example, the association between nonverbal intelligence and reading comprehension was .30 and .48 for children in grades one and three, respectively. However, it is important to note that the strength of this relationship is mediated by decoding ability.

Singer and Crouse (1981) examined the relationship between nonverbal intelligence, decoding skills, letter discrimination, vocabulary, context use and reading comprehension outcomes among a group of children in grade six. Findings revealed a moderate (.43) effect[2] between nonverbal intelligence and reading comprehension outcomes. The strength of this relationship decreased (.39) when letter discrimination was included. It declined further (.35) when both decoding and letter discrimination were taken into account. Nevertheless, the relationship was still moderate. However, nonverbal intelligence became insignificant (.06) after vocabulary, decoding, and letter discrimination were taken into account. These findings suggest that vocabulary mediates the relationship between nonverbal intelligence and reading comprehension.

Though the role of nonverbal reasoning is not as clear-cut as other factors discussed in this review, it is clear that it: a) contributes directly and/or indirectly to reading comprehension outcomes, and b) is likely to be mediated by other factors related to reading comprehension outcomes for traditional, print-based texts. The extent to which nonverbal reasoning ability is related to online reading comprehension is far less clear than its relationship with offline reading comprehension, but it is a relationship that warrants systematic investigation because of the tasks confronting readers in digital environments. For example, recognizing patterns and causal relationships among sources of visual information, analyzing graphs, and making quick decisions about novel information, may have an indirect and/or direct effect on locating, evaluating, synthesizing, and communicating information online. Though I was unable to locate empirical studies of the relationship between nonverbal intelligence and online reading comprehension outcomes, it is reasonable to suspect that the relationship may be stronger than it is for print comprehension.

[2] The effect sizes for this study were reported using standardized coefficients.

Internet Skills

As previously mentioned, online reading comprehension scholars (e.g., Leu et al., 2013; Coiro & Dobler, 2007), posit that online reading comprehension requires ICT related competencies—locating, evaluating, synthesizing, and communicating information—that differ significantly from the competencies required to comprehend offline texts. Thus, in this section I will review existing literature on the difference between online reading comprehension and offline reading comprehension with respect to the unique competencies new literacy scholars suggest. Additionally, I will review existing literature on the effects of Internet Skills on online reading comprehension outcomes.

Identifying important questions. According to RAND, when a learner has a purpose for learning, reading comprehension is positively impacted (RAND Reading Study group, 2002, pg. 26). To illustrate, Taboada & Guthrie (2006) found that elementary students who use self-generated questions to guide their reading were better able to: a) use *selective attention* (see Reynolds & Anderson, 1982) to: gather relevant information, b) identify relationships among concepts related to a specific topic, and c) construct situation models that aid reconstruction of and elaboration on ideas and perspectives about a specific topic. Results from the study also revealed that the level of inquiry made by these students influenced the quality of the situation models generated. Specifically, students who asked questions that required complex explanations were more likely to produce more elaborate explanations than those who asked less complex questions (i.e., literal-level questions). In essence, inquiry has a significant influence on reading comprehension outcomes (Palinscar & Brown, 1984; Rouet, 2003; Taboada & Guthrie, 2006).

Leu and his colleagues (2007) suggest that inquiry is "an important source of the difference between online and offline reading. That is to say, online reading, unlike offline reading, is mostly provoked by the desire to solve a problem or learn new information. In a study conducted by the Pew Research Center (2007), 58% of Americans were more likely to use the Internet than any other source to solve a problem or to acquire new knowledge about a specific topic. It should be noted, however, that a small percentage of Americans did prefer using alternative methods to inquire about certain kinds of information. More notable, though, is the findings from another study conducted by the Pew Research Center (2014), which revealed that 87% of Americans attributed knowledge acquisition to online inquiry (Pew Research, 2014). Therefore, one may conclude that online reading is the primary source for knowledge acquisition. However, these findings alone do not sufficiently support the notion that the inquiry is always the premise of online reading, but is not the premise of offline reading. Nevertheless, given the vast amount of information available on the Internet, it may be reasonable to conclude that online inquiry provides more opportunities to glean from multiple perspectives and generate a situation model that might be more elaborate than one generated from offline reading.

Locating information. According to Guthrie & Mosenthal (1987), the process of locating information requires readers to set goals to locate a specific set of information within a broad array of information. Accordingly, readers must develop a schema for the following the process—formulate a goal, inspect appropriate categories of information, sequence the inspection, extract details from one or more categories, and recycle to obtain a solution (Guthrie & Mosenthal, 1987). That is, readers start with a specific topic in mind and focus their attention only on information related to the topic. Then, readers skim and scan information by inspecting headings, units, tables, charts, and/or graphics for relevant information. Information gathered during this skimming and scanning process is central to determining the available, relevant information, and establishing categories that guide the direction of the search. For example, someone wanting to learn more information about pancreatic cancer may establish the following categories: causes, symptoms, treatment, and prognosis. Without these categories, readers will find it difficult to extract relevant information and calibrate the search as needed for goal attainment. Even so, it should be noted that both schema and task efficiency are influenced by factors affecting reading comprehension such as prior knowledge, vocabulary, inference making, text structure knowledge, and self-regulation (Pearson & Gallagher, 1983).

Both online and offline reading rely on the same logical processes to locate information, but locating information online is considered more challenging (Coiro, 2011; Coiro & Dobler, 2007; Henry, 2006). For example, Coiro and Dobler (2007) explored the distinctive features of online reading comprehension among sixth-graders. Findings suggested that strategically locating relevant information online, amid the large number of possibilities an Internet search returns, requires students to employ the processes of prior knowledge, inferencing, and self-regulation in more complex ways than would be required offline (Coiro & Dobler, 2007). Without the capacity to do so, online searchers are likely to find it frustrating to: a) initiate a search that returns relevant information (Bilal & Kirby, 2002), b) navigate the hyperlinks embedded within texts that may lead to a path contrary to the intended path (Cromley & Azevedo, 2009), c) identify outdated sources of information and quickly pinpoint a clear path to current information (Walraven, Brand-gruwel, & Boshuizen, 2008), d) unearth information in a boundless social (Lankshear & Knobel, 2006) and informational (Kuiper & Volman, 2008) environment, and e) extract relevant information from online texts that lack well-defined text structures and the uniformity that traditional texts afford readers (Coiro, 2006; Coiro & Dobler, 2006; Cromley & Azevedo, 2009). Thus, locating information requires readers to employ a level of cognitive spontaneity and adjustment that is not required when locating information offline.

Evaluating information. Critical analysis of information is the nucleus of reading comprehension. According to Afflerbach and his colleagues (2014), critical analysis involves evaluation of the source and the content. To evaluate a source, readers should vet the author (i.e., credentials, affiliation) and examine the publishing details (i.e., publication type, date of publication). For content evaluation, the reader should evaluate the stated claims and critique the evidence supporting the claims (Afflerbach & Cho, 2009). Failure to adequately evaluate the trustworthiness of the source and/or the accuracy of the information can have significant consequences for the quality and accuracy of the situation models the reader constructs.

Given the significance of critical evaluation, some scholars suggest that critical evaluation of online texts requires higher degrees of evaluation than typically required for traditional, print texts (Brem, Russell, & Weems, 2001; Julien & Barker, 2009; Leu, 2006; Zhang, 2013). For example, online texts may be posted without the author or the content being vetted. Because of this, readers have no other option than to assume the responsibility of editors and publishers. They must vet the author(s) of the texts and examine the quality of the content (see Zhang, 2013). Also, online texts are often more allusive than traditional texts due to the ease of linking to other sources. Therefore, readers must unearth the inconspicuous social, economic, and political agendas embedded within the texts to manage both knowledge acquisition and goal attainment (Cope & Kalantzis, 2009). In evaluating both author and content, readers must employ additional steps to make ongoing judgments about the suitability of texts while attempting to build adequate situation models that aid and promote comprehension (Afflerbach & Cho, 2009). Given these points, it is reasonable to conclude that evaluating online texts is not only more complicated, but it is also more cognitively taxing.

Zhang (2013) analyzed the critical evaluation skills among students in grade eight. Students used a digital notepad, which was designed to help them scaffold information from online scientific resources. The general intention was to promote students' ability to critically evaluate websites. Findings revealed that students, despite receiving prompts, relied on first impressions of websites and were not likely to vet the author of the texts or the information embedded within the texts. They took less than 10 seconds to make a decision about a site, and were often unable to answer questions about what they read beyond a superficial level.

Donald Leu and his colleagues found similar results among students. Among a group of 53 children in grade seven, who were identified as good readers, they found that 87% of the students judged a fictitious website about a tree octopi to be reliable. The students who did judge the website to be unreliable had just participated in a lesson about suspicious online information. This study suggests that teaching critical evaluation of online texts may be important, but it also suggests that prior knowledge may be as important to online reading comprehension as it is to offline reading comprehension (See Borgman, Hirsch, Walter, & Gallagher, 1995; see also Coiro, 2011).

Synthesizing information. Synthesizing information is an iterative process that is dependent upon a range of cognition (Chi, Leeuw, Chiu, & Lavancher, 1994; Wolfe & Goldman, 2005). According to the Construction-Integration model (Kintsch, 2004), to synthesize information readers must deconstruct literal and/or conditional meanings from the text, and then integrate the deconstructed meaning with prior knowledge. During the integration phase, readers generate new ideas and perspectives by iteratively and reflectively creating situation models that represent explicit and implicit information within a single text (see also Perfetti, Landi, & Oakhill, 2005). In contrast to the processes readers employ for single-text synthesis, multiple-text synthesis is more complex. It requires readers not only to create situation models for each single text, but also make intertextual connections among the texts to create a broad understanding of a specific topic (Perfetti, Rouet, & Britt, 1999).

Moreover, synthesizing multiple offline texts differs significantly from synthesizing multiple online texts (Leu et al., 2007). Meaning construction online is less dependent on upon the integration of existing knowledge and acquired knowledge of stable and fixed texts. Rather, it is more dependent on the types of situation models readers are able to construct after encountering unstable and irresolute texts (see McKenna, 2002). For example, to synthesize offline texts, readers must decipher messages of two separately developed texts that have complementary associations and may have two-dimensional graphics embedded to support meaning construction (Brunner & Tally, 1999; Callow, 2010). In contrast, to synthesize offline texts, readers must decipher information from multiple, nonlinear texts that may not have complementary associations and may embed multimedia forms—animated symbols, audio, video, interactive tables, and virtual reality environments—that may or may not aid meaning construction (Brunner & Tally, 1999; Coiro, 2011). This dynamic environment, the Internet, requires readers to decode color and font sizes, meaning bearing icons, hyperlinked texts, graphics, and to read across images (Ciolek, 1996). Consequently, online texts, unlike offline texts, require readers to ration cognitive resources among texts, multimedia forms, and technology manipulations as they organize and coordinate relevant information.

Wolfe & Goldman (2005) analyzed the ability of 44 students in grade six to read and synthesize information from multiple documents that focused on historical information. Using a think-aloud approach, they asked students to orally express what they were thinking after reading each sentence. After reading the documents in this manner, students discussed the similarities and differences between the documents during a post-reading interview. Findings revealed that students relied on the same text processing skills to construct meaning from multiple texts that are used to construct meaning from single text. Moreover, these students were able to connect information across the texts. Students who made efforts to make connections across both documents were more likely to explain the connection and to produce elaborate responses.

Cho (2014) found similar results among a group of seven high school students who participated in advanced placement courses. He used a think-aloud approach to determine the strategies that students use to synthesize information from multiple online texts about a self-selected controversial topic. He found that these students employed a combination of strategies that were cyclical and iterative in nature in order to extract and construct meaning from multiple texts. These strategies were related to the text processing strategies used in traditional, print-based, linear text (i.e., meaning making, self-monitoring, and information evaluation). However, the strategies were also combined with Internet specific skills that supported knowledge acquisition of online text (see Coiro, 2003). Cho noted that these participants planned ahead to guide their search, searched for and located relevant texts, while simultaneously making decisions to accept or reject ideas and perspectives that were not relevant. In addition, the participants were thoughtful about the pathways (e.g., hyperlinks, multimedia) and the sources they selected to inform their situation models. Thus, it is feasible that online reading comprehension may require more cognitive resources than does offline reading comprehension.

Communicating information. Available research suggests that the processes used to read, on the one hand, and to engage in discourse related to what is read, on the other, are similar (Fitzgerald & Shanahan, 2000; Kintsch & van Dijk, 1978; Rosenblatt, 2013; Shanahan & Lomax, 1986). Both processes rely on cognition and attribution (Kintsch, 2004). For example, during the reading process, the reception of the text is dependent upon an interaction between two distinct cognitive processes—word recognition and linguistic comprehension (Gough & Tunmer, 1986). The information acquired as a result of this interaction is cross-matched with readers' previous experiences (i.e., prior knowledge, linguistic experiences, and social-cultural interactions and experiences) to aid reconstruction of the message of the original text by adding new details, insights, and explanations (Kintsch, 2004; Perfetti, Landi, & Oakhill, 2005). According to Shanahan & Lomax (1986), this is the same process required for discourse.

In spite of the fact that available evidence suggest reading and discourse have a transactional, bidirectional relationship (Rosenblatt, 2013; Shanahan & Lomax, 1986), new literacies experts suggest that the skills required for reading and discourse online differ from those required offline (Coiro, Knobel, Lankshear, & Leu, 2008; Leu et al., 2007). Though there is little empirical evidence to support the notion that different skills are required, there are inferences that can be made from available evidence about communication online. For example, in a survey conducted by the Pew Research Center (2014), findings revealed that many, online readers seek information and/or share their knowledge in one or more of the many online media formats (Pew Research, 2014). More often than not, online readers are simultaneously reading and communicating across multiple texts and multiple media formats, respectively. In fact, 72% of Internet users admit that digital technologies have given them the ability "to share their ideas and creations with others" (Pew Research, 2014). For these reasons, it may be undeniable that this type of reading and discourse is unlikely to occur offline. Nonetheless, the skills required to read and communicate, whether online or offline, are, seemingly, the same. The exception, however, may lie in the amount of cognitive flexibility (see Spiro & Jehng, 1990) required for reading and discourse in such a dynamic and unrestricted environment like the Internet. Therefore, the level at which you can adapt and respond in a non-linear, multi-faceted, and dynamic environment may better discriminate online reading and discourse from that which is done offline.

In conclusion, new literacies of online reading comprehension theorists (see Leu et al., 2007) suggest that online reading comprehension differs from offline reading when a reader identifies a question (e.g., What is difference between purified water and distilled water?) and seeks to learn new information. Accordingly, the reader must locate information, evaluate the information, synthesize the information, and communicate the information. I assert that these skills are not vastly different from those required once a reader identifies a question and seeks to learn new information from traditional, linear texts. What is different, however, is the cognitive spontaneity that readers must employ to overcome such a complex, unrestricted, boundless network as the Internet. Therefore, educators should work to teach students strategies that will help them better apply traditional research skills in a digital environment.

In spite of educators' efforts to teach effective Internet strategies, it may still be necessary to teach specific Internet skills that may influence online reading comprehension. According to the National Council of Teachers of English (NCTE; 2013), online reading comprehension is influenced by the dynamic nature of technology and ICTs. Therefore, consideration for the competencies required to utilize technologies and ICTs may also be necessary to improve online reading comprehension (see NCTE, 2013). Needless to say, little evidence is available about the extent to which specific Internet skills (e.g., surfing the Internet, bookmarking Internet pages, creating a website, etc.) influence online reading comprehension. However, there is evidence (see Leu et al.,

2014) that suggests that both Internet use and computer use, which are consequences of socioeconomic status, have an effect on online research and comprehension outcomes.

CHAPTER 3

METHODOLOGY

According to the new literacies theory of online reading comprehension (e.g., Coiro & Dobler, 2006; Leu, Kinzer, Coiro, Castek, & Henry, 2013) skills required to read print-based texts are insufficient to read online texts. However, available empirical evidence gathered to expand this theory by articulating the subprocesses of online reading comprehension and how they may differ from those employed in comprehending print is mixed (e.g., Afflerbach & Cho, 2008; Coiro, 2011). Further, many of the studies aimed to expand the theory have been qualitative in nature.

In the present study, I conducted an analysis of secondary data to investigate: a) five constructs (decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) related to online reading comprehension, and b) the moderating effects of Internet skills on these associations. Thus, in this section, I described the: a) participants and the setting, b) data collection process, c) data analysis that I proposed for the study, and c) the limitations of the study.

Participants

Participants in the study were 269 sixth-grade students from 14 primary schools in the southern and central regions of the Netherlands. Of these participants, 131 were boys and 138 were girls. Ages among the participants ranged from 10 years, 8 months, to 13 years, 8 months, with an average age of 12 years, 4 months. Approximately 75% of these participants were natives of the Netherlands. Of non-native participants, 21% spoke a language other than Dutch at home (e.g., Turkish, Berber). All participants in this study participated in a general education curriculum. At least 75% of the participants had an academic achievement level consistent it average to above average performance (M=534.88)[3] on a standardized academic achievement test.

Setting. The Netherlands is a Western European country located between Belgium and Germany. Its total population is approximately 16,947,904 (Netherlands, 2015). Native westerners account for just over 85% of the population, while non-western ethnic minorities account for slightly less than 15% (Central Intelligence Agency [CIA], 2010). According to the CIA World Factbook (2010), non-western ethnic minorities in the Netherlands constitute five distinct groups —Turks, Moroccans, Indonesians, Surinamese, and people of Caribbean descent (CIA, 2010). Both native westerners and non-western ethnic minorities are expected to learn the official language—Dutch.

Schools. Public primary schools in the Netherlands consist of grades K4 to 8[4]. These schools are government-funded and overseen by the Ministry of Education, Culture, and Science or an appointed council. Neither the Ministry of Education, Culture, and Science nor any governing body of a primary school is responsible for establishing and/or enforcing a national curriculum. It is the responsibility of each school to create and enforce a school-wide curriculum. Pupils enrolled these schools have average to above average academic achievement and do not have learning disabilities or special needs (see Appendix A for school types in the Netherlands).

Data Collection

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[3] The total score for the standardized assessment was 550.
[4] Children attending primary school are grouped based on ability rather than age.

Instruments. The following instruments were administered to each participant. Each instrument was in Dutch.

Decoding. The Drie-Minuten-Toets (literally, the Three-Minute Test; Verhoeven, 1995) is a measure designed to assess the decoding skills of children in grades three through eight. The measure contains three leveled cards (i.e., Read Card 1, Read Card 2, and Read Card 3), which examinees read in a three-minute time span. Each card consists of four or five columns of 30 Dutch words that range in level of difficulty. Read Card 1 has five rows of 30, one-syllable words with one-to-one letter-sound correspondences (e.g., doos, kat[5]). Read Card 2 consists of five rows of 30 increasingly difficult monosyllabic and polysyllabic words that have varying patterns (i.e., rekken, tanden, vlecht, wenk[6]). Read Card 3 consists of four rows of 30 polysyllabic words with varying patterns and levels of difficulty (e.g., continent, ontwerp, verviervoudigen, vervoer[7]). Children are instructed to quickly and accurately read aloud as many words as possible from the top to the bottom of each column in one minute. Errors are recorded. The number of words read correctly is subtracted from the total number of words on the card to derive a total score. Total scores are compared to benchmark scores established for each leveled card to determine if the next higher card should be administered. Children in grades five through eight are initially administered Read Card 3 and decisions to administer the preceding cards are based on comparisons of the total score and the established benchmark score. In the present study, only Read Card 3 was administered.

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[5] The English translations for these examples are box and cat, respectively.
[6] The English translations for these examples are stretch, teeth, braid, and hint, respectively
[7] The English translations for these words are continent, design, quadruple, and transportation, respectively.

The reliability estimate for this measure is reported to be .95[8] (see Krom et al., 2010). This measure was used to determine the predictive power of decoding in online reading comprehension.

***Reading comprehension*.** The CITO (2007) is a standardized assessment that is commonly used in the Netherlands to assess the cognitive and linguistic abilities of children in primary and secondary schools. The assessment comprises four sections: 1) Language, 2) Arithmetic/Mathematics, 3) Study Skills, and 4) World Orientation. In the present study, only data from one section will be considered—Language. The Language section contains 100 multiple-choice questions distributed across five subsections: 1) Writing, 2) Spelling of Verbs, 3) Spelling (other than verbs), 4) Reading Comprehension, and 5) Vocabulary (i.e., vocabulary breadth). Raw scores are converted to percentile scores. The mean score for the measure of Language was reported to be 76.32 (SD = 13.49).). Data from the language section were used to determine the predictive power of linguistic comprehension in online reading comprehension. Other components of the Cito (2007) were not factors of interest in this study.

Vocabulary. A subtest, the "Leeswoordenschattaak" (i.e., Reading Vocabulary), from the Taaltoets Allochtone Kinderen Bovenbouw (i.e., Language Test for Immigrant Children in the upper elementary grades) (Verhoeven & Vermeer, 1993) measures receptive vocabulary in children from ages 8 to 12. The measure contains 50 printed Dutch phrases. Each phrase has one or more words underlined (e.g., Ik ben gewond[9]). Children are asked to read each phrase and choose the synonymous meaning of the

[8] The items on Read Card 1, 2, and 3, which are used to measure sixth-grade decoding, were combined to derive reliability.
[9] The English translation for this phrase is: I am injured.

underlined word or expression from four multiple-choice options. The total number of correct responses determines the total score. The reliability of this measure was reported to be .90 (see Verhoeven & Vermeer, 1996). This measure was used to determine the predictive power of vocabulary (i.e., vocabulary depth) in online reading comprehension

Nonverbal intelligence. The Raven Progressive Matrices Test (Raven, Court, & Raven, 1979) is designed to measure the intellectual capacity of children from age 6 to 16 and also adults. It assesses the examinee's ability to: a) perceive and analyze new patterns and relationships among complex data, and b) construct meaning of abstract, complex information through problem solving and reasoning independent of language abilities and declarative knowledge attained through formal education. The test consists of 60 multiple-choice items arranged in five sets. Each set is arranged in increasing order of difficulty. Within each set, each item contains a figure with a missing piece. Participants are tasked to choose a matching piece from a set of six or eight pieces to complete the figure. Consequently, the measure is language-free and presumably culture-free. Raw scores are converted to percentile ranks. The reliability estimates for this measure range from .60 to .98. This measure was used to determine the predictive power of nonverbal intelligence in online reading comprehension.

Internet skills. The Information and Communications Technology (ICT; Dutch Ministry of Education, Culture, and Science, 2002) is a 21-question questionnaire for grades four through six (see APPENDIX B). The measure comprises three subscales: 1) computer use at home and at school, 2) perceptions of computer skills, and 3) attitudes towards the computer. In the present study, only one subscale was considered—perceptions of computer skills. This subscale consists of 19 questions, six of which are related to Microsoft Word skills (e.g., cut text and paste it to another location in the text), and the remaining four questions are related to Internet skills (e.g., use a search engine). Participants were required to read a list of skills and indicate whether or not they possess a particular skill by checking either the *yes* or *no* box. A score of 1 was assigned to *yes* responses and a score of 0 was assigned to *no* responses. The number of *yes* responses determines the total score on the subscale. A total score for this subscale ranges from 0 to 10. The reliability estimates for this measure have been reported to be .80 (Dutch Education Ministry of Education, Culture, and Science, 2002). It should be noted that the perception of computer skills subscale was used as a measure to determine the effect of computer skills on the relationship between factors that contribute to online reading (reading ability) and online reading comprehension. The remaining subscales were not relevant to the present study.

Online reading comprehension. Two researcher-created content-specific tests were developed and administered to evaluate online reading comprehension among participants. One test was comprised of questions about tropical rainforests and the other was comprised of questions about climate change. Both tests contained 20 literal-level questions (e.g., Nitrogen oxide is a green house gas.) and two inferential-level questions (e.g., What would happen to the Earth if there were twice as many rainforest as there are now?; see APPENDIX C). For literal-level questions, participants chose from one of two response choices—true or false. A score of 1 was assigned for correct responses and a score of 0 was assigned for incorrect responses. For inferential-level questions, participants were required to provide constructed responses. Scores for inferential-level questions were determined by the accuracy of the response as well as the number of key words participants used in a response. A score of 0 was assigned for incorrect responses, a score of 1 was assigned for partially correct responses, and a score of 2 was assigned for correct responses. Total scores for the two inferential items consequently ranged from 0 to 4. Participants were administered a pre-test, a post-test and a retention test (after a week's a delay) for both passages. To minimize retest effects, literal-level pre-test questions 1-10 and 11-20 were reordered to create the post-test, so that questions 11-20 on the pre-test were 1-10 on the post-test and questions 1-10 were11-20. The retention test was the same as the pre-test. Inferential-level questions were the same for all three tests. The pre-tests were used as a factor of prior knowledge (domain-specific knowledge) to determine the predictive power of prior knowledge in online reading comprehension. The post-tests were used a measure of online reading comprehension.

Procedures. The data were collected over a three-day period at 14 different primary schools. Each school was assigned to a group (see APPENDIX D). Each group was assigned a domain-specific topic (i.e., climate change or tropical rainforest) as well as a task for Day 2 and Day 3 of the intervention. Students assigned to each group were instructed to read about the assigned domain-specific topic from four pre-selected websites (see APPENDIX E). After reading about the assigned topic, students were required to complete the assigned task. The task assigned was either ill-defined or well-defined. Well-defined tasks required participants to answer seven questions (see APPENDIX F) that were specific to the domain-specific topic assigned for the task. Ill-defined tasks required students to write a one-page article for a newspaper or journal that included keywords related to the domain-specific topic assigned for the task. After completing each task, students were administered post-tests. A follow-up test was administered one week after the study ended.

Day One. Trained undergraduate students administered the Drie-Minuten (Verhoeven, 1995) the Leeswoordenschattaak (Verhoeven & Vermeer, 1993), and the Raven Progressive Matrices (Raven & Court, 1979) to each participant. Researchers also administered a print-based pre-test for each topic. Participants were instructed to read and answer each question with the understanding that some of the information may be unknown but to do their best. Students were asked not to discuss or share answers. They were allowed to ask researchers questions before and during the tests.

Day Two. At each school, participants were placed in groups of 10 in a room separate from their respective classroom. In each room, a computer was available for each participant to complete the assigned task. The task was preloaded on the computer screen, and participants were instructed to complete it. Each task required children to locate the information needed to complete it by searching for and extracting information from the four pre-selected webpages. Participants were given one hour to complete the assigned task. Researchers gave participants verbal time cues when 30 minutes, 15 minutes, and five minutes remained. At the end of the hour, materials were collected and researchers administered the post-tests. The instructions for the post-tests were the same as those provided for the pre-tests.

Day Three. The second task was assigned. Procedures were the same as day two. A post-test also administered after the completion the task.

One week later. The teacher or the researcher administered a retention test for each topic.

Data Analysis

To investigate the correlates of online reading comprehension, I performed a hierarchical multiple regression analysis using the Statistical Package for Social Science (SPSS) version 22 (IBM, 2013). Hierarchical multiple regression is a statistical approach used to evaluate the relationships among a set of independent variables and a dependent variable while taking into account the relationship a different set of independent variables may have on the dependent variable (Fields, 2014). One benefit of the approach is that it allows the researcher to enter independent variables in a specific sequence, usually based on theory, and determine the unique predictive power of each new variable entered in the sequence on the predictor variable (Fields, 2014). Thus, in this study, I investigated the relationship of five independent variables (decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) on the predictor variable, online reading comprehension. I also took into account the influence of socioeconomic status (SES) on online reading comprehension. It is important to note that I considered theory that has been well established for offline reading comprehension to guide the entry of variables (see Gough & Tunmer, 1986; Hoover & Gough, 1990; Chen & Vellutino, 1997). Therefore, SES was entered first as the control variable. Next, linguistic comprehension was entered into the sequence first. Following this step, variables will be entered sequentially as follows: prior knowledge, vocabulary, nonverbal intelligence, and decoding.

To investigate the moderating effect of Internet Skills on the relationship between the independent variables (decoding, linguistic comprehension, vocabulary, and nonverbal intelligence) and the predictor variable (i.e., online reading comprehension), I used a statistical software package designed to estimate the direct and indirect effect of two- and three-way interactions in moderation models, Process Macro (Hayes, 2013). Moderating variables change the relationship by either increasing or decreasing a known effect of independent variables on dependent variables. Thus, I investigated the effect of an interaction among these variables.

Preliminary analysis of assumptions indicated that assumptions for normality and multicollinearity have been met. Data was interpreted using an alpha level of .05. Effect sizes will be interpreted using r-squared correlations of .1, .3, and .5 to determine small, moderate, and large effects, respectively. A power analysis was not conducted for this sample because the number of participants is fixed. Post-hoc power analysis is thought to be counterproductive when the number of participants will not change (Fields, 2014, p. 70).

The Model. Below is a statistical representation of the model, including the moderation variable:

$$\text{ORC} = [b_0 + b_1\,(\text{SES}_i) + b_2(\text{linguistic comprehension}_i) + b_3\,(\text{prior knowledge}_i) + b_4\,(\text{vocabulary}_i) + b_5\,(\text{nonverbal intelligence}_i) + b_6\,(\text{decoding}_i) + b_7\,(\text{Internet Skills}_i) + (b_8\,(\text{linguistic comprehension}_i)\,(\text{Internet Skills}_i)) + (b_9\,(\text{prior knowledge}_i)(\text{Internet Skills}_i)\,) + (b_{10}\,(\text{vocabulary}_i)(\text{Internet Skills}_i)) + (b_{11}\,(\text{nonverbal intelligence}_i)\,(\text{Internet Skills}_i) + b_{11}\,(\text{decoding}_i)\,(\text{Internet Skills}_i)\;] + \varepsilon_i$$

Limitations. Several limitations are evident and will curtail the interpretation and generalizability of the findings.

First, there were threats to external validity. The students in the sample spoke Dutch, which has a transparent orthography. Findings may offer limited insights concerning students who read languages with deeper orthographies. In addition, this study was conducted in the Netherlands, and, as a consequence, the results cannot be generalized to other settings (e.g., the United States).

Second, an internal threat to validity may be testing. Participants were asked to complete pre-tests and post-tests as part of the primary study. It is possible that the participants remembered questions from the test. Efforts to reduce the threat (alternate test form and time intervals between tests) were made. However, it is still plausible that participants became familiar with the tests.

CHAPTER 4

RESULTS

The purpose of this dissertation was to a) examine the extent to which cognitive factors (decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) contribute to online reading comprehension outcomes, and b) investigate the role of skills related to the Internet and ICTs in online reading comprehension outcomes. Analyses were therefore guided by the following research questions:

1) To what extent does decoding, linguistic comprehension, vocabulary, prior knowledge, and nonverbal reasoning predict online reading comprehension outcomes?
2) To what extent do Internet skills moderate the relationship?

In this chapter, for each research question, I describe a) the primary analysis, b) the data screening process, c) missing values, d) assumptions, and e) results. Lastly, I provide a summary of the findings relative to each research question.

Findings of the Present Study

Research Question 1— To what extent does decoding, linguistic comprehension, vocabulary, prior knowledge, and nonverbal reasoning predict online reading comprehension outcomes?

To investigate the extent to which decoding, listening, comprehension, vocabulary, prior knowledge, and nonverbal reasoning predict online reading comprehension outcomes, I performed a hierarchical multiple regression, which is an adapted version of a multiple regression. I entered a new variable based on theory. I entered the data blockwise to ensure that: a) the order of the variables was theoretically sound and b) the model could be replicated in the future (Field, 2013).

Data Screening Process

Prior to the analysis, the dataset was inspected for data entry errors. An inspection of frequency tables for each variable revealed that there were no errors in the data.

Missing Values

Prior to the analysis, the dataset was inspected for missing data. There were 269 participants in the original study, and 7 variables of interest. An inspection revealed that data were missing for a number of variables. To determine the extent to which the data were missing, I performed a Missing Values Analysis in SPSS. Results of this analysis revealed that 1) values were not missing completely at random (MCAR; Hill, 1997), $\chi^2 = 214.54$, df = 160, p = .01, and 2) two variables were missing more than 10% of the data. Therefore, I omitted both variables—prior knowledge (Tropical Rainforest) and ORC (Tropical Rainforest). It should be noted that these variables were to be combined with other variables—prior knowledge (Climate Change) ORC (Climate Change) to create a combined score for prior knowledge and a combined score for ORC. Given that the variables were correlated, I decided that omitting the variables would not affect the outcome of the study. After omitting the variables, I conducted a second Missing Values Analysis. Results revealed that the data were MCAR, $\chi^2 = 88.24$, df = 68, p = .05. I determined accordingly that listwise deletion was appropriate for the analysis of the sample. The revised sample was reduced by less than 15%, n = 230.

Assumptions

Hierarchical multiple regression has four main assumptions: 1) linearity, 2) independence of error, 3) homoscedasticity, and 4) normality (Field, 2013). To determine whether the assumption of linearity was met, I inspected the Normal P-Plot and determined that the relationship between the dependent variable and the predictors was linear. Next, I tested the assumption of independence error with the Durbin-Watson test, D = 2.02, and determined that the assumption was met. Then, I inspected the scatterplot to determine homogeneity of the variance. I determined that the assumption was met. Lastly, I tested the assumption of normality with the skew and kurtosis statistic (see Table 1). To further investigate normality, I inspected the histograms and determined that the normality assumption was met.

Table 1. Test of Normality for Predictor Variables

	N	Skewness	SE	Kurtosis	SE2
SES	267	0.96	0.15	-0.95	.30
Linguistic Comp.	263	-0.52	0.15	-0.87	.30
Prior Knowledge	258	-0.26	0.15	0.29	.30
Vocabulary	260	-1.405	0.15	3.07	.30
NonVI	264	-.80	0.15	1.10	.30
Decoding	263	-0.59	0.15	1.79	.30

Results

In this section, I highlight the results of the hierarchical multiple regression analysis. Specifically, I present the: a) descriptive statistics, b) correlations, c) collinearity, d) model summary, e) outliers, and f) summary of the analysis.

Descriptive statistics. The hierarchical multiple regression analysis included over 200 participants (n =230) and 7 variables. Descriptive statistics are displayed in Table 2 to provide a basic summary of the data analyzed.

Table 2. *Descriptive Statistics of Predictor Variables and the Dependent Variable*

	Mean	Std. Deviation	N
SES	2.14	1.62	230
Linguistic Comp.	58.35	27.67	230
Prior Knowledge	12.92	2.364	230
Vocabulary	86.61	13.64	230
NonVI	43.59	7.34	230
Decoding	86.61	13.64	230
ORC	12.92	2.364	230

Note. SES= parent level of education; NonVI = nonverbal intelligence; ORC = online reading comprehension

Correlations. To determine the relationships between variable pairs in the model, I computed Pearson product-moment correlation coefficients (see Table 3). The relationship between the outcome variable and the predictor variables ranged from -.047 to .31. A number of the relationships were statistically significant. Especially notable was the significant correlation between linguistic comprehension and vocabulary, r= .682.

Table 3. *Correlations between the Dependent Variable and Predictor Variables*

Variables	1	2	3	4	5	6	7
1. ORC	---	-.05	.31*	.23*	.277	.10	.06
2. SES	-.05	---	-.25*	.07	-.42*	-.08	-.02
3. LC	.31*	-.25*	---	.21*	.68	.22	.30*
4. P. Knowledge	.23*	.07	.21	---	.19*	.02	.02
5. Vocab	.28*	-.42*	.68*	.19*	---	.31*	.17*
6. NonVI	.20	-.08	.22*	.02	.31*	---	.14*
7. Decoding	.06	-.02	.30*	.02	.17*	.14*	---

Note. *p <.01. ORC = online reading comprehension; SES = parent level of education; LC = linguistic comprehension; P. Knowledge = prior knowledge

Collinearity. Given that a number of predictor variables correlated either moderately or highly with the outcome variable, I examined the data for multicollinearity. The collinearity diagnostics, variance inflation factor (VIF) and tolerance, both revealed that the multicollinearity was absent between variables. The VIF did not exceed 10 between any two predictors (see Bowerman & Connell, 1990), and the tolerance statistic did not fall below .01.

Model summary. To determine the factors that contribute to online reading comprehension outcomes and their predictive power, I tested a hierarchical series of regression models. The first regression was a simple correlation between the predictor variable, SES, and the outcome variable, online reading comprehension ($ORC = b_0 + b_1 (SES) + \varepsilon_i$). Thereafter, an additional predictor variable was entered into the model. I examined the fit of each model to determine: a) its predictive ability and b) the changes in predictability across models. Results of the regression revealed that that the full model, $ORC = b_0 + b_1 (SES_i) + b_2 (\text{linguistic comprehension}_i) + b_3 (\text{prior knowledge}_i) + b_4 (\text{vocabulary}_i) + b_5 (\text{nonverbal intelligence}_i) + b_6 (\text{decoding}_i) + \varepsilon_i$, was not statistically significant ($F_{1,228} = .23$, $p = .64$). The best model fit was the third model, ORC = $b_0 + b_1$ (SES_i) + b_2 (linguistic $comprehension_i$) + b_3 (prior $knowledge_i$) + εi, $F_{1,226} = 6.76$, $p = .01$. Table 4 displays the model summary.

Table 4. *Model Summary of Hierarchical Multiple Regression Analyses Predicting Socioeconomic Status, Linguistic Comprehension, Prior Knowledge, Vocabulary, Nonverbal Intelligence, and Decoding with Online Reading Comprehension*

Model[g]	R	R2	Adjusted R^2	SE	R2Δ	FΔ	Sig. F
SES	.05[a]	.00	-.00	2.37	.00	.52	.47
Ling. Comp	.31[b]	.09	.09	2.26	.09	23.05	.00
P Knowledge	.35[c]	.12	.11	2.23	.03	6.76	.01
Vocabulary	.36[d]	.13	.11	2.23	.01	2.33	.13
NonVI	.36[e]	.13	.11	2.23	.00	.08	.78
Decoding	.36[f]	.13	.11	2.23	.00	.23	.64

Note. a. Predictors: (Constant), SES; b. Predictors: (Constant), SES, LC; c. Predictors: (Constant), SES, linguistic comprehension, prior knowledge; d. Predictors: (Constant), SES, linguistic comprehension, prior knowledge, vocab; e. Predictors: (Constant), SES, linguistic comprehension, prior knowledge, Vocab, nonverbal intelligence; f. Predictors: Constant), SES, linguistic comprehension, prior knowledge, Vocab, nonverbal intelligence, decoding; g. Dependent Variable: ORC

Outliers. Outliers can bias a statistical model (Field, 2013). To determine whether the model was biased, I inspected the data for outliers. There was evidence that seven cases differed from the main trend in the model. That is, the standardized residuals for these cases were outside the established limits, ±2. Though it is reasonable to expect at least 5% of the cases to have standardized residuals outside of the limits (Field, 2013), I investigated the cases further to determine if the cases biased the model. I evaluated the outliers using the established guidelines for Cook's Distance, Malahanobis Distance, and

Leverage (see Field, 2013). Results revealed that none of the seven outliers had a significant influence on the model.

Post hoc analysis. Given that vocabulary is known to play a significant role in offline reading comprehension outcomes for adolescents (see Chen & Vellutino et al., 2007), I performed follow-up analyses to determine whether the predictive power of vocabulary changed if it were entered into the regression before entering linguistic comprehension. Similar to the first analysis, I tested a hierarchical series of regression models. Results of the regression revealed that vocabulary contributes significantly when entered into the regression first, $F_{(1,228)} = 16.57$, $p < .01$. Different from the first set of analyses, the post hoc analyses suggest that best model fit is the fourth model, ORC = b_0 + b_1 (SES_i) + b_2 (linguistic $comprehension_i$) + b_3 (prior $knowledge_i$) +b_4 ($vocabulary_i$) + εi, $F_{(1,226)} = 5.73$, $p = .02$. Table 5 displays the model summary.

Table 5. *Model Summary of Hierarchical Multiple Regression Analyses Predicting Socioeconomic Status, Vocabulary, Prior Knowledge, Linguistic Comprehension, Nonverbal Intelligence, and Decoding with Online Reading Comprehension*

Model[g]	R	R2	Adjusted R^2	SE	R2Δ	FΔ	Sig. F
SES	.04[a]	.00	-.00	2.37	.00	.44	.51
Vocabulary	.26[b]	.07	.06	2.29	.07	16.57	.00
P Knowledge	.31[c]	.10	.09	2.26	.03	7.38	.01
Ling. Comp	.35[d]	.12	.11	2.23	.02	5.73	.02
NonVI	.35[e]	.12	.11	2.24	.00	.13	.72
Decoding	.35[f]	.12	.10	2.24	.00	.05	.83

Note. a. Predictors: (Constant), SES; b. Predictors: (Constant), SES, Vocabulary; c. Predictors: (Constant), SES, vocabulary, prior knowledge; d. Predictors: (Constant), SES, vocabulary, prior knowledge, linguistic comprehension; e. Predictors: (Constant), SES, vocabulary, prior knowledge, linguistic comprehension, nonverbal intelligence; f.

Predictors: Constant), SES, vocabulary, prior knowledge, linguistic comprehension, nonverbal intelligence, decoding; g. Dependent Variable: ORC

Summary. Based on the results of the analyses, I adopted the third regression model as having the best fit. Subsequent analyses focus on this revised model—ORC = b_0 + b_1 (SES_i) + b_2 (linguistic $comprehension_i$) + b_3 (prior $knowledge_i$) + ε_i. See Table 4.

Table 6. *Hierarchical Multiple Regression Analyses Predicting Socioeconomic Status, Linguistic Comprehension, Prior Knowledge, Vocabulary, Nonverbal Intelligence, and Decoding with Online Reading Comprehension*

	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β
SES	-.05	.03	.01	.05	.05	.05*
Ling. Comp		.31*	.27*	.20*	.19*	.20*
P Knowledge			.17*	.16*	.16*	.16
Vocabulary				.14	.13	.13
NonVI					.02	.02
Decoding						-.03
ΔR2	.00	.09	.03	.03	.01	.00
FΔ	.52	23.05	6.76	2.33	.08	.22
df	228	227	226	225	224	223

Note. *p <.05

Research Question Two—To what extent do Internet skills moderate the relationship among linguistic comprehension, prior knowledge, and online reading comprehension?

To investigate the extent to which Internet skills moderate the relationship between factors in the model and reading comprehension, I performed two separate analyses, an exploratory factor analysis (EFA) and a moderation analysis. For each analysis, I will describe the: a) analysis, b) data screening process, c) missing values, d) assumptions, and e) results.

Exploratory Factor Analysis (EFA)

EFA is a statistical technique that can be used to identify clusters of related variables (Field, 2013). Given that this dataset included variables taken from a questionnaire that measured students' perceptions of their computer skills (see APPENDIX B), I performed an EFA to determine the factor structure of the questionnaire.

Data screening process. Prior to performing an EFA, I inspected the data for errors. Results from the data screening revealed that the items on the questionnaire were not scored consistently. Students' responses to the questionnaire were to be assigned a score of 0 for a *no* response and a score of 1 for a *yes* response. However, frequency charts revealed that a score of 2 was also assigned. Researcher notes from the primary analysis indicated that cases 106 through 135 were assigned a score of 1 for a *no* response and a score of 2 for a *yes* response. Therefore, I recoded scores, 2 è 1 and 1è 0, for those cases.

Missing values. To determine if values were missing from the dataset, I performed a missing values analysis. Results revealed that: 1) the data were missing completely at random based on the Little's MCAR test (Hill, 1997), $\chi^2 = 26.78$, df = 38, p = .92 and, b) less than 9% of the data were missing from each variable. Thus, the missing data does not exceed the exclusionary criterion of 10%.

Assumptions. Exploratory factor analysis has three assumptions: 1) normality, 2) sample size, and 3) correlations. The assumption of normality was evaluated with skew and kurtosis statistics. The evaluation revealed that 10 out of 20 variables met the established skewness guidelines, ±2, and therefore met the assumption of normality. The skewness of these variables ranged from -1.77 to .13. The remaining ten variables violated the assumption of normality. The skewness of the variables ranged from -11.36 to -2.65. (See Table 7). After further investigation of the skewed statistic of the variables that violated the assumption of normality, I decided to retain variables with a skewed statistic ±3(See Kline, 2011). The kurtosis statistic was also evaluated for the variables (k = 13) to be included in the factor analysis. Results revealed that 6 of the 13 variables met the established kurtosis guidelines ±2. The remaining variables (k =7) fell outside of the limits of those guidelines. Kurtosis scores for those variables ranged from 29.75 to 3.89 (see Table 7). Next, the reliability of the sample size was evaluated with the Kaiser-Meyer-Olkin (KMO) statistic. The KMO statistic (.84) was well above the minimum 0.5 criterion (Field, 2013). Therefore, I determined that: a) the sample size (n = 261) was appropriate for a factor analysis, and b) the sample could adequately generate a reliable factor analysis. Lastly, the assumption of correlations was tested with Bartlett's Test of Sphericity. Results revealed that the correlations were significantly different than zero, $\chi^2 = 863.08$, $df = 78$, $p < .001$. Additionally, an analysis of the correlates revealed that multicollinearity was absent between variables, determinant = .03. Given these results, I concluded that each question on the questionnaire measured the same underlying concept. Consequently, none of the variables was excluded from the analysis because the assumption of correlations was not violated.

Table 7. *Test of Normality for Computer Skills Variables*

	N	Skewness	Std. Error	Kurtosis	Std. Error
Save a text	261	-11.36	0.15	127.97	0.3
Change words to bold	261	-11.36	0.15	127.97	0.3
Cut and paste	261	-3.91	0.15	25.36	0.3
Put diacritics in a text	261	-0.75	0.15	3.88	0.3
Use spell check	261	-1.77	0.15	9.66	0.3
Add pictures to text	261	-5.48	0.15	28.22	0.3
Draw a circle & rectangle	261	-1.64	0.15	3.44	0.3
Change letter color	261	-0.82	0.15	1.13	0.3
Rotate an image	261	-0.51	0.15	1.15	0.3
Send an email	261	-2.64	0.15	29.75	0.3
Respond to an email	261	-4.121	0.15	33.98	0.3
Forward an email	261	-2.68	0.15	13.72	0.3
Attach file to email	261	-1.63	0.15	2.26	0.3
Surf the Internet	261	-7.06	0.15	48.16	0.3
Print a website	261	-3.99	0.15	13.99	0.3
Add a book mark	261	-0.64	0.15	0.89	0.3
Use a search engine	261	-2.79	0.15	22.89	0.3
Download from Internet	261	-0.77	0.15	1.90	0.3
Chat	261	-1.27	0.15	6.34	0.3
Create a website	261	0.13	0.15	0.37	0.3

Results

Factor extraction. I performed a principal axis factor analysis on 13 variables, which represented items from a 20-question questionnaire designed to measure students' perceptions of their computer skills. Results revealed that three factors had eigenvalues greater than 1. These eigenvalues ranged from 1.14 to 4.3 Cumulatively, these three factors accounted for approximately 53% of the variance that explained students' perceptions of their computer skills. Also, I inspected the inflections of the scree plot and determined that retaining two to three factors would be reasonable.

Factor rotation. To determine the structure for each factor, I rotated the factors orthogonally using the varimax rotation technique. After reviewing the factor loadings on the three factors, I decided to retain two factors, factor 1 and factor 3 (see Table 8). The cluster of items for Factor 1 suggests that this factor represents computer Internet skills. On the other hand, the clusters for Factor 2 suggest that the factor represents computer word skills.

Table 8. *Factor Loadings for Exploratory Factor Analysis With Varimax Rotation of Perceptions of Computer Skills*

	Factor 1	Factor 2	Factor 3
Download from Internet	.66		
Create a website	.66		
Rotate an image	.59		
Add a bookmark	.56		
Attach a file to email	.55	.31	
Chat	.40		

Forward an email		.75	
Rotate an image		.70	
Use spell check			.56
Draw a circle & rectangle	.40		.44
Change letter color	.35		.41
Use a search engine		.33	.39
Put diacritics in a text			.34

Note. Factor loading > .40 are in boldface. Factor 1= Computer Internet Skills; Factor 3 =Computer Word Skills

Reliability. To determine whether the variable clusters on each factor respectively reflect measures of computer Internet skills and computer word skills, I conducted a reliability analysis.

The analysis revealed that the measure of computer Internet skills is reliable, $\alpha = .80$. The measure for computer word skills had a respectable correlation, but was not considered reliable, $\alpha = .53$.

Moderation Analysis

A moderation analysis is a statistical procedure that uses regression-based path analysis to estimate the influence of a third variable on the effects of the predictor variable on the outcome variable (Hayes, 2013). The focus of this analysis was the influence of computer skills on the revised model—$ORC = b_0 + b_1 (SES_i) + b_2$ (linguistic comprehension$_i$)$+b_3$ (prior knowledge$_i$) $+ \varepsilon_{i.}$

Data screening. Prior to data analysis, I inspected the data for errors.

Missing values. To determine if values were missing from the dataset, I performed a missing values analysis. Results revealed that the data were missing completely at random, $\chi^2 = 30.88$, df = 32, p = .52.

Assumptions. A moderation analysis is a path of regressions. Therefore, the assumptions are similar to those associated with a multiple regression—linearity, independence, normality, and homoscedasticity. To test these assumptions, I performed a multiple regression. A visual inspection of the Normal P-Plot of Regression Standardized Residual revealed that a linear relationship existed between the dependent variable and predictor variables. The Durbin-Watson static, D = 1.98, revealed that the residuals were independent and were not correlated. A visual inspection of the histogram revealed that the data were normally distributed. Further, a report comprising descriptives of the data revealed that both the skew and kurtosis statistic met the established guides, ±2 (see Table 8). Lastly, a visual inspection of scatterplots revealed homogeneity of the variance. Further, the statistical software, PROCESS, I used to perform the moderation analysis, corrected for heteroscedasticity. All assumptions were met.

Collinearity. Prior to conducting the moderation analysis, I examined the collinearity statistics. The VIF met the established guideline, VIF <10, for single predictor variables. The VIF scores ranged from 1.05 to 8.56. The tolerance statistic for these variables met the established guideline, tolerance >.1. The tolerance statistic ranged from .17 to .95. The interaction variables (i.e., linguistic comprehension x computer Internet skills and prior knowledge x computer Internet skills) were multicollinear; however, this is expected for interaction terms and is resolved my centering the mean (Field, 2013). Given that the mean was centered prior to the analysis, I determined that multicollinearity was absent for each single predictor variable and that grand mean centering would resolve multicollinearity for interaction variables.

A priori analysis. Prior to conducting a moderation analysis, the mean of the variables must be centered. Otherwise, the beta will be too distorted, and as a result inferences drawn will be illogical. Also, a simple slope analysis must be performed to account for the differences in the findings for participants at the high end of the data and for those at the low end of the data (Field, 2013). These analyses are built into the statistical software, PROCESS (see Field, 2013).

Interaction.

Results

Descriptive statistics. There were over 200 participants (n=230) for each predictor variable. Descriptive statistics are displayed in Table 9 to provide a basic summary of the data analyzed.

Table 9. *Descriptive Statistics of the Predictor Variables, Dependent Variable, and the Moderator for a Moderation Analysis*

	N	Mean	Std. Deviation	Skewness	SE	Kurtosis	SE2
SES	267	2.2	1.7035	0.96	0.15	-0.95	0.3
LC	263	57.76	22.16	0.08	0.15	-0.87	0.3
PK	259	11.82	2.05	-0.26	0.15	0.29	0.3
ORC	248	12.92	2.33	-0.84	0.16	2.67	0.31
CIS	259	4.23	1.65	-0.43	0.15	1.12	0.30
LCXCIS	254	256.32	165.09	0.18	0.15	-0.6	0.30
PCXCIS	254	50.12	22.16	0.08	0.15	1.00	0.30

Note. *p < .05. SES =parent level of education; LC = linguistic comprehension; PK = prior knowledge; ORC = online reading comprehension; CIS =computer Internet skills

Model summary. To determine whether computer Internet skills moderated the relationship among online reading comprehension, linguistic comprehension, and prior knowledge, I, first, investigated whether or not computer Internet skills moderated the relationship between linguistic comprehension and online reading comprehension. Please note, I chose to investigate this relationship first because linguistic comprehension is the stronger predictor of online reading comprehension. Results from the moderation analysis revealed that computer Internet skills did not moderate the relationship between linguistic comprehension and online reading comprehension, $F_{1, 224} = .92$, $p= .34$ (ORC = $b_0 + b_1$ (Linguistic Comprehension$_i$) + b_2 (CIS$_i$)+$_{b3}$ ((Linguistic Comprehension$_i$)(CIS$_i$)) + b_4C_1 (SES) + b_5 C_2 (prior knowledge) + ε_i).

Next, I investigated whether computer Internet skills moderated the relationship between prior knowledge and online reading comprehension. I chose to evaluate this relationship after the linguistic comprehension because prior knowledge is not as strong a predictor of online reading comprehension as is linguistic comprehension. Results from the moderation analysis revealed that computer Internet skills did not moderate the relationship between prior knowledge and online reading comprehension, $F_{1, 224} = .37$, $p= .54$ (ORC = $b_0 + b_1$ (background knowledge$_i$) + b_2 (CIS$_i$)+$_{b3}$ ((background knowledge$_i$)(CIS$_i$)) +b_4C_1 (SES) + b_5 C_2 (linguistic comprehension$_i$) + ε_i). Table 10 displays the results of the moderation analysis.

Table 10. *Moderation Analysis of Linguistic Comprehension, Prior Knowledge, and Internet Skills with Online Reading Comprehension*

	Model 1	Model 2
	B	B

CIS	-.11	-.12
LC	.02*	.02*
LC x CIS	-.00	
SES	.03	.03
PK	.20*	.21*
PK x CIS		.03
ΔR2	.01	.00
FΔ	.92	.37
df	224	224

Note. *p <.05. CIS =computer Internet skills; LC =linguistic comprehension; SES =parent level of education; PK = prior knowledge

Summary of Findings

In this chapter, I presented the results of two quantitative investigations—hierarchical multiple regression and moderation analysis. In this section, I summarize the findings for each investigation.

Hierarchical Multiple Regression

I conducted a hierarchical multiple regression analysis to determine the extent to which cognitive factors (i.e., linguistic comprehension, prior knowledge, vocabulary, nonverbal reasoning, and decoding) contribute to online reading comprehension outcomes. To determine whether these factors contributed uniquely, I controlled for SES. Results revealed that a) SES was negligible and b) linguistic comprehension and prior knowledge explained the most significant variance in online reading comprehension outcomes for adolescents. Therefore, the tested model, $ORC = b_0 + b_1 (SES_i) + b_2$

(linguistic comprehension$_i$) + b_3 (prior knowledge$_i$) +b_4 (vocabulary$_i$) + b_5 (nonverbal intelligence$_i$) + b_6 (decoding $_i$) + εi, was not the best model fit. In fact, there was not a significant change in the amount of variance accounted for in online reading comprehension after prior knowledge was entered in the model. Vocabulary did not significantly contribute to online reading comprehension outcomes for adolescents, and both decoding and nonverbal intelligence were negligible. However, a follow-up analysis indicated that vocabulary contributed significantly to online reading comprehension when entered into the model before prior knowledge and linguistic comprehension. Nevertheless, the best model fit is ORC = b_0 + b_1 (SES$_i$) + b_2 (linguistic comprehension$_i$) + b_3 (prior knowledge$_i$) + εi.

Moderation Analysis

I conducted a moderation analysis to determine the extent to which computer Internet skills moderated the relationship between reading skills (linguistic comprehension and vocabulary) and online reading comprehension. Results revealed that computer Internet skills did not moderate the relationship between linguistic comprehension and online reading comprehension neither does it moderate the relationship between prior knowledge and online reading comprehension.

CHAPTER 5

DISCUSSION

A review of the literature revealed that our understanding of the developmental processes of reading might be sufficient to guide research, theory and practice for offline reading comprehension. However, given what we know about the composition of digital texts, traditional definitions and theories of offline reading comprehension, and the research findings traditional theories and definitions have occasioned, our understanding may be insufficient when considering the complex processes required for online reading comprehension (see Leu, Kinzer, Coiro, & Cammack, 2008). Therefore, the purpose of this study was twofold: 1) to investigate the extent to which cognitive factors (i.e., decoding, linguistic comprehension, prior knowledge, vocabulary, and nonverbal intelligence) contribute to online reading comprehension and 2) to investigate the extent to which Internet skills moderate the relationship between those processes and online reading comprehension outcomes.

I will begin this chapter by summarizing the findings. Next, I will discuss the findings. Then, I will discuss the implications of the findings. Lastly, I will discuss the limitations of the findings.

Summary of Findings

To determine the extent to which cognitive factors (i.e., linguistic comprehension, prior knowledge, vocabulary, nonverbal reasoning, and decoding) contributed to online reading comprehension, I conducted a hierarchical multiple regression. I controlled for

SES to determine which factors uniquely contributed to online reading comprehension beyond that which could be explained by SES. Thereafter, factors were entered into the regression hierarchically—linguistic comprehension, prior knowledge, vocabulary, nonverbal intelligence, and decoding—based on theory. Results revealed that SES was negligible. Further, there was not a significant change in the amount of variance accounted for in online reading comprehension after prior knowledge was entered into the regression model. In other words, beyond linguistic comprehension and prior knowledge no additional variance could be attributed to vocabulary, nonverbal intelligence, or decoding.

To determine the extent to which Internet skills moderated the relationship between reading ability and online reading comprehension, I performed a moderation regression analysis. Results revealed that Internet skills did not moderate the relationship among linguistic comprehension, prior knowledge, and online reading comprehension.

Review of Findings

In this section, I will briefly highlight the role of SES in ORC. I will also compare and contrast the findings of the present study with findings of previous research within the context of the three theoretical perspectives that framed this study: 1) the simple view of reading (Gough & Tunmer, 1986), 2) the interactive model of reading (Rumelhart, 1994), and 3) the new literacies of online reading comprehension (Leu et al., 2015).

Socioeconomic Status (SES)

Findings from this study suggest that the influence of SES on ORC is negligible. These findings were unexpected given what is known about the role of SES in offline reading comprehension (see Hart & Risley, 1995) and online reading comprehension

(Leu et al., 2014). However, it should be noted that, similar to findings from previous research, SES was significantly correlated with linguistic comprehension (*r* = -.25) and prior knowledge (*r* = -.42; see Table 3). Therefore, it is reasonable to conclude that SES influences both linguistic comprehension and prior knowledge, which are proximal factors of online reading comprehension. In other words, SES has may have an indirect effect on online reading comprehension outcomes.

It should be noted, however, that findings from the present study should be interpreted with caution when considering findings of previous research (e.g., Leu et al. 2014) that highlight the role of SES in online reading comprehension outcomes. To illustrate, Leu et al. (2014) found that SES played a significant role in online reading comprehension. However, this conclusion was based upon the relationship between computer access and online reading comprehension outcomes (e.g., Leu ORCA studies). In contrast, findings from the present study are based upon the predictive power of parent level of education on online reading comprehension, which was measured by pre-tests and posts scores on domain-specific knowledge tests. Therefore, it is ill advised to compare and contrast the present study with previous research.

The Simple View of Reading

The premise of the simple view of reading (Gough & Tunmer, 1986) is that reading comprehension is the result of a complex interaction between two distinct processes—decoding and linguistic comprehension. According to this theory, reading comprehension is the product of language comprehension (LC) and decoding (D), so that RC =D X LC. Consequently it cannot occur in the absence of one or both of these processes – that is, if D and/or C is zero (Gough & Tunmer, 1986). However, there is evidence to suggest that reading comprehension can occur in the absence of one of these processes, RC = D + LC (see Dreyer & Katz, 1992; see also Chen & Vellutino, 1997). Among this evidence, there are also studies that examine the relationship between offline reading comprehension outcomes and other cognitive processes—vocabulary (Ouellette & Beers, 2009; Tilstra et al., 2009), prior knowledge (Stahl et al., 1991; Recht & Leslie, 1998) and nonverbal intelligence (Singer & Crouse, 1981). The caveat with respect to these findings, however, is that the investigations focus solely on print-based texts. It is not clear, though it is assumed (Leu et al., 2007), whether these factors contribute similarly to online reading comprehension. Therefore, in the present study, I performed a hierarchical multiple regression to examine the extent to which cognitive factors (i.e., linguistic comprehension, prior knowledge, vocabulary, nonverbal intelligence, and decoding) contribute to online reading comprehension.

The results of the present study both confirm and challenge previous findings. For example, in previous studies linguistic comprehension was found to be a stronger predictor ($r = .81$; Chen & Vellutino, 1997; see also Singer & Crouse, 1981) of reading comprehension than decoding ($r = .34$) for sixth-grade students. Similarly, results from the present study revealed that linguistic comprehension was a stronger predictor ($r = .31$) of online reading comprehension than decoding ($r = .06$). On the other hand, the notion that both linguistic comprehension and decoding together account for a substantial amount of the variance in reading comprehension (28-65%; Chen & Vellutino, 1997) was not confirmed in the present study. These results revealed that decoding and linguistic comprehension accounted for approximately 9% of the variance in online reading comprehension. Further, decoding did not have any explanatory power beyond the variance explained by linguistic comprehension and prior knowledge. One explanation may be the comprehensive nature of the measure for linguistic comprehension (see Chapter 2). Another explanation may lie in the shallow orthography of the Dutch language, which minimizes the decoding difficulties experienced by Dutch students. Still another may be that the prior knowledge and online comprehension variables were measures of content-specific knowledge (see Stahl, 1991).

According to Stahl and his colleagues (1991), vocabulary mediates the relationship between domain-specific knowledge and reading comprehension outcomes for print-based texts. As a result, domain-specific knowledge accounts for a small, non-significant amount of the variance (4%) in reading comprehension when vocabulary is taken into consideration. However, in the present study, vocabulary did not mediate the relationship between domain-specific knowledge and online reading comprehension. Instead, domain specific knowledge accounted for a significant, but small (3%), amount of the variance in online reading comprehension beyond that which was explained by vocabulary (7%). In fact, domain-specific knowledge, in the present study, is a proximal factor of online reading comprehension.

Still, findings from the present study differ from findings from previous research that considered the role of vocabulary in reading comprehension in print settings. Results from other studies confirm that vocabulary significantly contributes to offline reading comprehension outcomes (e.g., Anderson, 2013; Anderson & Freebody, 1985). To illustrate, Tilstra et al. (2009) found that vocabulary accounted for a small but significant amount of variance (8%) in reading comprehension beyond that explained by listening comprehension (35%) among a group of seventh graders. On the other hand, Ouellette and Beers (2009) found that vocabulary breadth accounted for 15.3% of the variance in reading comprehension beyond that which was explained by listening comprehension (5%) among a group of sixth graders. However, findings from that study should be interpreted cautiously because the hierarchy of variables entered into the regression—phonological awareness, decoding, irregular word reading, listening comprehension, vocabulary breadth, vocabulary depth—was not theoretically sound[10]. Nevertheless, in the present study, vocabulary did not explain any significant amount of the variance in online reading comprehension beyond that which was explained by linguistic comprehension (9.4%) and prior knowledge (3%). It should be noted, though, that the linguistic comprehension measure contained a measure of vocabulary breadth and the vocabulary measure in this study measured vocabulary depth. Furthermore, the vocabulary and linguistic comprehension measures were highly correlated (r= .68), and, therefore may explain the insignificant role vocabulary played in the online reading comprehension.

On the other hand, the contributions that nonverbal intelligence and decoding make to offline and online reading comprehension are similar. For example, Singer and Crouse (1981) found that vocabulary mediates the relationship between nonverbal intelligence, decoding, and offline reading comprehension. Similarly, nonverbal intelligence and decoding were negligible in online reading comprehension once both linguistic comprehension ($r^2 = .094$, $p < .001$), and prior knowledge ($r^2 = .121$, $p = .010$) were considered. To that end, the notion that linguistic comprehension and decoding are distinct processes that together largely explain offline reading comprehension may have

[10] Previous research suggests that linguistic/listening comprehension is a stronger predictor of reading comprehension than decoding (Chen & Vellutino, 2007).

merit. However, linguistic comprehension and prior knowledge may better predict online reading comprehension for the present sample. The relationship can be expressed as follows:

$$ORC = LC + PK$$

The Interactive Model

The Interactive Model of Reading (Rumelhart, 1994; see also Perfetti et al., 2005) is predicated on the simple view of reading. This model suggests that an interaction between decoding and linguistic comprehension occurs to aid meaning construction (Plaut et al., 1996; Stanovich, 2000). Once the reader identifies the words of a written text, the reader relies of subprocesses (see Chapter 2) of the linguistic comprehension process to construct and extract the meaning of the text (Perfetti et al., 2005). During these processes, the reader integrates the meaning of the text with prior knowledge. These processes are iterative and bidirectional. In Rumelhart's view, decoding is frequently automatic but is also guided in part by meaning that has been constructed to any given point in the text. It is reasonable to assume that this interaction is largely the same in both print and online reading contexts.

In light of the present finding that online reading comprehension is better explained by linguistic comprehension and prior knowledge, it was reasonable to determine next whether the variance in the relationship was more appropriately described by a linear relationship between the two predictors or by the interaction of the two. Results of this study revealed that the interaction between linguistic comprehension and prior knowledge was statistically significant but did not explain more variance than the linear relationship. This finding is consistent with findings about the relationship between decoding and linguistic comprehension in adolescents. The product model is considered too restrictive given the compensatory strategies often used by older children (see Savage, 2006).

The New Literacies of Online Reading Comprehension

The theory of the new literacies of online reading comprehension posits that meaning construction of online texts requires a different set of skills than those required to construct meaning in traditional, linear print texts. However, it is not clear how the "new" skills proposed by theorists of online reading comprehension differ significantly from those required to critically evaluate and synthesize information when performing tasks consistent with learning new information (e.g., research and critique). According to Leu and his colleagues (2015), the first step of online reading comprehension is inquiry. If online reading comprehension begins with an inquiry, then certain research skills are necessary. Specifically, Leu and his colleagues (2015) suggest that one must be able to locate, analyze, synthesize, and communicate information. However, I argue that this same skill set is required to learn new information in traditional settings. The important difference is the way in which information is accessed and analyzed in online environments versus traditional settings.

As noted in Chapter 2, inquiry in digital environments requires a considerable amount of cognitive flexibility because, unlike local libraries, the Internet is a dynamic, unbounded, and unsystematic environment. The question is what skills, beyond those that are required to read traditional, linear texts, are necessary for online reading comprehension? Previous studies (Leu et al., 2005; Coiro, 2011) have examined the skills necessary for online reading comprehension beyond those required for offline reading comprehension. The findings have been inconsistent. For example, Leu et al. (2005) suggested that the proposed "new" skills are uncorrelated with offline reading, which would suggest that the skills required for online reading are fundamentally different from those required for offline reading. However, Coiro (2011) found (using the same assessment, ORCA) that the "new" skills were positively correlated, (r= .61, p< .01) with offline reading. This finding suggests that the "new" skills are not meaningfully different from those that contribute to offline reading comprehension. Consequently, it is difficult to know if these skills are different from skills required for offline reading.

In the present study, I investigated specific Internet skills to determine if those skills differed from skills required for online reading comprehension. A composite score of specific Internet skills —downloading information from the Internet, sending an email with an attachment, creating a website, rotating an image, and adding a bookmark—was not significantly correlated (r=-.07, p= .13) with offline reading (linguistic comprehension). This finding suggests that these skills were different from those that contributed to offline reading comprehension. However, pertinent to this study was whether computer skills moderated the relationship between linguistic comprehension, prior knowledge, and online reading comprehension.

Results of a moderation analysis revealed that computer Internet skills did not moderate the relationship among linguistic comprehension, prior knowledge, and online reading comprehension. A number of factors might explain this result. One factor that may have contributed to this finding is prior knowledge. Prior knowledge is thought to effect online navigational skills and, subsequently, online reading comprehension (see Calisir & Gruel, 2003). Given that prior knowledge reached a level of significance in this study, it is plausible that prior knowledge may mediate the relationship between computer Internet skills and online reading comprehension rather than moderate the relationship. Another factor might be the novelty of this approach. The computer Internet skills tested in this study have not been investigated in previous studies, and, therefore, future investigations may reveal different results. Lastly, the academic experience of the participants may also be a factor. Rouet (2003) suggested that comparable performance on an online reading comprehension assessment for students with high levels and those with lower levels of prior knowledge may be the result of academic experience rather than prior knowledge. Findings from this study may suggest something similar. The majority (~75%) of the participants in this study were performing in the average to above average range academically. For these reasons, further investigation is warranted.

It is important to note that the use of specific Internet skills in an analysis to determine whether an effect is present on the relationship between reading ability and online reading comprehension is a novel concept. Previous research focuses on strategies that may influence online reading comprehension but fails to investigate specific Internet skills that may aid online reading comprehension outcomes (see Afflerbach, Pearson, & Pressley, 2008). It is not yet clear how incorporating specific computer Internet skills may influence online reading comprehension outcomes. Given that this is a novel approach, further exploration is warranted. It is possible that different results may be found among a different population. It is also possible that one or more of these skills may have an effect that was absent among a combination of these skills.

Implications and Future Research

In this section, I will discuss the theoretical, methodological, and practical implications of this study and directions for future research.

Theoretical Implications

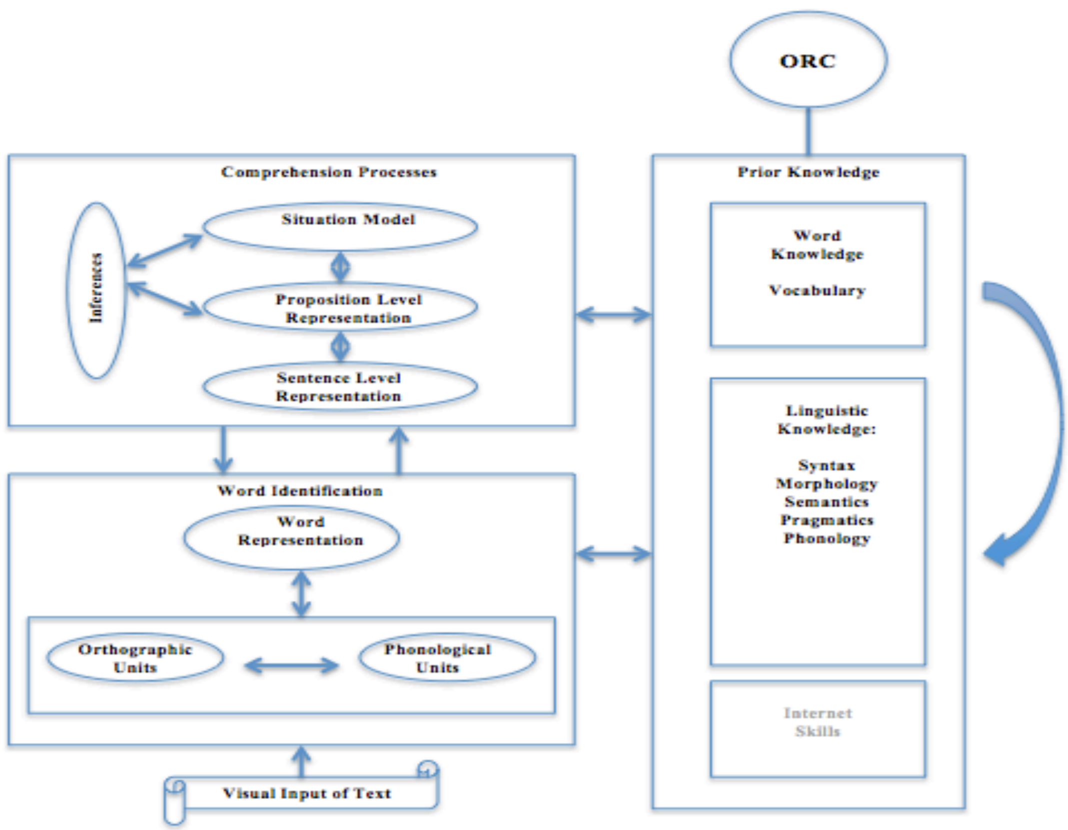
The theory of new literacies of online reading comprehension is still somewhat novel. A number of researchers (Afflerbach & Cho, 2009; Cho, 2013; Coiro & Dobler, 2007; Rouet, 2003) have examined factors that contribute to online reading comprehension; however, a model has yet to be established (Leu et al., 2007). The current study investigated factors that contribute to online reading comprehension. Results from the present study revealed that linguistic comprehension and prior knowledge accounted for the most unique variance in online reading comprehension. These findings provide a basis for establishing a model ($ORC = b_0 + b_1$ (linguistic comprehension$_i$) + b_2 (prior knowledge$_i$) + ε_i) that can be tested and disentangled.

In addition to providing a basis for a model of new literacies of online reading, findings from this study confirm the need to continue to investigate Internet skills that may influence the relationships among linguistic comprehension, prior knowledge, and online reading comprehension. Previous studies have suggested that a unique set of skills is required for readers to be able to extract and construct meaning from online texts (Coiro & Dobler, 2008; Cho, 2013). However, it is still unclear if the skills proposed by theorists of the new literacies of online reading comprehension are significantly different than those required for offline reading (see Coiro, 2011) or, in cases where they differ, whether the differences influence comprehension in meaningful ways.

To begin exploring the role of Internet skills play in ORC, I suggest an adapted version of Interactive Model of Reading proposed by Perfetti and colleagues (2005). The adapted version of the model highlights the findings from the present study to suggest that prior knowledge and linguistic comprehension are proximal components of ORC. It also suggests that Internet Skills may play a role in ORC, but further exploration is necessary. See Figure 1.

Figure 1

The Model of Online Reading Comprehension



Methodological Implications

Previous studies (see Coiro & Dobler, 2008; see also Leu et al., 2004) have acknowledged that the new literacies of online reading comprehension theory is not clearly defined. This lack of clarity can have significant consequences for theory, research, and practice. The present study defines online reading comprehension as that which occurs as a result of inquiry about a specific topic (see Leu et al., 2007). Thus, meaning construction occurs as a result of: a) gathering relevant information about a specific topic from online texts, b) identifying relationships within that information, and c) constructing situation models that aid reconstruction of and elaboration on ideas and perspectives about a specific topic (see Taboada & Guthrie, 2006). In the course of these actions, the reader activates relevant schemata during reading, and new information is either assimilated (if it is consistent with existing schemata) or accommodated (if it is inconsistent). Either way, the reader's schemata are altered through reading, and this alteration we can think of as learning (Piaget, 1952, 1957).

With this definition in mind, then it is clear that the way in which online reading comprehension is measured is imperative. The aforementioned definition suggests the following criterion for online reading comprehension: a) inquiry about a topic, b) evidence of prior knowledge of a topic, c) online research, and d) evidence of learning. This criterion suggests that measures of both prior knowledge and learning should be domain specific. It seems reasonable that prior knowledge and evidence of learning should be central to online reading comprehension research. The present study used researcher-created, domain-specific tests to measure both prior knowledge and online reading comprehension. However, this methodological decision was based on a guiding definition. Therefore, it may be necessary to establish a definition for the new literacies of online reading comprehension that reflects the purpose of the theory and ultimately guides online reading comprehension research.

Practical Implications

An established line of research suggests that online reading comprehension requires five unique competencies—identifying important questions, locating information, critically evaluating information, synthesizing information, and communicating information (Coiro, 2011; Coiro & Dobler, 2006; Leu et al., 2013). The implication of this theory suggests that these skills will improve online reading comprehension. However, the NCTE (2013) suggests that: a) online reading comprehension is influenced by the dynamic nature of ICTs, and b) consideration for the competencies required to utilize ICTs may also be necessary to improve online reading comprehension. Findings from the present study suggest a need to further explore specific Internet skills and the effect of those skills on the relationship among linguistic comprehension, prior knowledge, and online reading comprehension. Without theoretical and empirical consideration for the role of specific Internet skills, educators are left to build curricula that support online reading comprehension without guidance based on established best practices.

However, to determine if online reading comprehension is sufficient, teachers must be clear about the criteria for an assignment, they must be aware of the competencies required to successfully complete that assignment, and they must have an understanding of the applications students may use to complete it. Therefore, the quandary is, what should be assessed? In a previous study, Leu and his colleagues proposed a standardized assessment, Online Reading Comprehension Assessment (ORCA), to assess the online reading comprehension competencies of students (see Leu et al., 2015). ORCA is hosted in a digital environment and is designed to situate students in discipline-specific scenarios that require them to locate, critically evaluate, synthesize, and communicate information. Student performance in these scenarios is captured and data on their online reading comprehension competencies is available. However, findings from the present study suggest that prior knowledge and linguistic comprehension are predictors of online reading comprehension, and, therefore, should be assessed prior to an assignment. Educators should assess the level of knowledge a student has about a particular topic to: a) be able to determine if the instructions provided or skills that were taught helped students to gain new information during their search, and b) determine if students will need additional support during their online inquiry.

Furthermore, educators should continue to build students' knowledge of Internet applications. Though this study was unable to pinpoint specific skills that educators should incorporate in lessons, it is reasonable to suggest that students should be familiar with Internet applications that are pertinent to an assignment. Given that the Internet changes daily (see Chapter 1), new and updated skills may be required as new applications are introduced and "old" applications are updated. Therefore, findings revealed in the present study that suggests that Internet skills did not influence the relationship between reading ability and online reading comprehension should be interpreted cautiously. These findings are premature and further exploration is required to move theory forward, and ultimately provide theoretical and practical guidance to educators.

Limitations

A number of limitations of this study should be acknowledged**.** One limitation is generalizability. The students in the sample spoke Dutch, which has a transparent orthography. Findings may offer limited insights concerning students who read languages with deeper orthographies. In addition, this study was conducted in the Netherlands, and, as a consequence, the results cannot be generalized to other settings (e.g., the United States).

A second limitation was testing. Participants were asked to complete pre- and posttests as part of the primary study. It is possible that the participants remembered questions from the pretest. Efforts to reduce the threat (alternate test form and time intervals between tests) were made. However, it is still plausible that participants may have become familiar with the tests.

A final limitation was self-reporting. In the primary study, participants were asked to complete a questionnaire indicating tasks they could perform on a computer. It is possible that participants overestimated their ability to apply one or more Internet skills. In such case, the findings relative to Internet skills could have been influenced by response bias (see Paulhus & Vazire, 2007).

References

Adlof, S.M., Catts, H. W., & Little, T. D., (2006). Should the simple view of reading include a fluency component? *Reading and Writing, 19,* 933-958. doi: 10.1007/s11145-0006-9024-z.

Afflerbach, P., & Cho, B.Y. (2009). Identifying and describing constructively responsive comprehension strategies in new and traditional forms of reading. In S.E. Israel & G.G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 69-90). New York, NY: Routledge.

Afflerbach, P., Cho, B. Y., & Kim, J. Y. (2014). Inaccuracy and reading in multiple text and Internet/hypertext environments. In D. N., Rapp & J. L.G., Braasch (Eds.), *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the Educational Sciences* (pp. 403-424). Cambridge, MA: Massachusetts Institute of Technology Press.

Afflerbach, P., Pearson, P. D., & Paris, S. G. (2008). Clarifying differences between reading skills and reading strategies. *The Reading Teacher*, *61*, 364-373.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In 1. T. Guthrie (Ed.), *Comprehension and teaching: Research reviews* (pp. 77-117). Newark. DE: International Reading Association.

Beck, I. L., Perfetti, C. A., & McKeown, M. G. (1982). Effects of long-term vocabulary instruction on lexical access and reading comprehension. *Journal of Educational*

Psychology, *74*, 506-521.

Bilal, D., & Kirby, J. (2002). Differences and similarities in information seeking: children and adults as Web users. *Information Processing & Management*, *38*, 649-670. doi: 10.1016/S0306-4573(01)00057-7

Bonin, P. (2003). *Mental lexicon: "Some words to talk about words."* New York, NY: Nova Scotia Publishers, Inc.

Borgman, C. L., Hirsh, S. G., Walter, V. A., & Gallagher, A. L. (1995). Children's searching behavior on browsing and keyword online catalogs: The Science Library Catalog project. *JASIS*, *46*, 663-684.

Bransford, J. D., & Johnson, M. K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior*, *11*, 717-726.

Brem, S. K., Russell, J., & Weems, L. (2001). Science on the Web: Student evaluations of scientific arguments. *Discourse Processes*, *32*(2-3), 191-213. doi:10.1080/0163853X.2001.9651598

Brunner, C., & Tally, W. (1999). *The new media literacy handbook: An educator's guide to bringing new media into the classroom*. New York, NY: Anchor Books.

Calisir, F., & Gurel, Z. (2003). Influence of text structure and prior knowledge of the learner on reading comprehension, browsing and perceived control. *Computers in Human Behavior*, *19*(2), 135-145.

Callow, J. (2010). Spot the difference: The changing nature of page-based and screen-based texts. *Screen Education*, *58*, 106–110.

Carey, S., & Bartlett, E. (1978). Acquiring a single new word. *Papers and Reports on*

Child Language Development, 15, 17-29.

Catts, H. W., Adlof, S. M., & Weismer, S. E., (2006). Language deficits in poor comprehenders: A case for the simple view of reading. *Journal of Speech, Language, and Hearing Research, 49,* 278-293. doi: 10.1044/1092-4388(2006/023).

Catts, H. W., Hogan, T. P., & Adlof, S. M., (2005). Developmental changes in reading and reading disabilities. In H. Catts & A. Kamhi (Eds.), *Connection between languages and reading disabilities* (pp. 2025-2040). Mahwah, NJ: Erlbaum.

Chall, J. (1967). *Learning to read: The great debate*. New York, NY: McGraw-Hill.

Chen, R., & Vellutino, F. R. (1997). Prediction of reading ability: A cross-validation study of simple view of reading. *Journal of Literacy Research*, *29*, 1-24. doi:10:1080/10862969709547947.

Chi, M. T., Leeuw, N., Chiu, M. H., & LaVancher, C. (1994). Eliciting self-explanations improves understanding. *Cognitive Science*, *18*, 439-477. doi:10.1207/s15516709cog1803

Cho, B. Y. (2013). Adolescents' constructively responsive reading strategy use in a critical Internet reading task. *Reading Research Quarterly*, *48*, 329-332.

Central Intelligence Agency. (2010). *The CIA world factbook*. Retrieved October, 2015, https://www.cia.gov/library/publications/the-world-factbook/.

Ciolek, T. M. (1996). The six quests for the electronic grail: Current approaches to information quality in WWW resources. *Revue informatique et statistique dans les sciences humaines (RISSH)*, *32*, 1-4.

Coiro, J., & Dobler, E. (2007). Exploring the online reading comprehension strategies used by sixth-grade skilled readers to search for and locate information on the Internet. *Reading Research Quarterly*, *42*, 214-257. doi:10.1598/RRQ.42.2.2

Coiro, J. (2011). Predicting reading comprehension on the Internet contributions of offline reading skills, online reading skills, and prior knowledge. *Journal of Literacy Research*, *43*, 352-392. doi: 10.1177/1086296X11421979

Cope, B., & Kalantzis, M. (2009). “Multiliteracies”: New literacies, new learning. *Pedagogies: An international journal*, *4*(3), 164 -195. doi:10.1080/15544800903076044

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative, and qualitative research.* New York, NY: Sage publications.

Cromley, J. G., & Azevedo, R. (2009). Locating information within extended hypermedia. *Educational Technology Research and Development*, *57*, 287-313. doi:10.1007/s11423-008-9106-5

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. *Elementary English*, *42*, 895-948.

Dochy, F. J., & Alexander, P. A. (1995). Mapping prior knowledge: A framework for discussion among researchers. *European Journal of Psychology of Education*, *10*, 225-242.

Dochy, F. J., Moerkerke, G., & Martens, R. (1996). Integrating assessment, learning and instruction: Assessment of domain-specific and domaintranscending prior knowledge and progress. *Studies in Educational Evaluation*, *22*, 309-339.

Dutch Ministry of Education, Culture and Science. (2002). *ICT-onderwijs-monitor*. [ICT-education monitor]. Dordrecht, The Netherlands: Mainstream Marketing

Communicatie B.V.

Eagleton, M., Guinee, K., & Langlais, K. (2003). Teaching Internet literacy strategies The hero inquiry project. *Voices from the Middle*, *10*, 28-35.

Field, A. (2014). *Discovering statistics using IBM SPSS statistics*. New York, NY: Sage.

Fitzgerald, J., & Shanahan, T. (2000). Reading and writing relations and their development. *Educational Psychologist*, *35*, 39-50. doi:10.1207/S15326985EP3501_5

Graesser, A. C., Wiley, J., Goldman, S. R., O'Reilly, T., Jeon, M., & McDaniel, B. (2007). SEEK web tutor: Fostering a critical stance while exploring the causes of volcanic eruption. *Metacognition and Learning*, *2*(2-3), 89–105. doi: 10.1007/s11409-007-9013-x

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education*, *7*(1), 6-10. doi: 10.1177/074193258600700104

Guthrie, J. T., & Mosenthal, P. (1987). Literacy as multidimensional: Locating information and reading comprehension. *Educational Psychologist*, *22*, 279-297. doi:10.1080/00461520.1987.9653053

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul H Brookes Publishing.

Hathorn, L. G., & Rawson, K. A. (2012). The roles of embedded monitoring requests and questions in improving mental models of computer-based scientific text. *Computers & Education*, *59*, 1021-1031. doi:10.1016/j.compedu.2012.04.014

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.

Henderson, E. (1981). *Learning to read and spell: A child's knowledge of words.* Dekalb, IL: Northern Illinois University Press.

International Reading Association (2007). *Position Statement: New Literacies and 21st century technologies.* Newark, DE: Author

Henry, L. A. (2006). SEARCHing for an answer: The critical role of new literacies while reading on the Internet. *The Reading Teacher*, *59*, 614-627. doi: 10.1598/RT.59.7.1

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal*, *2*, 127-160. doi: 10.1007/BF00401799.

Hulme, C., Hatcher, P. J., Nation, K., Brown, A., Adams, J., & Stuart, G. (2002). Phoneme awareness is a better predictor of early reading skill than onset-rime awareness. *Journal of Experimental Child Psychology*, *82*(1), 2-28.

Julien, H., & Barker, S. (2009). How high-school students find and evaluate scientific information: A basis for information literacy skills development. *Library & Information Science Research*, *31*(1), 12-17. doi:10.1016/j.lisr.2008.10.008

Kintsch, W. (2004). The construction-integration model of text comprehension and its implications for instruction. In R.B., Ruddell & N., Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1270-1328). Newark, DE: International Reading Association.

Kintsch, W., & Van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological review*, *85*(5), 363. doi:10.1037/0033-295X.85.5.363

Kirby, J. R., & Savage, R. (2008). Can the simple view deal with the complexities of reading? *Literacy*, *42*, 75-82. doi: 10.1111/j.1741-4369.2008.00487.x.

Krom, R., Jongen, I., Verhelst, N., Kamphuis, F., & Kleintjes, F. (2010). *DMT en AVI. Groep 3 tot en met 8.* [Three-minutes test and AVI-test. Grade 1 to 6]. Arnhem, The Netherlands: Cito.

Kuiper, E., & Volman, M. (2008). The Web as a source of information for students in K–12 education. In Coiro, J., Knobel, M., Lankshear, C., Leu, D.J. (Eds.), *Handbook of research on new literacies* (5th ed., pp., 241-266). New York, NY: Routledge.

Kutner, M. A., Greenberg, E., & Baer, J. (2005). *National Assessment of Adult Literacy (NAAL): A first look at the literacy of America's adults in the 21st century*. Washington, DC: National Center for Education Statistics, US Department of Education, Institute of Education Sciences.

LaBerge, D., & Samuels, S. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology, 6,* 293-323. doi:10.1016/0010-0285(74)90015-2

Lawless, K. A., Schrader, P. G., & Mayall, H. J. (2007). Acquisition of information online: Knowledge, navigation and learning outcomes. *Journal of Literacy Research*, *39*, 289-306.

Leu, D. J. (2006). New literacies, reading research, and the challenges of change: A deictic perspective. In J. Hoffaman, D. L. Schallert, C. M. Fairbanks, J. Worthy, B. Maloch (Eds.), *55th yearbook of the National Reading Conference* (pp. 1-20). Chicago, IL: National reading Conference.

Leu, D. J., Forzani, E., Rhoads, C., Maykel, C., Kennedy, C., & Timbrell, N. (2015). The new literacies of online research and comprehension: Rethinking the reading achievement gap. *Reading Research Quarterly*, *50*, 37-59. doi:10.1002/rrq.85

Leu, D. J., Kinzer, C. K., Coiro, J. L., & Cammack, D. W. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R. B. Ruddell & N. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1570-1613). Newark, DE: International Reading Association.

Leu, D. J., Kinzer, C. K., Coiro, J., Castek, J., & Henry, L. A. (2013). New literacies: A dual level theory of the changing nature of literacy, instruction, and assessment. In D. E. Alvermann, N. J. Uranu, & R. B. Ruddell (Eds.), *Theoretical models andprocesses of reading* (6th ed., pp. 1150-1181). Newark, DE: International Reading Association.

Leu, D. J., Zawilinski, L., Castek, J., Banerjee, M., Housand, B., Liu, Y., & O'Neil. M. (2007). What is new about the new literacies of online reading comprehension? In L. S. Rush, A. J. Eakle, & A. Berger (Eds.). *Secondary school literacy: What research reveals for classroom practices* (pp.37-68). Urbana, IL: National Council of Teachers of English.

Lankshear, C., & Knobel, M. (2011). *New literacies: Everyday practices and social learning: Everyday practices and social learning*. New York, NY: McGraw-Hill Education.

McKenna, M.C. (2002). Hypertext. In B. J. Guzzetti (Ed.), *Literacy in America: An encyclopedia of history, theory, and practice* (pp. 233-237). Santa Barbara, CA: ABC-CLIO.

Metsala, J. L., & Walley, A. C. (1998). Spoken vocabulary growth and the segmental restructuring of lexical representations: Precursors to phonemic awareness and early reading ability. In J. L. Metsala & L. C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 89-120). Mahwah, NJ: Lawrence Erlbaum Associates.

Mezynski, K. (1983). Issues concerning the acquisition of knowledge: Effects of vocabulary training on reading comprehension. *Review of Educational Research*, *53*, 253-279.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Thousand Oaks, CA: Sage.

Miller, J. W., & McKenna, M. C. (2016). *World literacy: How countries rank and why it matters*. New York, NY: Routledge/Taylor and Francis.

Morris, D. (1983). Concept of word and phoneme awareness in the beginning reader. *Research in the Teaching of English*, *17*, 359-373.

Nagy, W. E., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. *Journal of Educational Psychology*, *95*, 730-742.

Nagy, W. E., & Scott, J. A. (2013). Vocabulary processes. In D. E. Alvermann, N. J. Unrau, & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (6th ed., pp. 923-956). Newark, DE: International Reading Association.

Nation, K., & Hulme, C. (1997). Phonemic segmentation, not onset-rime segmentation, predicts early reading and spelling skills. *Reading Research Quarterly*, *32*, 154-167.

Navarro, J., & Poynter, T. (2011). *Louder than words: Take your career from average to exceptional with hidden power of nonverbal intelligence*. New York, NY: Harper

Collins.

Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology*, *98*, 554-566. doi: 10.1037/0022-0663.98.3.554

Ouellette, G. P., & Beers, A. (2010). A not-so-simple view of reading: How oral vocabulary and visual-word recognition complicate the story. *Reading and Writing, 23,* 189-298. doi: 10.1007/s11145 008-9159-1.

Palinscar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, *1*, 117-175. doi: 10.1207/s1532690xci0102_1

Paulhus, D. L., & Vazire, S. (2007). The self-report method. In R.W. Robins, R.C. Fraely, & R.F. Krueger (Eds.), *Handbook of research methods in personality psychology* (pp. 224-239). New York, NY: Guilford Press.

Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology*, *8*, 317-344. doi:10.1016/0361-476X(83)90019-X

Perfetti. C. A., Landi. N., & Oakhill. J. (2005). The acquisition of reading comprehension skill, In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 227-247). Maiden. MA: Blackwell.

Perfetti, C. A., Rouet, J. F., & Britt, M. A. (1999). Toward a theory of documents representation. In H. van Oostendorp & S. R., Goldman (Eds.), *The construction of mental representations during reading* (pp. 88-108). Mahwah, NJ: Taylor & Francis.

Pew Research Center. (2014). *Americans feel better informed thanks to the Internet.* Retrieved from http://www.pewinternet.org/files/2014/12/PI_InformedWeb_120814_02.pdf

Pew Research Center. (2007). Information searches that solve problems. Retrieved from http://www.pewinternet.org/2007/12/30/information-searches-that-solve-problems/

Piaget, J. (1957). *Construction of reality in the child.* London, UK: Routledge & Kegan Paul.

Piaget, J., & Cook, M. T. (1952). *The origins of intelligence in children*. New York, NY: International University Press.

Pressley, M., & Afflerbach, P. (1995). *Verbal protocols of reading: The nature of constructively responsive reading*. New York, NY: Routledge.

RAND Reading Study Group. (2002). *Reading for understanding: Toward an R & D program in reading comprehension*. Santa Monica, CA: Author.

Recht, D. R., & Leslie, L. (1988). Effect of prior knowledge on good and poor readers' memory of text. *Journal of Educational Psychology*, *80*(1), 16-20.

Reynolds, R. E., & Anderson, R. C. (1982). Influence of questions on the allocation of attention during reading. *Journal of Educational Psychology*, *74*, 623-632.

Rosenblatt, L. M. (2013). The transactional theory of reading and writing. In D. E. Alvermann, N. J. Unrau, & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (6th ed., pp. 923-956). Newark, DE: International Reading Association.

Rouet, J. F. (2003). What was I looking for? The influence of task specificity and prior knowledge on students' search strategies in hypertext. *Interacting with Computers*, *15*, 409-428. doi:10.1016/S0953-5438(02)00064-4

Rouet, J. F., Favart, M., Britt, M. A., & Perfetti, C. A. (1997). Studying and using multiple documents in history: Effects of discipline expertise. *Cognition and Instruction*, *15*, 85-106.

Rumelhart, D. E. (1994). *Toward an interactive model of reading*. Newark, DE: International Reading Association.

Schneider, W., Körkel, J., & Weinert, F. E. (1989). Domain-specific knowledge and memory performance: A comparison of high- and low-aptitude children. *Journal of Educational Psychology*, *81*, 306-312.

Shanahan, T., & Lomax, R. G. (1988). A developmental comparison of three theoretical models of the reading-writing relationship. *Research in the Teaching of English*, *22*, 196-212.

Shapiro, A. M. (2004). How including prior knowledge as a subject variable may change outcomes of learning research. *American Educational Research Journal*, *41*, 159-189.

Spiro, R. J. (2004). Principled pluralism for adaptive flexibility in teaching and learning to read. In R.B. Ruddell & N. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 654-659). Newark, DE: International Reading Association.

Spiro, R. J., & Jehng, J. (1990). Cognitive flexibility and hypertext: Theory and technology for the non-linear and multidimensional traversal of complex subject matter. In D. Nix & R. Spiro (Eds.), *Cognition, education, and multimedia* (pp. 163-207). Hillsdale, NJ: Erlbaum.

Stahl, S. A. (1986). Three principles of effective vocabulary instruction. *Journal of Reading*, *29*, 662-668.

Stahl, S. A., & Nagy, W. E. (2006). *Teaching word meanings*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Stothard, S. E., & Hulme, C. (1992). Reading comprehension difficulties in children: The role of language comprehension and working memory skills. *Reading and Writing*, *4*, 245–256. doi:10.1007/BF01027150

Taboada, A., & Guthrie, J. T. (2006). Contributions of student questioning and prior knowledge to construction of knowledge from reading information text. *Journal of Literacy Research*, *38*, 1-35. doi:10.1207/s15548430jlr3801

Tannenbaum, K. R., Torgesen, J. K., & Wagner, R. K. (2006). Relationships between word knowledge and reading comprehension in third-grade children. *Scientific Studies of Reading*, *10*, 391-398. doi: 10.1207/s1532799xssr1004_3.

Tobias, S. (1994). Interest, prior knowledge, and learning. *Review of Educational Research*, *64*, 37-54.

Verhoeven, L., & Vermeer, A. (1993). *Taaltoets Allochtone Kinderen-Bovenbouw* [Language Test for Minority Children-grades 5 to 8]. Tilburg, The Netherlands: Zwijsen.

Verhoeven, L., & Vermeer, A. (1996). *Taalvaardigheid in de bovenbouw*. [Language proficiency in the upper elementary grades]. Tilburg, The Netherlands: Tilburg University Press.

Walraven, A., Brand-Gruwel, S., & Boshuizen, H. P. (2008). Information-problem solving: A review of problems students encountered and instructional solutions.

Computers in Human Behavior, *24*, 623-648. doi:10.1016/j.chb.2007.01.030

Wolfe, M. B., & Goldman, S. R. (2005). Relations between adolescents' text processing and reasoning. *Cognition and Instruction*, *23*, 467-502. doi:10.1207/s1532690xci2304_2

Zhang, M. (2013). Prompts-based scaffolding for online inquiry: Design intentions and classroom realities. *Educational Technology & Society, 16*(3), 140-151.

APPENDIX A

Types of Schools in the Netherlands

School Type	Descriptions
Public School	A state-run school that provides a secular education. The curriculum is not geared towards specific religious principles, philosophies, or pedagogical principles. A few of these schools may focus on a specific pedagogical principle (i.e., Montessori), but none focus on specific religious principle. In general, the foci of the curriculum are Dutch, English, Science, Social Studies (i.e., history, geography), Art, and Physical Education. A small percentage of these schools may include second languages (e.g., German, French) in the curriculum.
Private School	A school similar to a public school, except the education focus differs. These schools are geared toward religious principals (e.g., Roman Catholic, Islam) and/or specific pedagogical principles (i.e., Montessori).
International School	A school similar to a public school, except the student population may be more diverse than that of a public or private school. In general, students at this type of school are migrant children who can be of any nationality. The curriculum in this type of school varies to meet the needs of international children ages 4-19.

Private International School	A school that is similar to International Schools, except the curriculum focus may vary. The curriculum at this type of school may be similar to that of an International school, but it might focus on the national curriculum of a specific country (e.g., America, Britain, Japan, Indonesia).
Special School	A school that is designed to meet the needs of students with learning disabilities and/or special needs. Students attending this type of school must meet specific criteria (e.g., medical referral, Intelligence Quotient [IQ] < 70) to attend.
Ipad Schools	This type of school is more technologically advanced than many of the schools in the Netherlands. This school uses Ipads and educational apps to replace items that are generally used in traditional school settings (e.g., books, blackboards). Learning is more student-centered and based on *constructionism* (see Papert, XXXX). Therefore, the role of the teacher is to coach rather than to lecture and/or instruct.

APPENDIX B

Computer Survey

Vrangelist voor groep 8

Computers op school: wat doe jij ermee? (Computers in school: What do you do with it?)

1. Hoe oud ben je? (How old are you?)
   ☐ ☐ jaar

2. Ben je een meisje of een jongen? (Are you a boy or a girl?)

   meisje ☐ (girl)
   jongen ☐ (boy)

3. Gebruik je wel eens een compuer op school? (Do you ever use a computer at school?)

nooit (never)	☐
alleen in de klas (only in class)	☐
alleen buiten de klas (outside of class only)	☐
in en buiten de klas (in and outside of class)	☐

4. Heb je op school geleerd hoe je een computer gebruikt? (Have you learned to use a computer at school?)

nee (no) ☐
ja (yes) ☐

5. Hoe vaak gebruik je de computer bij de volgende vakken? (How often do you use the computer in the following subjects?)

a. Lezen (read)	☐ ☐ ☐ ☐ ☐
b. Nederlandse taal (Dutch language)	☐ ☐ ☐ ☐ ☐
c. Engelse taal (English language)	☐ ☐ ☐ ☐ ☐
d. Rekenen en wiskunde (mathematics)	☐ ☐ ☐ ☐ ☐
e. Aardrijkskunde (geography)	☐ ☐ ☐ ☐ ☐
f. Geschiedenis (history)	☐ ☐ ☐ ☐ ☐
g. Natuur (nature/science)	☐ ☐ ☐ ☐ ☐
h. Tekenen/muziek/handvaardigheid (art/music/crafts)	☐ ☐ ☐ ☐ ☐
i. Verkeer (traffic)	☐ ☐ ☐ ☐ ☐
j. Computerles/informatica/informatiekunde (computers/information)	☐ ☐ ☐ ☐ ☐
k. Godsdienst/geestelijke stromingn (religion/spiritual movements)	☐ ☐ ☐ ☐ ☐

6. Hoe vaak gebruik je op school de computer voor de volgende dingen? (How often do you use the school computer for things delivered?)

a. het oefenen va bv. Woordjes, sommen of topografie (practicing words, sums, or topgography)	☐ ☐ ☐ ☐ ☐
b. het maken van een tekening (making a drawing)	☐ ☐ ☐ ☐ ☐
c. het maken van een proefweerk (making a test)	☐ ☐ ☐ ☐ ☐
d. het verzamelen van materiaal voor een spreekbeurt/werkstuk (collecting material for a school/work)	☐ ☐ ☐ ☐ ☐
e. het schrijven van een brief of verhaal (tekstverwerken) (writing a letter or story (word processing)	☐ ☐ ☐ ☐ ☐
f. het maken van een werkstuk (making of a workpiece)	☐ ☐ ☐ ☐ ☐

g. het doen van proefjes (bv. Bij biologie, natuur of techniek) □ □ □ □ □
(doing experiments (e.g., in biology, nature or technique)

h. het houden van een spreekbeurt/presentatie □ □ □ □ □
(hold a lecture/presentation)

i. het schrijven en lezen van e-mail □ □ □ □ □
(writing and reading e-mail)

j. het surfen op internet □ □ □ □ □
(surfing the internet)

k. chatten □ □ □ □ □
(chatting)

l. maken van een website □ □ □ □ □
(making a website)

m. programmeren □ □ □ □ □
(programming)

n. e-mailen met kindren uit andere landen □ □ □ □ □
(e-mailing with a child from another country)

7. Hoeveel tijd pr week gebruik je de computr onder schooltijd voor schoolwork? (How often per week do you use the computer during school hours for school work?)

nooit (never) □
minder dan een half uur (less than half an hour) □
tussen half uur en een uur (between half an hour and an hour) □
tussen 1 en 3 uur (between one and three hours) □
tussen 3 en 5 uur (between three and 5 hours) □
meer dan 5 uur (more than 5 hours) □

8. Wat vind je van de computerprogramma's die je op school gebruikt? (What do you think of computer programs you use in school?)

a. sluiten goed aan bij de les (fit in well with the lesson) □ □ □ □
b. ik leer er wat van (I learn something) □ □ □ □
c. zien er leuk uit (look nice) □ □ □ □
d. zijn snel (fast) □ □ □ □
e. zijn moeilijk (be difficult) □ □ □ □
f. handig om meet e oefenen (convenient to practice) □ □ □ □

9. Gebruik je wel eens een computer buiten school, voor schoolwork? (Do you ever use a computer outside of school for school work?)

nee (no) è ga naar vraag 13 (go to question 13) □
ja (yes) □

10. Als je buiten school de computer gebruikt voor schoolwork, waar doe ja dat dan meestal? ***Kruis een antwoord aan.*** (When using the computer outsie of schoolwork where do you do it often? *Cross on a response)*

thuis (home) □
bij een vriend (-in) (at a friend) □
bij familie (with family) □
bij e buren (at the neighbors) □
in het wijkcentrum (at the community center) □
in de bibliotheek (in the library) □

11. Hoeveel tijd per wek gebruik je de computer buiten schooltijd voor schoolwork? (How many times per week do you use the computer for schoolwork outside of school?)

nooit (never) ☐
minder dan een half uur (less than half an hour) ☐
tussen half uur en een uur (between half an hour and an hour) ☐
tussen 1 en 3 uur (between one and three hours) ☐
tussen 3 en 5 uur (between three and 5 hours) ☐
meer dan 5 uur (more than 5 hours) ☐

12. Hoe vaak ebruik je buiten chool de computer voor de volgende dingen? (How often do you use the computer outside of school for the following?)

a. het oefenen va bv. Woordjes, sommen of topografie ☐ ☐ ☐ ☐ ☐
(practicing words, sums, or topgography)
b. het maken van een tekening ☐ ☐ ☐ ☐ ☐
(making a drawing)
c. het maken van een proefweerk ☐ ☐ ☐ ☐ ☐
(making a test)
d. het verzamelen van materiaal voor een spreekbeurt/werkstuk ☐ ☐ ☐ ☐ ☐
(collecting material for a school/work)
e. het schrijven van een brief of verhaal (tekstverwerken) ☐ ☐ ☐ ☐ ☐
(writing a letter or story (word processing)
f. het maken van een werkstuk ☐ ☐ ☐ ☐ ☐
(making of a workpiece)
g. het doen van proefjes (bv. Bij biologie, natuur of techniek) ☐ ☐ ☐ ☐ ☐
(doing experiments (e.g., in biology, nature or technique)
h. het houden van een spreekbeurt/presentatie ☐ ☐ ☐ ☐ ☐
(hold a lecture/presentation)
i. het schrijven en lezen van e-mail ☐ ☐ ☐ ☐ ☐
(writing and reading e-mail)
j. het surfen op internet ☐ ☐ ☐ ☐ ☐
(surfing the internet)
k. chatten ☐ ☐ ☐ ☐ ☐
(chatting)
l. maken van een website (making a website) ☐ ☐ ☐ ☐ ☐
m. programmeren ☐ ☐ ☐ ☐ ☐
(programming)
n. e-mailen met kindren uit andere landen ☐ ☐ ☐ ☐ ☐
(e-mailing with a child from another country)

13. Heb je thuis een computer die je kunt gebruiken? (Do you have a computer at home?)

a. nee, hebben geen computer thuis (No, we don't have a computer at home) ☐
b. ja, ik he been eigen computer (yes, I have my own computer) ☐
c. ja, we hebben een computer die het hele gezin kan gebruiken ☐
(Yes, we have a computer that the family shares)
d. ja, we hebben een computr geleend van (Yes, we have borrowed a computer from school) ☐

14. Wat heft de computer die je thuis gebruikt? (What does the computer you use at home?)
Je mag meer hokjes aankruisen. (Check more than one box.)

Internet ☐
e-mail ☐
geluidsboxen (speakers) ☐
c-romspeler (C.D. rom) ☐
scanner☐

15. Ken je de website van kennisnet? (You know the Kennisnet website?)

ne, ik weet niet wat kenninet is (No, I don't what kennisnet is.) ➔ ga naar vraag 19 (go to question 19) ☐
ja (yes) ☐

16. Waarvoor gebruik je kennisnet? (Which do you use the Kennisnet?)

a. om informative van anderen te krijgen ☐ ☐ ☐
b. om informative op te zoeken voor werkstuk of spreekbeurt ☐ ☐ ☐
c. om sites gemaakt door andere kinderen/scholen te bekijken ☐ ☐ ☐
d. om 'links naar interessante sits te vinden ☐ ☐ ☐
e. om plaatjes geluiden te vinden ☐ ☐ ☐
f. om spelletjes te spelen ☐ ☐ ☐
g. om spelletjes te downloaden ☐ ☐ ☐
h. voor hulp bij het maken van werkstuk/opdracht ('basisbot') ☐ ☐ ☐
i. voor tips over surfen op internet ☐ ☐ ☐
j. om contact met andere kinderen te krijgen ☐ ☐ ☐

17. Wat vind je van kennisnet? (What do you think of Kennisnet?)

a. je kunt er gemakkelijk iets op vinden (You can find something easily) ☐ ☐ ☐
b. je kunt er snel iets op vinden (You can find something quickly) ☐ ☐ ☐
c. ziet er leuk uit (looks nice) ☐ ☐ ☐
d. is gemakkelijk te gebruiken (easy to use) ☐ ☐ ☐
e. het is duidelijk waar ik moet zoeken (clear where to look) ☐ ☐ ☐
f. het is makkelijk om in conact te komen met andere kinderen ☐ ☐ ☐
(easy to come in contact with other children)

18. Als je dewebsite van kennisnet een rapportcijfer zou geven, welk cijfer van 1 to 10 geef je dan? (If you could give a score visiting the website of Kennisnet, any number from 1 to 10, please register)

	1	2	3	4	5	6	7	8	9	10
cijfer	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

19. Wat kun jij allemaal op de computer? (What can you do on the computer?)
Kruis aan wat je wel kunt (Check what you can do)

Ik kan: (I can)

a. een tekst bewaren (save a text) ☐
b. woorden vet (dikgedrukt) maken (change words to bold) ☐
c. zinnen op een andere plaats in een verhaal zetten (cut and paste sentences to another place in the text) ☐
d. letters met leestekens (bijv. E, e, e) in de tekst etten (put diacratics in a text) ☐
e. gebruik maken van de spellingscontrole (use spell check) ☐
f. ik kan een bestaan plaatje in een verhaal toevoegen (add a picture to a text) ☐
g. een rechthoek en een cirkel tekenene op de computer (draw a rectangle and a circle using the computer) ☐
h. de kleur van de letters veranderen in een tekening (change the color of letters in a drawing) ☐
i. een afbeelding op zijn kop zetten (rotate an image) ☐
j. een e-mail versturen (send an image) ☐
k. een e-mail beantwoorden (answer an e-mail) ☐
l. een e-mail doorsturen (forward an e-mail) ☐
m. een bestand met de e-mail meesturen (send a file to the e-mail) ☐
n. surfen op internet (surf the internet) ☐

o.	een internet-pagina printen (print an internet website)	☐
p.	bladwijzers/bookmarks/favorieten maken (add a bookmark)	☐
q.	gebruik maken van zoekprogramma's op internet (use a search engine)	☐
r.	een bestand van internet halen (downloaden) en installeren (download from the Internet)	☐
s.	chatten (chatting)	☐
t.	een website maken (creating a website)	☐

20. Hoe goed vind je jezelf met: (How well do you consider yourself knowing:)

		Slecht	niet zo goed	best wel goed	heel erg goed
a.	de computer (the computer)	☐	☐	☐	☐
b.	het Internet (the Internet)	☐	☐	☐	☐

21. Wat is jouw mening hierover? (What is our opinion about this?)

		nee	ja
a.	ik vind praten met anderen over computers leuk (I find talking to others about the computer fun)	☐	☐
b.	mijn ouders moedigen mij aan om met oemputers te werken (My parents encourage me to work on computers)	☐	☐
c.	computes kunnen me helpen om dingen makkelijker te leren (Computers help me learn things easier)	☐	☐
d.	ik weet dat computers mij veel nieuwe dingen kunnen leren (Computers can teach me many new things)	☐	☐
e.	met computers is het mogelijk om veel dingen te doen (It's possible to do many things with computers)	☐	☐
f.	mijn ouders willen dat ik goed kan werken met computers (My parents want me to work well with computers)	☐	☐
g.	je hebt er veel aan, als je goed computers kunt gebruiken (You have a lot of, if you can make good use of computers)	☐	☐
h.	alle kinderen moeten op school met computers leren omgaan (All children must learn to cope in school computers)	☐	☐
i.	ik wil veel over computers weten (I want to know a lot about computers)	☐	☐
j.	computers interesseren me weinig (computers interest me a little)	☐	☐
k.	lessen waarbij de computer gebruikt wordt, vind ik leuk (Lessons that use computers, I like)	☐	☐
l.	wie met computers kan werken , krijgt latereen betere baan (people who can work with computers, get a better job later)	☐	☐
m.	ik moet de leraar vragen om de computer te mogen gebruiken (I have to ask the teacher for permission to use the computer)	☐	☐
n.	ik wil de computer op school vaker gebruiken (I want to use the computer at school more often)	☐	☐
o.	ik weet meer van computers dan de leraar (I know more about computers than my teacher)	☐	☐
p.	ik weet meer van computers dan de leraar (I know more about computers than my father)	☐	☐
q.	ik weet meer van computers dan de leraar (I know more about computers than my mother)	☐	☐
r.	thuis wrk ik met moeilijkere programma's dan op school (I work with more difficult programs than at school)	☐	☐
s.	ik vind het leuk om dingen op internet op te zoeken (I like to look at things on the internet)	☐	☐

APPENDIX C

Prior Knowledge Test (Climate Change)

Nakennistest Klimaatverandering 2

Datum…………….

Naam………………………….

School………………………….

Geef antwoord op de volgende vragen:

1) Wat moeten mensen volgens jou doen om de klimaatverandering tegen te gaan?

2) Hoe kunnen mensen in Nederland zich voorbereiden op de gevolgen van klimaatverandering?

De volgende vragen moet je beantwoorden door een rondje om het geode antwoord te zetten.

1. De onderste lag van de atmosfeer is de ozonlaag.
2. De broeikasgassen zijn voor een groot deel verantwoordelijk voor de temperatuur op aarde.
3. Lachgas is een broeikasgas.
4. Door alle inspanningen van de mens is de uistoot van gassen inmiddels sterk verminderd.
5. Een auto verbruikt de minste brandstof in de eerste vijf kilometer.
6. Naast de aarde warmen ook andere planeten op door het broeikasefect.
7. Als je minder vlees eet help je mee aan energie besparing.
8. Het tekort aan drinkwater wordt groter door de klimaatverandering.
9. Het klimaat zorgot voor de verhouding tussen land en zee, natte en droge gebieden, warme en koude streken.
10. Een boom zorgt ervoor date er koolzuurgas uit de lucht wordt gerhaald.
11. In de laatste 50 jaar is de temperatuur op aarde sterk toegenomen.
12. Kerncentrales zijn een geode oplossing in de strijd tegen het broeikaseffect.
13. Door de indusrialisatie neemt het problem rondom de klimaatverandering af.
14. Veel land-en tuinbouw vermindert het broeikaseffect.

15. Zonder atmosfeer zouden we nog prima op de aarde kunnen leven.
16. Klimaatverandering zorgt ervoor date er geen nieuwe plantsoorten kunnen ontstaan.
17. De ozonlaag kan niet meer hersteld worden
18. Door de gaten in de ozonlaag verbrand je sneller
19. Groenen energie is een nieuwe sort energie met een groenachtige kleur.
20. De straling van de aarde noemen we infrarode straling.

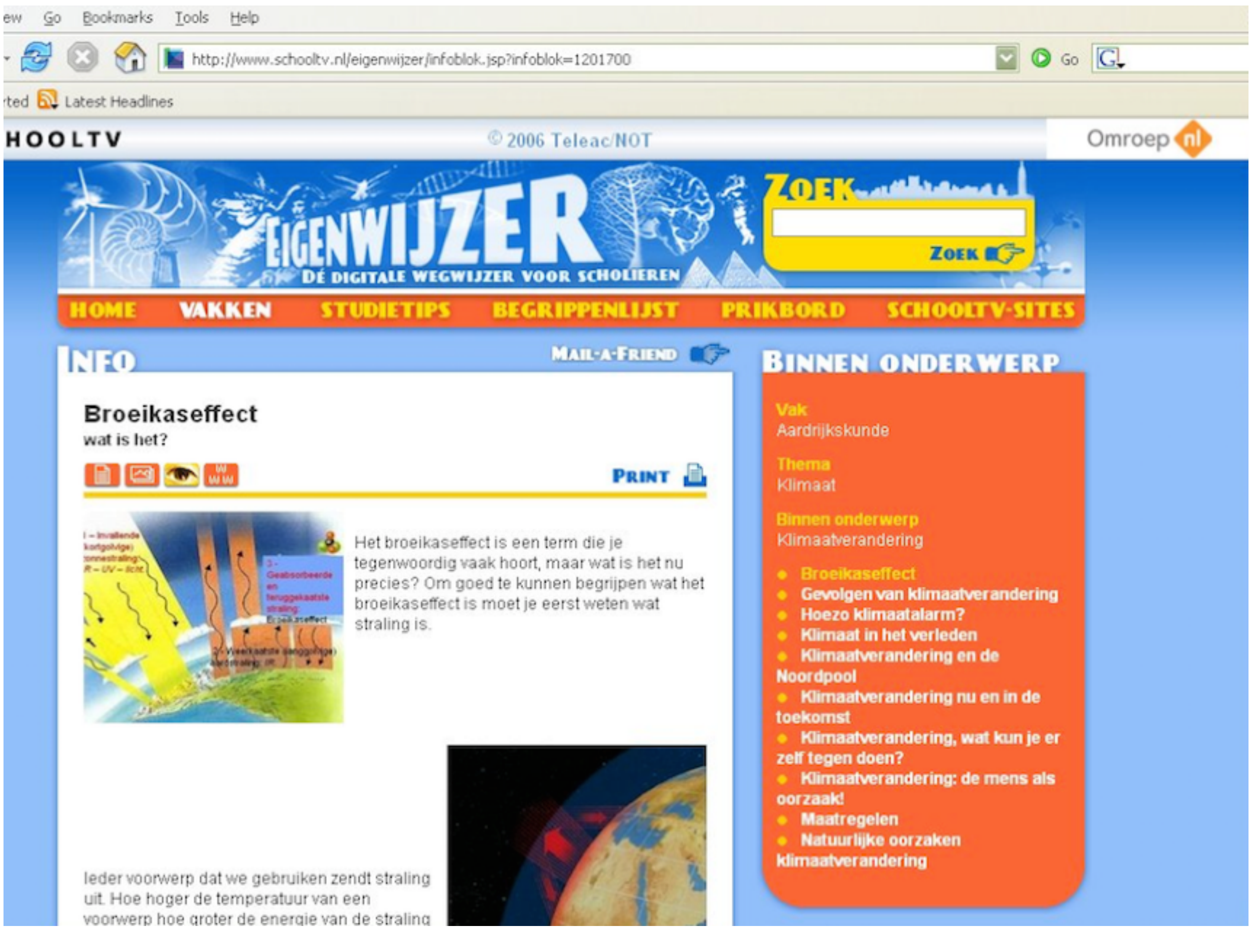
APPENDIX D

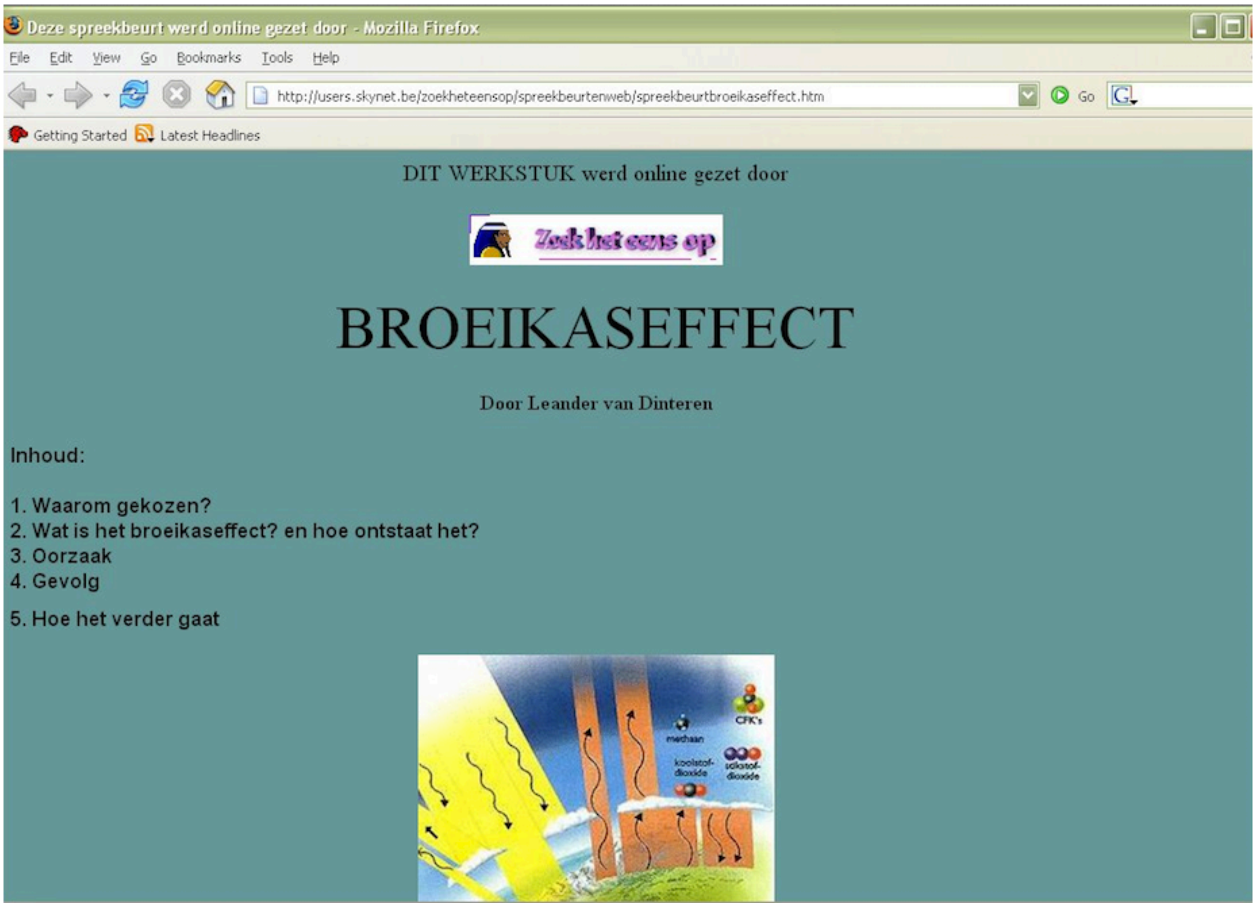
Group Membership for Schools

	Day Two		Day Three	
	Task	**Topic**	**Task**	**Topic**
Group 1	Ill-Defined	Tropical Rainforest	Well-Defined	Climate Change
Group 2	Well-Defined	Tropical Rainforest	Ill-Defined	Climate Change
Group 3	Ill-Defined	Climate Change	Well-Defined	Tropical Rainforest
Group 4	Well-Defined	Climate Change	Ill-Defined	Tropical Rainforest

APPENDIX E

Preselected Websites





Deze spreekbeurt werd online gezet door - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://users.skynet.be/zoekheteensop/spreekbeurtenweb/spreekbeurtbroeikaseffect.htm

Getting Started Latest Headlines

DIT WERKSTUK werd online gezet door

Zoek het eens op

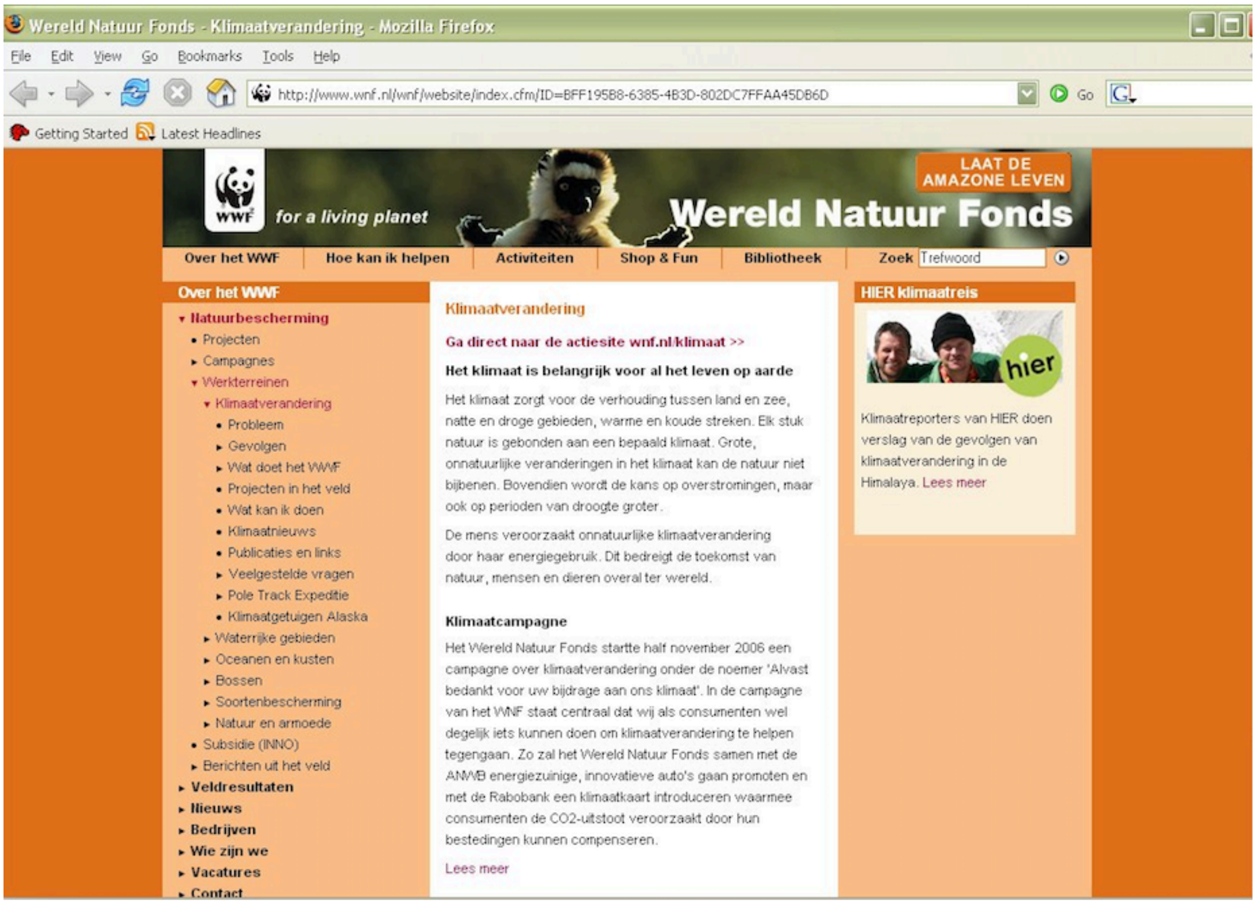
BROEIKASEFFECT

Door Leander van Dinteren

Inhoud:

1. Waarom gekozen?
2. Wat is het broeikaseffect? en hoe ontstaat het?
3. Oorzaak
4. Gevolg
5. Hoe het verder gaat


ESA - Kids - De Aarde - Opwarming van de Aarde - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.esa.int/esaKIDSnl/SEM76WXDE2E_Earth_0.html
Go
Getting Started
Latest Headlines
esa kids
De Aarde
Europese Ruimtevaartorganisatie
ESA Kids
Ons Heelal
Leven in de Ruimte
De Lancering
Nuttige Ruimte
De Aarde
12-Apr-2007
Lab
Fun
Nieuws
Klimaatverandering
Natuurrampen
Natuurbescherming
De wereld onder water
Klimaatverandering
Opwarming van de Aarde
Elke keer als we uitademen, komt er koolzuur in de atmosfeer. Koolzuur is een zogenaamd broeikasgas. Die gassen heten zo omdat ze warmte vasthouden.
De afgelopen honderd jaar is er steeds meer koolzuur in de atmosfeer gekomen. Dat komt vooral door menselijk toedoen, zoals olie- en gasverbranding en kaalslag van bossen.
Bossen halen heel veel koolzuur uit de lucht. Maar die koolstof is in de bomen opgeslagen en komt weer in de atmosfeer als we ze kappen of verbranden.
Uit satellietgegevens blijkt dat de wereld warmer lijkt te worden. De meeste wetenschappers denken dat de temperatuur op Aarde stijgt doordat er steeds meer broeikasgassen zijn. Dat noemen we het 'broeikaseffect'.
Klimaatverandering
Aantasting van de ozonlaag
Aërosolen
Orkanen


Wereld Natuur Fonds - Klimaatverandering - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.wnf.nl/wnf/website/index.cfm/ID=BFF195B8-6385-4B3D-802DC7FFAA45DB6D
Go
Getting Started Latest Headlines
WWF
for a living planet
LAAT DE AMAZONE LEVEN
Wereld Natuur Fonds
Over het WWF
Hoe kan ik helpen
Activiteiten
Shop & Fun
Bibliotheek
Zoek
Trefwoord
Over het WWF
Natuurbescherming
Projecten
Campagnes
Werkterreinen
Klimaatverandering
Probleem
Gevolgen
Wat doet het WWF
Projecten in het veld
Wat kan ik doen
Klimaatnieuws
Publicaties en links
Veelgestelde vragen
Pole Track Expeditie
Klimaatgetuigen Alaska
Waterrijke gebieden
Oceanen en kusten
Bossen
Soortenbescherming
Natuur en armoede
Subsidie (INNO)
Berichten uit het veld
Veldresultaten
Nieuws
Bedrijven
Wie zijn we
Vacatures
Contact
Klimaatverandering
Ga direct naar de actiesite wnf.nl/klimaat >>
Het klimaat is belangrijk voor al het leven op aarde
Het klimaat zorgt voor de verhouding tussen land en zee, natte en droge gebieden, warme en koude streken. Elk stuk natuur is gebonden aan een bepaald klimaat. Grote, onnatuurlijke veranderingen in het klimaat kan de natuur niet bijbenen. Bovendien wordt de kans op overstromingen, maar ook op perioden van droogte groter.
De mens veroorzaakt onnatuurlijke klimaatverandering door haar energiegebruik. Dit bedreigt de toekomst van natuur, mensen en dieren overal ter wereld.
Klimaatcampagne
Het Wereld Natuur Fonds startte half november 2006 een campagne over klimaatverandering onder de noemer 'Alvast bedankt voor uw bijdrage aan ons klimaat'. In de campagne van het WNF staat centraal dat wij als consumenten wel degelijk iets kunnen doen om klimaatverandering te helpen tegengaan. Zo zal het Wereld Natuur Fonds samen met de ANWB energiezuinige, innovatieve auto's gaan promoten en met de Rabobank een klimaatkaart introduceren waarmee consumenten de CO2-uitstoot veroorzaakt door hun bestedingen kunnen compenseren.
Lees meer
HIER klimaatreis
hier
Klimaatreporters van HIER doen verslag van de gevolgen van klimaatverandering in de Himalaya. Lees meer

APPENDIX F

Well-defined Questions

Questions for Climate Change

1. Why is climate change so important?
2. What is the relationship between greenhouse gasses and the greenhouse effect?
3. How does the greenhouse effect impact climate change? Give four examples.
4. Why is the atmosphere important to life on Earth?
5. How would you best describe the ozone layer?
6. How can you help reduce or stop climate change?
7. What cause the greenhouse effect? Give at least two causes/reasons.

Questions for Tropical Rainforest

1. Why are tropical rainforests so important?
2. How do people who live in rainforest survive?
3. How can people save rainforest? Give four ways in which people can save the rainforest.
4. Why do most of the animals live in the canopy of tropical rainforests?
5. How would you best describe the climate in tropical rainforests?
6. Why is the existence of rainforest in danger?
7. What makes each tropical rainforest different? Give two reasons